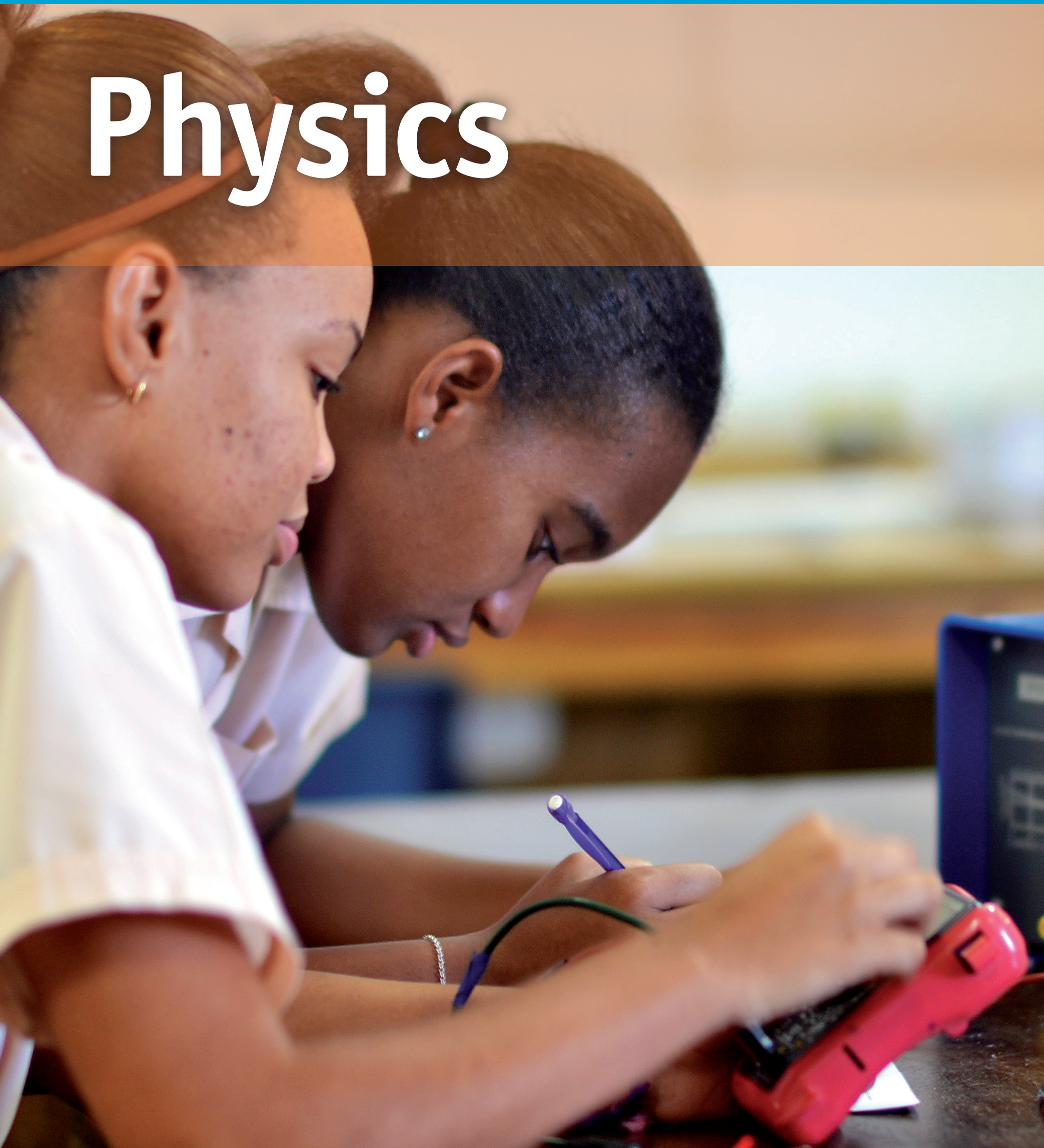
CARIBBEAN EXAMINATIONS COUNCIL

Physics



CSEC® PAST PAPERS

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CSEC® Physics Past Papers

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TEST CODE **01238020**

FORM TP 2005119

MAY/JUNE 2005

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$1\frac{1}{2}$ hours

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Graph paper for Question 1.

GO ON TO THE NEXT PAGE

1. **You are to spend no more than $\frac{1}{2}$ hour on this question.**

In this question you will find the refractive index of a rectangular block of glass.

A student was given this experiment as a CXC SBA activity and produced the following results.

Angle of incidence i/degrees	**Angle of refraction r/degrees**	**Sin $\hat{i}$**	**Sin $\hat{r}$**
10.0	6.0		
20.0	12.0		
30.0	18.0		
40.0	24.0		
50.0	30.0		
60.0	36.0		

(a) Complete the table above. **(4 marks)**

(b) Plot a graph of Sin $\hat{i}$ against Sin $\hat{r}$ on the graph paper provided on page 2. **(10 marks)**

(c) Find the slope, n, of the graph.

____

____

____

____

____

(4 marks)

(d) What does the slope, n, of the graph represent?

____

____

(1 mark)

GO ON TO THE NEXT PAGE

(e) Draw a labelled diagram identifying the apparatus used and angles measured by the student to obtain the results.

(6 marks)

(f) A ray of light is incident at an angle of $35°$. With the aid of dotted lines use your graph to calculate the angle of refraction produced.

____

____

____

____

____

(5 marks)

Total 30 marks

GO ON TO THE NEXT PAGE

MECHANICS

2. (a) (i) State the principle of conservation of energy.

___

___

(2 marks)

(ii) Define the term 'potential energy'.

___

___

(1 mark)

(iii) Give ONE example of a body possessing potential energy.

___

___

(1 mark)

(iv) Define the term 'kinetic energy'.

___

___

(1 mark)

(v) Give ONE example of a body possessing kinetic energy.

___

___

(1 mark)

(b) At a football match between two college teams, the referee ordered a free kick. The ball of mass 1.5 kg was placed at rest. The kick was about to be taken by an eager footballer.

What was the potential energy of the ball just before the kick was taken?

___

___

(1 mark)

(c) The footballer kicked the ball and it was caught by the opposing goalkeeper, 4 metres above the ground. The ball was travelling at 10 m s^{-1}.

(i) Calculate the potential energy of the ball just before it was caught.

____

____

____

(3 marks)

(ii) Calculate the kinetic energy of the ball just before it was caught.

____

____

____

(3 marks)

(iii) After the ball was caught, what was the kinetic energy converted into?

____

____

____

(2 marks)

Total 15 marks

3. (a) Define the 'heat capacity of a substance' and state its SI unit.

(3 marks)

(b) Name the THREE modes of heat transfer.

(3 marks)

(c) A well-insulated hot water tank is used to supply hot water to a residential dwelling house. The immersion heating element inside the tank has a power rating of 2200 W and the tank contains 125 kg of water at 28°C. Calculate

(i) the heat energy supplied by the heating element in 2 hours

(3 marks)

(ii) the heat energy supplied to the water, given that its temperature increases to 58°C

(3 marks)

[specific heat capacity of water is 4200 J kg^{-1} K^{-1}]

(iii) the heat capacity of the tank, assuming that the tank and the water reach the same final temperature of 58°C.

(3 marks)

Total 15 marks

4. (a) Explain what is meant by the term ‘magnetic field’.

____

____

(2 marks)

(b) TWO bar magnets are close to each other so that their magnetic fields interact. Sketch the field pattern for the TWO arrangements shown below.

(i)

(ii)

(4 marks)

(c) In Figure 1 below the primary of the transformer is connected to a battery and a switch while the secondary is connected to a centre-zero galvanometer.

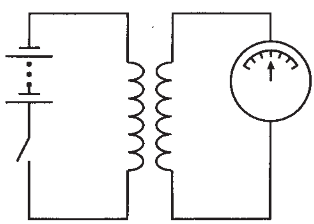

Figure 1

(i) Describe what would be observed on the galvanometer when the switch is closed.

(2 marks)

(ii) Explain your answer.

(3 marks)

(iii) Describe what would be observed on the galvanometer if the switch is subsequently opened.

(2 marks)

(iv) Deduce what would be observed on the galvanometer if the battery were replaced by a **low frequency** a.c. supply.

(1 mark)

(v) How would these observations be affected if the number of turns on the transformer secondary were significantly increased?

(1 mark)

Total 15 marks

5. (a) Identify the logic gates described in the first column of the table below and hence complete the table by writing in the names and logic symbols in the appropriate columns.

DESCRIPTION	NAME	SYMBOL
Output is always **low** except when **both** inputs are **high**.		
Output is always **high** except when **both** inputs are **low**.		
Output is always **high** except when **both** inputs are **high**.		

(6 marks)

(b) Figure 2 shows a logic circuit.

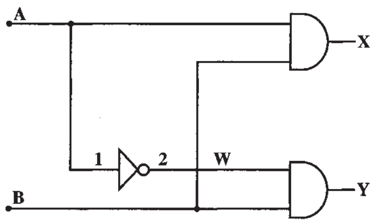

Figure 2

Examine the logic circuit shown in Figure 2 and complete the TRUTH TABLE below:

A	B	W	X	Y
0	0			
0	1			
1	0			
1	0			

(6 marks)

GO ON TO THE NEXT PAGE

(c) The logic circuit of Figure 2 is incorporated into the electrical system of a car as shown in Figure 3 below, and switches S1 and S2 are operated according to the table below.

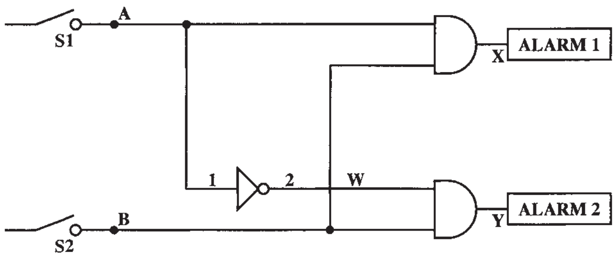

Figure 3

	ENGINE ON	ENGINE OFF	DOOR OPEN	DOOR CLOSED
SWITCH S1	ON	OFF	ANY STATE	ANY STATE
SWITCH S2	ANY STATE	ANY STATE	ON	OFF

Explain what happen if:

(i) the DOOR is OPEN and the ENGINE is OFF.

____

____

(2 marks)

(ii) the DOOR is OPEN and the ENGINE is ON.

____

____

(1 mark)

Total 15 marks

END OF TEST

TEST CODE **01238030**

FORM TP 2005120

MAY/JUNE 2005

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03 – General Proficiency

1 hour

06 JUNE 2005 (a.m.)

In addition to the 1 hour, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. Answer ANY THREE questions.
2. ALL WORKING MUST BE SHOWN in your answer booklet, since marks will be awarded for correct steps in calculations.
3. The use of non-programmable calculators is allowed.
4. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. (a) An acetate rod may be charged positively by rubbing it with a dry cloth, whereas a polyethylene rod will be negatively charged if similarly rubbed. Explain why this occurs. Explain, with the aid of diagrams if necessary, why it is possible to pick up small bits of paper with either of these charged rods. **(8 marks)**

(b) The positively charged acetate rod and the negatively charged polyethylene rod are made to touch each other, causing 3 μA of current to flow from one rod to the other for a period of 4 ms.

Calculate

(i) the amount of charge which flows through the rod

(ii) the number of electrons involved in this current flow.

(Charge of electron = 1.6×10^{-19}C)

(6 marks)

(c) A cloud has the charge distribution shown in Figure 1 below.

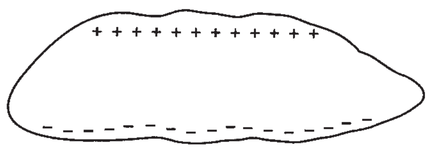

Figure 1

(i) In your answer booklet sketch the electric field pattern inside the cloud, treating the charge distribution as that for TWO parallel plates.

(ii) If this cloud is directly over a tall building, explain how the distribution of charges in the building's structure will be affected.

(iii) The air between the cloud and the building breaks down and there is a flash of lightning. Deduce the direction in which the electrons will flow in this lightning bolt.

(6 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

2. (a) An investor is interested in a nuclear power station project. He has the option of using natural or artificial radioactive decay processes to obtain energy. In helping him to decide, he consults an engineer who compares the energy obtained from the following TWO nuclear reactions:

natural: $^{212}_{83}\text{Bi} \rightarrow {}^{208}_{81}\text{Tl} + {}^{4}_{2}\text{He} + \text{Energy}$

artificial: $^{1}_{0}\text{n} + {}^{235}_{92}\text{U} \rightarrow {}^{A}_{54}\text{Xe} + {}^{90}_{38}\text{Sr} + 3\,({}^{1}_{0}\text{n}) + \text{Energy}$

Table 1 below gives the data for these nuclides where $u = 1.66 \times 10^{-27}$ kg.

Table 1: Showing nuclide and atomic mass

Nuclide	Atomic mass / u.
$^{235}_{92}\text{U}$	235.04393
$^{212}_{83}\text{Bi}$	211.99127
$^{208}_{81}\text{Tl}$	207.98201
$^{A}_{54}\text{Xe}$	142.93489
$^{90}_{38}\text{Sr}$	89.90730
$^{4}_{2}\text{He}$	4.00260
$^{1}_{0}\text{n}$	1.00867

(i) Calculate the number of neutrons in Bismuth (Bi). **(3 marks)**

(ii) Determine the atomic mass number of Xenon (Xe). **(2 marks)**

(iii) Calculate the energy released in EACH nuclear reaction and the ratio of the larger to the smaller. Deduce the recommendation that the engineer will give to the investor. **(7 marks)**

GO ON TO THE NEXT PAGE

(b) Radioactive materials emit alpha (α), beta (β) and gamma (γ) radiation. Table 2 summarises some of the properties of these types of radiation. Copy the table in your answer booklet and complete the missing entries.

Table 2: Properties of α, β and γ radiation

	Range in air	**Behaviour in electric field**	**Type of tracks in cloud chamber**
α			
β			
γ			faint track (poor ionizers)

(8 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

3. (a) With the aid of a neat, clearly labelled diagram, describe an experiment to prove the relationship between the angle of incidence, i, and the angle of reflection, r, for a ray of light incident on a plane mirror. **(8 marks)**

(b) Figure 2 is a side view of ABCD, a prism made from fused quartz (a type of glass) of refractive index 1.46.

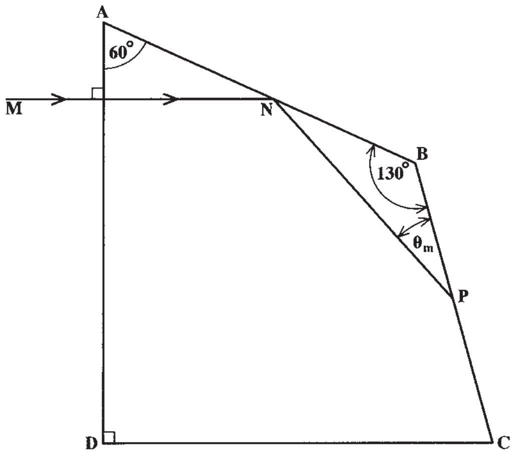

Figure 2

The ray MN is incident on face AD as shown.

(i) Show that MN will be totally internally reflected from the face AB. **(7 marks)**

Redraw the diagram in your answer book.

(ii) Determine, θ_m, the angle which the reflected ray makes with the face BC at point P.

(iii) Sketch on your diagram the ray from point P, showing clearly the path from P through to its emergence from the prism.

Indicate any refraction. **(5 marks)**

Total 20 marks

GO ON TO THE NEXT PAGE

4. (a) With the aid of a labelled diagram describe an experiment to determine the centre of gravity of an irregularly shaped sheet of cardboard. **(8 marks)**

(b) Figure 3 shows a bicycle of mass 15 kg resting in a vertical position, with the front and back wheels touching the horizontal ground at points P and Q respectively, where PQ = 1 m.

The centre of gravity of the bicycle is vertically above O, a point on PQ where PO = 30 cm.

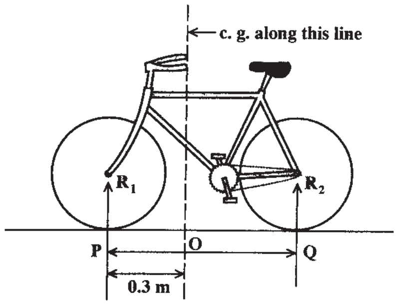

Figure 3

Given that the normal reactions of the ground on the front and rear wheels are R_1 and R_2 respectively, write TWO equations, in R_1 and R_2, which satisfy the conditions of equilibrium. **(4 marks)**

(c) Kenny and Candy decided to sit on a see-saw while visiting a local play park. Candy, of mass 50 kg, sat 250 cm from the pivot of the seesaw.

(i) Where should Kenny, of 60 kg mass, sit so that a state of stable equilibrium exists? **(5 marks)**

(ii) What should Kenny do if he wanted to elevate Candy? **(3 marks)**

(Acceleration due to gravity = 10 N kg^{-1})

Total 20 marks

5. (a) (i) Distinguish between EACH of the following pairs of terms:

a) 'Solidification' and 'fusion'

b) 'Condensation' and 'vaporisation' **(4 marks)**

(ii) Describe FULLY the process of sublimation. **(2 marks)**

(b) For the changes of state mentioned in a) and b) above to take place energy must be added to or removed from a substance. Give the general name for this type of energy and state what happens to the temperature during these processes. **(2 marks)**

(c) A student placed 700 g of water at 28°C in a freezer. After 6 minutes and 15 seconds the water was transformed to ice.

Calculate

(i) the heat energy transferred from the water during the temperature change **(4 marks)**

(ii) the latent heat of solidification, given that 235200 J of heat energy was transferred during the change of state **(3 marks)**

(iii) the rate of heat energy transfer for the entire process. **(5 marks)**

(Specific heat capacity of water = 4200 J $kg^{-1}K^{-1}$)

Total 20 marks

END OF TEST

TEST CODE **01238020**

FORM TP 2006121

MAY/JUNE 2006

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$1\frac{1}{2}$ hours

READ THE FOLLOWING DIRECTIONS CAREFULLY

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DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. A student was asked to investigate the variation in temperature of 2 kg of water initially at 30°C, when heat energy was supplied to it by an electric heater rated at 1400 W. The following measurements were taken and recorded in Table 1.

Table 1

Temperature of water, θ/°C	30.0	40.0	51.0	62.5	72.0	80.0	89.0
Heating time, t/s	0	60	120	180	240	300	360
Temperature change, $\Delta\theta = (\theta - 30)$/°C	0						
Energy supplied, Q = 1400t/J	0						

(a) Complete the table above. **(3 marks)**

(b) Plot on the graph page opposite a graph of energy supplied against temperature change. **(11 marks)**

(c) Calculate the gradient of the graph.

(6 marks)

(d) Assuming that the energy loss to the container and the surroundings is negligible, what physical quantity does this gradient represent?

____

(1 mark)

(e) Determine the value of this quantity if 1 kg of water were used and state the physical quantity this represents.

(2 marks)

GO ON TO THE NEXT PAGE

(f) Water boils at 100°C. Calculate the heat energy which must be supplied in order to completely convert the 2 kg of water to steam.

(3 marks)

(g) Distinguish between boiling and evaporation.

____

____

____

____

____

(4 marks)

[Specific latent heat of vaporization of water = 2.3×10^{6} Jkg^{-1}]

Total 30 marks

2. (a) Explain what is meant by 'electrical resistance'.

____

____

____

(2 marks)

(b) The circuit shown in Figure 1 shows the interconnection between electrical devices, B and C, and voltage source A.

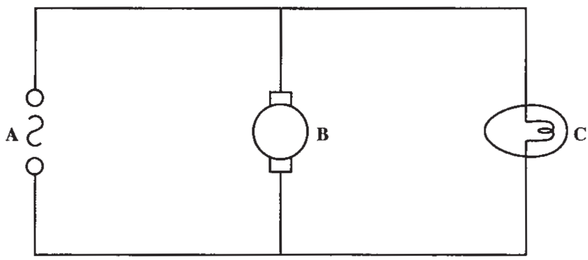


Figure 1

(i) Identify the type of connection employed in this circuit.

____

(1 mark)

(ii) Give the meaning of the circuit symbols labelled:

B ____

C ____

(2 marks)

(iii) Name the type of voltage produced at A.

____

(1 mark)

(c) (i) A fluorescent lamp is rated at 15W, 120V. Calculate the current which the lamp draws from the main supply.

(3 marks)

(ii) Calculate the resistance of this lamp while it is lit.

(3 marks)

(iii) When the lamp is lit, 4 W of the energy supplied is lost as heat. Calculate the efficiency of the lamp.

(3 marks)

Total 15 marks

3. (a) Figure 2 shows successive stages in the generation of a transverse wave on a stretched slinky spring.

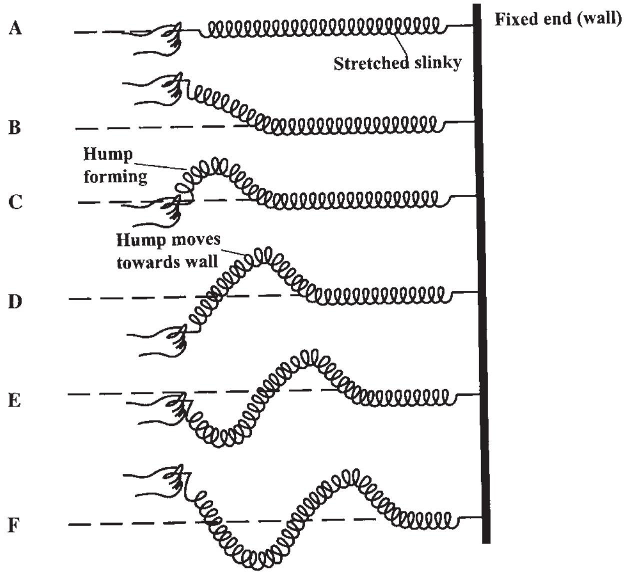


Figure 2

(i) Indicate on Figure 2F by appropriately labelling

a) the position of a crest
b) the position of a trough. **(2 marks)**

(ii) Draw labelled arrows on Figure 2E to show

a) the direction of the wave
b) the direction of hand movement needed to produce this wave. **(3 marks)**

(iii) Indicate on Figure 2A the direction of hand movement needed to produce a longitudinal wave. **(1 mark)**

(b) In a classroom demonstration a student uses a slinky spring to generate waves of frequency 5 Hz with 0.65 metres separation between successive crests. Determine the speed of these waves.

(**3 marks)**

(c) (i) Deduce whether the velocity of a sound wave will increase, decrease or remain constant when the wave travels from a denser to a less dense medium, given that the frequency remains constant and the wavelength decreases.

____

____

(**1 mark**)

(ii) Compare the waves produced on the slinky spring in part (b) with a typical sound wave in terms of the motion of the particles.

Transverse wave on slinky spring ____________________

____

Sound wave ________________________________

____

(**2 marks)**

(d) In Figure 3 below, a ship sends out pulses of high-frequency sound (ultrasound) which are reflected from the sea bed and received at the ship every 1.2×10^{-2} seconds.

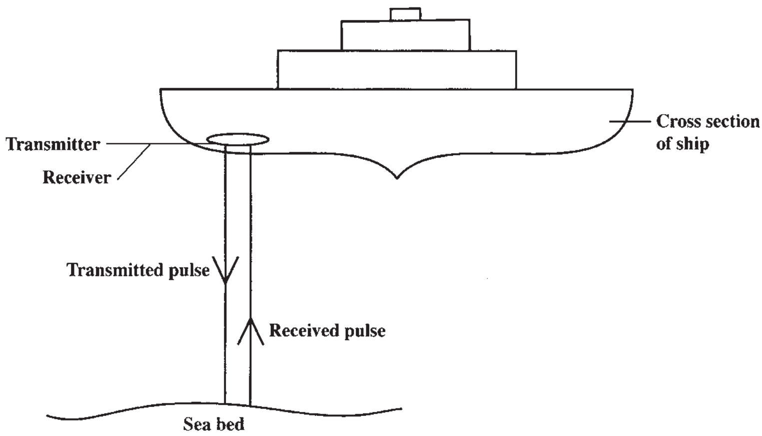


Figure 3

Calculate the depth of the sea bed below the transmitter.

(Speed of sound in sea water = 1 500 m s^{-1})

(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

4. (a) Define 'the moment of a force'.

(3 marks)

(b) State the principle of moments.

(3 marks)

(c) A cyclist hangs his bicycle with the rear wheel in contact with the ground and the handle attached to a light string as shown in Figure 4. The entire assembly is in equilibrium.

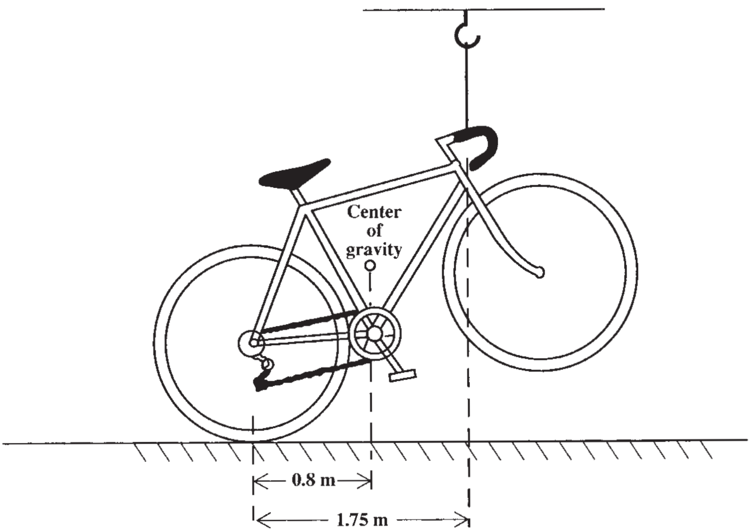


Figure 4

(i) Indicate by drawing arrows on Figure 4 the forces acting on the bicycle.

(3 marks)

(ii) Write TWO equations relating these forces.

(3 marks)

GO ON TO THE NEXT PAGE

(iii) The bicycle has a mass of 20 kg. Use the result you obtained in Part (c) (ii) to determine the tension in the string.

[Acceleration due to gravity, $g = 10 \text{ m s}^{-2}$]

(3 marks)

Total 15 marks

5. (a) Complete Table 2 below showing the International Insulation Colour Code.

Table 2

Code	Live Wire	Neutral Wire	Earth Wire
International Insulation Colour			

(3 marks)

(b) Fuses are sometimes used to protect electrical equipment from excess current. Explain how a fuse works.

(3 marks)

GO ON TO THE NEXT PAGE

(c) A household has the following appliances

- Heating iron rated at 1200 W, 110 V
- Television set rated at 70 W, 110 V
- Electrical fan 52 W, 110 V

(i) Calculate the total power consumed by these devices.

(**1 mark**)

(ii) These devices are in use for 4 hours per day. Calculate the energy consumed in kilowatt-hours in a 30-day month.

(**2 marks)**

(iii) Calculate the bill for the month if each unit of electricity costs 40¢.

(**2 marks)**

(iv) Assuming that these devices are connected in parallel across the mains supply, and are switched ON, calculate the TOTAL current drawn from the mains.

(**3 marks)**

(v) Fuses are available with the following current ratings: 5A, 10A, 15A, 25A. Select a suitable fuse for protecting these devices.

____

(**1 mark**)

Total 15 marks

END OF TEST

TEST CODE **01238030**

FORM TP 2006122

MAY/JUNE 2006

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03 – General Proficiency

1 hour

29 MAY 2006 (a.m.)

In addition to the 1 hour, candidates are allowed a reading time of 10 minutes. Candidates must NOT write in their answer booklets during this time.

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. Answer ANY THREE questions.
2. ALL WORKING MUST BE SHOWN in your answer booklet, since marks will be awarded for correct steps in calculations.
3. The use of non-programmable calculators is allowed.
4. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. (a) State, **in words**, Newton's three Laws of Motion. **(8 marks)**

(b) The Boeing 737 - 800 aircraft can accelerate from rest to a takeoff speed of 300 km hr^{-1} in 25 seconds. Calculate in m s^{-2} the value of this acceleration, assuming it to be constant. **(5 marks)**

(c) (i) The aircraft has a mass of 6×10^4 kg. Two identical jet engines provide a thrusting force. Calculate the magnitude of the thrusting force needed to give the aircraft the acceleration calculated in part (b). Hence find the corresponding thrust for EACH engine.

(ii) The thrust calculated in (i) is a theoretical value. Suggest a reason why this thrust if applied IN PRACTICE would NOT provide the expected acceleration.

(iii) The mass of the aircraft was increased by loading additional passengers and luggage. How could this affect the time taken to reach take-off speed? **(7 marks)**

Total 20 marks

2. (a) With the aid of a labelled diagram, explain how you would observe Brownian motion. **(8 marks)**

(b) Use the Kinetic Theory of Matter to explain

(i) the Pressure Law

(ii) how a drop of blue ink placed in a container of pure water eventually spreads out to occupy the entire volume. **(7 marks)**

(c) Mr Shah decided to do some measurements on one of his motor car tyres. The temperature of the air in the tyre was found to be 20°C and the pressure was 200 kPa above atmospheric pressure.

After driving for a few kilometres, he again measured the air pressure of the tyre and found it to be 240 kPa above atmospheric pressure.

(i) What was the final temperature of the air in the tyre, assuming that the volume of the tyre remained constant?

(ii) What other assumption is necessary for your calculation to be valid?

(Atmospheric pressure = 100 kPa) **(5marks)**

Total 20 marks

GO ON TO THE NEXT PAGE

3. (a) (i) Describe FOUR of the properties of electromagnetic waves.

(ii) X-rays and ultraviolet radiation are both electromagnetic in nature. For EACH of these two types of radiation, name TWO means of detection.

(8 marks)

(b) The distance between the earth and the moon has been measured by transmitting a laser beam from earth to a reflector on the moon and measuring the time taken for the reflected beam to be received back on earth.

(i) The laser used had a wavelength of 450 nm. What was its frequency?

(Velocity of laser light = 3.0×10^8 m s^{-1})

(ii) The transit time was found to be 2.5 s.

Calculate the distance between the earth and the moon.

(iii) A prism such as ABC shown in Figure 1 can be employed as a reflector for a laser beam as represented as WXYZ.

Determine the relationship between θ_A and θ_B.

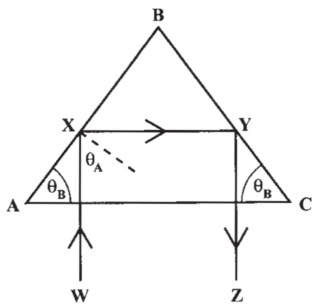


Figure 1

(iv) Find the condition which θ_B must satisfy in order that total internal reflection occurs at AB.

(12 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

4. (a) Compare the characteristics of zinc-carbon primary cells with those of lead-acid batteries by drawing and completing the comparison table shown below. You should indicate typical numeric values wherever possible.

	LEAD-ACID	**ZINC-CARBON**
Terminal voltage		
Maximum current		
Internal resistance		
Rechargeability		

(8 marks)

(b) (i) Calculate the power output of a lead-acid battery of terminal voltage 12V when supplying a load of 80A.

(ii) The energy storage capacity of automobile batteries is usually quoted in Ampere-hours (Ah). Energy storage capacity may also be expressed in joules. Conversion from Ampere – hours to joules uses the following formula:

Energy (joules) = Terminal voltage x Ampere hours x 3600.

Calculate the energy in joules stored in a 12 V, 240 Ah battery. Express your result in megajoules.

(6 marks)

(c) Electric cars employ an array of batteries to drive an electric motor which in turn drives the road wheels. The array may consist of N columns of batteries, two of which are shown in Figure 2. An equivalent circuit of this arrangement is shown in Figure 2.

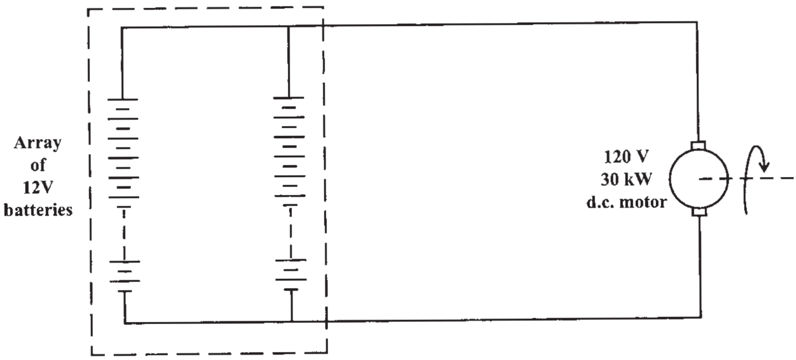


Figure 2

(i) Determine the minimum number of 240 Ah batteries which can supply the POWER REQUIREMENT of the motor.

(ii) Determine the number of 12 V batteries which must be connected across the motor to supply its rated voltage. Hence find N, the number of columns and the total number of batteries required.

(6 marks)

Total 20 marks

5. (a) Radioactive isotopes have been used in the following areas:

(i) Medicine

(ii) Industry and Agriculture

Describe briefly, TWO useful applications in EACH of areas (i) and (ii). Give an example of the isotope or type of radiation in EACH of your four applications.

(8 marks)

(b) (i) Represent EACH of the following nuclear reactions in the standard form ${}^{a}_{b}X \rightarrow {}^{c}_{d}Y + {}^{e}_{f}W$:

a) Bismuth (Bi) with a mass number of 212 and an atomic number of 83 emits radiation to form Thallium (Tl) with a mass number of 208 and an atomic number of 81.

b) Carbon (C) with a mass number of 14 and an atomic number of 6 emits radiation to form Nitrogen (N) with a mass number of 14 and an atomic number of 7.

c) More unstable Technetium (${}^{m}Tc$) with a mass of 99 and an atomic mass of 43 emits radiation to form more stable Technetium (Tc) with same mass and atomic numbers.

(ii) Determine the number of protons in Bismuth and calculate the number of neutrons in that same element.

(iii) Calculate the release in energy in the first nuclear reaction at a).

Element	**Atomic mass unit**
Bi	211.99127 u
Tl	207.98201 u
Helium	4.002604 u

$u = 1.66 \times 10^{-27}$ kg $\qquad c = 3.0 \times 10^{8}$ m s^{-1}

(12 marks)

Total 20 marks

END OF TEST

TEST CODE **01238030**

FORM TP 2006122

MAY/JUNE 2006

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03 – General Proficiency

NOTE TO CANDIDATES

ERRATUM SHEET

Page 3 - Question 3 (b) (i)

This part of the question should read;

(i) The laser light used had a wavelength of 450 nm. What was the frequency?

(Velocity of laser light = 3.0×10^8 m s^{-1}, 1 nm = 10^{-9} m)

Please refer to this statement and not the original on your question paper.

TEST CODE **01238020**

FORM TP 2007117

MAY/JUNE 2007

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$1\frac{1}{2}$ hours

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.

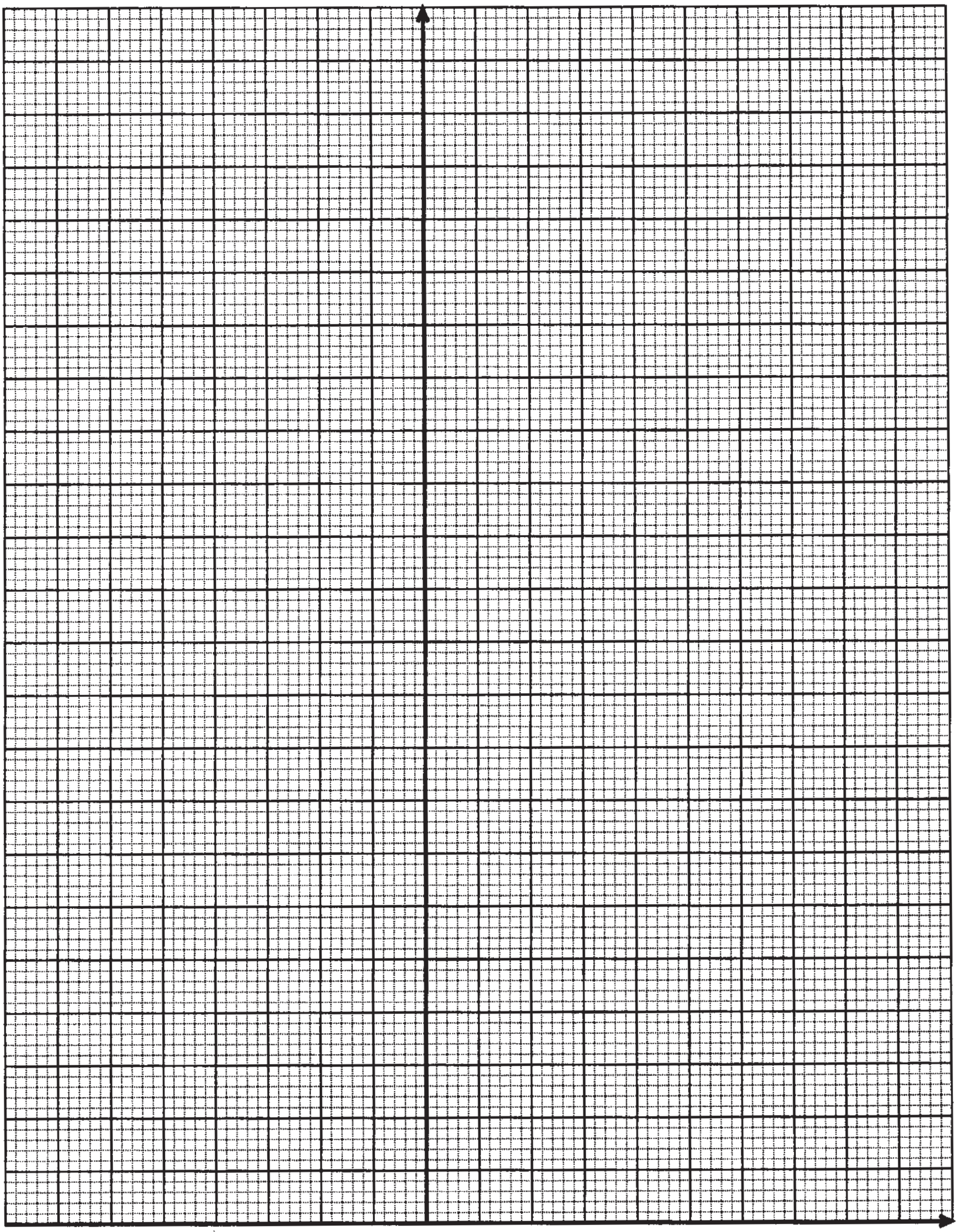
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.

3. Attempt ALL questions.

4. The use of non-programmable calculators is allowed.

5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO



Graph for Question 1

1. **No more than $\frac{1}{2}$ hour should be spent on this question.**

DATA ANALYSIS

A student investigates the relationship between the volume and temperature of a fixed mass of gas at a constant pressure of 1 atmosphere.

The results she obtained are shown in the table below.

Temperature / °C	20	50	100	150	200	250
Volume / cm^3	49.1	54.0	61.3	70.5	78.9	87.0

(a) With the aid of a diagram, describe a method that the student could have used to obtain her results.

____

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(6 marks)

(b) Plot a graph of volume, *V*, (y-axis) against temperature, *T*, (x-axis). The axes have been drawn for you. The scale for the x-axis should include the range –300 °C to +300°C, with 50 °C per division. Label the graph line of *V* against *T* "Line 1".

(9 marks)

GO ON TO THE NEXT PAGE

(c) From the graph determine V_1, the volume of the gas at $-120\ ^{\circ}C$.

(2 marks)

(d) At what temperature is the volume $2V_1$?

(2 marks)

(e) Determine the slope, S, of the graph. Include its units.

(4 marks)

(f) From your graph read off the temperature, T_O, at which the volume would be zero. Explain the significance of T_O.

(3 marks)

(g) The equation of the graph line is $V = mT + C$. Write down the values of m and C.

(2 marks)

(h) The pressure on the gas is doubled and the experiment repeated. Draw, on the same set of axes, the line that would be obtained if the experiment is repeated at this higher pressure. Label this line "Line 2".

(2 marks)

Total 30 marks

GO ON TO THE NEXT PAGE

2. (a) Explain what is meant by the terms 'velocity' and 'acceleration'.

____

____

____

____

(3 marks)

(b)

A **B** **C**

← — — — 27 m — — — → ← — — — — — — — — — 54 m — — — — — — — →

Figure 1

Figure 1 above shows a car at A moving towards C, with a constant velocity of 30 m s $^{-1}$. As the car passes A, the driver sees an obstruction in the road at C. Due to the reaction time of the driver, the car travels a distance of 27 m, at the same velocity, before the brakes are applied at B. The car now decelerates uniformly and comes to a halt at C, which is 54 m from B.

(i) Calculate the reaction time of the driver.

(2 marks)

(ii) The car takes 3.6 s to travel from B to C. In the space below, draw a velocity-time graph to represent the motion of the car between A and C.

(3 marks)

GO ON TO THE NEXT PAGE

(iii) What is the average speed of the car between B and C?

____

____

(3 marks)

(iv) If the mass of the car is 750 kg, find the braking force that slows the car between B and C.

____

____

____

____

(5 marks)

Total 16 marks

3. (a) **Figure 2** below shows a shiny kettle which is placed on a gas stove to heat the water inside it.

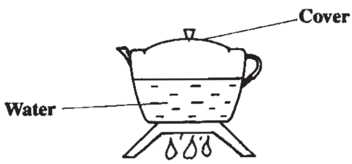

Figure 2

(i) By what process is heat transferred to the water through the kettle?

____

(1 mark)

(ii) Explain why kettles are usually shiny on the outside.

____

(1 mark)

(iii) How does the cover prevent heat losses?

____

____

(2 marks)

(b) Only about one-third of the thermal energy generated by burning the gas goes into heating the water, whilst the remainder is wasted.

State where the wasted energy goes and give the process by which this wasted heat is transferred.

____

____

(2 marks)

(c) If the mass of water in the kettle is 1.5 kg, calculate the thermal energy required to raise its temperature from 30 °C to 100 °C.

(3 marks)

(d) How much more energy must the water absorb for 0.2 kg of it to boil off?

____

____

(3 marks)

(e) Explain why it is better not to fill the kettle when making one or two cups of tea.

____

____

____

(2 marks)

(Specific heat capacity of water = 4.2×10^3 J kg^{-1} K^{-1}.
Specific latent heat of vaporization of water = 2.3×10^6 J kg^{-1}.)

Total 14 marks

GO ON TO THE NEXT PAGE

4. In the seventeenth century, two conflicting theories concerning the nature of light were put forward.

(a) State what these theories considered light to be.

Theory A

____

____

Theory B

____

____

(2 marks)

(b) **Table 1** below lists some of the properties of light.

Indicate, by ticking the relevant boxes, the properties which these theories can explain. Place an X in the box if the theory CANNOT satisfactorily explain the property.

Property	**Theory A**	**Theory B**
Travels in a straight line		
Reflection		
Conveys energy		
Diffraction		

Table 1

(4 marks)

(c) An optical fibre is a flexible glass rod of extremely small diameter which is used to carry light signals over distances of several kilometres.

Figure 3 below shows the structure of a typical optical fibre, with a glass core of refractive index, 1.50, surrounded by a glass cladding of different refractive index, n_2. Once the light enters the core, it is totally internally reflected and remains inside the fibre until it reaches the other end of the fibre. The ray of light, *AB*, in air is refracted into the core along the path, *BC*.

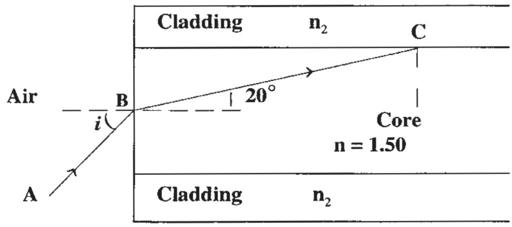

Figure 3

(i) What is meant by 'total internal reflection' at point C?

____

____

____

(2 marks)

(ii) Is the refractive index of the cladding greater or smaller than that of the core?

____

(1 mark)

(iii) Draw on **Figure 3**, the ray that shows the path of the light continuing on from *C*.

(1 mark)

(iv) Calculate the angle of incidence of the light entering the fibre.

(3 marks)

(v) Given that the speed of light in air is 3×10^8 m s^{-1}, determine the speed of light in the core of the fibre.

____

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(3 marks)

Total 16 marks

GO ON TO THE NEXT PAGE

5. (a) A negatively charged polythene strip is used to attract a small piece of insulating paper as shown in **Figure 4** below.

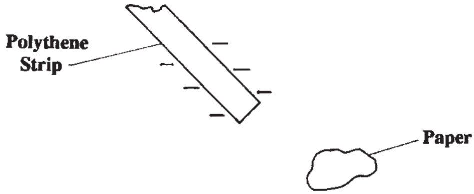


Figure 4

(i) Show, on the diagram above, the charge distribution on the paper.
(2 marks)

(ii) Explain why there is a net force of attraction.

____

____

(2 marks)

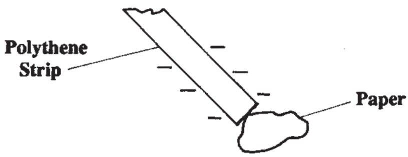


Figure 5

(iii) Draw, on **Figure 5** above, the charge distribution on the paper when it is in contact with the polythene strip. **(1 mark)**

(iv) State whether the paper gains or loses charge and the type of charge transferred, when it touches the strip.

____

____

____

(2 marks)

(b) When lightning strikes the earth, there is a massive flow of electrons from a thundercloud to the earth during a short time interval.

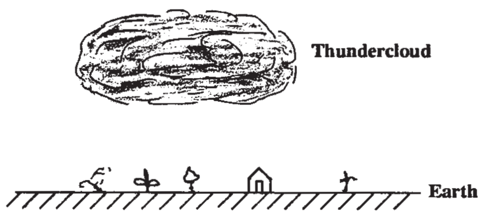


Figure 6

(i) Draw, on **Figure 6** above, electric field lines between the cloud and the earth. **(2 marks)**

(ii) Describe a precaution which may be taken to protect a building against lightning.

____

____

____

(2 marks)

(c) During a certain lightning strike, a current of 5×10^4 A flows for a time period of 0.15 ms.

Calculate the quantity of charge that flows from cloud to earth during the strike.

(3 marks)

Total 14 marks

END OF TEST

FORM TP 2007118 MAY/JUNE 2007

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03 – General Proficiency

1 hour

28 MAY 2007 (a.m.)

In addition to the 1 hour, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. Answer ANY THREE questions.
2. ALL WORKING MUST BE SHOWN in your answer booklet, since marks will be awarded for correct steps in calculations.
3. The use of non-programmable calculators is allowed.
4. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. (a) State Newton's first and second laws of motion. Use these laws to explain how a satellite remains in orbit around the earth. **(8 marks)**

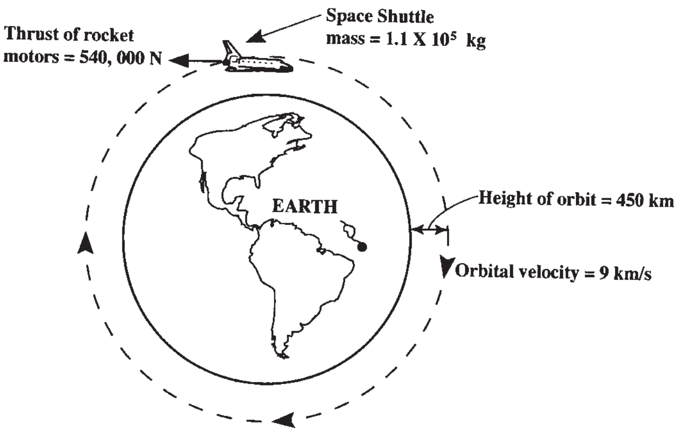


Figure 1

(b) (i) The mass of a space shuttle is 110 tonnes (1.1×10^5 kg). It orbits the earth at a height of 450 km, with a speed of 9 km s^{-1}. Calculate the kinetic energy of the shuttle in this orbit.

(ii) The shuttle also possesses gravitational potential energy. Assuming that the gravitational field strength (g) is the same at all heights up to 450 km, calculate the total energy of the shuttle as it orbits the earth at this height.

(7 marks)

(c) When the space shuttle is to return to Earth, it fires its rockets in order to slow down. The total thrust of the rocket motors is 540 000 N and the rockets are fired for 360 s.

Calculate the

(i) deceleration of the space craft while the rockets are firing

(ii) reduction in speed during the 360 s. **(5 marks)**

(g = 10 N kg^{-1})

Total 20 marks

GO ON TO THE NEXT PAGE

2. (a) Sound is a longitudinal wave that is produced by vibrating sources. Sound waves emitted from two sources are found to be vibrating in phase. Explain what is meant by the terms underlined. **(3 marks)**

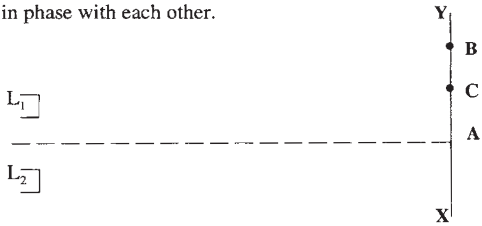
(b) (i) Pitch and loudness are terms used to describe sound. How are the frequency, wavelength and amplitude of a sound wave affected by an increase in the

a) pitch of the sound?

b) loudness of the sound?

(ii) The note, middle C, played first on a piano and then on a violin sounds different on the two instruments. The notes are said to have a different quality. Explain this observation. **(5 marks)**

(c) The diagram below shows two loudspeakers, L_1 and L_2, connected to the same source and vibrating in phase with each other.



(i) The loudspeakers produce notes of frequency 132 Hz. If the speed of sound is 330 m s^{-1}, what is the wavelength of the notes?

(ii) Consider, at any instant, a sound wave starting at L_1 and proceeding in the direction of A. Sketch a graph of displacement (of the air molecules) against position for the first 7.5 m of this wave.

(iii) A student walks along the line **XY**. At both **A** and **B** the sound is loud whereas at **C** the sound is quite faint. Explain these observations.

With the frequency of the notes still 132 Hz, the loudspeakers are moved closer together. What will be the effect on the observations at **A, B** and **C**?

(iv) The frequency of the sound is now changed to 264 Hz with the loudspeakers returned to the original positions. Will the wavelength now be larger or smaller than before? What will be the effect on the observations at **A, B** and **C**? **(12 marks)**

Total 20 marks

3. (a) Answer the following questions using the kinetic theory of matter.

(i) Explain why thermal energy has to be supplied to a liquid at its boiling point to be changed into a gas, without any change in temperature, and why the volume of the gas produced is much greater than the original volume of the liquid. State the energy change that occurs during the phase change from liquid to gas.

(ii) A gas exerts a pressure on the walls of its container. What causes this pressure? If the temperature of a gas in a container is reduced, the pressure in the container falls. Why does this occur? **(8 marks)**

(b) At standard temperature and pressure, that is, 0 °C and 1.01 x 10^5 Pa pressure, the density of oxygen is 1.43 kg m^{-3}.

Oxygen is stored in a container of volume 3.87 m^3, at a pressure of 2.02 x 10^5 Pa and at a temperature of 25 °C.

(i) What volume would the same mass of oxygen occupy at 'standard temperature and pressure'? Calculate the mass of oxygen in the container.

(ii) The container is now heated to 45 °C. What will be the new pressure? Assume the container does not expand.

(iii) Sketch a graph of pressure against KELVIN temperature for the gas. Indicate on the graph the original temperature and pressure. **(12 marks)**

Total 20 marks

4. (a) Describe the procedure used in the Geiger-Marsden experiment. State the results of the experiment and outline what these results suggested about the structure of atoms. **(8 marks)**

(b) The common isotope of sodium, Na, is stable, while the sodium isotope, with a mass number of 24, sodium-24, is radioactive. Sodium-24 decays into an isotope of magnesium (Mg) by the emission of a β–particle.

Write a nuclear equation to represent the decay of sodium-24. How many (i) neutrons and (ii) protons are in the nucleus of magnesium which is formed and how many electrons are there in a neutral atom of magnesium? **(6 marks)**

(c) A radioactive source is found to be emitting, on average, 880 particles per second. If the source has a half life of 25 minutes, how much time will elapse before the average emission rate becomes 110 per second?

Explain why the measured count rate in one second is unlikely to be exactly 110. What will be the effect on the count rate of (i) gently heating the radioactive sample and (ii) heating the sample to a very high temperature? **(6 marks)**

Total 20 marks

5. (a) Draw a diagram of a simple moving-coil loudspeaker.

Explain how a changing voltage applied to the loudspeaker results in sound being emitted from it. **(8 marks)**

(b) A loudspeaker is usually enclosed in a box to improve its efficiency of converting electrical energy into sound. The loudspeaker is then connected to the output of an amplifier. A certain loudspeaker has a resistance of 16 Ω and operates at an efficiency of 15%. It is connected to an amplifier which provides voltage of 12 V to the loudspeaker. Calculate:

(i) The current flowing in the loudspeaker

(ii) The electrical power being delivered by the amplifier

(iii) The sound energy per second being emitted. **(7 marks)**

(c) A second identical loudspeaker is now connected in parallel with the first loudspeaker across the output of the same amplifier which still provides an output voltage of 12 V. Determine:

(i) The combined resistance of the two loudspeakers

(ii) The total sound energy per second being emitted **(5 marks)**

Total 20 marks

END OF TEST

TEST CODE **01238020**

FORM TP 2008022

JANUARY 2008

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$1\frac{1}{2}$ hours

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.

2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.

3. Answer ALL questions.

4. The use of non-programmable calculators is allowed.

5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

Graph paper for Question 1.

1. A student investigating a relationship between extension and force for a spring of original length 60.0 cm obtained the results seen in Table 1 below.

TABLE 1

Mass, m/g	Force, F/N	Final length of spring, l/cm	Extension, e/cm
20.0		60.5	
40.0		61.0	
60.0		61.5	
80.0		62.0	
100.0		62.4	
120.0		63.0	

(a) Complete Table 1 by calculating the force, F, and the extension, e, of the spring. [acceleration due to gravity, $g = 10 \text{ N kg}^{-1}$] **(4 marks)**

(b) Plot a graph of Extension against Force on the graph paper on page 2. **(10 marks)**

(c) From your graph, calculate the slope, S.

(4 marks)

(d) The spring constant is related to the slope of the graph as follows.

$$\text{Spring constant} = \frac{1}{S}.$$

Calculate the spring constant.

(2 marks)

GO ON TO THE NEXT PAGE

(e) Draw a labelled diagram showing the apparatus as used in this investigation.

(5 marks)

(f) With the aid of dotted lines, use your graph to

(i) determine the force which would cause an extension of 1.8 cm

____

____

(2 marks)

(ii) estimate the extension of the spring if a force of 1.3 N is applied.

____

____

(2 marks)

(g) If the student continues to take readings, a point may be reached where proportionality no longer exists.

Name this point.

____

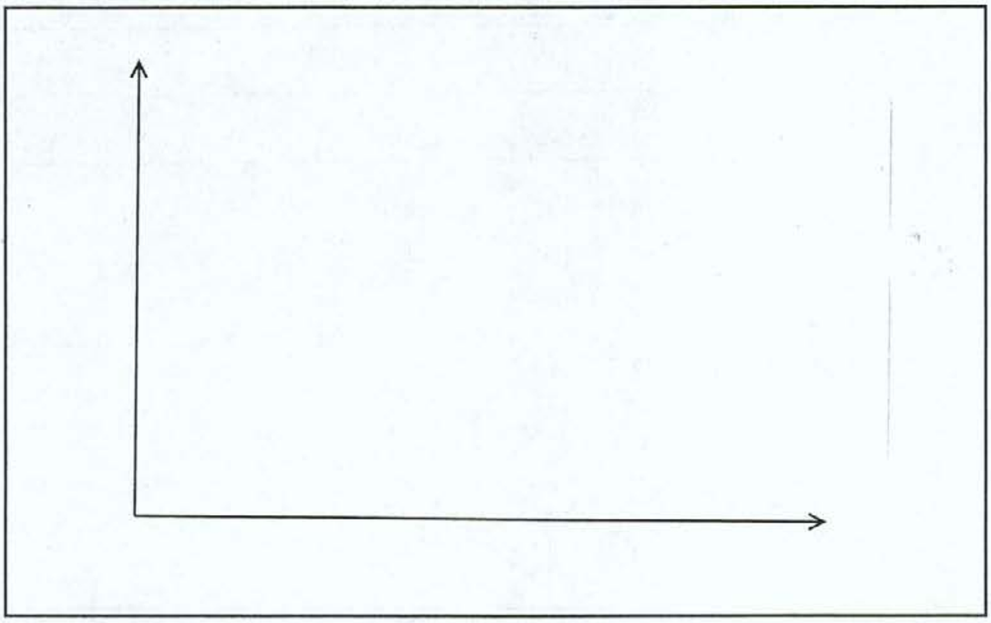
(1 mark)

Total 30 marks

2. (a) (i) State Boyle's Law.

(2 marks)

(ii) Using the axes below, sketch the linear graph you would expect to obtain from a Boyle's Law experiment.



(4 marks)

(b) A police car tyre had a fixed mass of air at a temperature of 24°C. The air pressure was 210 KPa above atmospheric pressure. After a high speed chase, the air pressure in the tyre was 260 KPa above atmospheric pressure.

(i) Apply the kinetic theory of matter to explain the increased pressure in that tyre.

(4 marks)

(ii) Determine the new temperature of the air in the tyre, assuming no change in the volume. (Atmospheric pressure = 100 KPa).

(5 marks)

Total 15 marks

3. Figure 1 shows light passing through a rectangular glass block. Important features of this arrangement are labelled A, B, C, D, E and *x*.

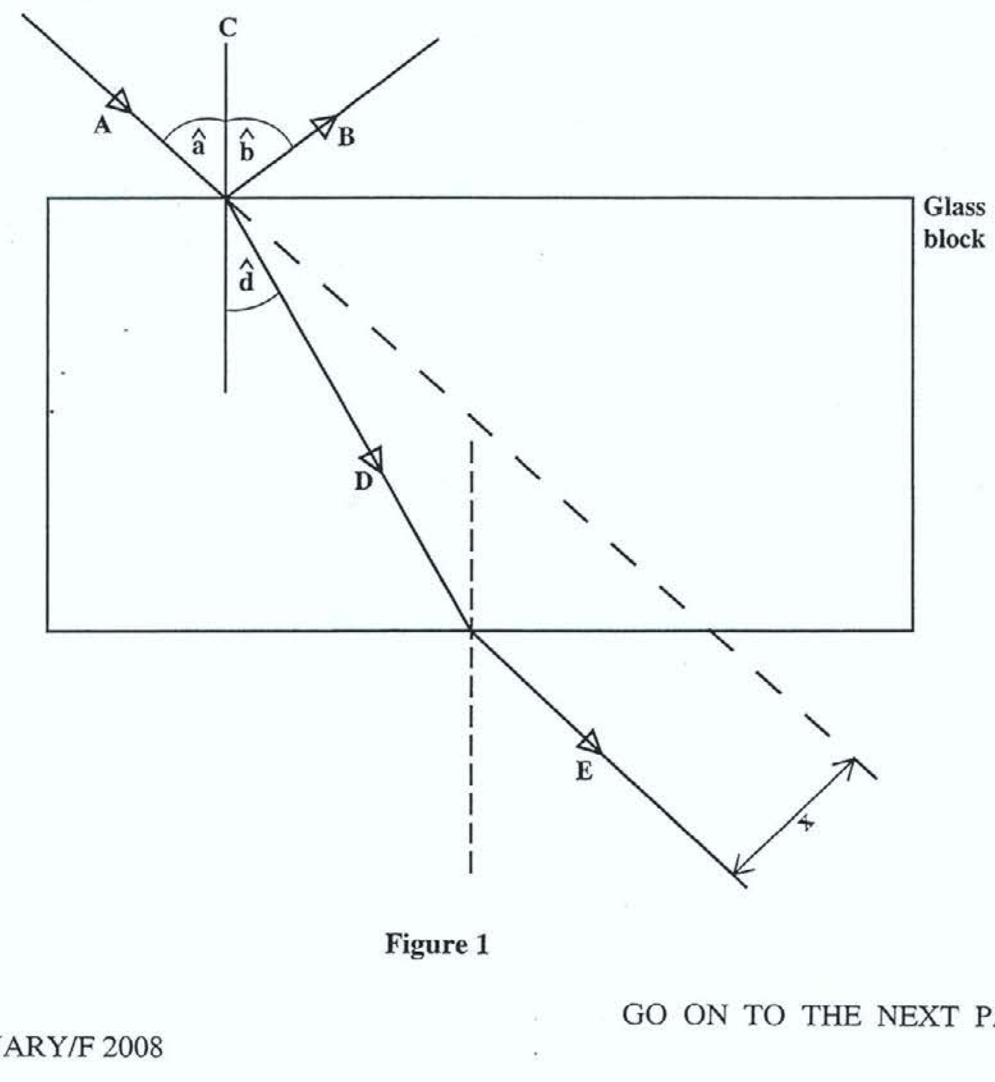


Figure 1

(a) Identify the labelled parts of Figure 1.

A ____________________________

B ____________________________

C ____________________________

D ____________________________

E ____________________________

x ____________________________

(6 marks)

(b) The refractive index of this glass block is 1.5.

(i) Determine the value of angle b ($\hat{b}$) when $\hat{a} = 60°$.

(1 mark)

(ii) State a reason for your answer in (b) (i).

(1 mark)

(iii) Calculate the value of angle d, ($\hat{d}$).

(4 marks)

(iv) Determine the value which angle d ($\hat{d}$) must exceed if E is to be totally internally reflected.

(3 marks)

Total 15 marks

4. Figure 2 represents an alternating current generator.

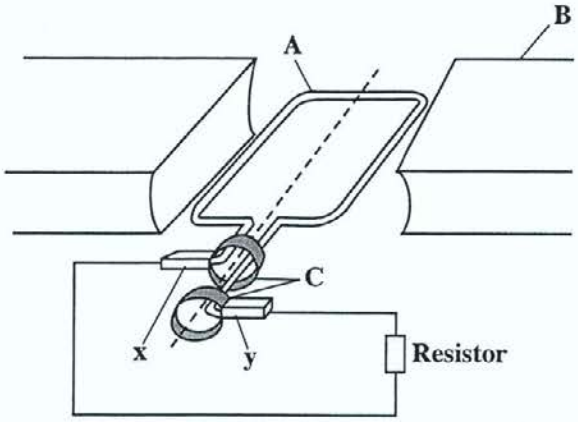


Figure 2

(a) (i) Write the name of the components labelled A, B, C and x.

A

B

C

x

(4 marks)

(ii) Explain why a voltage is obtained across the terminals x and y.

(2 marks)

GO ON TO THE NEXT PAGE

(b) The terminals x and y are connected to a 5 Ω resistor. The peak output voltage across x – y is 12 V.

(i) Calculate the peak value of the output current.

(3 marks)

(ii) The component labelled A in Figure 2 makes 10 revolutions in one second. On the grid provided, sketch a graph to represent the variation of output current with time during the first two revolutions. Indicate the SCALE used on EACH axis.

(3 marks)

(iii) The speed of rotation of component A is tripled with no other change involved. Determine the effect on

a) the period of the output current

(2 marks)

b) the peak value of the output current.

(1 mark)

Total 15 marks

5. (a) Draw circuit diagrams showing

(i) two resistors connected in series

(1 mark)

(ii) two resistors connected in parallel.

(1 mark)

(b) State ONE characteristic of resistors connected in

(i) series

____

____

(1 mark)

(ii) parallel.

____

____

(1 mark)

GO ON TO THE NEXT PAGE

(c) Figure 3 shows a circuit diagram in which devices A_1, B_1, A_2 and B_2 are connected.

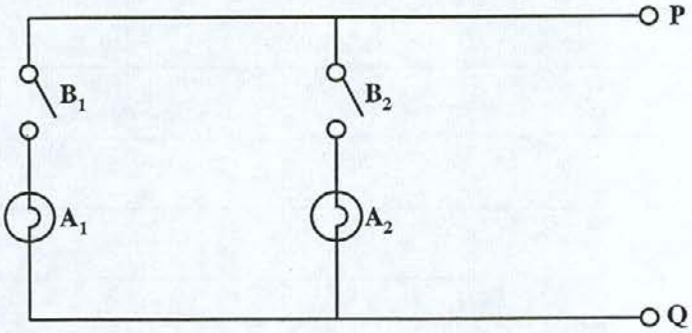


Figure 3

(i) Identify the devices labelled by the

A's ______________________

B's ______________________

(2 marks)

(ii) The devices labelled A_1 and A_2 are identical with the rating 60 W, 140 Ω. A resistance meter is connected across the terminals P and Q. Complete Table 2 showing any necessary working.

TABLE 2

Devices		Resistance Meter Reading / Ω
B_1	B_2	
open	open	
open	closed	
closed	closed	

____

____

____

____

____

(5 marks)

(d) The resistance meter is removed and a battery is connected across P and Q. What should be the voltage of the battery in order to deliver the rated power to both A_1 and A_2?
SHOW ALL YOUR WORKING.

(4 marks)

Total 15 marks

END OF TEST

DO NOT

WRITE ON

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TEST CODE **01238030**

FORM TP 2008023

JANUARY 2008

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03 – General Proficiency

1 hour

17 JANUARY 2008 (a.m.)

<u>In addition to</u> the 1 hour, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. Answer ANY THREE questions.
2. ALL WORKING MUST BE SHOWN in your answer booklet, since marks will be awarded for correct steps in calculations.
3. The use of non-programmable calculators is allowed.
4. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. (a) Draw a clear labelled diagram of a U-tube manometer and describe how it may be used for measuring the excess pressure of a gas above atmospheric pressure. **(8 marks)**

(b) Some farmers and gardeners use a pressurized sprayer to apply pesticide to their crops or plants.

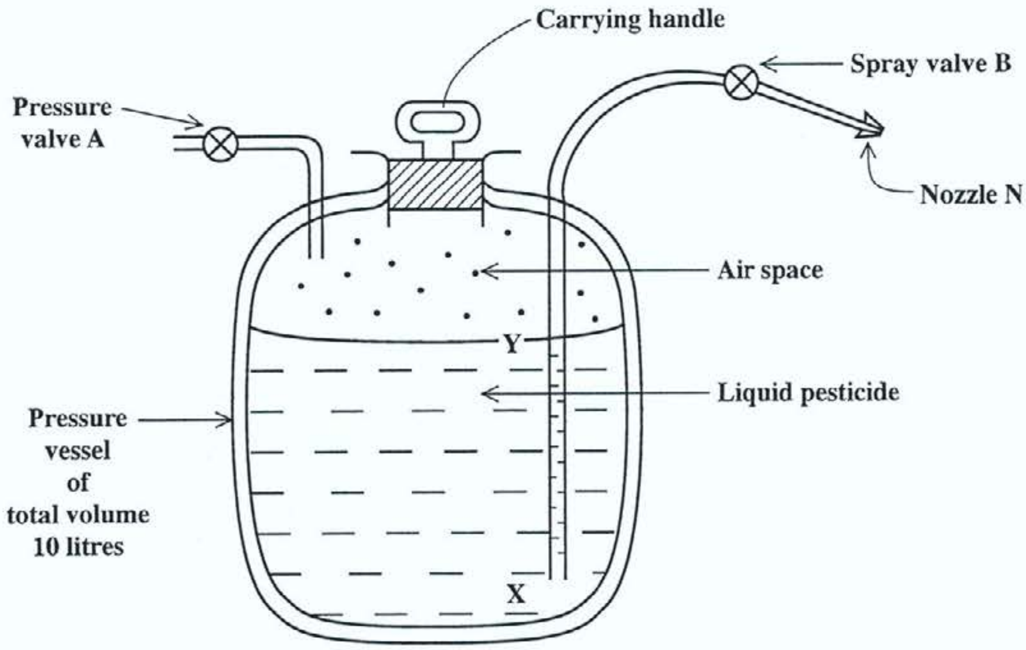


Figure 1

Figure 1 shows such a sprayer, consisting of a pressure vessel of volume 10 litres, containing 8 litres of liquid pesticide. Valve B is first closed. The space above the liquid is filled with air at a pressure of 200 KPa, pumped in with a hand pump through open valve A until the desired pressure is reached. Valve A is then closed.

(i) The sprayer is operated by opening valve B thereby causing the liquid pesticide to squirt out of nozzle N. Explain why this occurs by considering the forces acting on the liquid column X – Y. Hence predict the condition under which liquid will NOT squirt out of the nozzle when valve B is opened.

(ii) The sprayer is used for a certain period of time during which the liquid level falls and the pressure above the liquid is reduced.

Calculate the volume of pesticide which would still remain in the tank when air pressure above the liquid is 150 KPa if all temperatures remain constant.

[Assume all pressure differences due to hydrostatic pressure of liquid to be negligible; i.e. pressure at upper surface of liquid = pressure at bottom of tank.]

[Atmospheric pressure = 100 KPa]

(12 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

2. (a) Name TWO methods of heat transfer and describe THREE characteristics of EACH method identified. **(8 marks)**

(b) Figure 2 shows the curved reflecting surface of a solar cooker which focusses sunlight onto a pot containing food. The area of the reflecting surface is $0.75\ m^2$ and the solar power incident on it is $800\ Wm^{-2}$. Only 76% of the energy incident on the curved surface is reflected towards the pot.

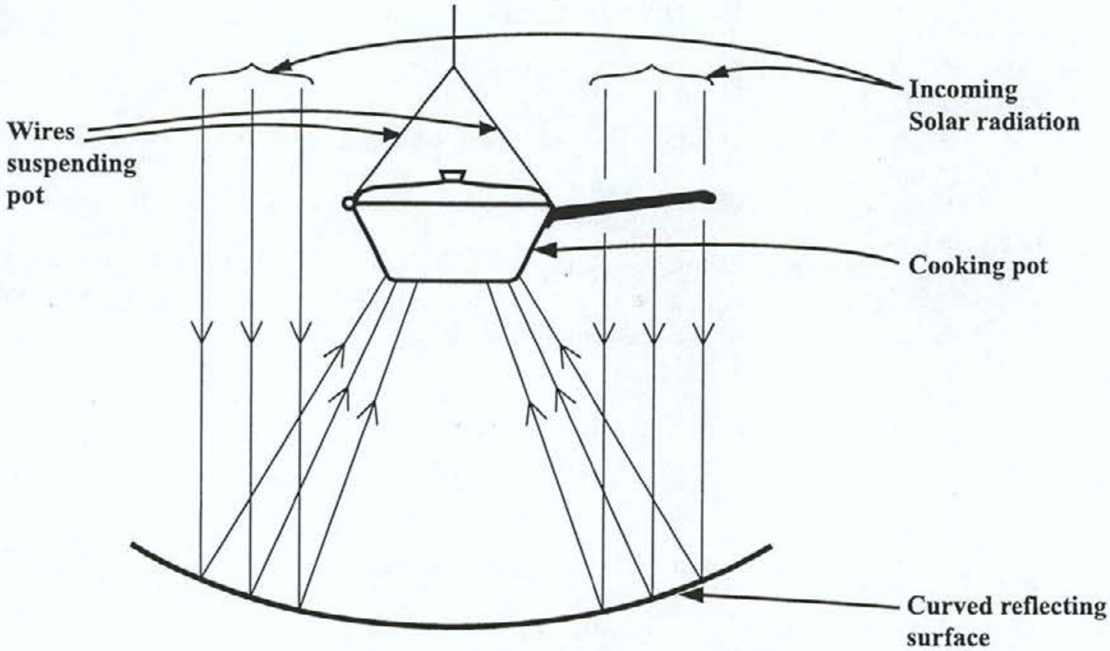


Figure 2

Calculate

(i) the energy arriving at the curved surface each second

(ii) the total energy reflected towards the pot in one hour

(iii) the energy absorbed by the pot and its contents if this energy is just enough to raise their temperature by 70° C

[Heat capacity of pot and food $= 8500\ J\ K^{-1}$]

(iv) the efficiency of the solar cooker. **(12 marks)**

Total 20 marks

3. (a) You are making a presentation to your class on the image formed by a converging lens acting as a magnifying glass.

(i) Draw a labelled diagram to show the following clearly:

a) The principal axis

b) The principal focus

c) The focal length

d) The image formed

(ii) Is the image formed in this situation real or virtual? **(5 marks)**

(b) Identify THREE differences between a real image and a virtual image. **(3 marks)**

(c) A stamp collector views a stamp of height 2.0 cm with a hand lens placed 1.5 cm from the stamp. The distance of the image from the lens is 5.0 cm. The object distance, u, image distance, v, and focal length, f, of a lens are related by

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}.$$

Calculate

(i) the height of the image of the stamp

(ii) the magnification of the lens used

(iii) the focal length of the lens

(iv) the position of the image formed if the object distance was doubled.

(12 marks)

Total 20 marks

4. (a) (i) Electrical energy is used in many appliances in the home. The fan, television set and fluorescent lamps are three such appliances. In EACH case, name the MAJOR form of energy into which electrical energy is converted.

(ii) Describe FOUR ways by which electrical energy can be conserved in the home.

(8 marks)

(b) Mr Williams approached Melissa, a physics student, to confirm whether his monthly electrical bill of \$320.00 was reasonable. The appliances in his house and usage are as follows:

Number	Electrical Device	Estimated Usage
8	100 W bulbs	210 hours
1	125 W Colour Television	120 hours
1	1100 W Microwave oven	300 minutes

(i) Calculate the total number of units of energy consumed by Mr Williams' appliances.

(ii) Calculate the total electricity bill if \$1.60 is the cost per unit.

(iii) What should Melissa tell Mr Williams about the correctness of his bill?

(iv) You are provided with 1 A, 5 A, and 10 A fuses. Select an APPROPRIATE fuse for the microwave oven given a 120 V electricity supply.

(12 marks)

Total 20 marks

5. (a) Explain what is meant by the term 'radioactive decay'. **(2 marks)**

(b) State the name and nature of THREE types of radioactive emissions. **(6 marks)**

(c) During a nuclear fission reaction, the uranium isotope, $^{235}_{92}U$ is struck by a neutron and splits into barium (Ba), krypton (Kr) and two neutrons.

Table 1 gives the masses of the particles involved in the nuclear reaction.

TABLE 1

Particles	**Mass/Kg**
Neutron	1.675×10^{-27}
Uranium nucleus	390.989×10^{-27}
Barium	238.893×10^{-27}
Krypton	149.241×10^{-27}

[The speed of light, $c = 3.0 \times 10^8$ m s^{-1}].

(i) Represent this reaction in the standard form of a nuclear equation, given that the atomic mass of barium is 144 and the atomic number of krypton is 36.

(ii) Calculate

a) the total mass of the starting products: uranium nucleus and the neutron

b) the total mass of the final reaction products: the barium and krypton nuclei and the two neutrons.

(iii) Explain why the answers to (c) (ii) a) and (c) (ii) b) are different.

(iv) Calculate the energy released in this reaction and deduce the form in which this energy will appear.

(12 marks)

Total 20 marks

END OF TEST

TEST CODE **01238042**

FORM TP 2008024

JANUARY 2008

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 04/2 – General Proficiency

ALTERNATIVE TO SBA

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Answer ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. A Physics teacher told one of her gifted students that it is possible to determine the density of an object without knowing its volume. He immediately set about investigating the problem theoretically and produced a formula for finding the density in the way described.

His formula was :

$$\frac{W_a}{W_w} = \frac{S}{S-1} \qquad \text{------- (Y)}$$

where W_a = weight of object in air

W_w = weight of object when immersed in water

$$S = \frac{\rho}{\rho_w} \qquad \text{------- (Z)}$$

ρ_w = density of water

ρ = unknown density of object

Figure 1 shows diagrammatic representations of measurements taken in an experiment to test the validity of this formula.

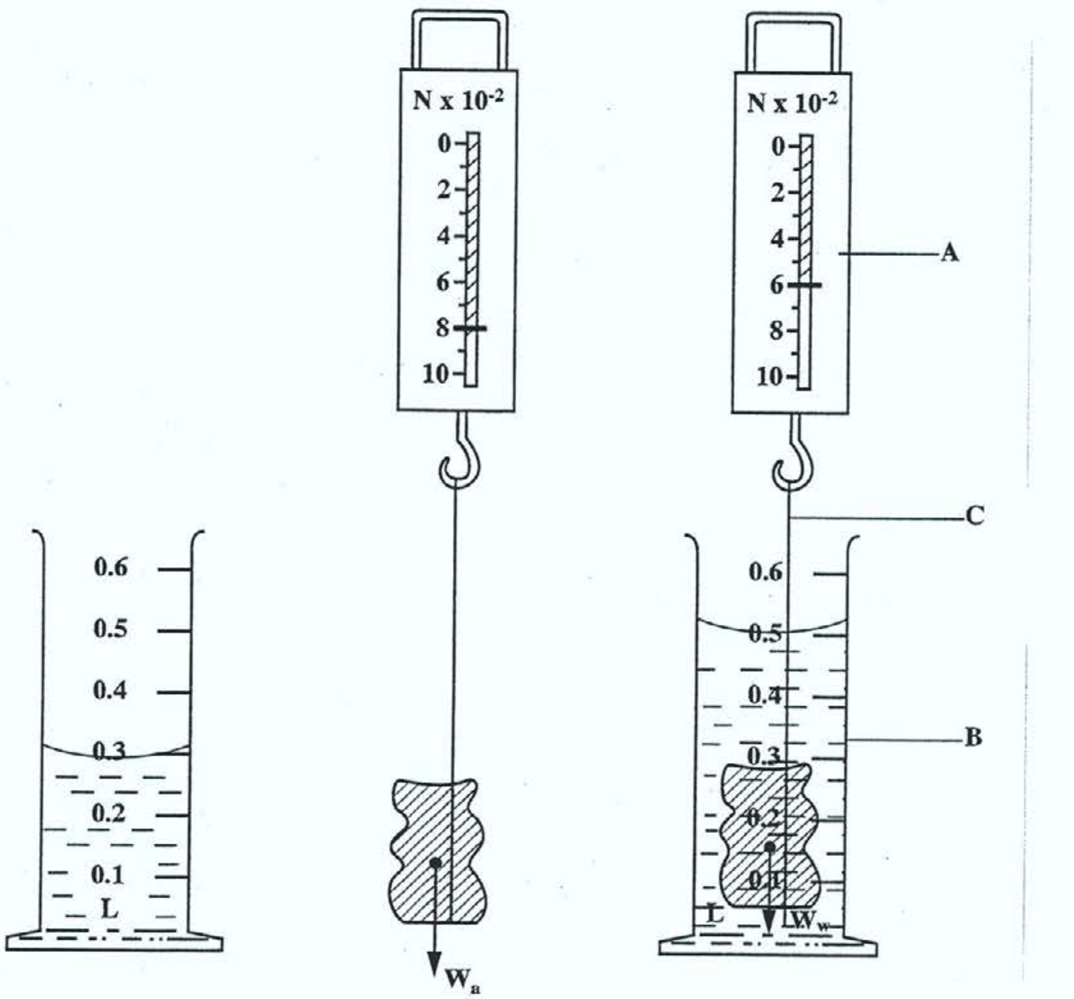


Figure 1

(a) Identify the items of apparatus labelled A, B, C.

A ______________________________

B ______________________________

C ______________________________

(3 marks)

(b) (i) What is W_a, the weight of the object in air?

____

(1 mark)

(ii) What is W_w, the weight of the object in water?

____

(1 mark)

(iii) What is V the volume of the object being investigated?

____

(1 mark)

(c) (i) Calculate S from the formula Y.

(2 marks)

(ii) Calculate ρ from the equation Z.

(2 marks)

(d) Use data from (b) to calculate ρ, the density of the object.

(4 marks)

(e) (i) Compare the values of ρ calculated in (c) (ii) and (d).

(1 mark)

(ii) Write down your conclusion about the validity of the student's formula.

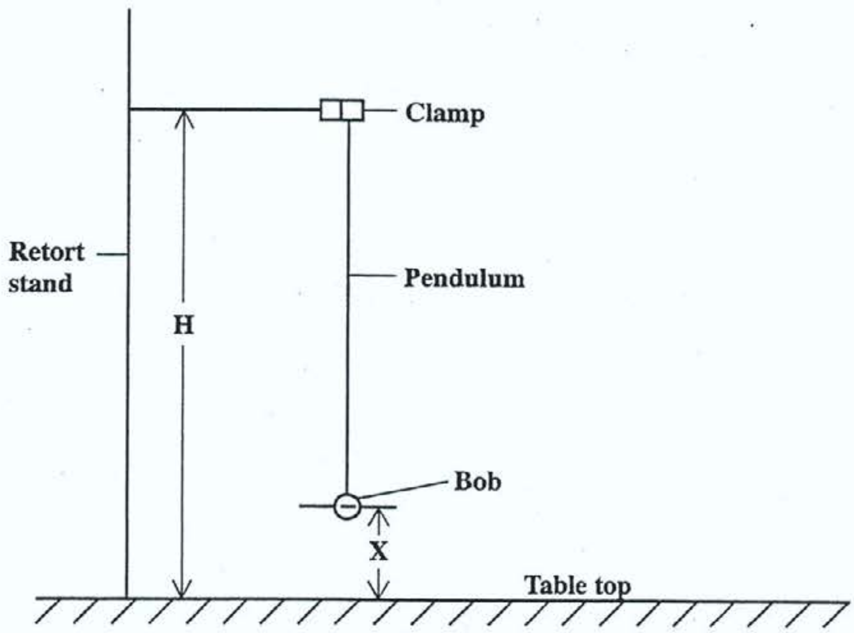
(1 mark)

Total 16 marks

NOTHING HAS BEEN OMITTED

2. In an experiment to determine the acceleration due to gravity, the experimental set up in the diagram below was used.

The pendulum was supported at a height H, above the table top, and X was the vertical distance between the middle of the bob and the table top.



At first, the pendulum was set up such that X = 0.200 m.

The time, t_{25}, taken for 25 oscillations was recorded. Further readings of t_{25} were taken as X was varied. The results are shown in Table 1.

Table 1

Distance, X/m	Time for 25 oscillations, t_{25}/s	Time for 1 oscillation, T/s	Time squared, T^2/s^2
0.2	58.0		
0.4	51.5		
0.6	48.1		
0.8	41.5		
1.0	35.4		

(a) Complete Table 1. **(4 marks)**

(b) Plot a graph of T^2/s^2 (y-axis) against X/m (x-axis) on page 7. **(8 marks)**

GO ON TO THE NEXT PAGE

(c) Determine the gradient of the graph, N.

(4 marks)

(d) Ignoring the negative sign of N,
calculate the value of the acceleration due to gravity, g, using

$$g = \frac{40}{N}$$

(2 marks)

(e) If the intercept on the T^2 axis is $\frac{40\ H}{g}$, determine the value of H.

(2 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

3. Many years ago, a Tanzanian high school student claimed to have discovered that hot water freezes faster than cold water. His claim was greeted with ridicule at the time but in recent years his discovery has been accepted by eminent scientists. The phenomenon is now named in his honour – the Mpemba Effect.

You are required to carry out an experiment to test the validity of the Mpemba Effect for several samples of hot (i.e. at elevated temperatures of your choice) and cold (at room temperature and below) water. Your answer should include:

(a) A list of the apparatus you would need.

(b) A description of the procedure you plan to use.

(c) A sample of the kind of observations you expect to make.

(d) An account of how you would use your observations to verify or disprove the validity of the Mpemba Effect.

a) Apparatus

____

____

____

(4 marks)

b) Procedure

____

____

____

____

____

____

____

____

____

____

(5 marks)

c) Observations

(2 marks)

d) Conclusion

(1 mark)

Total 12 marks

END OF TEST

DO NOT

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TEST CODE **01238020**

FORM TP 2008112

MAY/JUNE 2008

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$2\frac{1}{2}$ hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in the answer booklet provided.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.
6. Mathematical tables may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

GO ON TO THE NEXT PAGE

SECTION A

Answer ALL questions.
You MUST write your answers in the spaces provided in this booklet.

1. In the experimental setup shown in Figure 1, a variable a.c. voltage source, V_1, drives the primary of a step down transformer of turns ratio 5000 : 600. A resistor, $R = 8\ \Omega$, is connected across the secondary winding.

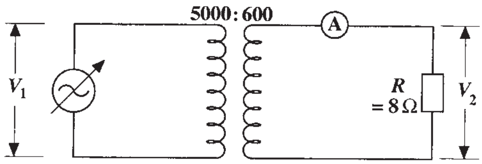


Figure 1

Table 1 shows the values obtained for V_2 when V_1 is varied from 0 V to 90 V.

Table 1

V_1 / V	0	15	30	45	60	75	90
V_2 / V	0	2.0	4.7	7.1	8.6	11	14

(a) Use the readings from Table 1 to plot a graph of V_2 vs V_1 on the graph page opposite.

(6 marks)

(b) Find the slope, S, of your graph.

____

____

____

____

____

(4 marks)

(c) What does the slope of your graph represent?

____

(1 mark)

(d) Use your graph to determine the value of V_2 when $V_1 = 50$ V.

____

(1 mark)

(e) Calculate the current I_2 in the secondary windings when $V_1 = 50$ V

(3 marks)

(f) Use the slope of your graph and the equation

$$I_1 = SI_2$$

to determine the current I_1 in the primary winding.

____

____

____

(2 marks)

GO ON TO THE NEXT PAGE

(g) (i) Calculate the power delivered to the resistor, R, by the secondary windings.

(3 marks)

(ii) Calculate, also, the power input to the primary windings by the source.

(1 mark)

(h) (i) State TWO **major** sources of energy loss in transformers.

____

____

(2 marks)

(ii) Describe the constructional features of commercial transformers which minimize the losses stated in Part (h) (i).

____

____

(2 marks)

Total 25 marks

2. (a) Table 2 is an incomplete table showing the quantity to be measured, the instrument used to measure the quantity and its S.I. unit.

Complete Table 2 by writing in the missing information.

Table 2

Quantity to be measured	**Instrument**	**S.I. Unit**
Volume of a liquid		
	Clinical thermometer	
		Newton
Time	Stop clock	

(7 marks)

(b) A swimming pool 30 metres long is filled with water to a depth of 1 metre at the shallow end and 5 metres at the deep end (see Figure 2 not drawn to scale).

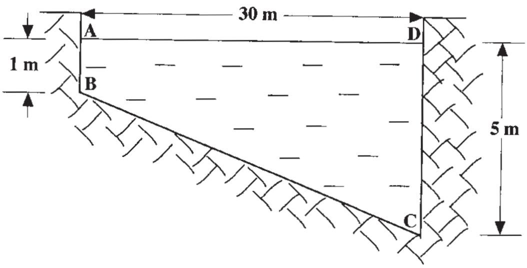


Figure 2

(i) ABCD the vertical cross-section through the pool has the shape of a trapezium with area given by:

Area ABCD $= \frac{1}{2}(AB + CD) \times AD$

Calculate the area ABCD.

(2 marks)

GO ON TO THE NEXT PAGE

(ii) Determine the volume of water in the pool, given that it is 20 metres wide.

____

____

____

(3 marks)

(iii) Calculate the mass of water in the pool.

[density of water = 1000 kg m^{-3}] **(3 marks)**

Total 15 marks

3. (a) The THREE MAIN particles in an atom are:

A. ____

B. ____

C. ____

(3 marks)

(b) The corresponding location of EACH of these particles is:

A. ____

B. ____

C. ____

(3 marks)

(c) The particle with NO charge is called

____

(1 mark)

GO ON TO THE NEXT PAGE

(d) How many half-lives would it take for a sample of Carbon–14 to be reduced to $\frac{1}{32}$ of its original mass?

(2 marks)

(e) Given that Carbon–14 has a half-life of 5700 years, determine how long it would take for this reduction to occur.

(2 marks)

(f) Carbon dating involves the use of Carbon–14 to determine the age of ancient objects. Explain how this is accomplished.

(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Answer ALL questions.
You MUST write your answers in the answer booklet provided.

4. (a) (i) Define the 'moment of a force'.

(ii) Draw a diagram to illustrate the action of a force multiplier lever.

(iii) Explain the operation of a force multiplier lever. **(6 marks)**

(b) Figure 3 shows a wheelbarrow and stones with a total mass of 43 kg. The wheelbarrow is in equilibrium with two of the three forces acting on it shown in Figure 3.

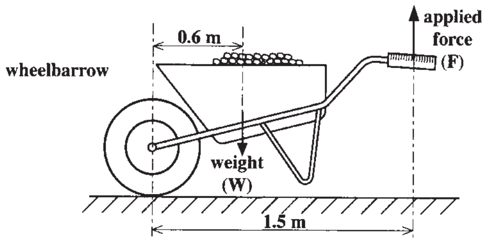


Figure 3

(i) Identify the nature and point of action of the third force acting on the wheelbarrow. Write down an equation showing the relationship between the THREE forces.

(ii) Calculate

a) the weight, W (see Figure 3)

b) the value of the applied force, F (see Figure 3).

[acceleration due to gravity, g = 10 ms^{-2}]

(9 marks)

Total 15 marks

5. (a) Describe an experiment to verify Snell's law. State the apparatus used, your method, and the results you would take to arrive at your conclusion. **(6 marks)**

(b) Figure 4 shows a ray of light, XY, incident on a right-angled prism, PQR, of refractive index 1.5. The point of incidence on PR is such that the refracted ray inside the prism is incident on PQ.

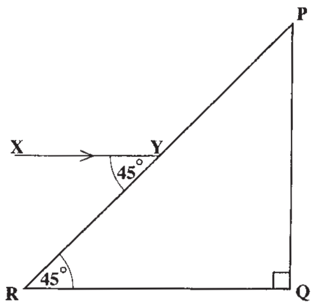


Figure 4

(i) Calculate the angle of refraction at the boundary, PR.

(ii) Given that the critical angle for the glass-air boundary, PQ, is 41.8°, deduce whether or not there would be total internal reflection at this boundary.

(9 marks)

Total 15 marks

6. (a) The method of mixtures is used to determine the specific heat capacity of liquids and solids by experiment. Describe the procedure, the measurements to be taken and the use of these measurements to obtain the result in such an experiment. **(6 marks)**

(b) It is recommended that in order to maintain good health a person should drink at least 4×10^{-3} m^3 [4 kg] of water per day. Assume that this entire volume of water, initially at 15°C, is eventually excreted as urine at 37°C.

Find the amount of heat removed each day by the quantity of urine.

[Assume the specific heat capacity of urine = specific heat capacity of water = 4200 J kg^{-1} K^{-1}, density of urine = density of water = 1000 kg m^{-3}] **(6 marks)**

(c) What mass of perspiration would remove the same quantity of heat as the urine in Part (b), when completely evaporated from the skin?

Assume that evaporation is equivalent to a change of phase from liquid to vapour without an increase in temperature.

[Specific latent heat of vapourisation of water = 2.3×10^6 J kg^{-1}]

(3 marks)

Total 15 marks

END OF TEST

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE

SPECIMEN PAPER
MULTIPLE CHOICE QUESTIONS FOR

PHYSICS

READ THE FOLLOWING DIRECTIONS CAREFULLY

Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.

Sample Item

The SI unit of length is the

(A) newton
(B) metre
(C) kilogram
(D) second

Sample Answer

Ⓐ ● Ⓒ Ⓓ

The best answer to this item is "metre" so answer space (B) has been shaded.

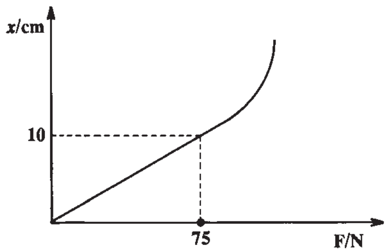
1. 2 μm means

(A) 2×10^{6} m
(B) 2×10^{3} m
(C) 2×10^{-3} m
(D) 2×10^{-6} m

2. 1 gram is equal to

(A) 10 milligrams
(B) 100 milligrams
(C) 1 000 milligrams
(D) 10 000 milligrams

3. The diagram below shows a simple force (F)/ extension (w) graph for a light spring.



Which of the following statements would be true?

I. The elastic limit of the spring was exceeded.
II. The spring obeyed Hooke's law over its entire extension.
III. The force per unit extension in the elastic region was 7.5 N cm^{-1}.

(A) I only
(B) I and III only
(C) II and III only
(D) I, II and III

4. Which of the following measurements has THREE SIGNIFICANT figures?

(A) 0.0293 kg
(B) 0.94 A
(C) 5.321 V
(D) 10.42 m

5. The periodic time of a simple pendulum can be increased by

(A) increasing the length of the cord
(B) decreasing the length of the cord
(C) increasing the mass of the bob
(D) decreasing the amplitude of oscillation

6. The relative density of brass is 8.4. Which of the following is the BEST statement that can be made?

(A) Brass is heavier than water.
(B) Water is heavier than brass.
(C) 100 cm^3 of brass is heavier than 100 cm^3 of water.
(D) 100 cm^3 of water is heavier than 100 cm^3 of brass.

7. A falling raindrop reaches a constant speed when

(A) there is no net force acting on it
(B) the pull of the earth on the raindrop is equal to the weight of the raindrop
(C) the upthrust due to the air is at a minimum
(D) the air surrounding the raindrop becomes saturated with water vapour

GO ON TO THE NEXT PAGE

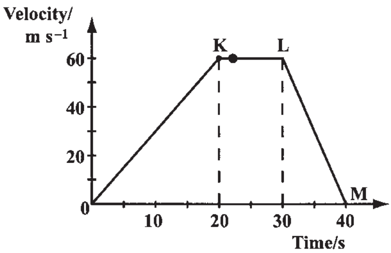
8. A stable well designed racing car must have a

(A) low centre of gravity
(B) narrow wheel base
(C) sun roof
(D) long front

9. *"When body A exerts a force on body B, body B exerts an equal and opposite force on body A."* This principle is attributable to which of the following scientists?

(A) Aristotle
(B) Einstein
(C) Galileo
(D) Newton

Item **10** refers to the following graph which shows the journey made by a motorist.



10. When is the velocity constant?

(A) Between O and K
(B) Between K and L
(C) Between L and M
(D) Between O and M

11. Two smooth spheres, A and B, collide head on. Which of the following statements is/are true?

I. The momentum of A is the same after collision as it was before.
II. The momentum of B is the same after collision as it was before.
III. The total momentum of A and B is the same after collision as it was before.

(A) I only
(B) III only
(C) II and III only
(D) I, II and III

12. If the resultant force on an object is zero, the object will move with

(A) decreasing velocity
(B) constant velocity
(C) constant acceleration
(D) increasing velocity

13. A ball attached to a string is whirled round at a constant speed in a horizontal circle. It is true to say that

(A) the velocity is constant
(B) there are no forces acting on the body
(C) the motion is accelerated
(D) if the string breaks the ball drops vertically downwards

14. Which of the following is a scalar quantity?

(A) Energy
(B) Acceleration
(C) Velocity
(D) Weight

15. An object is removed from the ground and placed on a shelf. Which of its properties would you expect to change?

(A) Mass
(B) Volume
(C) Potential energy
(D) Kinetic energy

16. Coal is sometimes burnt in order to drive steam engines. Which of the following is the sequence of energy changes involved in this activity?

(A) Chemical $\rightarrow$ kinetic $\rightarrow$ electrical
(B) Chemical $\rightarrow$ heat $\rightarrow$ kinetic
(C) Kinetic $\rightarrow$ electrical $\rightarrow$ chemical
(D) Chemical $\rightarrow$ kinetic $\rightarrow$ heat

17. What is the gain in gravitational potential energy of a body of weight 2 000 N as it rises from a height of 20 m to a height of 25 m above the earth's surface?

(A) 400 J
(B) 1 000 J
(C) 10 000 J
(D) 20 000 J

18. A balloon when filled with hydrogen gas and released will accelerate upwards. The balloon must therefore have displaced a weight of air

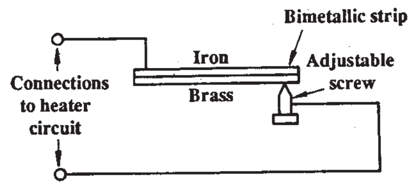
(A) less than its own weight
(B) equal to its own weight
(C) greater than its own weight
(D) equal to the weight of the basket and fabric only

19. Which of the following implements is/are designed to take advantage of a large moment provided by a relatively small force?

I. Claw hammer
II. Crowbar
III. Pair of tweezers
IV. Pair of wire cutters

(A) III only
(B) I and IV only
(C) I, II and III only
(D) I, II and IV only

20. The diagram below shows the thermostat in an electric oven.



Brass expands more than iron when heated. To cut off the current at a higher temperature it would be necessary to

(A) adjust the screw so that it is higher than shown
(B) adjust the screw so that it is lower than shown
(C) raise the bimetallic strip
(D) increase the current in the heater circuit

21. A light bulb is filled with a gas at a temperature of 293 K. If the initial pressure of the gas is P, what will it be when the temperature increases to 360 K?

(A) $\frac{293}{360} \times P$

(B) $\frac{360}{293} \times P$

(C) $\frac{293}{360} \times \frac{1}{P}$

(D) $\frac{360}{293} \times \frac{1}{P}$

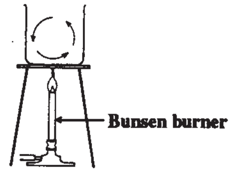
22. Which of the following would explain why an ordinary 0 – 110°C laboratory thermometer is not used to measure human body temperature?

I. The reading would change when the thermometer is taken from the patient's mouth.
II. It is not sensitive enough to measure small changes in temperature.
III. It does not have a large enough range.

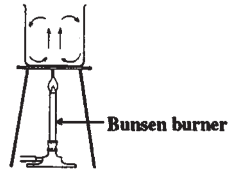
(A) I only
(B) I and II only
(C) II and III only
(D) I, II and III

23. Which of the following diagrams BEST illustrates convection current in a liquid?

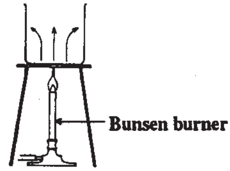
(A)



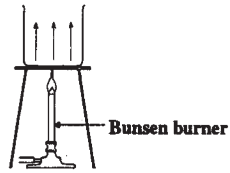
(B)



(C)



(D)



24. Which of the following statements about heat radiation is NOT true?

(A) Radiation is the transfer of heat by electromagnetic waves.
(B) A shiny surface is a better emitter of radiation than a dull black surface.
(C) Radiation can occur through a vacuum.
(D) Solar heat panels on houses are painted black to absorb more thermal radiation.

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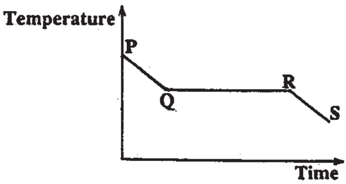
25. The graph below, arising from an experiment on change of phase, shows that solidification started at Q.



During which of the stages is the substance in the liquid phase?

(A) At P only
(B) Between Q and R
(C) Between R and S
(D) Between P and Q

26. When smoke in a cell is viewed with bright illumination under a microscope, bright specks are seen moving in an irregular jerky manner. The MAIN conclusion that we can draw from this observation is that

(A) smoke particles move when illuminated
(B) air molecules are moving about randomly
(C) air molecules can be seen under a microscope
(D) smoke particles have more energy than air molecules

27. Which of the following is true of evaporation?

(A) It occurs throughout the liquid at no definite temperature.
(B) It occurs at the surface of the liquid at no definite temperature.
(C) It occurs at the surface of the liquid at a definite temperature.
(D) It occurs throughout the liquid at a definite temperature.

28. In an experiment designed to investigate the relationship between the volume and pressure of a gas at constant temperature, the pressure is increased step by step. Before reading the new volume of the gas after each pressure increase, it is advisable to wait a minute or two to allow

(A) the pressure to equalize throughout the gas
(B) the volume change to be completed
(C) for changes in atmospheric pressure
(D) the temperature of the gas to return to room temperature

29. Which of the following statements about waves is NOT correct?

(A) The amplitude is the distance between maximum and minimum displacements.
(B) The wavelength is the distance the wave travels in one cycle.
(C) The period is the time taken to go through one cycle.
(D) The frequency of a wave is the number of cycles it describes in one second.

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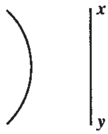
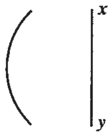
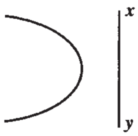
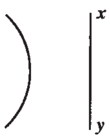
30. The circular wave front shown above is progressing towards the reflecting surface *xy*.

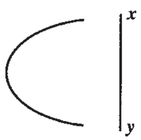


Which of the diagrams below correctly shows the shape of the wavefront after reflection?

(A) 

(B) 

(C) 

(D) 

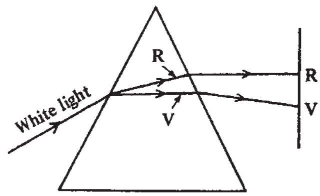
31. A normal human ear can detect frequencies in a range of about

(A) 10 Hz to 20 Hz
(B) 10 Hz to 100 Hz
(C) 20 Hz to 20 kHz
(D) 20 Hz to 100 kHz

32. If sounds of differing frequencies are played on a piano, in which of the following would a change be detected?

(A) Loudness
(B) Speed
(C) Pitch
(D) Wavelength

33. The diagram below shows a ray of white light being dispersed by a prism to form a visible spectrum.



Which of the following makes this possible.

I. The colour violet has the shorter wavelength, hence refracts more than colour red.
II. The colour red has the longer wavelength, hence refracts less than colour violet.
III. The colour violet has the longer wavelength, hence refracts more than colour red.
IV. The colour red has the shorter wavelength, hence refracts more than colour violet.

(A) I and II only
(B) I and IV only
(C) II and III only
(D) III and IV only

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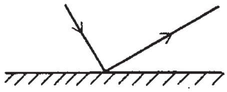
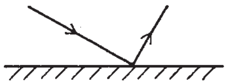
34. Which of the following diagrams MOST clearly shows the path of a ray of light when it strikes a plane mirror?

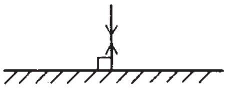
(A)



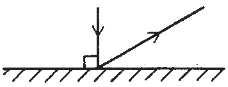
(B)



(C)



(D)

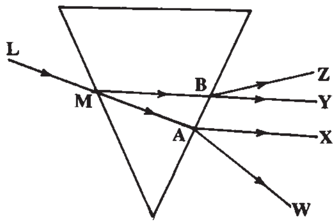


35. Which of the following would be true of the image of an object placed at the bottom of a tank of water and viewed vertically from above?

I. It is virtual.
II. It is diminished.
III. It is nearer to the eye than the object.

(A) IV only
(B) I and II only
(C) I and III only
(D) II and III only

36. A ray of light, LM, is incident on one side of a glass prism as shown in the diagram below.



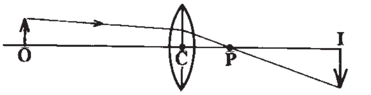
The light emerges on the other side along the path

(A) AW
(B) AX
(C) BY
(D) BZ

37. Which of the following does NOT apply to sound waves?

(A) They can travel fast in a vacuum.
(B) They can be diffracted.
(C) They transmit energy.
(D) They are propagated by a series of compressions and rarefractions.

Item 38 refers to the following diagram which shows an object, O, which forms an image, I, when placed in front of a converging lens. OI is the principal axis of the lens. The path of one ray from the object is shown going to the image.



38. The magnification produced by the lens above can be found from the ratio

(A) $\frac{OC}{IC}$

(B) $\frac{IC}{OC}$

(C) $\frac{IP}{OP}$

(D) $\frac{IP}{PC}$

39. Total internal reflection in glass occurs when

(A) the angle of incidence is 90°
(B) the incident ray is perpendicular to the glass boundary
(C) the critical angle is exceeded
(D) all the light is transmitted

40. Which TWO of the following statements about insulators are true?

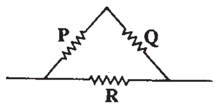
I. In an insulator all electrons are bound firmly to their atoms.
II. In an insulator many electrons can move freely from atom to atom.
III. An insulator cannot be charged by rubbing.
IV. A good insulator retains the charge better than a conductor.

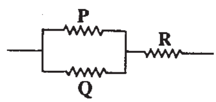
(A) I only
(B) I and II only
(C) II and III only
(D) I, II and III

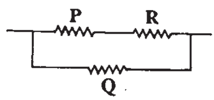
41. Which of the following is true of a secondary cell?

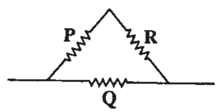
(A) It is formed by connecting two or more primary cells.
(B) It can be recharged by passing a direct current in the same direction as it delivers current.
(C) It can be recharged by passing a direct current in the opposite direction to which it delivers current.
(D) It can be recharged by 'topping up' with dilute sulphuric acid.

42. In which of the following diagrams are resistors P and Q in series with each other and parallel with R?

(A)


(B)


(C)


(D)


43. The BEST material for the core of an electromagnet is

(A) aluminium
(B) wood
(C) steel
(D) iron

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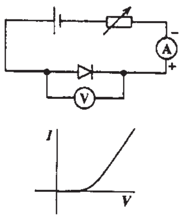
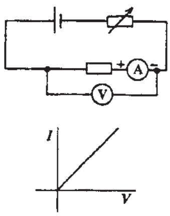
44. Which of the following graphs could have been obtained from measurements made using the circuits associated with the graph(s)?

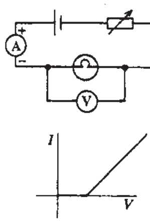
I



II



III

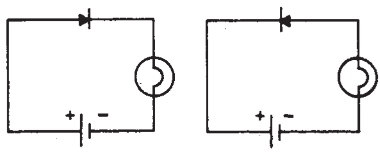


(A) I only
(B) I and II only
(C) I and III only
(D) I, II and III

45. Which of the following statements concerning voltmeters is correct?

	Resistance of a voltmeter	**How it is connected to the component**
(A)	Low	in parallel
(B)	High	in parallel
(C)	Low	in series
(D)	High	in series

46. A simple experiment was conducted using the circuit diagrams shown below.



The same components were used and the bulb was lit to normal brightness in each case.

Which of the following statements would be correct?

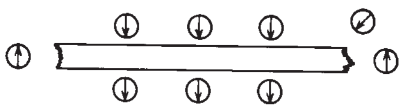
I. The bulb is defective.
II. The battery is defective.
III. The diode is defective.

(A) I only
(B) III only
(C) I and II only
(D) II and III only

47. Which of the following pairs of statements is true for BOTH iron and steel?

	Iron is	Steel
(A)	easily magnetised	does not retain magnetism
(B)	not easily magnetised	retains its magnetism well
(C)	easily magnetised	retains its magnetism well
(D)	not easily magnetised	does not retain its magnetism

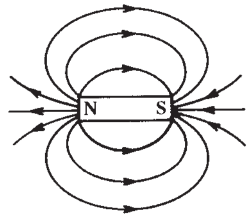
48. In the diagram below, a piece of rubber magnet from a refrigerator is surrounded by plotting compasses.



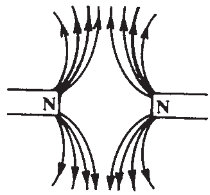
The rubber magnet has

(A) poles at the ends
(B) poles at the centre
(C) poles at the sides
(D) no poles

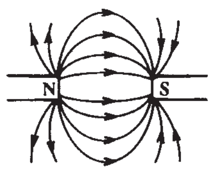
49. The diagrams below show the magnetic field lines plotted by a student.



I



II

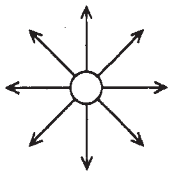


III

Which of the following are correct?

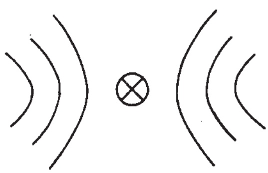
(A) I and II only
(B) I and III only
(C) II and III only
(D) I, II and III only

50. Which of the following shows the shape of the magnetic field around a straight conductor perpendicular to the page and carrying current INTO the page?

(A) 

(B) 

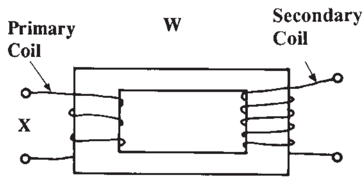
(C) 

(D) 

51. An electromagnet consists of insulated wire wrapped around an iron core. It works because

(A) iron is a good electrical conductor
(B) a magnetic field is produced inside the coil
(C) an electric field is produced inside the coil
(D) iron is always magnetised

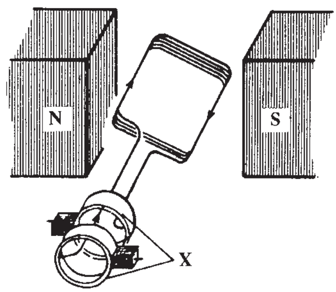
Item 52 refers to the following diagram.



Appropriate labels for W and X would be

	W	X
(A)	step-down transformer	a.c. input
(B)	step-down transformer	d.c. input
(C)	step-up transformer	a.c. input
(D)	step-up transformer	d.c. input

Items 53 - 54 refer to the following diagram.



53. Which of the following does the diagram above represent?

(A) An a.c. generator
(B) A d.c. generator
(C) A voltmeter
(D) An ammeter

54. The parts labelled X in the diagram are known as the

(A) brushes
(B) commutator
(C) armature
(D) coil

55. The atom of an element $^{7}_{3}Li$ has

(A) 3 protons, 4 neutrons, 3 electrons
(B) 4 protons, 3 neutrons, 7 electrons
(C) 4 protons, 3 neutrons, 3 electrons
(D) 3 protons, 4 neutrons, 7 electrons

56. Which of the following is true for the relative charges on the neutron, proton and the electron?

	Relative charge on Neutron	Relative charge on proton	Relative charge on electron
(A)	0	+1	-1
(B)	+1	0	-1
(C)	+1	-1	0
(D)	0	+1	0

---

57. Which of the following is an isotope of $^{12}_{6}X$?

(A) $^{6}_{3}X$

(B) $^{13}_{6}X$

(C) $^{12}_{10}X$

(D) $^{3}_{1}X$

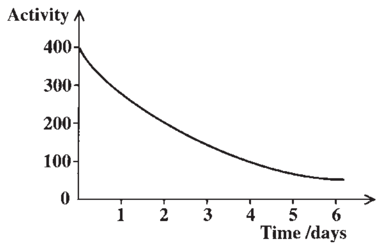
58. Which of the following electromagnetic radiations is produced only by a change in a nucleus?

(A) Ultra-violet radiation
(B) Infra-red radiation
(C) Gamma radiation
(D) Radio-waves

59. An alpha particle is

(A) a high speed electron
(B) a positive electron
(C) high frequency electromagnetic radiation
(D) a helium nucleus

60. The activity of a radioactive substance was measured at suitable intervals over a period of days and its radioactive decay curve plotted.



The half life is

(A) 1 day
(B) 2 days
(C) 3 days
(D) 4 days

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

SPECIMEN PAPER 2008

Item No.	Key
1	D
2	C
3	B
4	A
5	A
6	C
7	A
8	A
9	D
10	B
11	B
12	B
13	C
14	A
15	C
16	B
17	C
18	C
19	D
20	A
21	B
22	B
23	B
24	B
25	D
26	B
27	B
28	D
29	A
30	A

Item No.	Key
31	C
32	C
33	A
34	C
35	C
36	D
37	A
38	B
39	C
40	A
41	C
42	A
43	D
44	B
45	B
46	B
47	C
48	C
49	D
50	C
51	B
52	C
53	A
54	B
55	A
56	A
57	B
58	C
59	D
60	B

TEST CODE **01238020**

FORM TP 2009020

JANUARY 2009

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet. The answer for EACH question must be written in the space allocated at the end of the question.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.
6. Mathematical tables may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. A student conducted an experiment to determine how the pressure in a liquid varies with depth, see Figure 1.

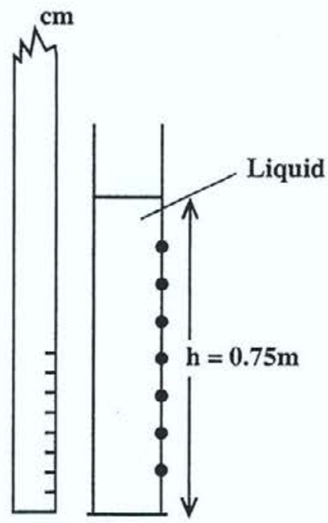


Figure 1

The student obtained the following results as shown in Table 1.

TABLE 1

Change in Pressure, ΔP/Pa	Change in Depth, Δh/m
1210	0.10
1890	0.20
2900	0.30
4300	0.40
4750	0.50
6920	0.70

(a) On the grid provided on page 3, plot the graph of ΔP against Δh. **(8 marks)**

(b) (i) Write an equation linking liquid pressure, density and depth.

____

(2 marks)

(ii) Calculate the slope, S, of the graph.

(5 marks)

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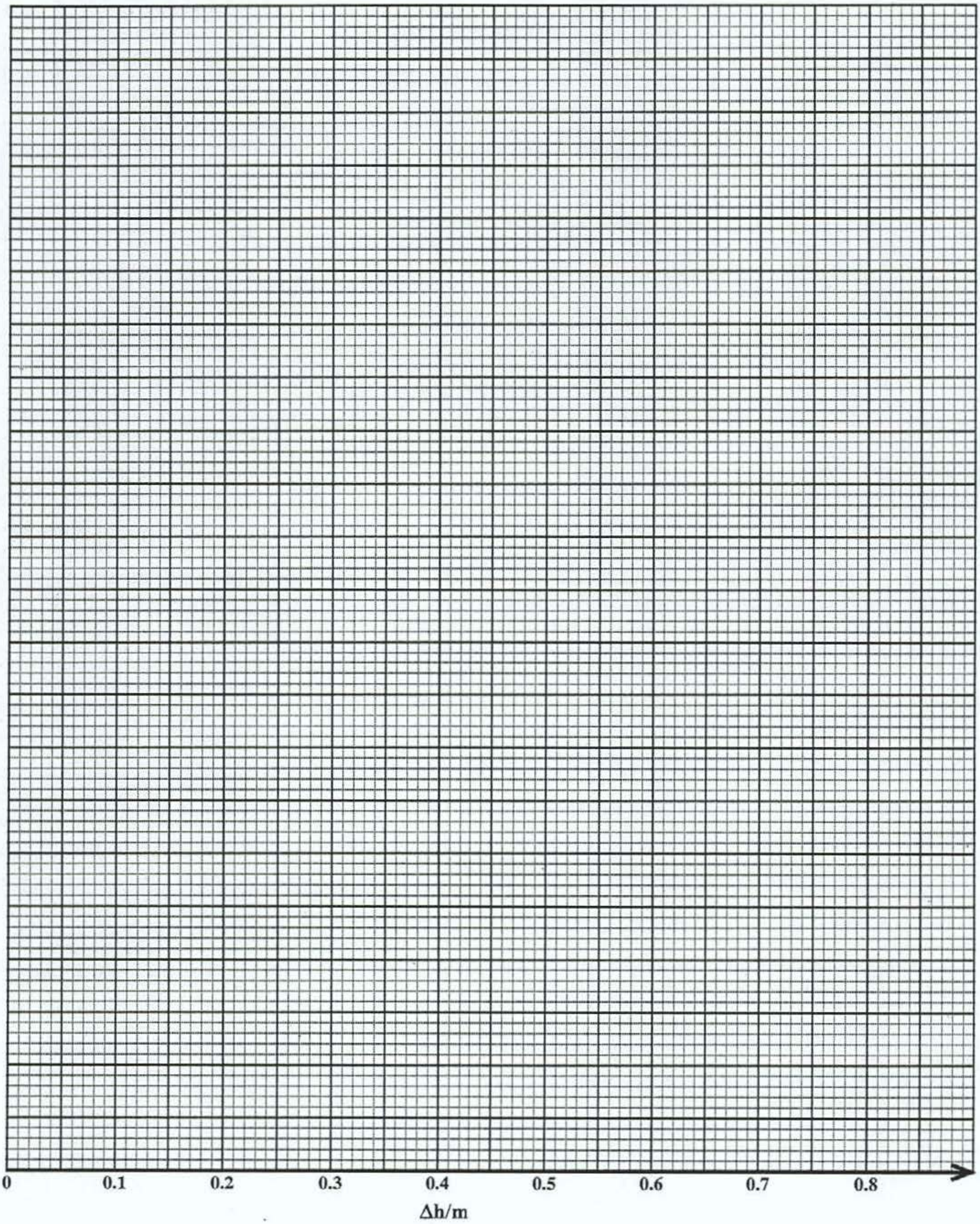

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(iii) Table 2 shows three liquids and their densities. Determine which of these liquids was used in the experiment.

TABLE 2

Liquid	Density/kg m^{-3}
Petrol	800
Water	1 000
Mercury	13 600

(4 marks)

(c) Using the graph you plotted on page 3, find the TOTAL pressure exerted on the base of the container in Figure 1.

(2 marks)

(Gravitational field strength, g = 10 Nkg^{-1})

(Atmospheric pressure = 1.03×10^5 Pa)

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(d) The diagram in Figure 2 shows a manometer being used to measure the pressure of the gas in a container.

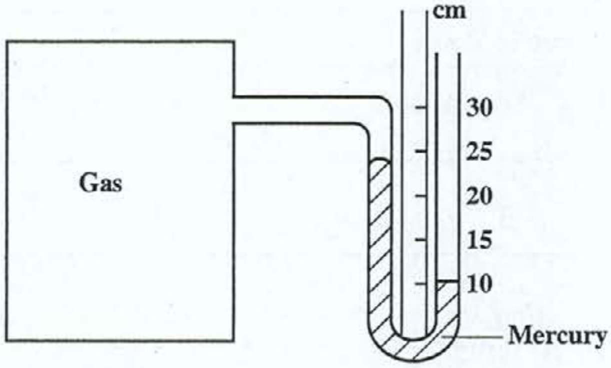

Figure 2

(i) State, giving a reason, if the pressure of the gas is LESS than or GREATER than atmospheric pressure.

____

____

(2 marks)

(ii) Calculate the EXCESS pressure in mm Hg.

(2 marks)

Total 25 marks

2. (a) Complete Table 3 below to show the link between an electromagnetic wave, its source and its use or effect.

TABLE 3

Electromagnetic Wave	**Source**	**Use or Effect**
Visible light		Photosynthesis
Microwaves		
		Cancer treatment
		Sunburn

(7 marks)

(b) Microwaves travel at a speed of 3.0×10^8 m s^{-1} in a vacuum and have a frequency of 1.5×10^{10} Hz. Calculate the wavelength of microwaves, in centimetres.

(4 marks)

(c) As the microwaves enter water at an angle of incidence of 45°, their speed is reduced to 2.0×10^8 m s^{-1}. Calculate the wavelength of the microwaves in water.

(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

3. (a) (i) Define the 'lower fixed point' on the Celsius scale.

____

____

(**2 marks)**

(ii) A changing temperature can cause the physical properties of a substance to vary.

Complete Table 4 by listing TWO other types of thermometers and the physical property which varies in EACH of the three thermometers.

TABLE 4

Thermometer	**Physical Property**
1 Thermocouple	
2	
3	

(**5 marks)**

(b) The temperature at the top of a popular waterfall is 22.0 °C. The temperature at its base, 210 m lower, is 22.5 °C.

(i) Calculate the specific heat capacity of the water.

[Acceleration due to gravity, $g = 10.0 \text{ m s}^{-2}$]

(**3 marks)**

(ii) If the waterfall was twice as tall, determine by how much the water temperature would change from its initial value.

(**2 marks)**

(c) A gas of volume 60.0 cm^3 and initial pressure 2.0×10^5 Pa has its pressure reduced to 1.6×10^5 Pa. If the temperature remains constant, what is the final volume of this gas?

(**3 marks)**

Total 15 marks

NOTHING HAS BEEN OMITTED.

SECTION B

Attempt ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) With the aid of a labelled diagram, describe an experiment to show that the angle of incidence is equal to the angle of reflection. **(6 marks)**

(b) Figure 3 below shows a ray of light entering a rectangular glass block ABCD of refractive index 1.5. The angle of incidence is 60°.

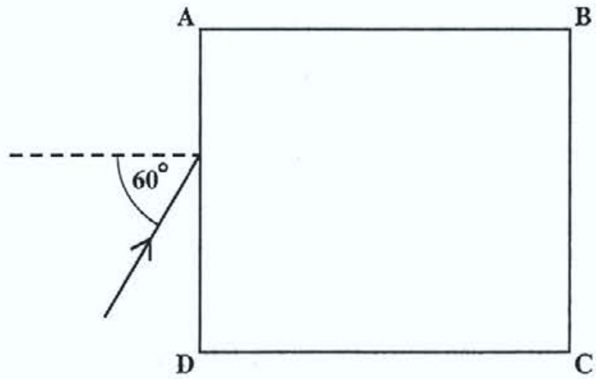

Figure 3

(i) Calculate the angle of refraction at the AD boundary.

(ii) What is the value of the angle of emergence at the BC boundary?

(iii) If the critical angle for glass is 42°, describe what would happen to the ray if its angle of incidence on boundary BC was 42.5°.

(iv) State the reason for your conclusion at (iii) above.

(9 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

Write your answer to Question 4 here.

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) Explain the meaning of EACH of the following terms:

(i) Atomic number

(ii) Mass number

(iii) Neutron number **(3 marks)**

(b) With reference to the symbol ${}^{A}_{Z}X$, write the formula that links the neutron number to the atomic number and the mass number. **(1 mark)**

(c) (i) Describe the relationship between the shell model of the atom and the periodic table.

(ii) Explain the meaning of the term 'isotope'. **(2 marks)**

(d) One gram of a living plant containing Carbon-14, decays at about 16 disintegrations per minute. It is found that one gram of a dead plant decays at 1 disintegration per minute. The half-life of Carbon-14 is about 5500 years. Calculate the probable age of the plant. **(5 marks)**

(e) Radioactive Lead decays in three stages to form stable Lead.

Stage I $\quad {}^{212}_{82}Pb \rightarrow {}^{212}_{83}Bi$

Stage II $\quad {}^{212}_{83}Bi \rightarrow {}^{212}_{84}Po$

Stage III $\quad {}^{212}_{84}Po \rightarrow {}^{208}_{82}Pb$

(i) Copy the three stages above and complete EACH equation.

(ii) Explain why lead is used when handling radioisotopes. **(4 marks)**

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

Write your answer to Question 5 here.

6. Figure 4 shows an ideal transformer being used to step down a 220V a.c. supply, in order to operate a low-voltage lamp.

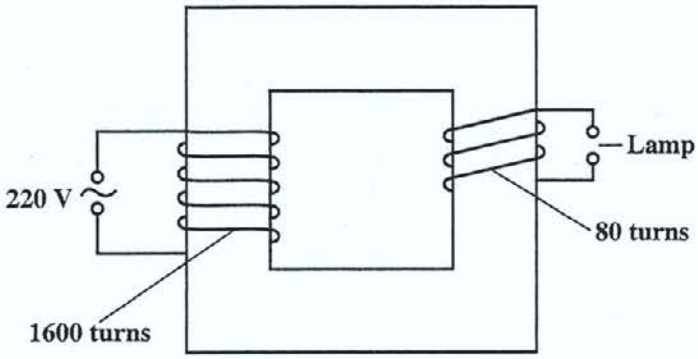

Figure 4

(a) Explain the principles involved in the workings of the transformer, and how it is able to step down the input voltage. **(5 marks)**

(b) A lamp is connected to the secondary coil of the transformer by long leads which have a resistance of 2.5 Ω. The power input to the primary coil is 44 W.

Calculate

(i) the voltage across the secondary coil of the transformer

(ii) the current in the secondary coil of the transformer

(iii) the electrical power dissipated in the lamp. **(9 marks)**

(c) High voltages are used to transmit electrical energy over long distances through long-distance cables. State an advantage of using high voltages. **(1 mark)**

Total 15 marks

Write your answer to Question 6 here.

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Write your answer to Question 6 here.

END OF TEST

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TEST CODE **01238032**

FORM TP 2009021

JANUARY 2009

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03/2 – General Proficiency

Alternative to SBA

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

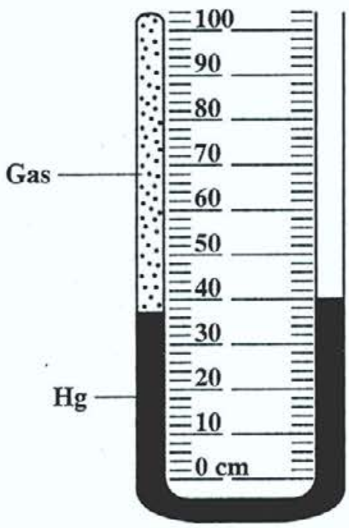
READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

1. In an effort to verify Boyle's Law, a student reads a manometer containing a fixed mass of trapped gas. She carefully adds a little mercury to the manometer before taking each new set of readings. Precautions are taken to ensure that the apparatus remains at a constant temperature. The atmospheric pressure was previously determined to be $P_A = 76$ centimetres of mercury (cm Hg).

(a) Record in Table 1 on page 3 the height of trapped gas in Frame 2 to Frame 4.



Frame 1

Frame 2

Frame 3

Frame 4

TABLE 1

FRAME	Top of gas reading/cm	Bottom of gas reading/cm	Height of gas h / cm
1	104	37	67
2	104		
3	104		
4	104		

(3 marks)

(b) State at LEAST ONE precaution taken when reading the manometer.

____

____

____

(1 mark)

(c) Complete Table 2 by calculating the volume, $V = \pi \left[\frac{d^2}{4}\right] h$, of the trapped gas given that the internal diameter, d, of the manometer is 4.3 cm.

TABLE 2

FRAME	Volume of gas V/cm^3
1	970
2	
3	
4	

(3 marks)

(d) By reading off the mercury heights on the two sides of EACH manometer to calculate Δh, complete Table 3.

TABLE 3

FRAME	Right side reading/cm	Left side reading/cm	Δh / cm
1	40	37	
2			
3			
4			

(7 marks)

(e) Use Δh as a measure of the excess pressure ΔP in cm Hg. Calculate the pressure of the gas, P_G.

TABLE 4

FRAME	P_A/cm Hg	ΔP / cm Hg	P_G / cm Hg
1	76	3	79
2	76		
3	76		
4	76		

(3 marks)

(f) Calculate P_G x V for EACH frame and complete Table 5.

TABLE 5

FRAME	P_G x V / cm^4Hg
1	
2	
3	
4	

(4 marks)

(g) Do the values calculated in Part (f) verify or refute Boyle's law for the gas? Explain your response.

____

____

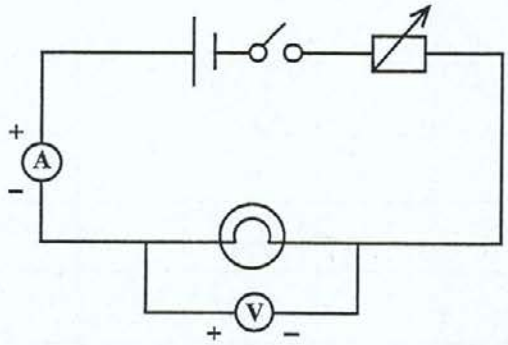
____

(2 marks)

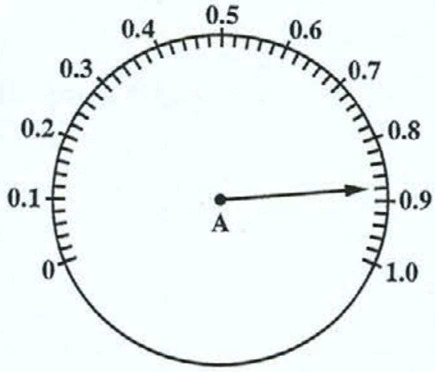
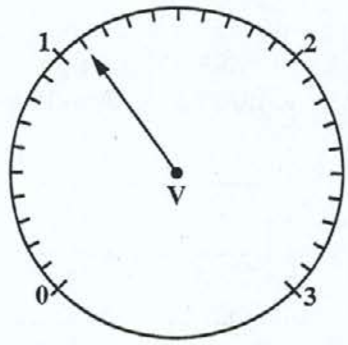
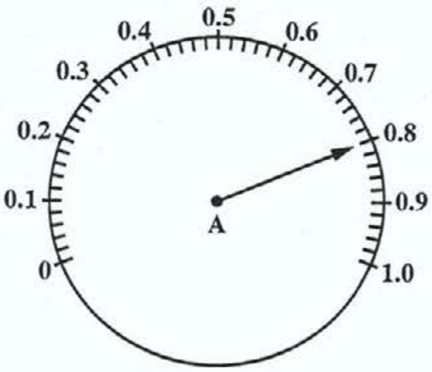
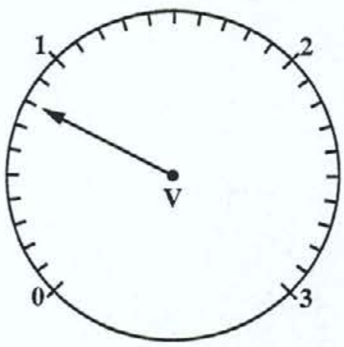
Total 23 marks

2. As a School-Based Assessment task in Physics, students were asked to investigate the relationship between current and potential difference for a filament lamp.

A student used the following circuit.



The readings for current and potential difference were as follows:

Reading Number	**Current I / A**	**Potential Difference V / V**
1		
2		

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(a) Complete Table 6 by recording the appropriate current and potential difference values for EACH reading number.

TABLE 6

Reading Number	Current I / A	Potential Difference V / V
1		
2		
3	0.70	0.60
4	0.65	0.50
5	0.48	0.30

(4 marks)

(b) Plot on page 7, the graph of current, I/A, versus potential difference, V/V.

(8 marks)

(c) From this activity, describe the relationship between the current and potential difference for a filament lamp.

____

____

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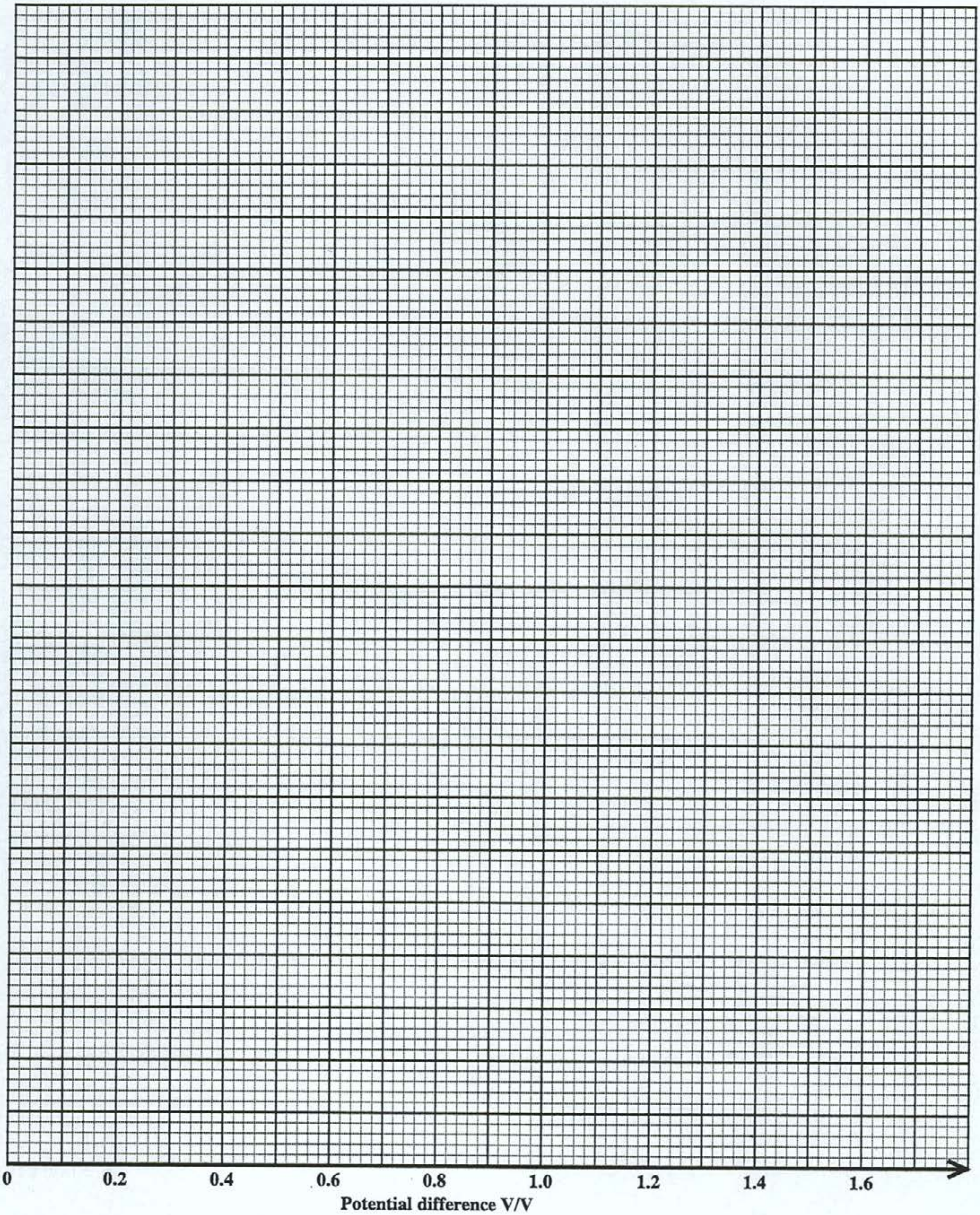
(1 mark)

Total 13 marks



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3. A fifth form Physics student, Shaquille, wanted to convince his younger brother that rubber bands do in fact obey Hooke's law and they extend in proportion to the applied force when stretched.

Describe **clearly**, an experiment Shaquille could perform to convince his brother.

Include in your answer:

(a) Apparatus list

____

____

____

____

(4 marks)

(b) A description of the procedure

____

____

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____

____

(4 marks)

(c) Observations to be made

____

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(3 marks)

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TEST CODE **01238020**

FORM TP 2009104

MAY/JUNE 2009

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$2\frac{1}{2}$ hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in the space provided after EACH question in this answer booklet.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.
6. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A

Answer ALL questions.

You MUST write your answers in the spaces provided in this booklet.

1. In determining the half-life of an alpha-emitting radioactive source, a student recorded the following data in Table 1.

TABLE 1

Time, t/s	Count rate, R/s^{-1}
0	100
50	76
100	62
150	47
200	37
250	29

(a) Plot on page 3, a graph of count rate (R) versus time (t). **(7 marks)**

(b) What is meant by the 'half-life' of a radioactive sample?

____

____

(1 mark)

(c) Describe the procedure a student would use to obtain the results in Table 1. State ONE precaution.

____

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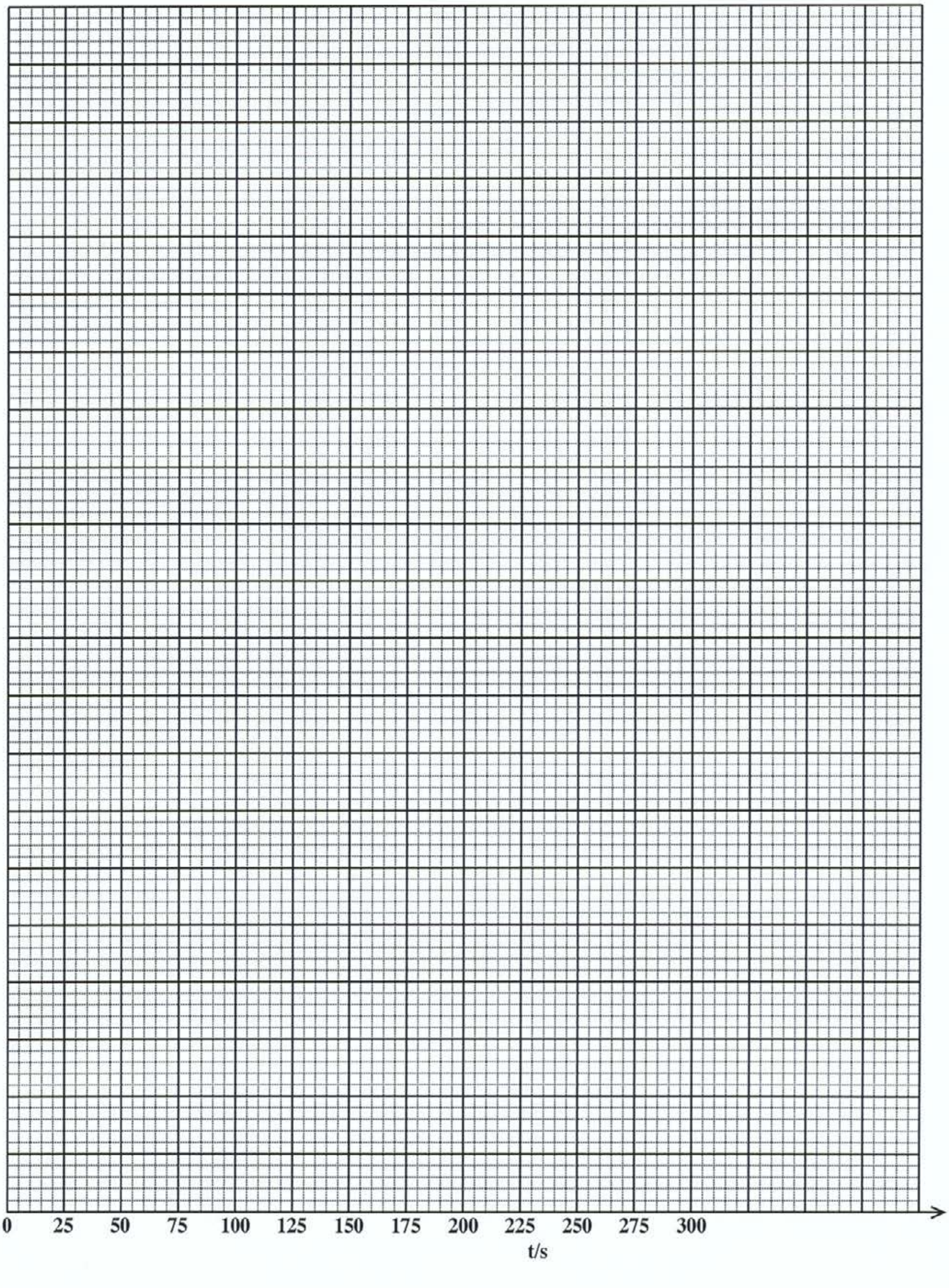
(3 marks)


0
25
50
75
100
125
150
175
200
225
250
275
300
t/s

(d) (i) From the graph, make TWO calculations of the half-life of the sample.

(6 marks)

(ii) From your results in (d) (i), calculate the mean (average) half-life.

(2 marks)

(e) Estimate the count rate of the sample after

(i) 425 s

(ii) 4 half-life periods.

(6 marks)

Total 25 marks

2. (a) (i) Give the difference between a 'vector quantity' and a 'scalar quantity'.

____

____

(1 mark)

(ii) Complete Table 2 by writing EACH of the physical quantities from the list below in the appropriate column:

Mass, Momentum, Displacement, Heat Capacity, Temperature, Half-Life, Upthrust.

TABLE 2

Vector	Scalar
	Mass

(6 marks)

(b) A taxi reaches a traffic police officer while travelling at 30 m s^{-1} on the highway. The officer immediately signals the taxi which decelerates uniformly and comes to a complete stop in 5 s. (Assume zero reaction time.)

(i) In the space below, draw a velocity-time graph to represent the motion of the taxi from the moment the officer signals, to when the taxi comes to a stop.

(2 marks)

(ii) Determine the distance travelled by the taxi from the time the police signals until the taxi stops.

(3 marks)

(iii) If the speed limit is 80 km h^{-1}, determine whether or not the driver should receive a speeding ticket.

(3 marks)

Total 15 marks

3. (a) When travelling along a hot road on a hot day a traveller may see a distant object with its image directly below it as shown in Figure 1. The image is called a mirage. Three light rays on the diagram are labelled A, B and C.

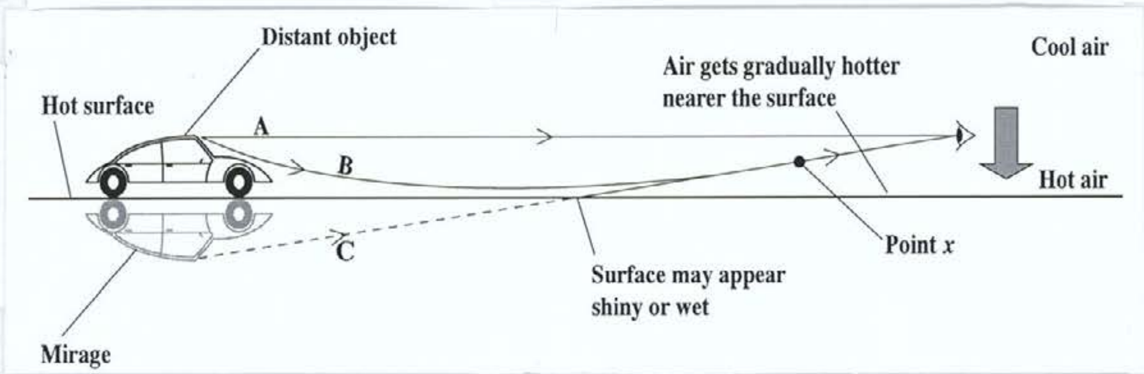


Figure 1

(i) Why does Ray A travel in a straight line from the object to the observer?

____

____

____

(1 mark)

(ii) What is the name given to the bending of Ray B as it approaches the hot surface?

____

(1 mark)

(iii) With reference to the normal, the temperature and the density of the air, explain the direction of the bending of Ray B at Point x.

____

____

____

____

(2 marks)

(iv) The mirage is a virtual image. With reference to Rays B and C, explain how the mirage is formed and why it is described as a virtual image.

____

____

____

____

(2 marks)

(b) Ultrasounds may be used in determining the growth of a baby in its mother's womb. Sound pulses are directed towards the baby's skull and reflected pulses (echoes) from the front and back of the baby's skull are detected and displayed on an oscilliscope screen, as shown in Figure 2.

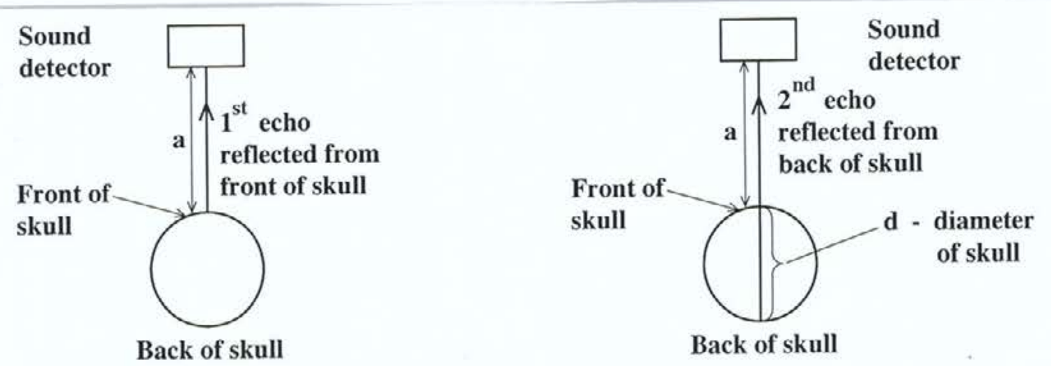


Figure 2

(i) In terms of the distances a and d, write an expression for

a) the distance travelled by the sound pulse after reflection from the front of the skull to the sound detector

____

(1 mark)

b) the distance travelled by the sound pulse after reflection from the back of the skull to the sound detector.

____

(1 mark)

(ii) The oscilliscope screen shows that the time between the first and the second echo is 0.11 ms. The speed of the sound pulses is 1200 m s^{-1}.

Determine

a) the difference in distance travelled between the first and the second echo

(2 marks)

GO ON TO THE NEXT PAGE

b) the diameter, d, of the baby's skull.

(1 mark)

(c) Figure 3 shows how a human eye focuses to see an object O. C represents the optical centre of the lens in the eye.

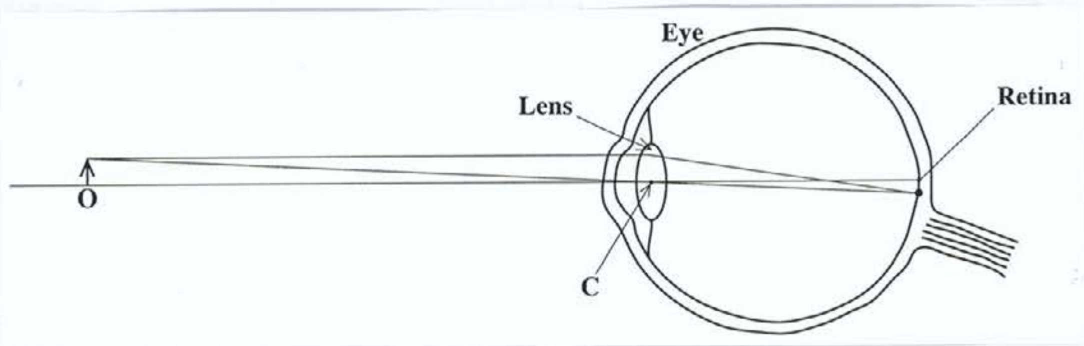


Figure 3

(i) The object O is 100 m from the centre of the eye lens and the magnification of the eye lens is 0.005.

Determine the distance of the retina from the centre of the eye lens.

(3 marks)

(ii) Write a formula for calculating the magnification of the eye lens using the object height and the image height

____

____

(1 mark)

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Answer ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) (i) State the law of the conservation of energy.

(ii) What is the difference between 'potential energy' and 'kinetic energy'?

(iii) Does the fact that heat is lost when work is done against friction violate the law of conservation of energy? Justify your answer.

(6 marks)

(b) The three-week-long cycling race, the Tour de France, is said to be one of the most gruelling sporting events in the world.

(i) If a cyclist of mass 70 kg uses a bicycle of mass 7 kg, how much work must the cyclist do against gravity in order to ascend to 2100 m from sea level (0 m)?

(ii) One particular descent goes from 2100 m to 1600 m. Assuming the work done against friction is 90% of the potential energy change of the cyclist and the cycle, what INCREASE in speed in km/h can a rider attain by the end of the descent?

(iii) What is the average rate of energy conversion of the cyclist and cycle if the descent in part (ii) takes 1 minute at constant speed?

(Acceleration due to gravity, $g = 10 \text{ m s}^{-2}$) **(9 marks)**

Total 15 marks

Write the answer to Question 4 here.

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Write the answer to Question 4 here.

Write the answer to Question 4 here.

5. Magnets are characterized by magnetic field lines.

(a) Sketch the magnetic field associated with (i) a single bar magnet and (ii) between two strong bar magnets with their north poles facing, and in line with, each other. **(4 marks)**

(b) An emergency flashlight is an essential item during hurricanes and blackouts. One model has a crank handle connected to an alternating current generator, rechargeable batteries and light emitting diodes (LEDs) as shown in Figure 4. When the handle is turned, a permanent magnet also turns in the presence of a stationary coil. This produces a current which charges the batteries.

Figure 4

(i) How is the electromotive force (e.m.f.) generated in the stationary coil?

(ii) What ADDITIONAL component is needed to be able to charge the batteries?

(iii) At a reasonable cranking rate, the unit generates 6.2 V. Calculate the current in the circuit if the resistance is 310 Ω.

(5 marks)

(c) A similar device includes a transformer so that an MP3 player can also be charged. The primary coil has 300 turns.

(i) How many turns are needed in the secondary winding if the voltage is stepped up from 6.2 V to 15.5 V?

(ii) Given that the current in the primary winding is 10 mA, what power is transmitted to the secondary windings if the transformer is 77% efficient?

(6 marks)

Total 15 marks

Write the answer to Question 5 here.

Write the answer to Question 5 here.

6. (a) You are given a container of negligible heat capacity and a thermometer.

Describe how the specific latent heat of fusion of ice can be determined using the method of mixtures. **(6 marks)**

(b) A physics student was provided with 25 g of ice to convert to steam. How much heat is needed to change this 25 g of ice at 0° C to steam at 100° C? **(9 marks)**

(Specific heat capacity of ice = 2×10^3 $Jkg^{-1}K^{-1}$)
(Specific heat capacity of water = 4.2×10^3 $Jkg^{-1}K^{-1}$)
(Specific latent heat of vaporisation of water = 2.3×10^6 Jkg^{-1})
(Specific latent heat of fusion of ice = 3.4×10^5 Jkg^{-1})

Total 15 marks

Write the answer to Question 6 here.

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FORM TP 2010020

JANUARY 2010

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$2\frac{1}{2}$ hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.
6. Mathematical tables are provided.

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Graph paper for Question 1

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SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. In an experiment to investigate Charles' Law, a Physics student used a fixed mass of dry air trapped in a glass capillary tube as seen in Figure 1. The student recorded in Table 1 how the length of the air column varied with temperature.

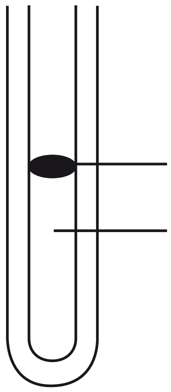

Figure 1. Diagram showing air trapped in a capillary tube

TABLE 1: RESULTS OF THE EXPERIMENT

Length of the air column, L/mm	152.0	158.0	163.0	170.0	179.0	182.0
Temperature, T/°C	14.0	29.0	40.0	57.5	78.0	85.0
Temperature, T / K						

(a) Complete Table 1 by calculating the temperature, T / K. **(3 marks)**

(b) Use the readings from the completed Table 1 to plot a graph of length of the air column (L/mm) against Temperature (T/K) on the graph page on page 2.

The L-axis starts at 140 mm and the T-axis starts at 270 K. **(6 marks)**

GO ON TO THE NEXT PAGE

(c) From your graph, calculate the slope, S.

(4 marks)

(d) What information does the slope (gradient) of the graph provide?

____

(1 mark)

(e) Use your graph to determine the value of the length of the air column at 273 K.

____

(1 mark)

(f) State Charles' law.

____

____

____

(4 marks)

(g) In a related practical activity, 2 litres of a gas were heated from 35 $^{\circ}$C to 75 $^{\circ}$C. If the pressure was kept constant, calculate the final volume of the gas.

(6 marks)

Total 25 marks

GO ON TO THE NEXT PAGE

2. (a) (i) Complete the following table, by inserting the correct quantity, formula and unit.

Quantity	**Formula**	**Unit**
	F = ma	
Potential Energy		
		$kgms^{-1}$

(3 marks)

(ii) State the 'law of conservation of linear momentum'.

(4 marks)

(b) (i) <u>"BIG CRASH ON THE HIGHWAY"</u>

"Two trucks of equal mass collided head-on at the same speed on the busy East-West Highway. They both remained stationary on impact."

Explain this crash in terms of conservation of linear momentum. Assume the masses of other contents of the trucks are equal.

(4 marks)

(ii) A police recruit, while training, shot at a stationary target of mass 5.0 kg, with a bullet of mass 0.1 kg. The target was mounted on low-fiction wheels and as soon as the bullet struck the target, the target with the embedded bullet sped off with a velocity of 6.0 m s^{-1}.

Calculate the velocity of the bullet just before it hit the stationary target.

(4 marks)

Total 15 marks

3. (a) Two types of waves are longitudinal and transverse waves.

What is meant by the term ‘longitudinal wave’?

____

____

____

(2 marks)

(b) Figure 2 shows a wavetrain in which the points A to I and *w* to *z* are shown.

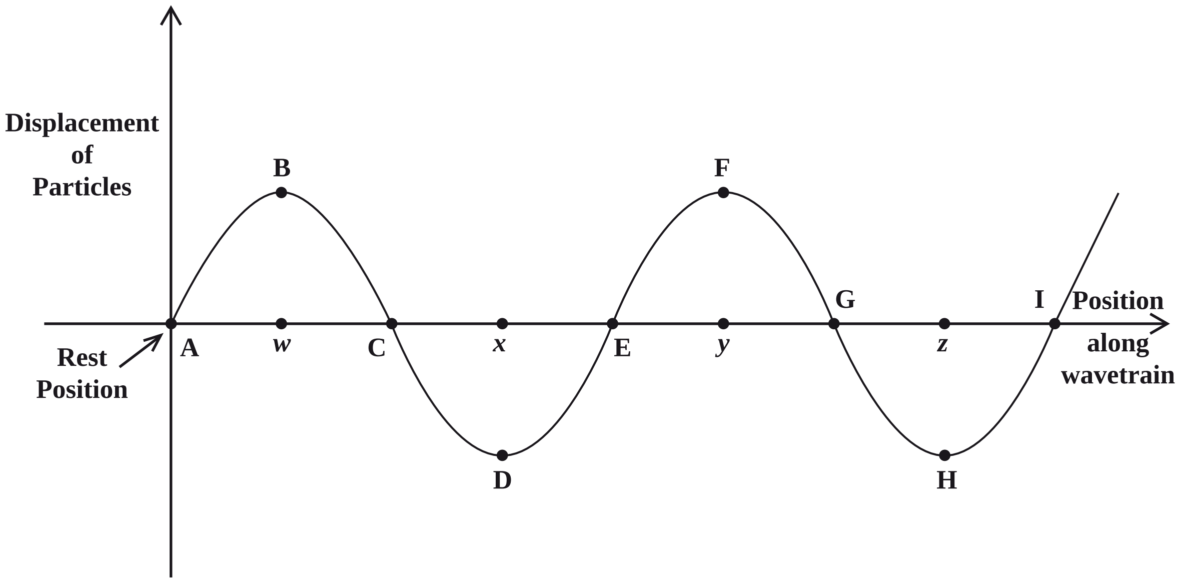

Figure 2. A wavetrain

Identify, using TWO letters, the distance between any TWO points of the following in the wavetrain:

(i) A wavelength ______________________________

(ii) The amplitude of the wave ______________________________

(2 marks)

(c) A slinky spring can be used to generate a transverse waveform. In the box below, draw and label this waveform, clearly identifying

(i) particle movement
(ii) waveform movement
(iii) at least one crest and one trough.

(3 marks)

(d) (i) A steelpan produces a sound of frequency 0.350 KHz. The speed of sound in air is 340 m s^{-1}. What is the wavelength of the sound generated by the pan?

(4 marks)

(ii) If, this sound is generated under water instead, what is the frequency that would be detected?

(1 mark)

(iii) The sound wave generated under water is refracted at the water - air boundary. Calculate the refractive index of water, given that the wavelength of this sound in water is 1.29 m.

(3 marks)

Total 15 marks

SECTION B

Attempt ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) A young student has just entered primary school. She is accustomed to having her home-cooked meal warmed up at lunch time in the microwave oven at her pre-school. She misses this and suggests to her parents that they buy her a flask similar to the one shown in Figure 3.

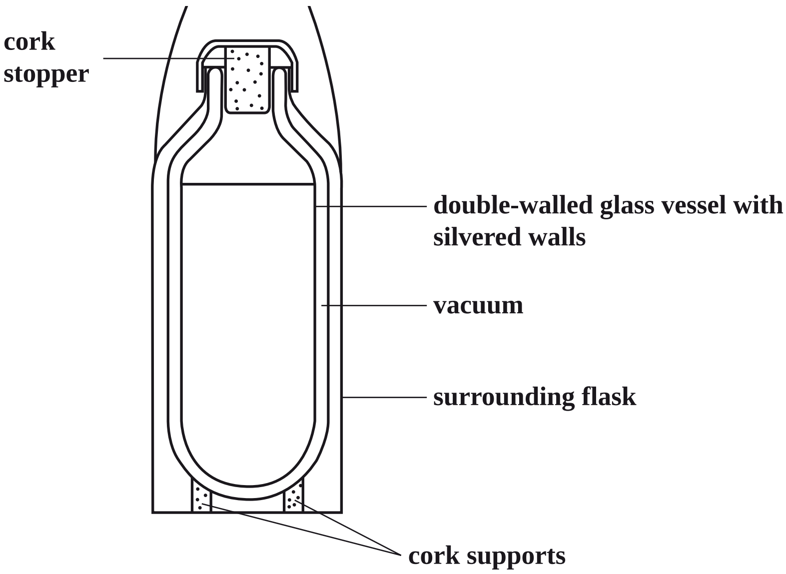

Figure 3. Cross-section of a vacuum flask

Using the information in Figure 3, explain how the home-cooked meal is kept warm.

(6 marks)

(b) A solar water heater system consists of a solar collector of area 5 m^2, a storage tank and hidden connecting pipes as shown in Figure 4.

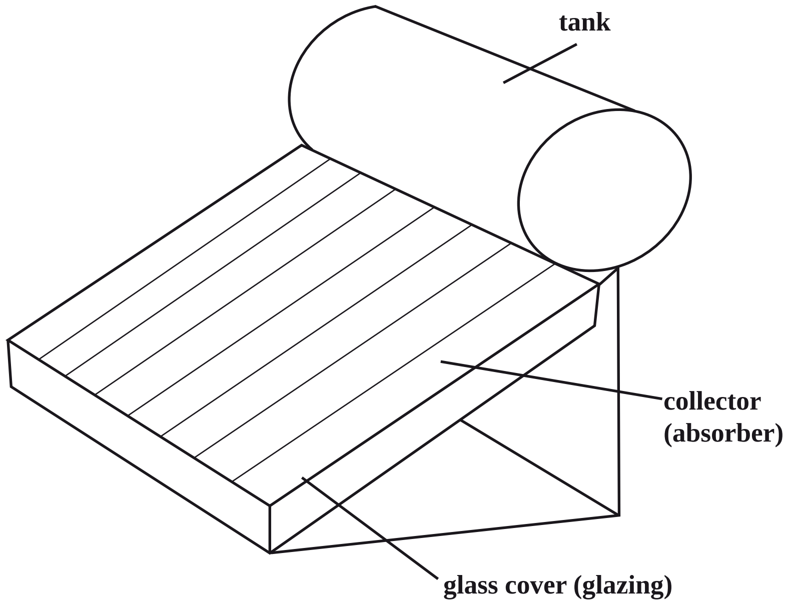

Figure 4. Diagram showing a solar water heater

Assume that the average solar radiation incident on Castries, St. Lucia is 5 $kWhm^{-2}$ per day, and the collector absorbs 95% of the solar radiation incident on it:

(i) Calculate the energy in kWh collected by the absorber per day. **(2 marks)**

(ii) Calculate how much energy per day can be used to heat water if the collector emits 50% of the heat energy it receives from the atmosphere. **(2 marks)**

(iii) A glass cover is now placed on the solar collector. The glass transmits 80% of the sunlight to the collector and allows 8% of the heat back into the atmosphere (the glass house effect). How much energy per day is now available to heat the water? **(2 marks)**

(iv) What mass of water can the glazed collector heat from 25°C to 55°C during the day? **(3 marks)**

1 kWh = 3.6×10^6J
Specific heat capacity of water, C = 4200 J kg^{-1} k^{-1}

Total 15 marks

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) With the aid of a CLEARLY labelled circuit diagram, explain how the I – V characteristics of an unknown electrical component, X, may be determined. **(6 marks)**

(b) The lights in a room are connected as shown in Figure 5. Each bulb has a resistance of 1000 Ω.

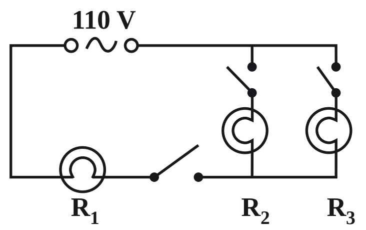

Figure 5. Circuit for lights in a room

Determine

(i) the total resistance

(ii) the current drawn from the supply if all three bulbs are lit. **(6 marks)**

(c) A microwave oven consumes 1100 W when operated on high power. What is the MINIMUM current rating for a fuse to be used to protect the oven if the mains potential difference is 110 V? **(3 marks)**

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

Write your answer to Question 5 here.

6. (a) It is suspected that a certain radioactive source emits alpha, beta and gamma radiations. With the aid of a diagram, describe how the presence of any TWO of the three types of radiation in such sample could be confirmed. **(6 marks)**

(b) Radioactive carbon $\left({}^{14}_{6}\text{C}\right)$ loses a beta particle to become Nitrogen (N).

Write a nuclear equation to represent this nuclear reaction. **(3 marks)**

(c) Calculate the energy released in the solar fusion of deuterium represented by

$${}^{2}_{1}\text{H} + {}^{2}_{1}\text{H} \rightarrow {}^{4}_{2}\text{He} + \text{energy}$$

Assume $u = 1.66 \times 10^{-27}$ kg

${}^{2}_{1}\text{H}$ has an atomic mass of 2.0140 u

${}^{4}_{2}\text{He}$ has an atomic mass of 4.0026 u

(6 marks)

Total 15 marks

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

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FORM TP 2010021

JANUARY 2010

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03/2 – General Proficiency

Alternative to SBA

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

1. A student plotted the graph shown in Figure 1 in an experiment to find the cooling curve of napthalene.

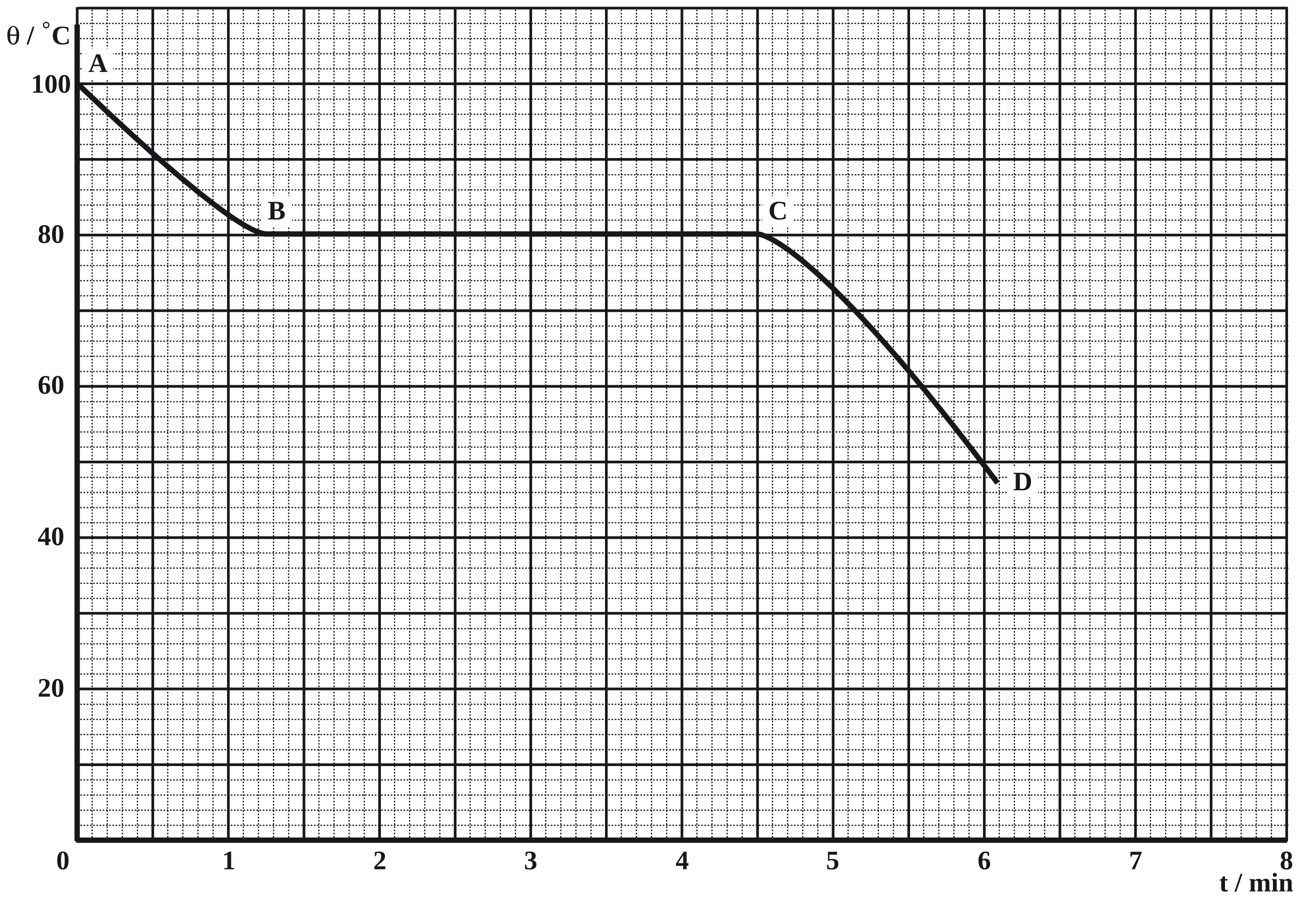

Figure 1. Cooling curve for napthalene as plotted by the student

(a) Complete Table 1 for values of θ and t using the graph shown in Figure 1.

TABLE 1

θ / ˚C					80	80	80					50
t / min	0	0.5	1.0	1.4	2.0	3.0	4.0	4.7	5.0	5.5	5.6	6.0

(6 marks)

GO ON TO THE NEXT PAGE

(b) Between which TWO points on the graph is napthalene

(i) a solid? ______________________________

(ii) a liquid? ______________________________

(2 marks)

(c) What is the melting point of napthalene in degrees Kelvin?

____

____

(3 marks)

(d) Write a brief description of a method the student could have used to conduct this experiment. Give ONE precaution to be taken and ONE source of error in outlining your method.

____

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(6 marks)

Total 17 marks

2. Two fourth form Physics students were asked to work together to investigate the relationship between extension, *e*, and the stretching force, *F*, for a spiral spring. Four sets of their results are shown in Figure 2.

(a) Use the diagrams shown in Figure 2 to complete Table 2.

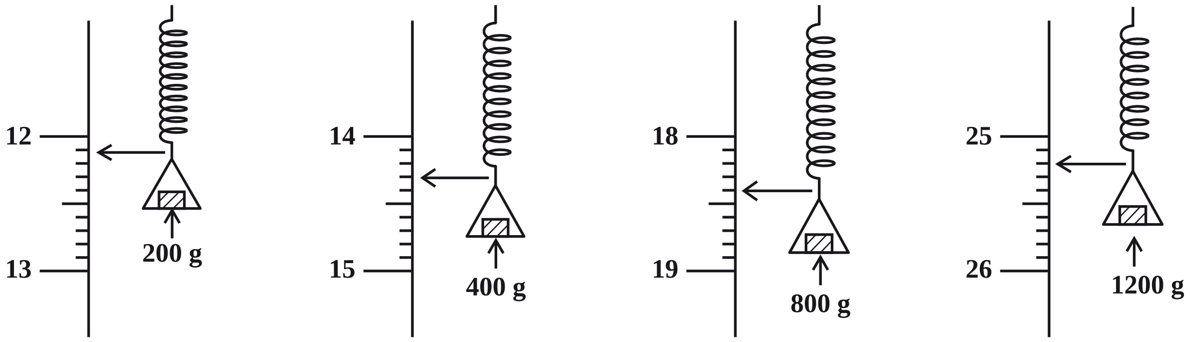

Figure 2. Diagram showing experiment

TABLE 2

Mass (m) /g	Stretching force (F) /N	Scale Reading /mm	Extension (e) /mm
0	0	10.0	0.0
200	2		
400	4		
600	6	16.3	6.3
800	8		
1000	10	21.4	11.4
1200	12		

(4 marks)

(b) On the graph paper on page 5, plot a graph of extension, (e) against stretching force, (F).
(8 marks)

(c) Identify the part of the graph where Hookes' law is NOT obeyed. Label the beginning and end of the part as A and B respectively. **(1 mark)**

GO ON TO THE NEXT PAGE

(d) Calculate the gradient of the straight line portion of the graph.

(4 marks)

(e) Use the graph to find the mass that would give an extension of 5.0 cm.
(Acceleration due to gravity = 10.0 m s^{-2}).

(2 marks)

(f) Identify ONE possible source of error and ONE precaution to be taken in conducting this experiment.

(2 marks)

Total 21 marks

3. A student asserts that “the thicker a wire is, the greater will be its resistance to current”.

You are required to investigate whether or not this is true for Nichrome wire.

Your answer should include:

(a) Apparatus list

____

____

____

____

____

(4 marks)

(b) Procedure and diagram

____

____

____

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____

____

(3 marks)

(c) Use of observations

(3 marks)

Total 10 marks

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FORM TP 2010021 – IS

JANUARY 2010

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03/2 – General Proficiency

Alternative to SBA

INSTRUCTIONS FOR SETTING UP THE ALTERNATIVE TO SBA EXAMINATION

Question 1

NONE

Question 2

NONE

Question 3

NONE

END OF INSTRUCTIONS

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

FORM TP 2010098

TEST CODE **01238020**

MAY/JUNE 2010

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

$2\frac{1}{2}$ hours

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in the space provided after EACH question in this answer booklet.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.
6. Mathematical tables may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO

SECTION A

Answer ALL questions.

You MUST write your answers in the spaces provided in this booklet.

1. Testing of a new material to be used as an anti-reflective coating for eye glasses has yielded the results shown in Table 1.

TABLE 1

Angle of incidence, $\hat{i}$ / °	30.0	40.0	50.0	60.0	70.0
Angle of refraction, $\hat{r}$ / °	23.5	30.5	38.0	43.7	48.5
sin $\hat{i}$					
sin $\hat{r}$					

(a) Complete Table 1 by calculating the values for sin $\hat{i}$ and sin $\hat{r}$. **(4 marks)**

(b) Use the readings from the completed Table 1 to plot a graph of sin $\hat{i}$ against sin $\hat{r}$ on the graph paper on page 2. **(7 marks)**

(c) Calculate the gradient of the graph.

(4 marks)

(d) State the TWO laws of refraction.

(1) ______________________________

____

(2) ______________________________

____

(4 marks)

GO ON TO THE NEXT PAGE

(e) Calculate the angle of refraction if the angle of incidence is 90° for this new material.

(3 marks)

(f) The anti-reflective coating works best if its refractive index is the square root of the refractive index of the lens in the eye glasses. Determine the refractive index of the lens that gives the best result.

(3 marks)

Total 25 marks

2. (a) Define EACH of the following terms.

(i) Velocity

(2 marks)

(ii) Acceleration

(2 marks)

(iii) Linear momentum

(2 marks)

GO ON TO THE NEXT PAGE

(b) In 2008, at the Beijing Olympics, Usain Bolt of Jamaica reclaimed his title as the world's fastest man. He completed the 100 m final in a world record time of 9.69 s. He accelerated uniformly from rest for the first 6.5 seconds, covering 60 m before coasting at maximum speed to the finish.

(i) Calculate his average speed for the first 6.5 s. **(2 marks)**

(ii) What was his maximum speed?

(2 marks)

(iii) What was his acceleration during the first 6.5 s?

(2 marks)

(iv) a) What MAJOR form of energy did BOLT possess when he crossed the finish line?

____

(1 mark)

b) Calculate the value of this energy if his mass was 86 kg.

(2 marks)

Total 15 marks

3. (a) A student connects the circuit in Figure 1 below to investigate rectification using a single diode.

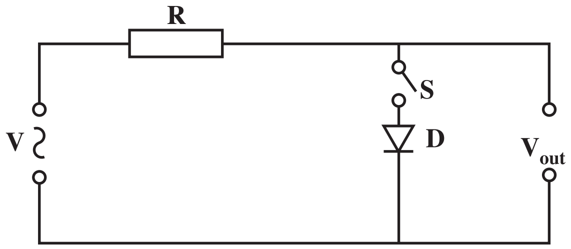


Figure 1

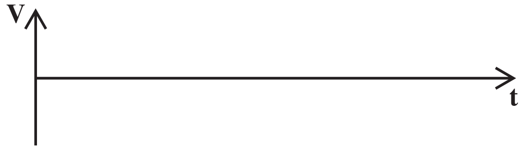
(i) Sketch the V_{out} – t graph when switch S is open.

(1 mark)

(ii) Sketch the V_{out} – t graph across diode D when switch S is closed.

(1 mark)

(iii) Sketch the V – t graph across a battery power source.



(1 mark)

(iv) What is the similarity in the voltage between (ii) and (iii)?

____

____

____

(1 mark)

(v) How can you use the circuit in Figure 1 to determine whether or not a semiconductor diode is defective?

____

____

____

(2 marks)

(b) (i) The truth table of a logic gate is shown below for inputs A and B and output C.

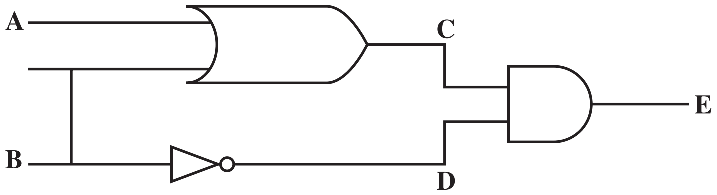
A	**B**	**C**
0	0	1
0	1	1
1	0	1
1	1	0

State the type of logic gate.

____

(1 mark)

(ii) Complete the truth table for the following logic circuit.



A	B	C	D	E
0	0	0	1	0
0	1			
1	0			
1	1		0	

(8 marks)

Total 15 marks

SECTION B

Answer ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) With reference to the diagram of a simple d.c. motor shown in Figure 2

(i) explain how this motor works **(5 marks)**

(ii) give the purpose of the commutator. **(1 mark)**

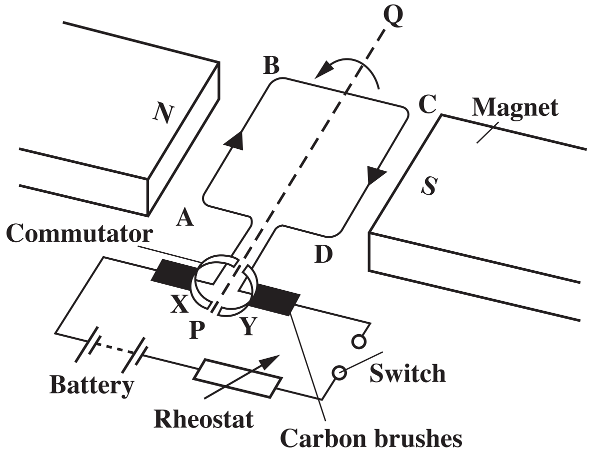


Figure 2. D.C. Motor

(b) A 24 V d.c. motor was used to lift a small appliance of mass 25 kg from the ground to the second floor of a multi-storey carpark. The floor is 30 m above the ground. The motor, operating at 100% efficiency, works at a steady rate and takes 5 s to complete the activity.

(i) Calculate the power provided by the motor. **(4 marks)**

(ii) Calculate the current drawn from the d.c. supply. **(4 marks)**

(iii) If the power required to lift the appliance was greater, what effect would this have on the value of the current? **(1 mark)**

Assume the voltage rating remains constant.

[$g = 10\ \text{N Kg}^{-1}$]

Total 15 marks

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) A CSEC Physics teacher gave two groups of students projects on Specific Heat Capacity. One group used an electrical method to calculate the specific heat capacity of a metal block. The circuit used in this method is shown in Figure 3.

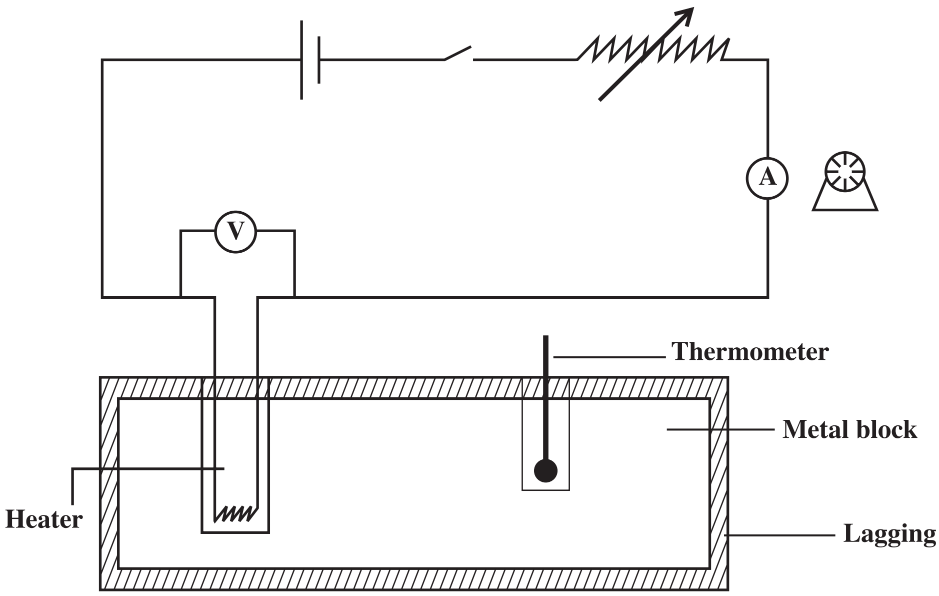


Figure 3

Describe the method used by this group to determine the specific heat capacity of the metal block. **(6 marks)**

(b) The second group of students determined the specific heat capacity of a liquid. One set of results is described below:

It took 300 s for the temperature of 0.1 kg of the liquid to be elevated from 25°C to 50°C. The energy supplied was 13.6 KJ during this period.

(i) Assuming that no heat was lost and ignoring the heat capacity of the container, detemine the value of the specific heat capacity of the liquid. **(6 marks)**

(ii) If the liquid was heated twice as long, what impact, if any, would this have on the specific heat capacity of the liquid? **(1 mark)**

(iii) Justify your response in part (ii). **(2 marks)**

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

GO ON TO THE NEXT PAGE

6. (a) You were asked to present to your class, a comparison of alpha (α) with gamma (γ) radiation. Compare these two types of radiation in terms of their

(i) range in air

(ii) behaviour in an electric field

(iii) type of track in a cloud chamber. **(6 marks)**

(b) A nuclear scientist proposed the following nuclear reaction based on an artificial radioactive decay process to produce energy.

$${}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{143}_{54}Xe + {}^{90}_{38}Sr + 3\,({}^{1}_{0}n) + \text{Energy}$$

Table 2 below gives the atomic mass for each nuclide. (u = 1.66 x 10^{-27} Kg.)

Table 2

Nuclide	Atomic Mass /u
${}^{1}_{0}n$	1.00867
${}^{235}_{92}U$	235.04393
${}^{143}_{54}Xe$	142.93489
${}^{90}_{38}Sr$	89.90730

(i) Calculate the number of neutrons in Xenon (Xe). **(2 marks)**

(ii) Determine the energy released in the proposed nuclear reaction. **(4 marks)**

(iii) If the energy released in an alternative, natural decay reaction is 9.98 x 10^{-13}J, which would be the preferred method for the production of a nuclear power station? Justify your choice. **(2 marks)**

(iv) Give the reason for your decision in (iii). **(1 mark)**

[c = 3.0 x 10^{8} ms^{-1}]

Total 15 marks

Write your answer to Question 6 here.

Complete the table to answer 6 (a)

	(i) Range in air	(ii) Behaviour in an electric field	(iii) Track in a cloud chamber
Alpha			
Gamma			

Write your answer to Question 6 here.

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FORM TP 2010099

MAY/JUNE 2010

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03/2 – General Proficiency

Alternative to SBA

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

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1. Janice was given a resistor by her teacher and asked to find its resistance using the circuit diagram shown in Figure 1.

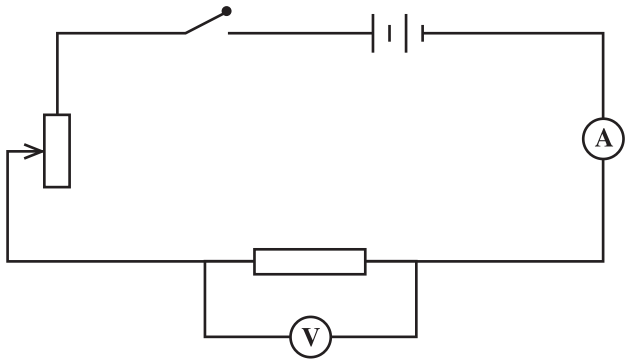

Figure 1

Table 1. shows Janice's results

Table 1. Janice's Results

I/A	0.20	0.34	0.57		0.91
V/V	1.0	2.0	3.0	4.0	5.0

(a) Complete Table 1 by reading the ammeter scale shown in Figure 2 which represents the current reading corresponding to a 4.0 V reading across the resistor. **(1 mark)**

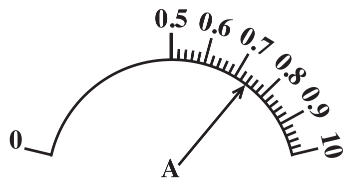

Figure 2

(b) State THREE precautions Janice should have taken when conducting this experiment.

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(3 marks)

(c) Plot a graph of I vs V on the graph paper on page 2. **(8 marks)**

GO ON TO THE NEXT PAGE

(d) Determine the gradient S of the graph.

(4 marks)

(e) Use the gradient S to calculate the resistance R of the resistor.

(4 marks)

Total 20 marks

NOTHING HAS BEEN OMITTED

2. A bicycle pump contains 50 cm^3 of air at 17°C and 1 atmosphere. As the air is compressed the following results were recorded for pressure (atm) x volume (cm^3) and temperature (K). (See Table 2.)

Table 2

PV / atm. cm^3	**T/ K**
50	290
53	300
57	310
61	320
65	330
68	340

(a) Plot a graph of PV against T on page 7. Begin the PV axis at 40 atm. cm^3 and the T axis at 270 K. **(8 marks)**

(b) Use the graph to find the pressure when the air is compressed to 10 cm^3 and its temperature rises to 35°C.

(4 marks)

(c) In an experiment to investigate the relationship between volume and temperature for a fixed mass of gas at constant pressure, the apparatus was set up as shown in Figure 3.

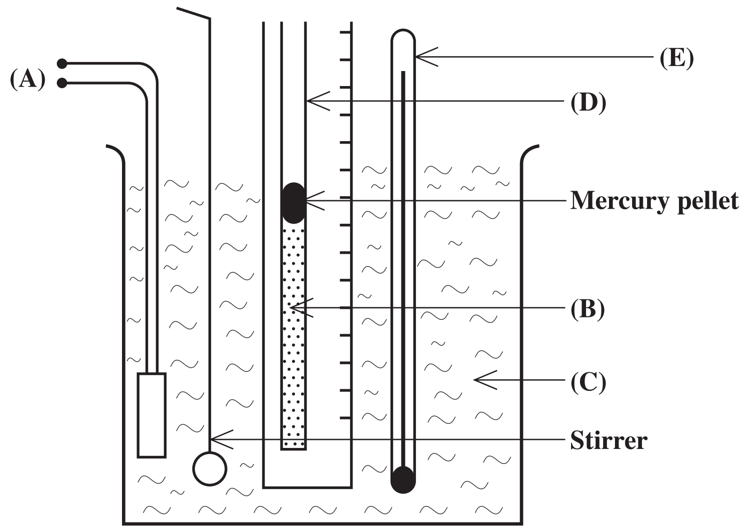

Figure 3

Write the name of EACH of the corresponding parts labelled A – E on the diagram in the spaces below.

A ____________________________ D ___________________________________

B ____________________________ E ___________________________________

C ____________________________

(5 marks)

(d) Explain why the length of the air column can be used to represent the volume.

____

____

____

(2 marks)

Total 19 marks

GO ON TO THE NEXT PAGE

3. A teacher gives her class an assignment to find out the effect that the mass of a pendulum bob has on the period of the pendulum. Describe the experiment to investigate the effect of the mass of the pendulum bob on the period of the pendulum.

Include in your answer:

(a) A list of the apparatus

____

____

____

(4 marks)

(b) The diagram and procedure

____

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(4 marks)

(c) An account of how the results would be used to find a conclusion.

(1 mark)

Total 9 marks

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FORM TP 2011022

JANUARY 2011

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

<u>READ THE FOLLOWING INSTRUCTIONS CAREFULLY.</u>

1. This paper consists of **SIX** questions.

2. Section A consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.

3. Section B consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.

4. All working **MUST** be **CLEARLY** shown.

5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.

6. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. A popular sprinter of mass 60 kg, was running a 100 m race. Her velocity was measured over a 10.0 s period. The results are recorded in Table 1.

TABLE 1

Velocity,v/ms^{-1}	0.0	2.5	5.0	7.5	10.0	10.0
Time, t/s	0.0	2.0	4.0	6.0	8.0	10.0

(a) Define the following terms:

Velocity

____

____

(2 marks)

Acceleration

____

____

(2 marks)

(b) Use the results from Table 1 to plot a graph of Velocity versus Time on page 3.

(7 marks)

(c) Determine the slope of the graph over the first 6.0 s of the race.

(4 marks)

GO ON TO THE NEXT PAGE

(d) How is the slope of the graph related to the acceleration of the sprinter?

____

(2 marks)

(e) Calculate the resultant force acting on the sprinter after 6.0 s.

(3 marks)

(f) Using the graph drawn on page 3, determine how far from the finish line the sprinter would be after 10.0 s.

(5 marks)

Total 25 marks

2. Electromagnetic waves consist of visible light and radiations higher or lower than the wavelength of light.

(a) (i) Identify ONE type of radiation with wavelength:

a) longer than visible light ______________________________

b) shorter than visible light. ______________________________

(2 marks)

(ii) Complete Table 2 which relates to the sources and uses of electromagnetic waves.

TABLE 2

Name of Wave	**Source**	**Use**
X-ray		To take X-ray pictures
Gamma Ray		
Radio wave		

(5 marks)

(b) (i) If gamma rays have a wavelength of 3.0×10^{-12} m, calculate the frequency of this type of radiation.

____

____

____

____

____

[Velocity of all electromagnetic waves $= 3.0 \times 10^{8}$ m s^{-1}]

(3 marks)

(ii) A ray of red light emerges from a glass block as shown in Figure 1.

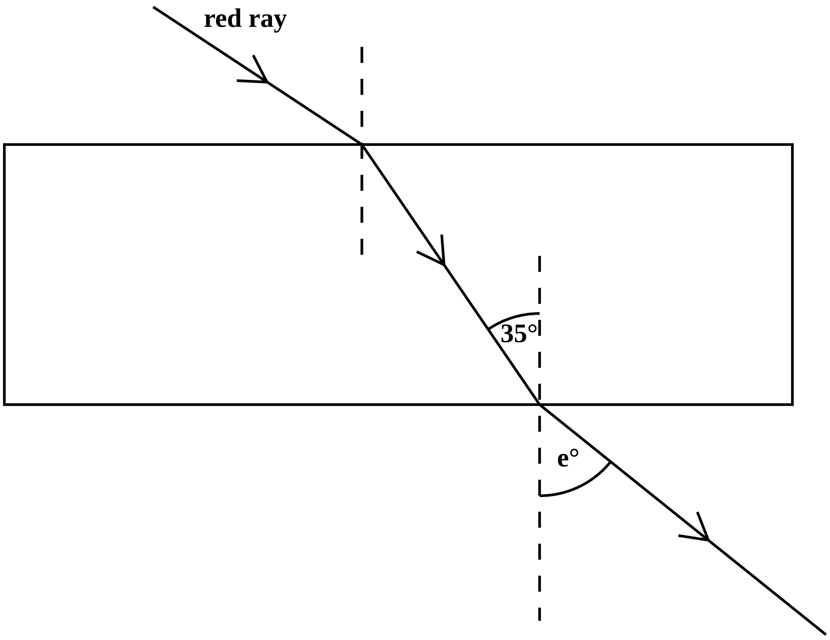


Figure 1

If the block has a refractive index of 1.5, determine the value of the angle e.

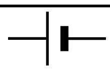
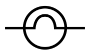
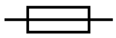
(5 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

3. (a) Complete Table 3 which relates electrical circuit symbols to the names of electrical components.

TABLE 3

Circuit Symbol	**Name of Components**
	
	Variable resistor
	
	
	Semi-conductor diode
 **or** 	

(6 marks)

(b) Figure 2 shows a circuit diagram.

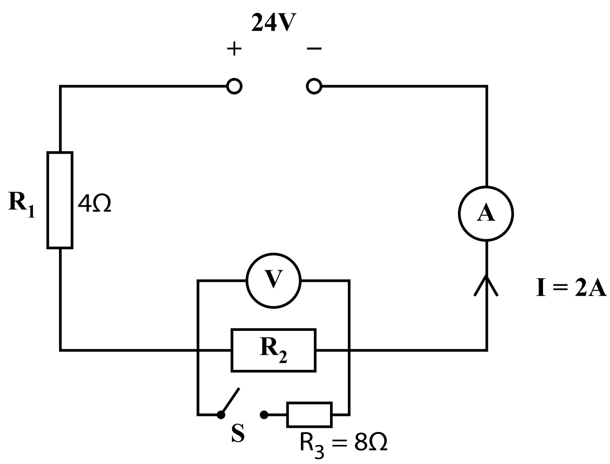


Figure 2

In the circuit shown in Figure 2, $R_1 = 4\Omega$, $R_3 = 8\Omega$ and the supply is 24V. With switch S open, the current I through the ammeter is 2 A.

(i) State the formula which relates voltage, V, current, I and resistance, R.

____

(1 mark)

(ii) Calculate the value of R_2.

(3 marks)

(iii) What is the reading on voltmeter V?

(2 marks)

(iv) If switch S is closed, what would be the new reading on ammeter, A?

(3 marks)

Total 15 marks

SECTION B

Attempt ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) Describe how the apparatus shown in Figure 3 below may be used to show how the temperature of a substance such as naphthalene, varies during cooling. Include in your description any other equipment that may be necessary.

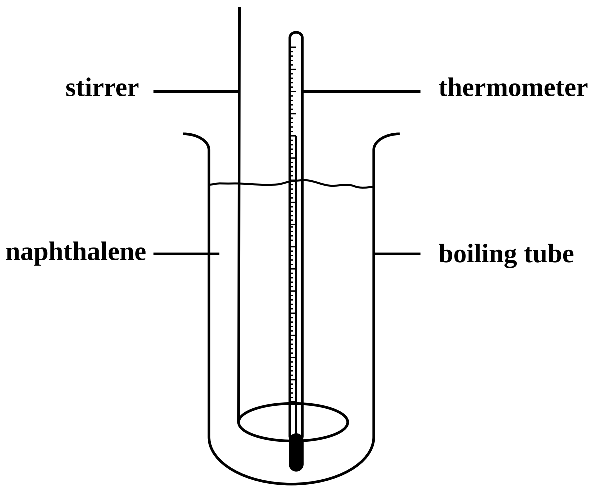


Figure 3

(6 marks)

(b) In an experiment to determine the specific latent heat of ice, the following results were obtained.

Initial mass of water at 30°C = 100 g
Final mass of water (initial water plus melted ice) at 20°C = 110 g

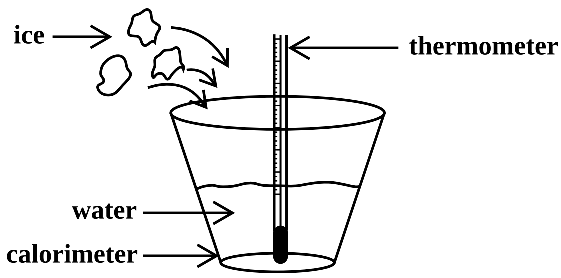


Figure 4

Assume the container has negligible heat capacity and that the heat lost to the surroundings is equal to the heat gained from the surroundings during the experiment.

GO ON TO THE NEXT PAGE

(i) Determine the mass of the melted ice. **(1 mark)**

(ii) Calculate the heat lost by the water. **(3 marks)**

(iii) Write down an expression for the TOTAL heat gained by the ice in melting and the melted ice in warming to 20°C. **(2 marks)**

(iv) Hence calculate the specific latent heat of fusion of ice. **(3 marks)**

[Specific Heat Capacity of water = 4.2 Jg^{-1} K^{-1}]

Total 15 marks

Write your answer to Question 4 here.

GO ON TO THE NEXT PAGE

Write your answer to Question 4 here.

5. (a) With the aid of at least one diagram, describe how the magnitude of the electromotive force (e.m.f.) induced in a conductor depends on the rate of change of magnetic flux that the conductor experiences. **(6 marks)**

(b) To make electric cars more efficient, they will need to be charged regularly using a magnetic field below the road surface. One solution is to designate one lane of the highway for recharging batteries.

(i) In the charging lane cars are required to keep moving. Why should this be so? **(3 marks)**

(ii) Assuming the magnetic field is constant, state with reason, how the speed of the car will affect the charging of the batteries. **(3 marks)**

(iii) In a certain section of road, 200 KW of power is expended to charge 100 cars. If each car converts 600 Watts of power to charging the battery, calculate the conversion efficiency. **(3 marks)**

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

GO ON TO THE NEXT PAGE

6. (a) Some great scientists contributed to the modern-day view of the model of the atom. Two of these were J. J. Thompson and Ernest Rutherford.

For EACH of these scientists, describe briefly TWO main ideas they put forward concerning the nature of the atom, including the name of EACH of their models.

(6 marks)

(b) In final revision for your CSEC Physics examinations, your teacher gave you the following data on some unknown elements:

$$^{40}_{19}P; \quad ^{235}_{92}Q; \quad ^{40}_{18}R; \quad ^{238}_{92}X; \quad ^{39}_{19}Y$$

You are required to determine:

(i) which nuclides have the identical mass number

(ii) how many neutrons are in the heaviest nuclide

(iii) which nuclides are isotopes. **(5 marks)**

(c) In a half-life experiment, the data shown in Table 4 were obtained.

TABLE 4

Count rate / minute	**Time / second**
4000	0.0
1000	55.0
500	80.0

Use the data to determine:

(i) TWO different values of the half-life of the element

(ii) The average half-life of the element **(4 marks)**

Total 15 marks

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

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TEST CODE **01238032**

FORM TP 2011023

JANUARY 2011

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03/2 – General Proficiency

Alternative to SBA

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

NOTHING HAS BEEN OMITTED.

1. Figure 1 shows an experiment that can be used to verify Snell's law. The results of the experiment are recorded in Table 1.

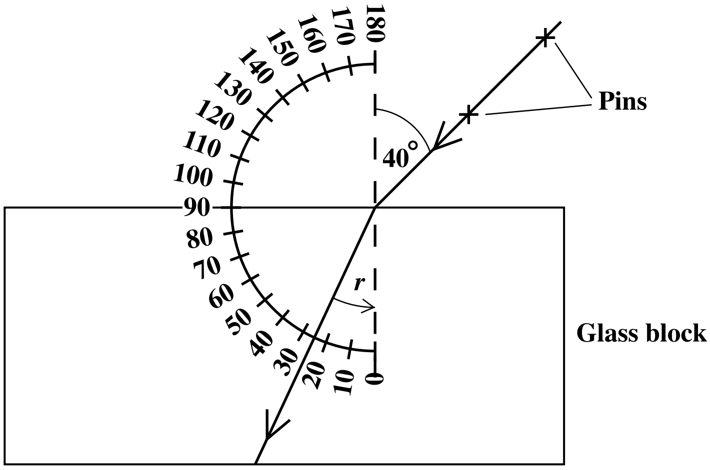


Figure 1

(a) Complete the diagram to show

(i) the path of the ray after it leaves the glass block

(ii) the BEST location of the eye from which to view the images of the pins.

(3 marks)

(b) Measure the angle of refraction (r), as shown in Figure 1 and enter it in Table 1.

(1 mark)

TABLE 1

i/degrees	**r/degrees**	**sin *i***	**sin *r***
20	13		
30	20	0.50	0.34
40			
50	31		
60	35		

GO ON TO THE NEXT PAGE

(c) Calculate sin *i* and sin *r* for all the values of *i* and *r* in the table.

(4 marks)

(d) Draw a graph of sin *i* against sin *r* on page 5. **(10 marks)**

(e) Use the graph to explain whether or not the results verify Snell's law.

____

____

____

(2 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

2. The graph on page 7 shows how the heat capacity, C, of a given sample varies with the mass, m.

(a) Use the graph to record FIVE values of the heat capacity of the substance with its mass.

C / JK^{-1}	m/kg

(5 marks)

(b) (i) Determine the slope of the graph.

(5 marks)

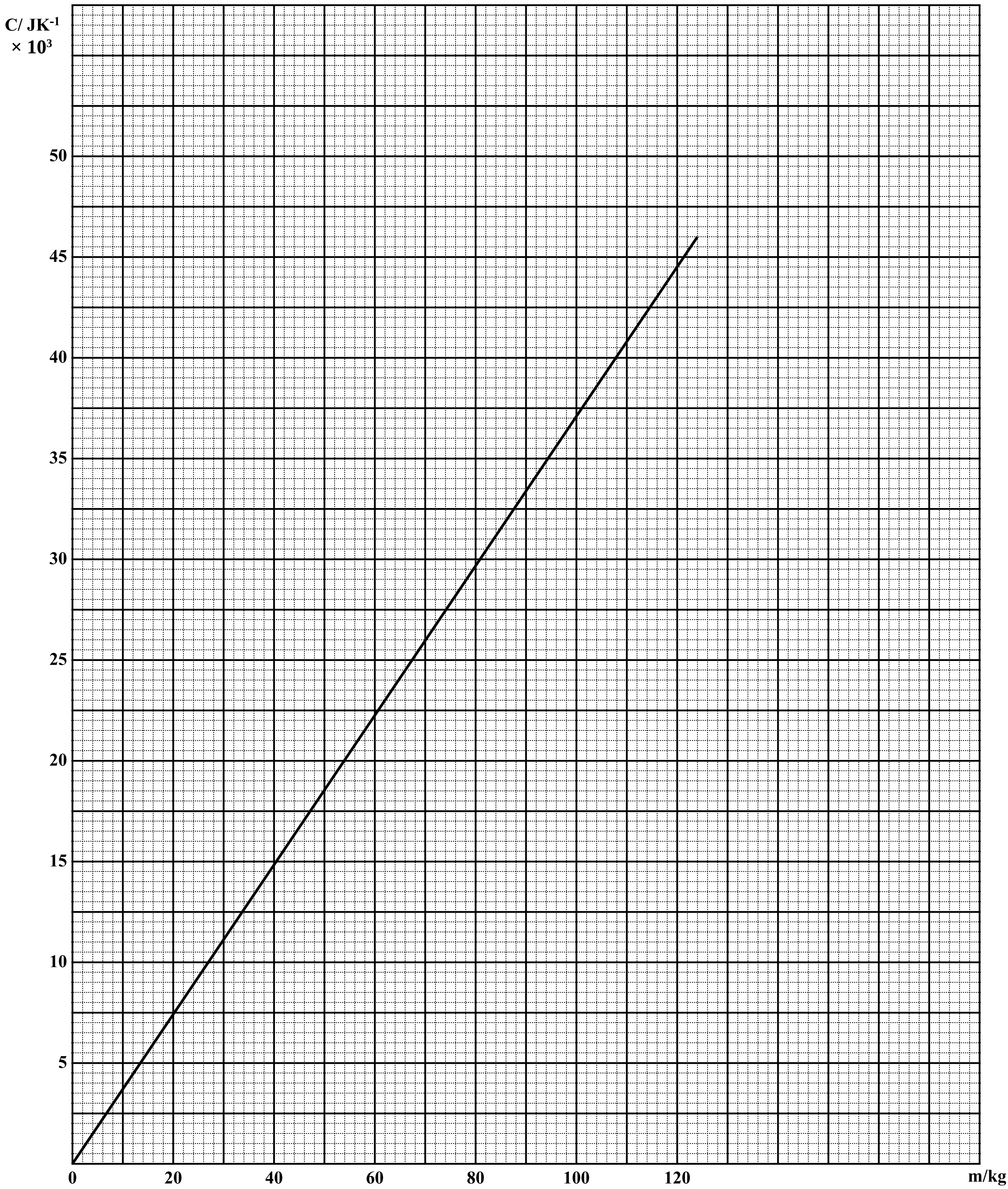
(ii) Hence, determine the material of the sample, using the table of specific heat capacities shown in Table 2.

TABLE 2

Substance	**Specific heat capacity c / Jkg^{-1} K^{-1}**
Water	4200
Copper	380
Lead	126
Aluminum	880

(3 marks)

GO ON TO THE NEXT PAGE



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(c) Briefly outline the procedure to be followed to find the specific latent heat of fusion of ice using the method of mixtures.

Procedure

(6 marks)

Total 19 marks

3. Marie, a fourth form Physics student, reads that the centre of gravity of all uniform and regular shapes is at the centre of the shapes. Describe clearly an experiment Marie can perform to test if this statement is true.

Your answer should include:

(a) Apparatus

____

____

____

(3 marks)

(b) A description of the procedure

____

____

____

____

____

____

____

(4 marks)

(c) Observations to be made

____

____

(1 mark)

(d) How the conclusion is reached

____

____

(1 mark)

Total 9 marks

END OF TEST

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FORM TP 2011103

MAY/JUNE 2011

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **SIX** questions.
2. Section A consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of **THREE** questions. Candidates must attempt **ALL** questions in this section. Answers for this section must be written in this answer booklet.
4. All working **MUST** be **CLEARLY** shown.
5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.
6. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. A taxi driver was taking his friends to a popular 20/20 cricket match. Table 1 shows the vehicle's velocity for the first minute of the journey.

TABLE 1

Velocity, V/ms^{-1}	Time, t / s
0.0	0.0
11.0	10.0
23.0	20.0
34 .0	30.0
47.0	40.0
57.0	50.0
69.0	60.0

(a) Plot on page 3, a graph of velocity (V) versus time (t). **(7 marks)**

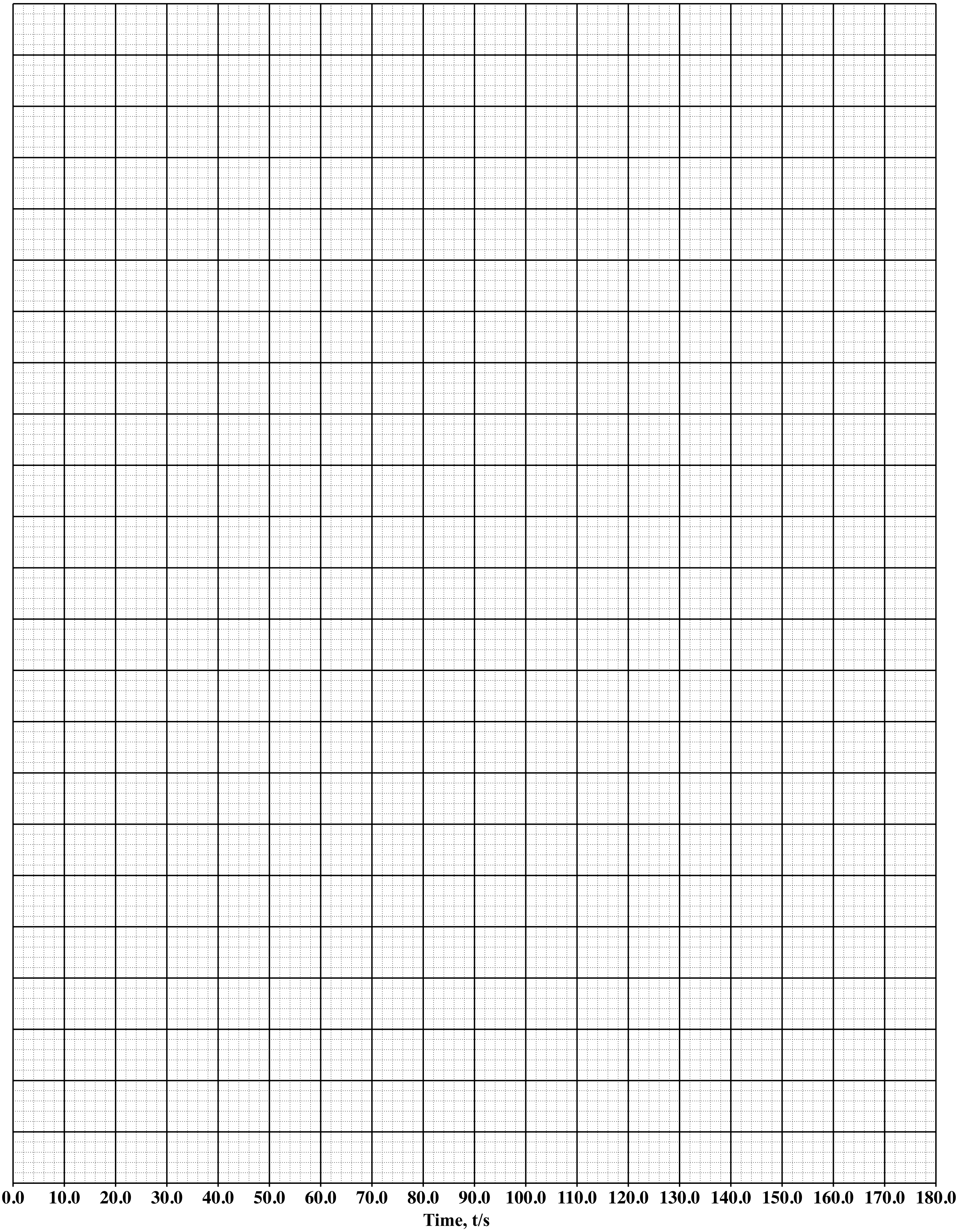
(b) From the graph, calculate the slope, p.

(4 marks)

(c) What quantity does the slope, p, represent?

____

(1 mark)



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(d) For the next minute, the vehicle's velocity was constant, then for the final minute, the vehicle decelerated uniformly to a stop on reaching the stadium.

(i) Continue the velocity-time graph on page 3, to show this information and use the graph to determine the total distance travelled.

(4 marks)

(ii) Calculate the average velocity of the taxi for the **complete** journey.

(2 marks)

(iii) If the total mass of the loaded taxi was 1 500 kg, determine the momentum of the vehicle when it is travelling at constant velocity.

(3 marks)

(e) (i) Define the term ‘displacement’.

____

____

(2 marks)

(ii) Complete Table 2 by ticking (√) the appropriate column that represents the quantity, given in the table.

TABLE 2

Quantity	**Scalar**	**Vector**
Displacement		
Acceleration		

(2 marks)

Total 25 marks

2. (a) (i) Complete Table 3 by inserting the correct symbol and SI Unit which relate to the quantity shown in Column 1.

TABLE 3

Quantity	**Symbol**	**SI Unit**
Specific Heat Capacity	c	________________
Specific Latent Heat of Vaporization	________________	________________

(3 marks)

(ii) Define the term ‘heat capacity of a substance’.

____

____

(2 marks)

(iii) Write the equation that relates specific heat capacity with heat capacity.

____

(1 mark)

(b) A busy housewife left 25 g of ice in an open insulated container while she was answering her cellphone. When she returned, the ice at 0 ºC was converted to water at 3.0 ºC.

(i) Calculate the energy needed for the ice to totally melt and to reach its present temperature. Assume no heat losses.

[Specific Heat Capacity of water = 4 200 J $Kg^{-1}K^{-1}$
Specific Latent Heat of Fusion of Ice = 340 000 J Kg^{-1}]

(6 marks)

GO ON TO THE NEXT PAGE

(ii) If this melting and heating activity took place over 300 s, calculate the rate at which the ice / water was receiving heat.

(3 marks)

Total 15 marks

3. Figure 1 shows a simple cell connected to a circuit.

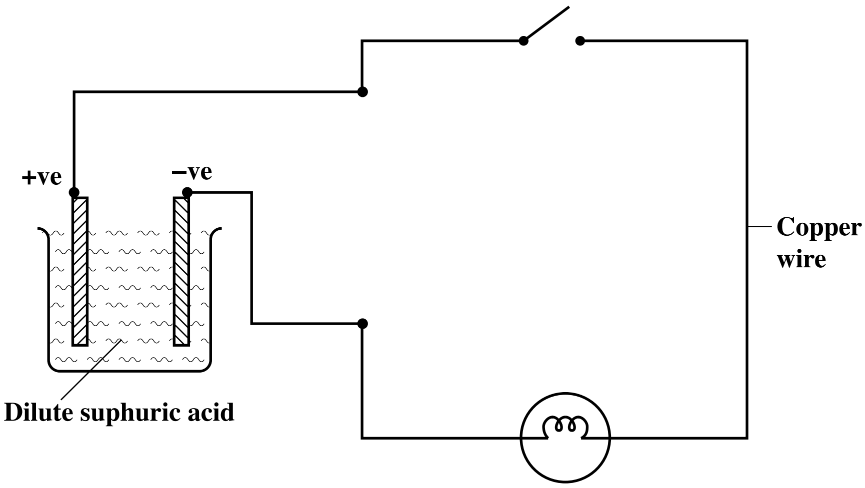


Figure 1

(a) (i) How does the flow of the current within the simple cell differ from that in a copper wire?

____

____

____

(2 marks)

(ii) Name the material used for the positive terminal in a dry cell.

____

(1 mark)

(iii) Name the material used for the negative terminal in a dry cell.

____

(1 mark)

(iv) In the circuit in Figure 1, if the current is steady at 0.1 A, calculate the charge that goes through the copper wire in 60 s.

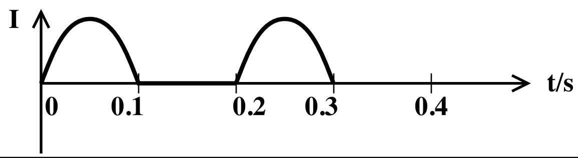
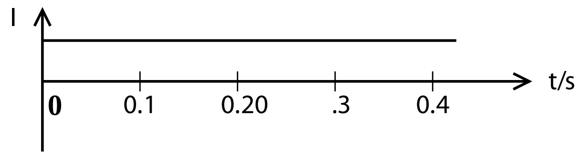
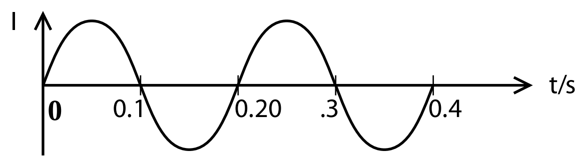
(3 marks)

(v) Determine how much charge goes through the simple cell in 60 s.

(1 mark)

(b) (i) Identify the type of current (d.c. or a.c.) which generated the specific waveforms A, B and C shown in Table 4.

TABLE 4

	Waveform	Type of Current
A		
B		
C		

(3 marks)

(ii) Determine the period **and** frequency for Waveform C.

(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Attempt ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) Eron, a form five Physics student, has available to him a bright filament light in a ray box, an opaque screen with two closely spaced narrow slits, and a large white screen.

Describe how he can set up the apparatus to be able to observe an interference pattern of light and dark bands on the white screen **and** briefly explain why this pattern forms.

(6 marks)

(b) Figure 2 shows a narrow beam of white light which is shone onto a triangular prism at an angle of incidence of 30°.

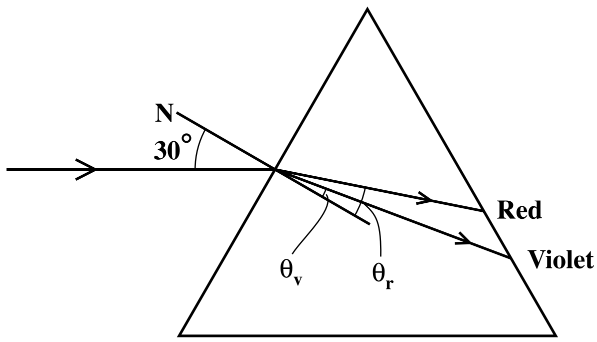


Figure 2

(i) If the angle of refraction for the violet light, θ_v, is 20°, what is the refractive index of this prism for violet light? **(3 marks)**

(ii) Calculate the speed of the violet light in the prism. **(3 marks)**

(iii) Calculate the frequency of violet light if the wavelength in air is 430 nm.

[1 nm = 10^{-9} m
Velocity of light in air = 3.0×10^8 m s^{-1}] **(3 marks)**

Total 15 marks

Write your answer to Question 4 here.

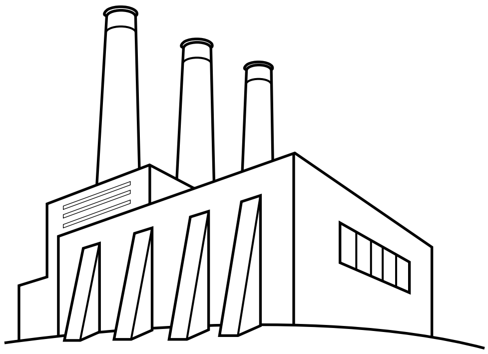
Write your answer to Question 4 here.

5. Many modern electrical appliances have been designed to operate with a.c. power rather than d.c. power because electrical power is transmitted as a.c. rather than d.c.

(a) (i) State TWO advantages of using a.c. to transmit electrical power. **(2 marks)**

(ii) Draw a diagram of a simple transformer indicating the features which enhance efficiency. **(4 marks)**

(b)



Electrical power produced by Powergen in Trinidad is stepped up from 11 000 V at 8 000 A to 110 000 V for transmission to Tobago.

(i) If the number of turns in the secondary coil is 900, calculate the number of turns in the primary coil for an ideal transformer. **(3 marks)**

(ii) Calculate the transmission current for the ideal transformer referred to at (b) (i). **(3 marks)**

(iii) Calculate the transmission power if the transformer is 70% efficient. **(3 marks)**

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

6. (a) (i) Outline THREE uses of radioisotopes in medicine. **(3 marks)**

(ii) State THREE safety precautions to be taken when using radioactive substances. **(3 marks)**

(b) (i) A gram of living plant material with Carbon –14, decays at a rate of about 16 disintegrations per minute. When the plant dies, the Carbon –14 decays, with a half-life of 5 600 years. A gram of the dead plant is found to decay at about 1 disintegration per minute. Calculate the probable age of the plant. **(4 marks)**

(ii) The mass of the sun is lost at the rate of 2.0×10^9 kg s^{-1}. If the speed of light in a vacuum is 3.0×10^8 m s^{-1}, calculate the power output of the sun in kilowatts. **(5 marks)**

Total 15 marks

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

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TEST CODE **01238032**

FORM TP 2011104

MAY/JUNE 2011

CARIBBEAN EXAMINATIONS COUNCIL

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 03/2 – General Proficiency

Alternative to SBA

2 hours

In addition to the 2 hours, candidates are allowed a reading time of 10 minutes. Writing may begin during the 10-minute period.

READ THE FOLLOWING DIRECTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

NOTHING HAS BEEN OMITTED.

1. The arrangement in Figure 1 was set up to find out how the image distance and object distance were related for a convex lens.

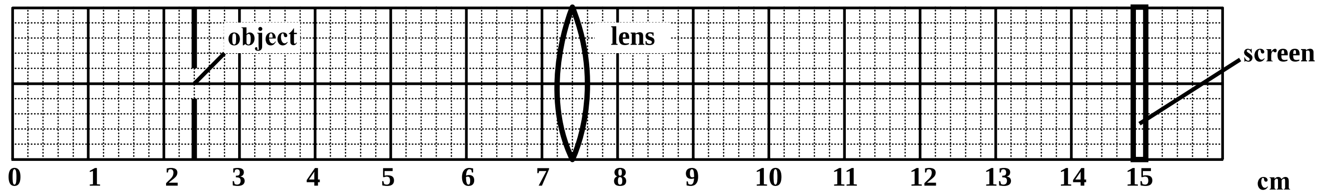

Figure 1

(a) (i) Record the positions of the object, lens and screen.

Object position ______________________________

Lens position ______________________________

Screen position ______________________________

(3 marks)

(ii) State ONE precaution to be taken when reading the scale.

____

____

____

(1 mark)

GO ON TO THE NEXT PAGE

(iii) Calculate the image distance *v*, and object distance *u*, for the arrangement in Figure 1 and enter these values in the appropriate spaces in Table 1 below.

TABLE 1

***v* / cm**	***u* / cm**
20	30
40	62
60	87
80	124

(2 marks)

(b) Plot on page 5, a graph of the image distance (*v*) against the object distance (*u*).

(10 marks)

(c) Use the graph to state the relationship between *v* and *u*. Justify your response.

____

____

____

____

(2 marks)

(d) Using the graph or otherwise, calculate the magnification of the lens.

(2 marks)

Total 20 marks

GO ON TO THE NEXT PAGE

2. (a) Akil was given a large rectangular block of plasticine and asked to find its density. Describe how he could do this using only a beam balance and a half-metre rule.

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(6 marks)

(b) The graph on page 7 was plotted using Akil's results obtained from several blocks of plasticine.

Use the graph to complete Table 2 to show the mass of FIVE different blocks of plasticine and their corresponding volumes.

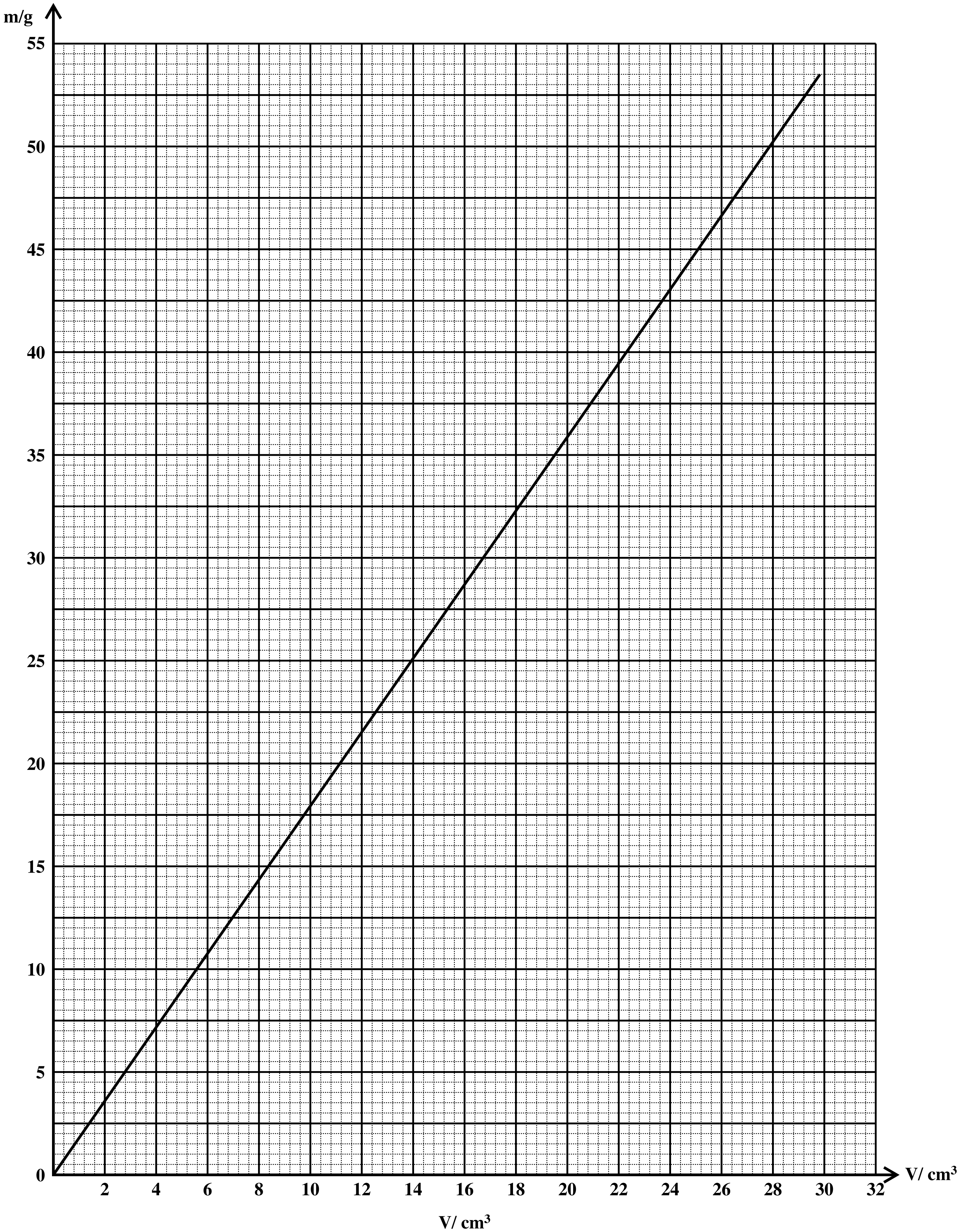
TABLE 2

m/g	**V/cm^3**
1.	
2.	
3.	
4.	
5.	

(5 marks)

(c) (i) Find the slope of the line.

(5 marks)



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(ii) Use the value of the slope you calculated in (c) (i), to find the relative density of plasticine.

[Density of water = 1 g cm^{-3}]

(3 marks)

Total 19 marks

3. Ramesh and Tameka were given six identical samples of solids of different materials and asked to find out which one was the best conductor of electricity and which one was the best insulator. Describe an experiment they could perform to accomplish this.

Include in your answer:

(a) Circuit diagram

(4 marks)

(b) A description of the procedure

____

____

____

____

(2 marks)

GO ON TO THE NEXT PAGE

(c) Observations to be made

(1 mark)

(d) How the observations can be used to come to a conclusion

(2 marks)

Total 9 marks

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FORM TP 2012022

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions.

2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section. Answers for this section must be written in this answer booklet.

3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section. Answers for this section must be written in this answer booklet.

4. All working MUST be CLEARLY shown.

5. The use of silent, non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalised.

6. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. A Form 4 Physics student performed an activity to determine the mass of a lump of plasticine, M_p. A diagram of the setup of the apparatus used is seen in Figure 1 below. The Principle of Moments was used.

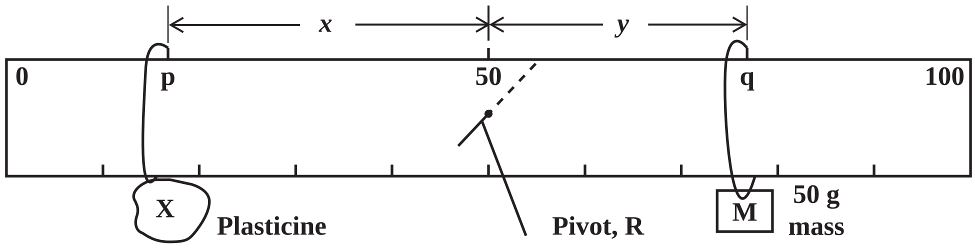

Figure 1. Setup of the activity

The results of the activity were recorded in Table 1 below.

TABLE 1: RESULTS OF THE ACTIVITY

Position of Plasticine, p/cm	Position of 50 g mass q/cm	*x*/cm	*y*/cm
10.0	86.0	40.0	
20.0	76.2	30.0	
30.0	66.0		16.0
35.0	62.8		12.8
40.0	57.9	10.0	
45.0	53.6	5.0	

(a) Complete Table 1 by calculating the values of *x* and *y*. **(3 marks)**

(b) Use the results from the completed Table 1 to plot a graph of y/cm against x/cm, on the graph paper provided on page 3. **(6 marks)**

(c) From your graph, calculate the slope, z.

(5 marks)

(d) Use your graph to determine how far the 50 g mass needs to be placed if it balances when the plasticine was placed 27.5 cm from the pivot, R.

(1 mark)

(e) State the Principle of Moments.

(4 marks)

(f) The weight of the plasticine, W_p, is related to the weight of the 50 g mass, W_m, by the formula,

$$W_p = \text{gradient} \times W_m.$$

(i) Determine the weight of the plasticine, W_p.

(4 marks)

GO ON TO THE NEXT PAGE

(ii) Calculate the mass of the plasticine, M_p.

[$g = 10$ N kg^{-1}] **(2 marks)**

Total 25 marks

2. (a) (i) Complete Table 2 relating fundamental quantities and their base unit symbols.

TABLE 2: FUNDAMENTAL QUANTITIES AND THEIR BASE UNITS

Name	Symbol	Base (SI) Unit
Mass	m	kg
Time		
Current		
Temperature		
Length		

(4 marks)

(ii) State the difference between a 'linear scale' and a 'non-linear scale'.

____

____

____

____

(2 marks)

(iii) You are provided with the following three measuring instruments.

Metre rule,	Clinical thermometer,	Conical flask

Which of the instruments listed above has a non-linear scale?

____

(1 mark)

(b) The container shown in Figure 2 is completely filled with cement.

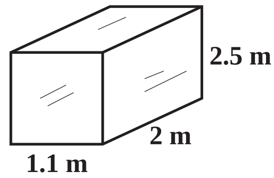

Figure 2. Container filled with cement

(i) If the mass of the cement is 15 000 kg, calculate the density of this cement sample in kg m^{-3}.

____

____

____

____

____

____

(4 marks)

(ii) What pressure, in Newtons, would the cement exert on the base of the container?

____

____

____

____

[g = 10 N kg^{-1}] **(4 marks)**

Total 15 marks

3. (a) (i) Albert Einstein put forward a theory that if the energy of a body changes, then its mass also changes. State the equation which relates these changes, clearly identifying the symbols or letters used in the equation.

____

____

____

____

(3 marks)

(ii) State TWO arguments EACH **for** and **against** the utilization of nuclear energy.

For: 1. ____

____

2. ____

____

Against: 1. ____

____

2. ____

____

(4 marks)

(b) Nuclear fission is a nuclear reaction in which a moving neutron strikes the nucleus of an atom splitting it into lighter nuclei, often producing free neutrons and photons in the form of gamma rays. One such reaction is given below.

$$^{1}_{0}\text{n} + {}^{235}_{92}\text{Uranium} \rightarrow {}^{A}_{56}\text{Barium} + {}^{90}_{Z}\text{Krypton} + 3\left({}^{1}_{0}\text{n}\right) + \text{energy}$$

(i) Calculate the values of A and Z.

(2 marks)

(ii) The energy released in the given reaction is 1.8×10^{-12} J. Calculate the excess mass (mass change) in this reaction.

____

____

____

____

(3 marks)

(c) Fusion is the joining together of two nuclei. One possible fusion reaction is

$$^{2}_{1}\text{Deuterium} + {}^{3}_{1}\text{Tritium} \rightarrow {}^{P}_{Q}X + {}^{1}_{0}\text{neutron} + \text{energy.}$$

By calculating P and Q, identify the nucleus X.

____

____

____

____

[c = 3.0 × 10^{8} ms^{-1}] **(3 marks)**

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Attempt ALL questions.

You MUST write your answers in the spaces provided after each question.

4. (a) Figure 3 shows the diagram of a simple d.c. motor connected in a circuit.

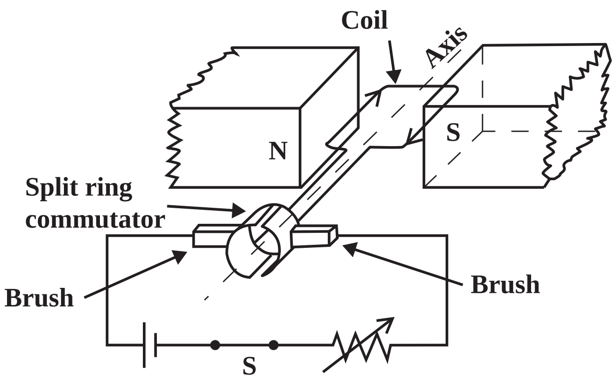

Figure 3. D.C. motor

With reference to the d.c. motor shown in Figure 3, explain how the coil is able to rotate continuously. **(6 marks)**

(b) The waveform shown in Figure 4 depicts the current through a resistor connected in an a.c. circuit.

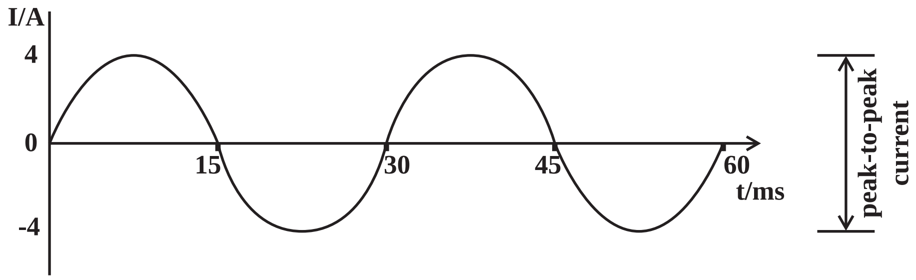

Figure 4. A.C. waveform

(i) Calculate the period and frequency of the alternating supply. **(3 marks)**

(ii) If the resistor is 45Ω, determine the peak-to-peak voltage across the resistor. **(3 marks)**

(iii) Calculate the maximum power dissipated in the resistor. **(3 marks)**

Total 15 marks

GO ON TO THE NEXT PAGE

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) Figure 5 shows two blocks of copper that are placed in contact with each other. Block *A* initially has a temperature of 40 °C and block *B* has a temperature of 70 °C.

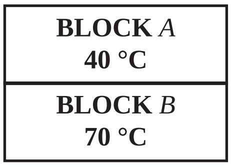

Figure 5. Two blocks of copper

(i) What is the direction of net heat transfer between the blocks? **(1 mark)**

(ii) The final equilibrium temperature of the blocks is 52 °C. Convert this temperature to Kelvin. **(3 marks)**

(b) Figure 6 shows the sketch of a natural convection solar water heating system.

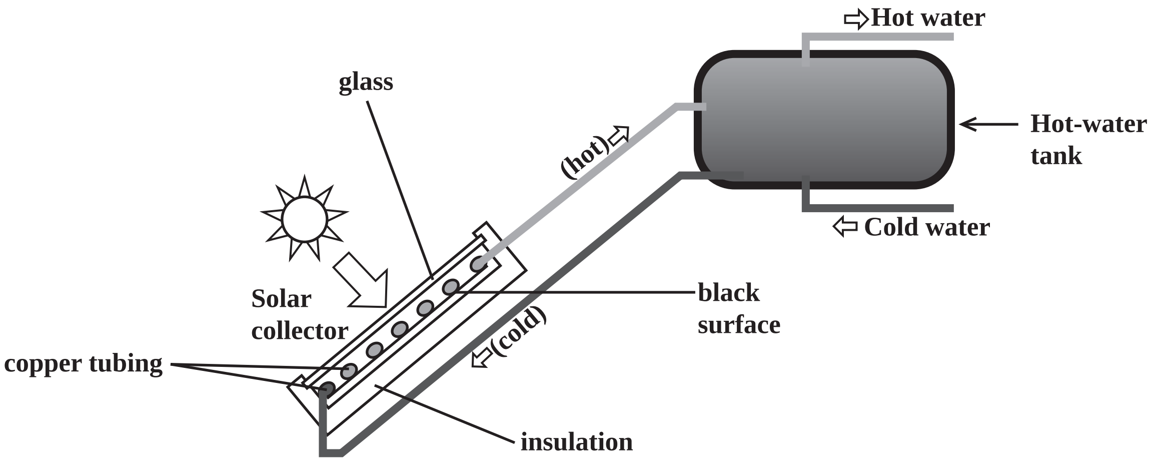

Figure 6. Solar water heating system

(i) The energy absorbed by the solar collector is 300 kJ and 40% of this is transferred to the 2 kg of water in the copper tubing. If the initial temperature of the water is 27 °C, calculate the final temperature of the water. **(6 marks)**

(ii) Outline which feature of the solar water heating system shown in Figure 6 demonstrates EACH of the following thermal energy principles:

a) Good absorption of heat

b) Heat transfer by convection

c) The green house effect

d) Good heat transfer by conduction

e) Reduction of heat transfer by conduction

[Specific heat capacity of water = 4.2×10^3 J kg^{-1} K^{-1}] **(5 marks)**

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

GO ON TO THE NEXT PAGE

6. (a) (i) What is the difference between 'longitudinal waves' and 'transverse waves'? **(2 marks)**

(ii) Given that red light has a wavelength of 700×10^{-9} m, calculate its frequency. **(4 marks)**

(b) In 2010, Sound Navigation and Ranging (SONAR) was used to detect the presence of submerged oil plumes in the Gulf of Mexico after a massive oil spill. Figure 7 shows a ship using SONAR to locate an oil plume.

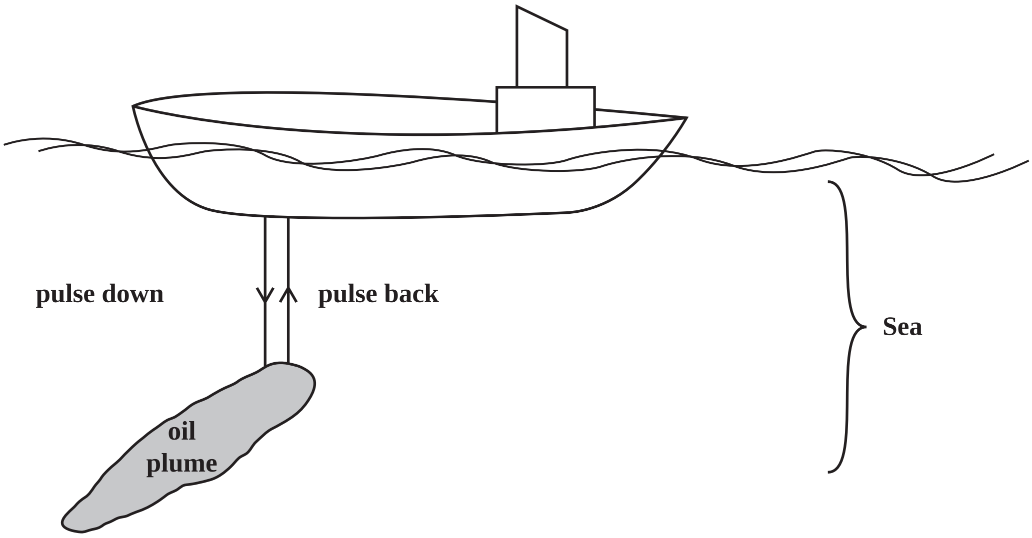

Figure 7. SONAR ship

(i) Explain, with reference to Figure 7, how SONAR was used to determine the depth of an oil plume. **(4 marks)**

(ii) If echoes are received 0.3 seconds after being sent, calculate the depth of the oil plume below the detector, given that Velocity = $\frac{\text{distance}}{\text{time}}$.

[Speed of sound in sea water = 1450 ms^{-1}]
[Speed of light in air = 3.0×10^8 ms^{-1}] **(5 marks)**

Total 15 marks

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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TEST CODE **01238032**

FORM TP 2012023

JANUARY 2012

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE
EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of silent, non-programmable calculators is permitted.
5. Mathematical tables are provided.
6. You are advised to take some time to read through the paper and plan your answers.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

NOTHING HAS BEEN OMITTED

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. Sandy was performing an experiment to determine the refractive index of a glass block using Snell's Law. Her results are shown in Table 1.

TABLE 1: RESULTS OF EXPERIMENT

Angle of Incidence, *i*/°	**Angle of Refraction, *r*/°**	**sin î**	**sin r̂**
10.0	6.0	0.174	0.105
$\square$	16.0	$\square$	0.276
30.0	20.0	0.500	0.342
40.0	24.0	0.643	0.407
50.0	30.0	0.766	0.500

(a) A protractor is shown in Figure 1. Complete Table 1 by reading the protractor to measure the angle of incidence, i, and enter sin î. **(2 marks)**

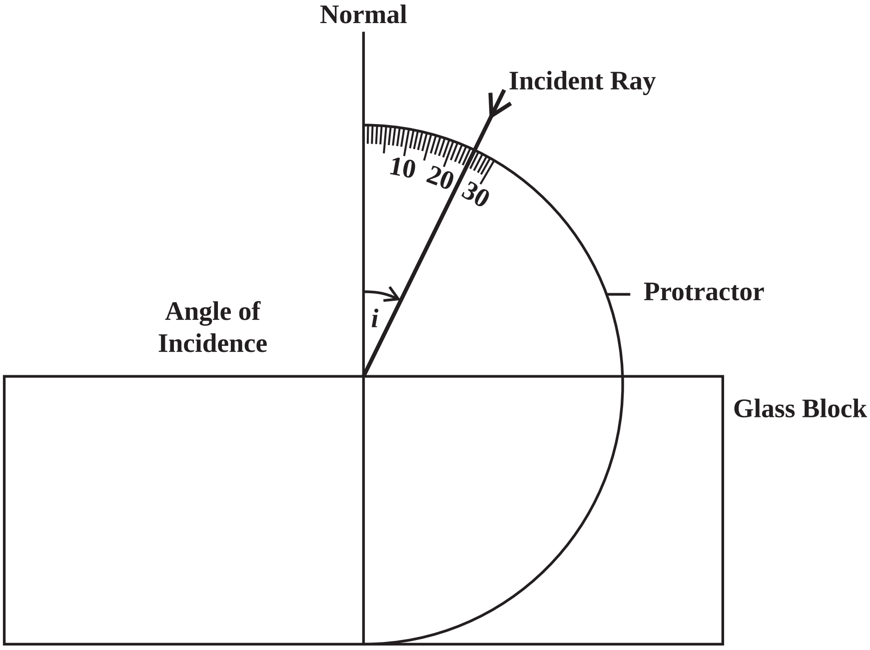

Figure 1. Protractor measurement for angle

GO ON TO THE NEXT PAGE

(b) State TWO precautions Sandy should take when conducting the experiment.

(2 marks)

(c) Using a suitable scale on each axis, plot a graph of sin r̂ against sin î on the graph paper on page 5. Start each axis at 0.100. **(8 marks)**

(d) Determine the gradient of the graph.

(4 marks)

(e) Use the gradient to calculate the refractive index of the glass block.

(4 marks)

Total 20 marks

2. In an experiment to determine the I – V characteristics of an electrical component **X**, the following apparatus were used:

- A d.c. supply
- An ammeter
- A switch
- A variable resistor
- A voltmeter
- Component **X**

(a) Complete the circuit shown in Figure 2 using the apparatus listed above.

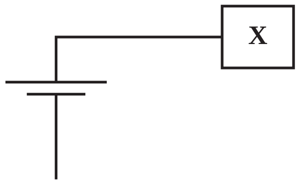

Figure 2. Circuit to determine I – V characteristics

(4 marks)

(b) By adjusting the variable resistor, the pairs of values shown in Table 2 were obtained.

TABLE 2: I – V results

Current I/A	**Voltage V/V**	**Resistance R/Ω**
0.00	0.00	___________
0.27	0.10	
0.47	0.20	
0.63	0.30	
0.78	0.40	
0.90	0.50	
1.10	0.60	
1.16	0.70	
1.19	0.80	

Complete Table 2 above by calculating the eight resistance values. **(6 marks)**

(c) On the graph paper provided below, plot a graph of I/A against V/V. **(8 marks)**

(d) Based on your results, suggest a suitable name for the component **X**.

____

(1 mark)

Total 19 marks

3. A teacher projected a bead horizontally with a speed of u cms^{-1}. The bead travels along the wire shown in Figure 3 on page 9. By observing the horizontal and vertical distances from the point of projection, he proposed to determine the acceleration of the bead.

(a) Record the horizontal (x) and vertical (y) distances of the bead at the points indicated in Table 3 below.

TABLE 3: RESULTS OF THE DISTANCE OF THE BEAD

Point	**A**	**B**	**C**	**D**	**E**
x / cm					
y / cm					

(5 marks)

(b) Given that $y = \dfrac{a}{2u^2} x^2$, outline the steps the teacher would use to determine the acceleration, a, of the bead using a graph.

(4 marks)

Total 9 marks

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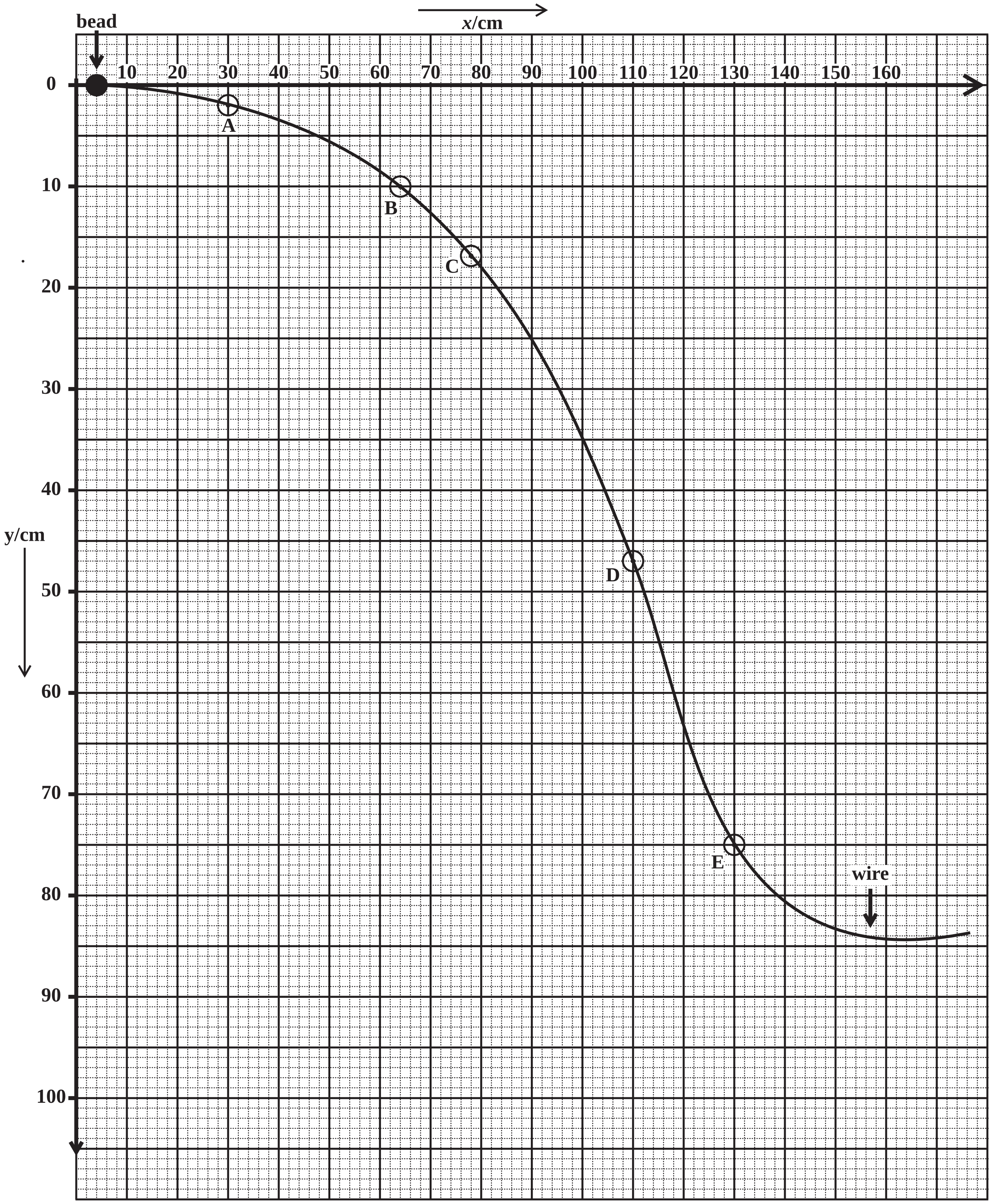

Figure 3. Position of bead after projection

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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TEST CODE **01238020**

FORM TP 2012103

MAY/JUNE 2012

C A R I B B E A N E X A M I N A T I O N S C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of **SIX** questions.

2. Section A consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in this answer booklet.

3. Section B consists of **THREE** questions. Candidates must answer **ALL** questions in this section. Answers for this section must be written in the space provided after EACH question in this answer booklet.

4. All working **MUST** be **CLEARLY** shown.

5. The use of non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalized.

6. Mathematical tables may be used.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Answer ALL questions.
You MUST write your answers in the spaces provided in this booklet.

1. A student investigated the relationship between the electrical potential difference across a device and the current flowing through that device. The results were recorded in Table 1.

TABLE 1

Potential difference (V)	1.5	4.0	10.0	18.0	30.0	45.0
Current (I)	0.02	0.05	0.15	0.24	0.40	0.60

(a) Plot on page 3, a graph of potential difference (V) versus current (I). **(8 marks)**

(b) Calculate the gradient of the line obtained in (a). (Do not use any point that coincides with a point from the table.)

(4 marks)

(c) State the physical property of the device with which the gradient is associated.

(1 mark)

(d) Using the information from the graph, comment on the relationship between the potential difference, (V), and the current (I).

____

____

(1 mark)

GO ON TO THE NEXT PAGE

GO ON TO THE NEXT PAGE

(e) Draw a labelled circuit diagram to show how the student should have connected his/her apparatus to conduct the investigation. **(4 marks)**

(f) With reference to 1 (e), describe the procedure used to conduct the investigation.

____

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(4 marks)

(g) Three devices with resistances 8 Ω, 12 Ω and 15 Ω are connected in a circuit. Find the combined resistance of these devices when they are arranged in parallel.

(3 marks)

Total 25 marks

2. (a) Complete Table 2 which relates the physical quantities and their derived SI units.

TABLE 2

(i)

Physical Quantity	**Derived SI Units**
Area	______________________
Volume	______________________
______________________	Kg m^{-3}

(3 marks)

(ii) State TWO fundamental quantities and their corresponding SI units.

Fundamental Quantity	SI Units
1.	
2.	

(4 marks)

(b) (i) Calculate the density of gasoline which occupies 150 cm^3 of space and has a mass of 102 g.

(3 marks)

(ii) If 325 g of mercury of density 13.6 gcm^{-3} occupies a certain space, determine the volume of the space.

(3 marks)

(iii) Calculate the relative density of gasoline using the density of mercury as the base quantity for the comparison.

(2 marks)

Total 15 marks

3. The yacht shown in Figure 1 has a mass of 8300 kg.

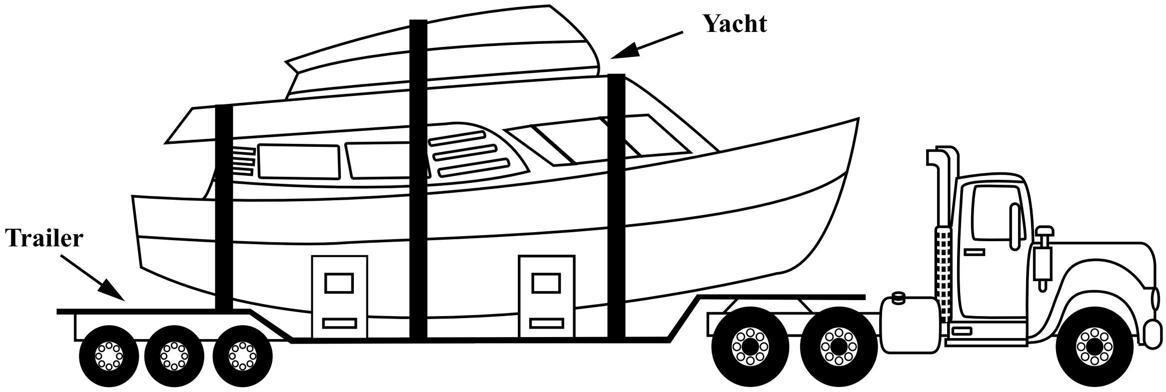

Figure 1. Diagram showing a yacht on a trailer

(a) Determine its weight in air.

[Acceleration due to gravity, g = 10 N Kg^{-1}]

(2 marks)

(b) For land transport, the yacht is secured on a trailer. Each tyre on the trailer can support up to a maximum of 7000 Newtons. What is the LEAST number of tyres the trailer should have to support the yacht adequately?

(2 marks)

GO ON TO THE NEXT PAGE

(c) (i) Many forces act on the yacht yet it is in equilibrium. State TWO conditions that must be satisfied for an object to be in equilibrium.

1. ____

____

2. ____

____

(2 marks)

(ii) State the effect that the position of the centre of gravity of an object has on its stability.

____

____

(1 mark)

(d) (i) State Archimedes' Principle.

____

____

____

(2 marks)

(ii) The yacht's hull is made of steel with density, ρ_s, equal 7850 kg m^{-3}. Explain how the yacht is able to float in sea water of density, ρ_w,1025 kg m^{-3}.

____

____

____

____

(2 marks)

(iii) Calculate the volume of sea water displaced by the yacht as it floats.

(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Answer ALL questions.

You MUST write your answers in the space provided after each question.

4. (a) Experiments into the fundamental nature of matter are being carried out at particle accelerator facilities. A hundred years ago, Geiger and Marsden performed the now famous gold – foil experiment at the suggestion of Rutherford.

Describe this experiment and explain how it established the nuclear structure of the atom.

(6 marks)

(b) One type of reaction in a nuclear reactor involves the bombarding of an Uranium atom ($^{235}_{92}U$) with a neutron. In the process, Krypton (Kr) and Barium (Ba) are created along with the release of 2 neutrons and energy. The incomplete equation for this reaction is:

$$^{235}_{92}U + {}^{1}_{0}n \rightarrow {}_{36}Kr + {}^{144}Ba + 2\,{}^{1}_{0}n + \text{energy}$$

(i) Rewrite and complete the nuclear equation for this process.

(2 marks)

GO ON TO THE NEXT PAGE

(ii) Table 3 below gives atomic mass data for nuclides.

TABLE 3

Nuclide	Atomic Mass / u
$^{235}_{92}U$	235.118
$_{36}Kr$	89.947
^{114}Ba	143.881
$^{1}_{0}n$	1.009

where u = 1.66×10^{-27} kg

Calculate the energy released in the nuclear reaction in 4 (b)(i). State your answer in Joules.

[$c = 3.0 \times 10^{8}$ m s^{-1}]

(7 marks)

Total 15 marks

5. (a) (i) State the equation for the General Gas Law.

(1 mark)

(ii) A little girl blew up a balloon during a Christmas celebration.
Explain, in terms of the kinetic theory, how pressure is exerted by the air in the balloon.

(5 marks)

(b) (i) A block of ice of mass 2000 g was heated from 0 °C to steam at 100 °C. Calculate the energy used in Joules.

(6 marks)

(ii) If the activity at (b) (i) took place in 6000 s, how much power was utilized?

(3 marks)

[Specific latent heat of vaporization of steam = 2 250 000 J Kg^{-1}
Specific latent heat of fusion of ice = 330 000 J Kg^{-1}
Specific heat capacity of water = 4 200 J Kg^{-1} K^{-1}]

Total 15 marks

6. (a) (i) Outline THREE differences between 'light waves' and 'sound waves'.

____

____

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____

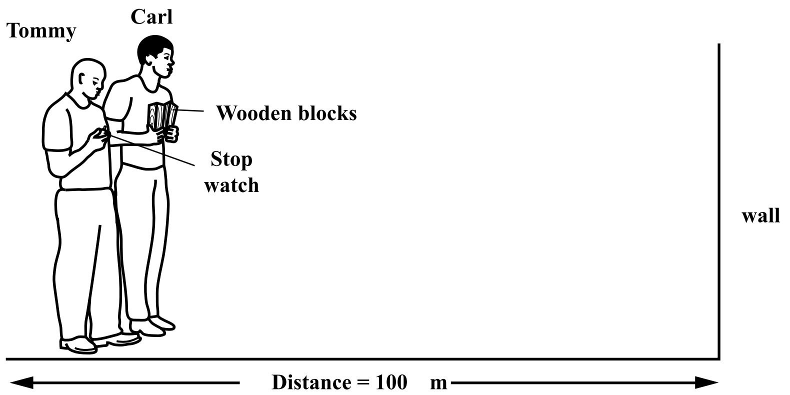
____

____

(3 marks)

(ii) Electromagnetic waves have many properties. Write a paragraph describing at least THREE properties not referred to in Part (a) (i). **(3 marks)**

(b) Carl and his friend Tommy were doing a School-Based Assessment on estimating the speed of sound in air using an echo method.



Carl stands 100 m from a wall. Carl claps two wooden blocks to produce a series of echoes and Tommy who was standing beside him starts his stop watch. After 1 echo Tommy stops the watch. This process is repeated and the time for 50 echoes was calculated to be 30.3 s.

Calculate the speed of the sound generated.

(5 marks)

(c) A popular radio station broadcasts with a frequency of 100 x 10^6 Hz.

Calculate, in centimetres, the wavelength of the sound waves generated. **(4 marks)**

[Speed of radio waves = 3.0 x 10^8 m s^{-1}].

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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TEST CODE **01238032**

FORM TP 2012104

MAY/JUNE 2012

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

SECONDARY EDUCATION CERTIFICATE EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. The use of non-programmable calculators is allowed.
5. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

1. A researcher investigated the relationship between the temperature and pressure of a fixed mass of gas by supplying it with heat energy at constant volume.

(a) Complete Table 1 by

(i) looking at the trend and choosing a suitable value for the temperature reading

(ii) reading the corresponding pressure values from the graph on page 3.

TABLE 1

Pressure/mm Hg						
Temperature/K	100	150	200	250	300	

(7 marks)

(b) From the graph calculate the amount by which the pressure changes when the temperature changes by 1 K.

____

____

____

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____

(5 marks)

(c) Determine the temperature in Celsius when the presure of the gas is 750 mm Hg.

____

____

____

____

(4 marks)

(d) Use the graph to determine the pressure in mm Hg when the temperature is

(i) 50 K

____

(ii) 400 K

____

(4 marks)

Total 20 marks

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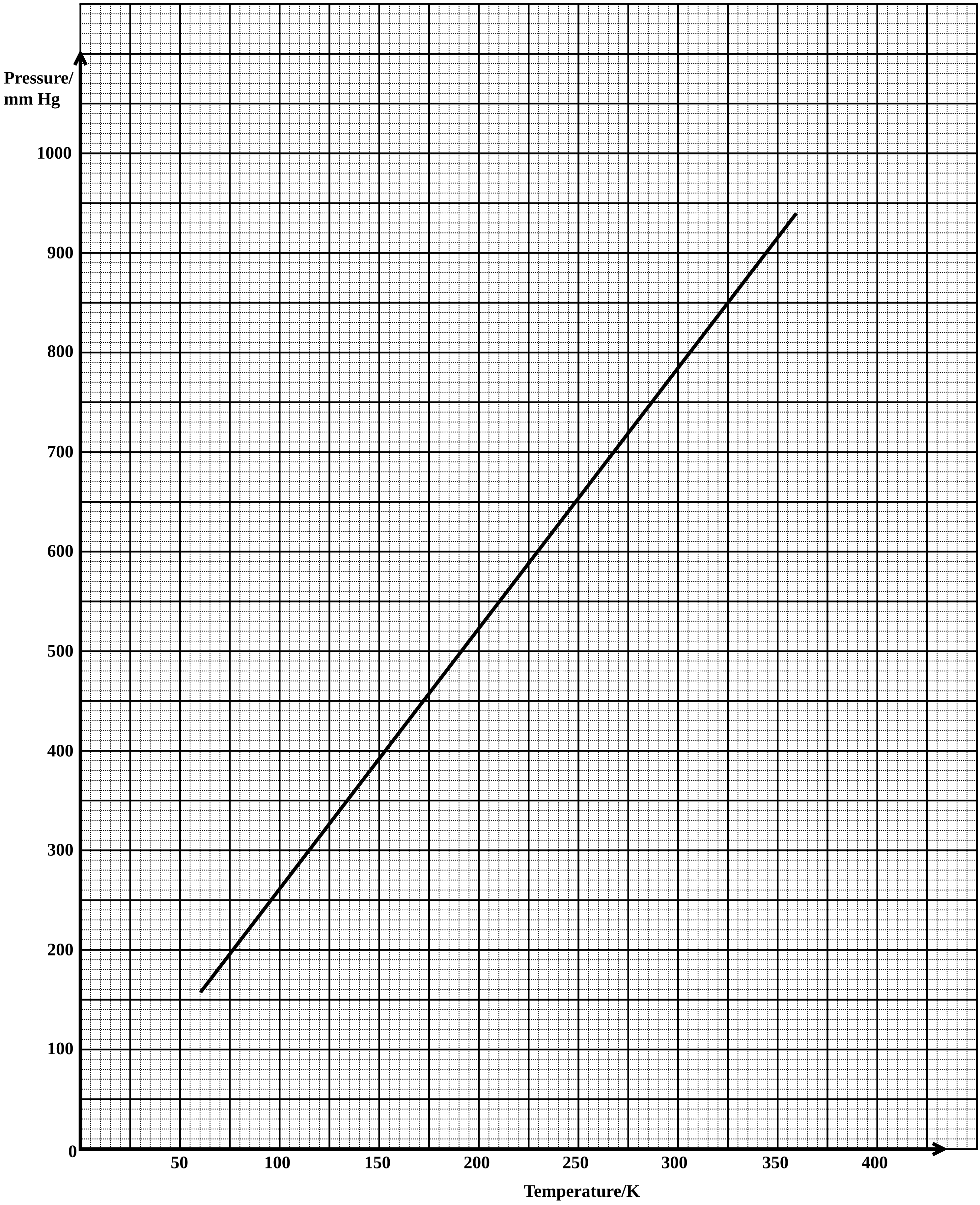

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NOTHING HAS BEEN OMITTED

2. A group of fifth form physics students was given a School-Based Assessment to

– investigate the relationship between voltage, V, and current, I, for a resistor at constant temperature

– draw a V–I graph and hence calculate the resistance, R, of the resistor.

(a) Figure 1 shows a circuit diagram of the apparatus used.

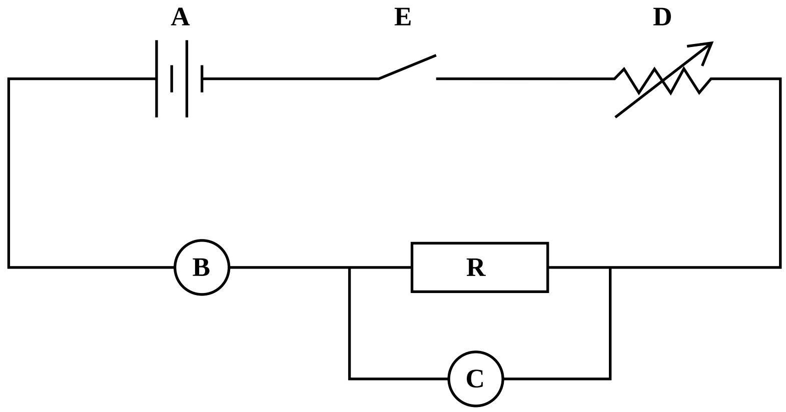

Figure 1. A circuit diagram

In Table 2 write the name of EACH of the components represented by the letters A – E as shown in Figure 1.

TABLE 2

Letter	Name of Component
A	
B	
C	
D	
E	

(5 marks)

(b) The results of the group's activity are recorded in Table 3.

TABLE 3

Voltage (V/V)	Current (I/A)
0.40	0.11
0.60	0.19
0.80	0.25
1.00	0.33
1.20	0.39
1.70	0.56

GO ON TO THE NEXT PAGE

(i) Plot a graph of V/V against I/A on page 7. Begin both axes at zero, the origin.

(6 marks)

(ii) Calculate the gradient of the line.

____

____

____

____

____

(4 marks)

(iii) Use the gradient to determine the resistance, R, of the conductor.

____

____

____

(1 mark)

(iv) The present resistor is now replaced by another resistor. The circuit is closed. The voltage is recorded as 1.9 V and current as 0.48 A. Calculate the resistance of this new resistor.

____

____

____

____

____

(3 marks)

Total 19 marks

3. A student is provided with three unlabelled radioactive sources: an alpha emitter, a beta emitter and a gamma emitter.

Design an experiment to help the student identify EACH radioactive source based on its range in different media.

Your answer should include:

(a) A list of the apparatus you would need

(b) A description of the procedure you plan to use

(c) One safety precaution the student should employ

(d) An account of how the student would use the observations to identify EACH type of source

a) Apparatus

____

____

____

____

(3 marks)

b) Procedure

____

____

____

____

____

____

____

(3 marks)

c) Safety precaution

(1 mark)

d) Conclusion

(2 marks)

Total 9 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions.

2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section. Answers for this section must be written in this answer booklet.

3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section. Answers for this section must be written in this answer booklet.

4. All working MUST be CLEARLY shown.

5. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalised.

6. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. The data in Table 1 showing V_s and V_p were obtained when testing a transformer.

TABLE 1

V_p/V	V_s/V
2.4	21.1
3.5	32.3
4.4	40.5
6.1	54.6
7.7	69.9

(a) On page 3, plot a graph of V_s against V_p. **(7 marks)**

(b) Determine the gradient, S, of the graph.

(4 marks)

(c) Use the gradient, S, to calculate

(i) the number of turns in the primary, N_p, given that the number of turns in the secondary, $N_s = 750$

(4 marks)

GO ON TO THE NEXT PAGE

(ii) the current in the secondary winding, if the primary current is 1.6 A.

(3 marks)

(d) (i) If the current in the secondary winding is actually 0.15 A, calculate the efficiency of this transformer.

(3 marks)

(ii) How would you know if this was 'an ideal transformer'?

(1 mark)

(e) State THREE features of the transformer that enable it to operate efficiently.

(3 marks)

Total 25 marks

2. (a) Complete Table 2 which shows physical quantities and the instruments used to measure them.

TABLE 2

Quantity	**Instrument**
Diameter of a wire	
Volume of a liquid	
	Thermometer
	Spring balance
Time	

(5 marks)

(b) A child, drops a stone as shown in Figure 1.

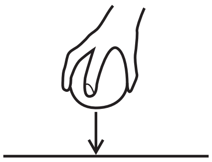


Figure 1

(i) Identify the force which acts on the stone, causing it to fall.

____

____

(1 mark)

(ii) Describe the change in motion of the stone as a result of this force.

____

____

(1 mark)

(c) (i) Given that the mass of a cricket ball is 0.06 kg, calculate its weight in newtons.

____

____

____

____

(3 marks)

[Acceleration due to gravity, g = 10 m s^{-2}]

(ii) Figure 2 is a vector diagram representing a cricket ball's velocity, OA, and the wind's velocity, OB.

a) By accurate scale drawing on Figure 2 below, determine the resultant vector.

Scale 1 cm = 2 ms^{-1}

Figure 2

(3 marks)

b) State its magnitude in m s^{-1} and its direction in degrees from OA.

____

____

____

____

(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

3. (a) (i) Draw and label a mercury laboratory thermometer, clearly indicating the fixed points.

(4 marks)

(ii) Draw arrows in Table 3 from each thermometer to map it to its operating range.

TABLE 3

Type of Thermometer	**Operating Temperature Range/°C**
Clinical	−20 to 110
Laboratory thermometer	−250 to 800
Thermocouple	35 to 43

(3 marks)

(b) Figure 3 shows a scuba diver ascending from 20 m below the surface where the water temperature is 10 °C, to the surface, where the temperature is 25 °C and the pressure is 1.01×10^5 Pa.

Figure 3

(i) Calculate the pressure the diver is subjected to at 20 m below the surface of the water.

___

___

___

___

(3 marks)

[Density of water = 1025 kg m^{-3}]

[Acceleration due to gravity, g = 10 m s^{-2}]

(ii) By using the general gas law, determine, as a result of the rise, the ratio of the final volume to the initial volume of a bubble.

(5 marks)

Total 15 marks

SECTION B

Attempt ALL questions.

You MUST write your answers in the spaces provided after each question.

4. (a) Describe EACH of the following terms as it relates to the laws of reflection:

(i) Normal

(ii) Angle of incidence

(iii) Angle of reflection

Describe what EACH of the terms means.

(3 marks)

(b) In the description of the formation of an image produced in a plane mirror, a physics student recalled THREE features.

State the THREE features of an image produced in a plane mirror. **(3 marks)**

(c) Using a relevant physics concept, explain why the word **AMBULANCE** is painted in this manner at the front of some emergency vehicles. **(4 marks)**

(d) Figure 4 shows a ray of white light, AO, incident at 30° to the PS boundary of the rectangular glass block, PQRS.

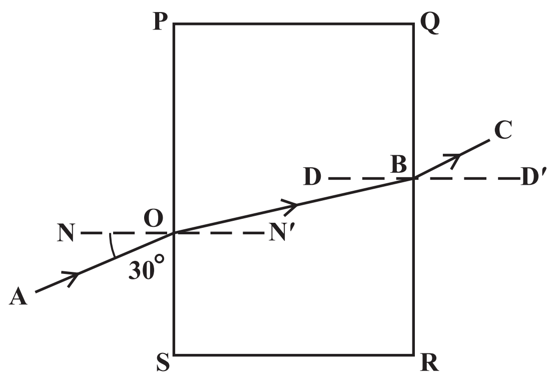


Figure 4

(i) Calculate the angle of refraction produced on the PS boundary.

(ii) Name the angle of refraction produced on the QR boundary. **(5 marks)**

[Refractive Index of glass = 1.5] **Total 15 marks**

Write your answer to Question 4 here.

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) (i) Describe a test to show that a semi-conductor diode is defective. **(2 marks)**

(ii) Sketch the I-V graph for a functioning semi-conductor diode. **(2 marks)**

(iii) Draw and complete a truth table for a 'NOT gate'. **(2 marks)**

(b) Figure 5 shows three resistors of values 2Ω, 6Ω and 12Ω in series.

(i) Calculate the equivalent resistance that one can use in series.

Figure 5

(2 marks)

(ii) In a second scenario, 2Ω, 6Ω and 12Ω resistors are placed in parallel as seen in Figure 6.

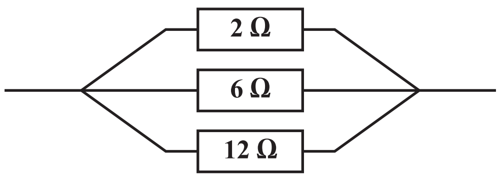


Figure 6

Calculate the equivalent resistance that one can use in parallel. **(4 marks)**

(c) Last year for Christmas, Paula had to put together a set of bulbs to light her family's Christmas tree. After much thought, she decided to put together strings of bulbs in series. Was that a wise decision? Justify your answer. **(3 marks)**

Total 15 marks

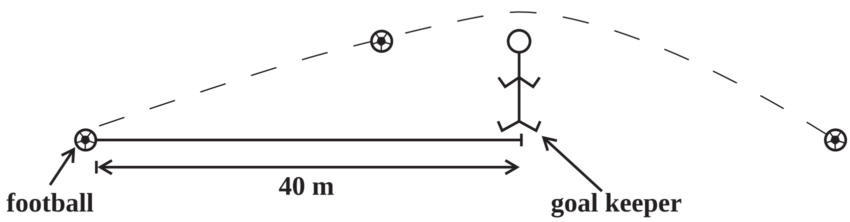
Write your answer to Question 5 here.

Write your answer to Question 5 here.

Write your answer to Question 5 here.

6. (a) Discuss the importance of alternative energy to the Caribbean with reference to two sources and their uses. **(6 marks)**

(b) A football is kicked from rest looping over the head of a goalkeeper who is 40 m away.



(i) Describe the energy changes taking place in the ball from when it was kicked to when it hit the ground behind the goalkeeper. (Assume no energy losses.) **(4 marks)**

(ii) After 1s, the ball of mass *m* kg and velocity *v* ms^{-1} is located *h* m from the ground.

Derive an expression in terms of *m*, *h* and *v* for the difference between the potential and the kinetic energy of the ball. **(2 marks)**

(iii) During a game, the ball of mass 0.43 kg hit the head of one of the players of height 1.5 m. The player was standing vertically. If the velocity of the ball at the point of contact with the player's head was 7 m s^{-1}, what momentum was transferred to the player? **(3 marks)**

Acceleration due to gravity, g = 10 N kg^{-1} **Total 15 marks**

Write your answer to Question 6 here.

GO ON TO THE NEXT PAGE

Write your answer to Question 6 here.

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

IF YOU BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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TEST CODE **01238032**

FORM TP 2013023

JANUARY 2013

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Attempt ALL questions.
4. You may use a silent, non-programmable calculator.
5. Mathematical tables are provided.
6. You are advised to take some time to read through the paper and plan your answers.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. A motor cyclist travels from St John's to the Vivian Richards Stadium in Antigua. His velocity was recorded at intervals for 60 s as shown in Table 1.

TABLE 1

Velocity, v/m s^{-1}	0	8	14	29	30	37	45
Time, t/s	0	10	20	30	40	50	60

(a) On page 3, plot a graph of velocity versus time. **(11 marks)**

(b) One of the readings was incorrectly recorded. Identify this reading and write a possible value.

____

____

(2 marks)

(c) Calculate the gradient of the graph.

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(6 marks)

(d) What physical quantity does the gradient represent?

____

(1 mark)

Total 20 marks

GO ON TO THE NEXT PAGE

2. (a) Boyle's law states that the volume of a fixed mass of gas is inversely proportional to its pressure if the temperature is constant.

Students in a fifth form class were given the apparatus shown in Figure 1 and told to use it to investigate this law.
Label Figure 1 and describe how the investigation may be done.

Include ONE precaution that should be taken to keep the temperature constant.

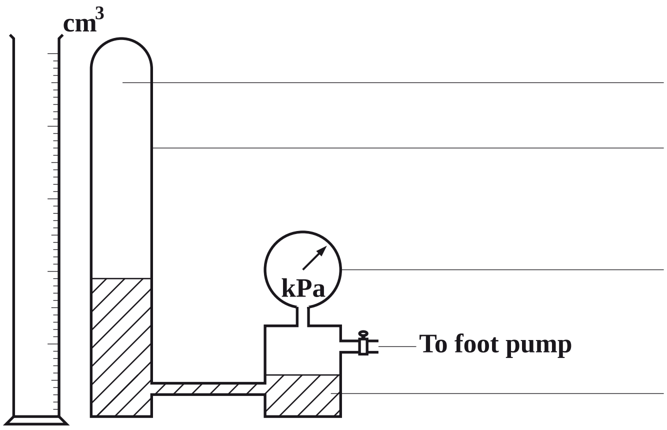

Figure 1

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(10 marks)

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(b) The students' results were plotted on the graph shown in Figure 2.

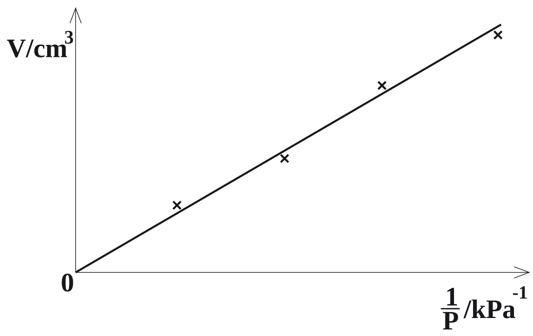

Figure 2

Explain whether the graph shows that Boyle's law is confirmed or not.

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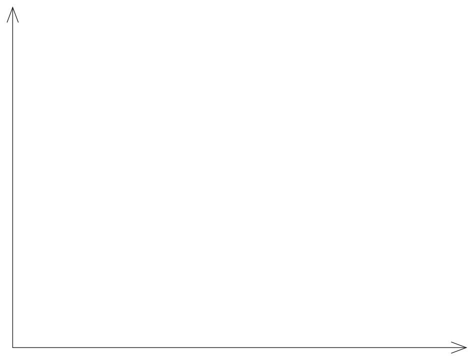
(4 marks)

(c) If the students had plotted instead a graph of V against P, **sketch** the graph they would have obtained.



(2 marks)

Total 16 marks

GO ON TO THE NEXT PAGE

3. (a) Jamal and Kim were asked to demonstrate, using a magnet with unmarked poles, how they could distinguish the North Pole from the South Pole. Describe, with the aid of a diagram, a method they might have used.

Diagram(s):

(2 marks)

Procedure:

(4 marks)

GO ON TO THE NEXT PAGE

(b) Jamal and Kim were also given two identical unmarked steel bars and told that one of them was a magnet while the other was a magnetic material. Show how they could identify which bar was the magnet.

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(6 marks)

Total 12 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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FORM TP 2013103

TEST CODE **01238020**

MAY/JUNE 2013

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION**

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section.
3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section.
4. All answers MUST be written in this answer booklet.
5. All working MUST be CLEARLY shown.
6. The use of silent, non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalized.
7. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. Table 1 shows the results obtained by a student who performed an experiment to investigate how the length of a spring varies with the load applied to the end of the spring.

TABLE 1

Load, F/N	Length, L/m
2.0	0.36
4.0	0.35
6.0	0.40
8.0	0.46
10.0	0.51

(a) Plot, on page 3, a graph of length (L) on the vertical axis versus Load (F). Start each axis at zero.

(7 marks)

(b) Determine the gradient of the graph.

____

____

____

____

____

(4 marks)

(c) What information about the spring does the gradient of the graph provide?

____

____

(1 mark)

GO ON TO THE NEXT PAGE

(d) (i) Use the graph to find the original length of the spring.

(2 marks)

(ii) Use the gradient to calculate the extension of the spring if a 0.7 kg mass hangs freely from the end of the spring. Hence calculate the length of the spring with the mass attached.

(6 marks)

[g = 10 N kg^{-1}]

(iii) If the spring was stretched beyond its elastic limit how would this affect the shape of the graph?

(1 mark)

(e) (i) How would you identify the region where proportionality exists?

(2 marks)

(ii) Classify EACH quantity shown in Table 2, as a scalar or vector by inserting a tick (✓) in the appropriate column.

TABLE 2

Quantity	**Scalar**	**Vector**
Load		
Extension		

(2 marks)

Total 25 marks

2. (a) (i) Define the term 'specific heat capacity' of an object.

____

____

(2 marks)

(ii) Complete Table 3 below by inserting the correct symbol and SI Unit which relate to the quantity shown in Column 1.

TABLE 3

Quantity	Symbol	SI Unit
Heat Capacity	C	
Specific Latent Heat of Fusion		J kg^{-1}

(2 marks)

(iii) Write the formula for the General Gas Law, stating clearly what each letter represents.

____

____

____

____

(3 marks)

(b) A physicist converts 8 kg of water at 33 °C to steam at 100 °C.

Assuming there is no heat lost, calculate the energy required

(i) to heat the water to 100 °C.

____

____

____

(3 marks)

(ii) to convert the water to steam at 100 °C.

____

____

____

(3 marks)

GO ON TO THE NEXT PAGE

(iii) What is the total energy, in mega joules, required to heat the 8 kg of water at 33 °C to steam at 100 °C?

(2 marks)

[Specific heat capacity of water = 4 200 J kg^{-1}K^{-1}]

[Specific latent heat of vaporization of water = 2 300 000 J kg^{-1}]

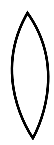
Total 15 marks

3. (a) (i) State Snell's Law.

(3 marks)

(ii) In the space below, draw a labelled diagram using the converging lens to show clearly the following features:

- Principal axis
- Principal focus
- Focal length
- Focal plane



(4 marks)

(b) (i) Describe the path into a prism and out of a prism when a ray of light is incident at 90° to the hypotenuse of a right-angled glass prism as shown in Figure 1.

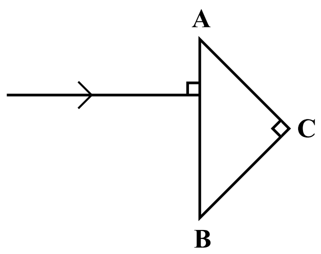


Figure 1

(7 marks)

(ii) Through what angle would the ray be turned after emerging?

(1 mark)

[Critical angle for glass = 42°]

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Attempt ALL questions.

You MUST write your answers in the spaces provided after each question.

4. (a) (i) State the law of conservation of linear momentum. **(3 marks)**

(ii) Describe a situation that demonstrates the law of conservation of linear momentum. **(3 marks)**

(b) A truck, of mass 1250 kg, heading north crossed the median on the Jasper Highway, then slammed head-on at 25 ms^{-1} into a 625 kg car heading south at 30 m s^{-1}.

(i) What was the initial momentum of the truck?

(ii) What was the initial momentum of the car?

(iii) Assuming the car and truck move as one following the collision, what is the speed and direction of the wreck right after the collision?

(9 marks)

Total 15 marks

Write your answer to Question 4 here.

Write your answer to Question 4 here.

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) Describe an experiment that can be used to determine the resistance of a metallic conductor. **(6 marks)**

(b) Figure 2 shows a 12 V battery of negligible internal resistance connected to an arrangement of resistors.

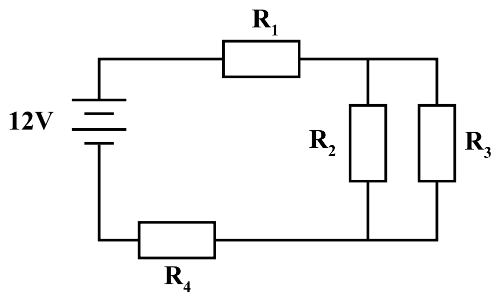


Figure 2

Given that resistors R_1 to R_4 each have a resistance of 3Ω, calculate

(i) the total resistance in the circuit **(3 marks)**

(ii) the current drawn from the 12V battery **(3 marks)**

(iii) the voltage across R_2. **(3 marks)**

Total 15 marks

Write your answer to Question 5 here.

GO ON TO THE NEXT PAGE

Write your answer to Question 5 here.

Write your answer to Question 5 here.

Write your answer to Question 5 here.

6. (a) Describe an experiment to compare the ranges of β and γ emissions in aluminium.

(6 marks)

(b) A liquid fluoride thorium reactor is said to be the new ‘green’ nuclear reactor.

(i) Rewrite the nuclear sequence to show how thorium-232 becomes uranium-233, a nuclear fuel, by calculating the numerical values of *x*, *y*, *u*, *v*, and *z*.

$$\mathbf{{}^{1}_{0}n + {}^{232}_{90}Th \longrightarrow {}^{x}_{y}Th}$$

$$\mathbf{{}^{x}_{y}Th \longrightarrow {}^{0}_{-1}e + {}^{u}_{v}Pa}$$

$$\mathbf{{}^{u}_{v}Pa \longrightarrow {}^{0}_{-1}e + {}^{233}_{z}U}$$

(5 marks)

(ii) The equation representing the fission of U- 233 is

$$\mathbf{{}^{233}_{92}U + {}^{1}_{0}n \longrightarrow {}^{133}_{51}Sb + {}^{98}_{41}Nb + 3\,{}^{1}_{0}n + energy} \; .$$

Table 4 provides the data for these nuclides where u = 1.66×10^{-27} kg.

TABLE 4

Nuclide	Atomic Mass/u
${}^{233}_{92}U$	233.03964
${}^{133}_{51}Sb$	132.91525
${}^{98}_{41}Nb$	97.91033
${}^{1}_{0}n$	1.00867

Calculate the energy released in the fission of ${}^{233}_{92}U$.

$$\mathbf{c = 3.0 \times 10^{8}\ m\ s^{-1}}$$

(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

Write your answer to Question 6 here.

GO ON TO THE NEXT PAGE

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

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FORM TP 2013104

TEST CODE **01238032**

MAY/JUNE 2013

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.

2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.

3. Attempt ALL questions.

4. The use of silent, non-programmable calculators is permitted.

5. Mathematical tables are provided.

6. You are advised to take some time to read through the paper and plan your answers.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. The results in Table 1 were obtained in an experiment to investigate how the volume of a fixed mass of gas varies with its temperature.

TABLE 1

V /cm³	96.6	98.2	100.0	101.9	103.2	105.0	108
Θ/°C	5	10	15	20	25	30	40

(a) With the aid of a labelled diagram, briefly describe the details of how the experiment may have been set up. Include at least one precaution to be taken to ensure accurate results.

(6 marks)

(b) On page 2, plot a graph of Volume, V, against Temperature, **ϴ**. Begin the Volume axis at 90 cm^3 and the Temperature axis at 0 °C. **(11 marks)**

(c) Use the graph to determine

(i) the intercept on the volume axis

____

(1 mark)

(ii) the volume of the gas when the temperature is 23°C.

____

(2 marks)

Total 20 marks

NOTHING HAS BEEN OMITTED.

2. Grade 10 students were asked to plan and design an experiment to measure the energy dissipated in a resistor due to the charge flowing through it. Using a joule metre, an ammeter and other relevant equipment the students obtained the results recorded in Table 2. These results are shown by the graph on page 7.

TABLE 2

Q/C		5	10	15	20		30
E/J		15		47.2	61.0	75.0	89.5

Using the graph on page 7:

(i) Complete Table 2 to show ALL of the plotted points. **(3 marks)**

(ii) Determine the potential difference across the resistor.

____

____

____

____

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(7 marks)

(iii) Determine the energy dissipated when a current of 0.5A flows for 15 s.

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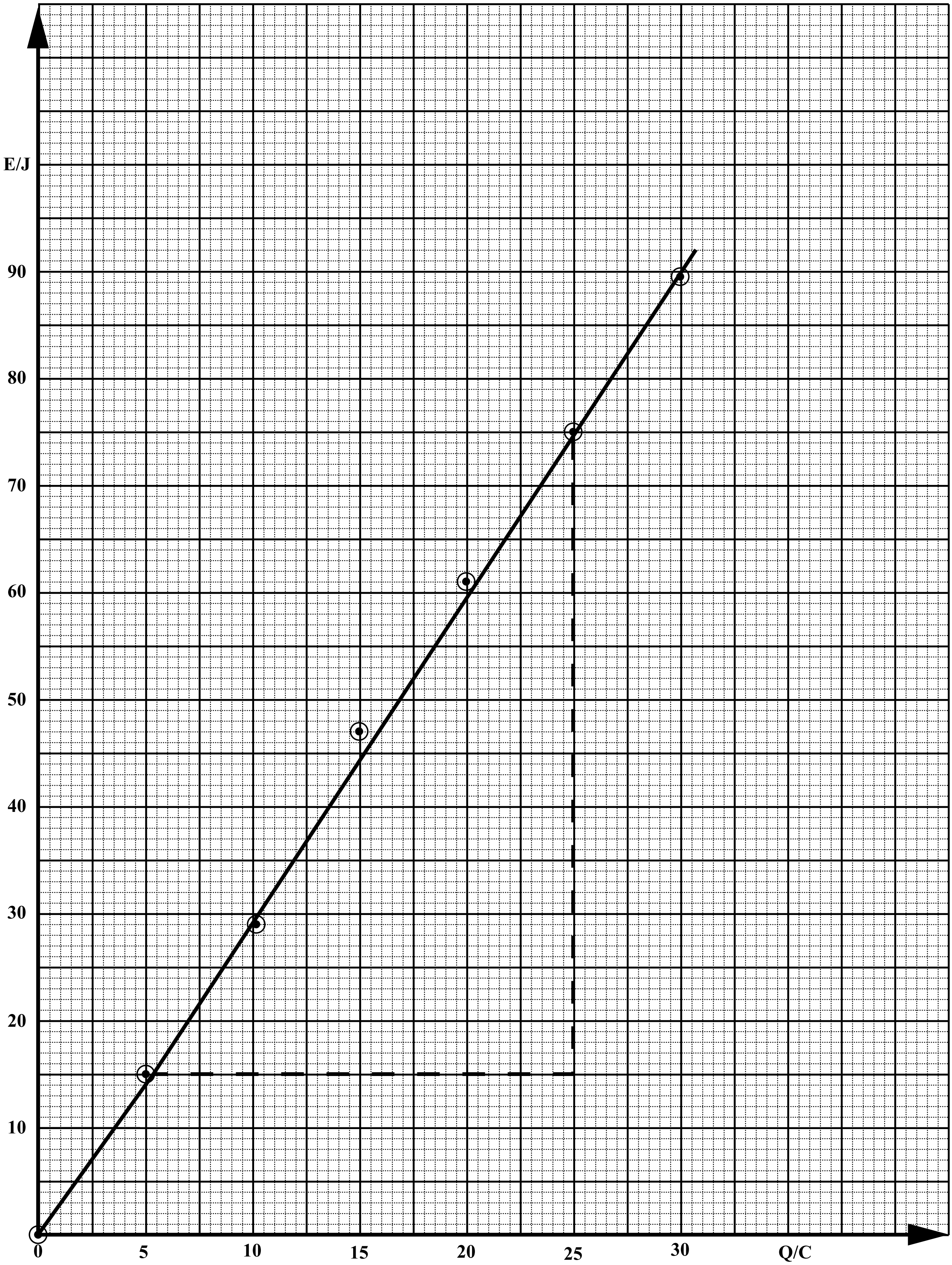
(4 marks)

Total 14 marks



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3. A diode and a resistor hidden in a matchbox, are joined in series and connected between points A, B and C as shown in Figure 1.

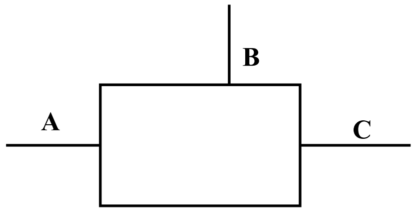

Figure 1

Using a 3V battery, an ammeter and a protective resistor, a student was asked to find out how they were connected.

After carrying out an experiment, the student concluded that they were connected as shown in Figure 2.

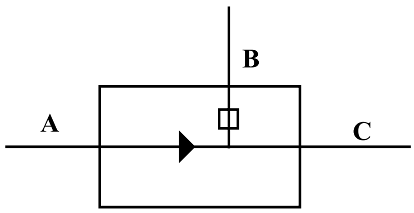

Figure 2

(a) Draw the current diagram that could have been used to conduct the experiment.

(4 marks)

GO ON TO THE NEXT PAGE

(b) Describe what the student must have done to obtain the results to support his/her conclusion.

(4 marks)

(c) Indicate what results would have led to the student's conclusion.

(6 marks)

Total 14 marks

END OF TEST

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TEST CODE **01238020**

FORM TP 2014022

JANUARY 2014

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of SIX questions.
2. Section A consists of THREE questions. Candidates must answer ALL questions in this section. Answers for this section must be written in this answer booklet.
3. Section B consists of THREE questions. Candidates must answer ALL questions in this section. Answers for this section must be written in this answer booklet.
4. All working MUST be CLEARLY shown.
5. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
6. Mathematical tables are provided.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Answer ALL questions.

You MUST write your answers in this answer booklet.

1. Keshorn investigated the relationship between image size, I, and object size, O, while studying shadows.

His results are presented in Table 1.

TABLE 1

Image Size, I/cm	2.5	5.0	7.6	10.0	12.6	15.0
Object Size, O/cm	0.5	1.0	1.5	2.0	2.5	3.0

(a) On page 3, plot a graph of image size, I, versus object size, O. **(7 marks)**

(b) Calculate the gradient, G, of the line obtained.

(5 marks)

(c) State the physical quantity with which the gradient of the graph, G, is associated.

____

____

____

(1 mark)

(d) During the investigation, Keshorn talked with his friend Atiba about the term ‘focal length’. Define the term ‘focal length’.

(3 marks)

(e) With what piece of apparatus in physics is the term ‘focal length’ associated?

(1 mark)

(f) A 10 cm tall tablet computer was placed vertically 20 cm from a plane mirror. Its image distance was found to be 20 cm.

Use the data given to calculate

(i) the height of the image of the computer

(4 marks)

(ii) the magnification of this image.

(4 marks)

Total 25 marks

2. (a) (i) Figure 1 shows some physical quantities and their units. Draw an arrow from EACH quantity to its unit.

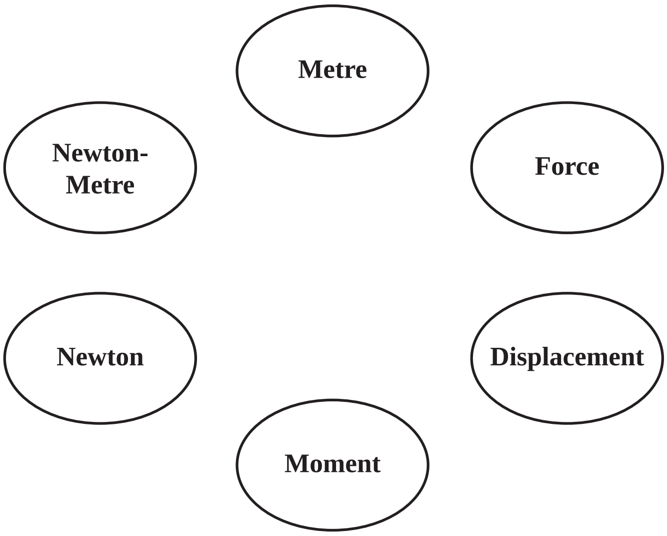

Figure 1

(3 marks)

(ii) Complete Table 2 to show the names of three forces and a situation in which EACH force acts.

TABLE 2

Force	**Situation**
1. ______________________________	A javelin falling in the air
2. Upthrust	______________________________
3. ______________________________	______________________________

(4 marks)

(b) Patrick and Patricia showed their class a 'magical' balancing act. They both sat on one side of a uniform 6.0 m plank. Patrick sat 1.0 m from the pivot located 0.5 m from the centre of the plank. Patricia sat 0.5 m from the pivot, on the same side as Patrick.

Figure 2 shows the 'magical' balancing act. X represents the pivot point.

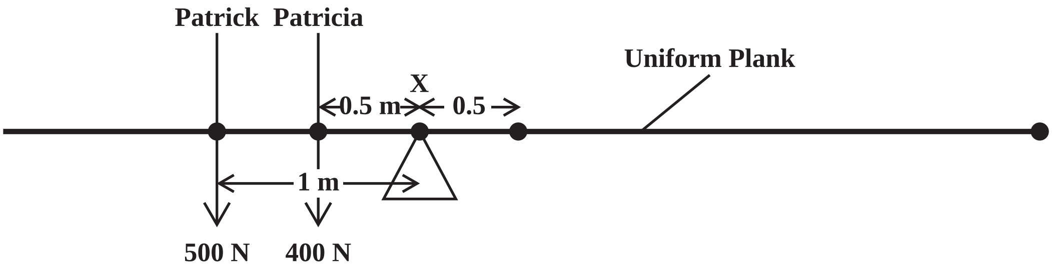

Figure 2

(i) Label, as W, the point on Figure 2 where the weight of the plank acts. **(1 mark)**

(ii) Calculate the weight of the plank, W.

(4 marks)

(iii) If Patrick sat alone on the plank, calculate where he would have to sit in order to maintain his 'magical' balancing act. The pivot remains as before.

(3 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

3. (a) State the physical property that varies with temperature in each of the following thermometers.

(i) A laboratory thermometer

____

(1 mark)

(ii) A thermomcouple

____

(1 mark)

(b) Complete Table 3 which relates the use of a thermometer to its design.

TABLE 3

Use of Thermometer	**Design Feature**
To measure body temperature	
To measure temperatures lower than −40ºC	
	Junction of small mass

(3 marks)

(c) (i) State Charles' Law.

____

____

____

____

(2 marks)

(ii) In a sealed cylinder, the volume of gas is recorded as 40 cm^3 with a temperature of 30^oC.

What is the **percentage** increase in volume of the gas if the cylinder is heated until the gas temperature reaches 70^oC?

(8 marks)

Total 15 marks

NOTHING HAS BEEN OMITTED.

SECTION B

Answer ALL questions.

You MUST write your answers in the spaces provided after each question.

4. (a) (i) State TWO properties of electromagnetic waves. **(2 marks)**

(ii) Visible light is a type of electromagnetic wave. State TWO other types of electromagnetic waves indicating whether the wavelength of each is higher or lower than that of visible light. **(4 marks)**

(b)

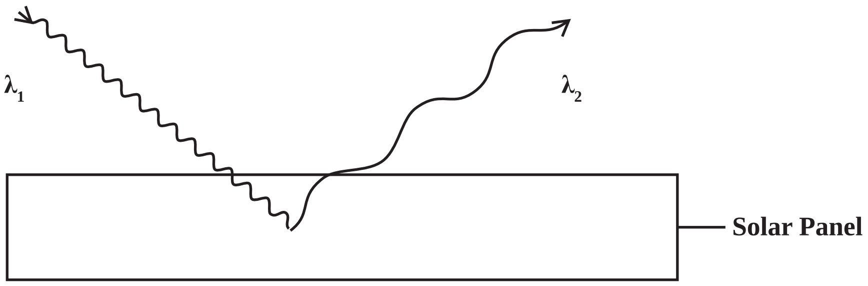

Figure 3

(i) Electromagnetic waves of one wavelength are absorbed by a solar panel and waves of a longer wavelength are emitted. If electromagnetic waves of wavelength $\lambda_1 = 2 \times 10^{-7}$ m are absorbed by a solar panel as shown in Figure 3 and waves of wavelength $\lambda_2 = 6.5 \times 10^{-5}$ m are emitted, calculate

a) the frequency in each case **(3 marks)**

b) the decrease in frequency, Δf. **(1 mark)**

(ii) We assume that the useful energy transferred to the solar panel is a constant, k, times the decrease in frequency of the e.m. waves. ($E = k\Delta f$). State the corresponding energy transferred, E_1, in terms of k. **(1 mark)**

(iii) With a change of conditions, the wavelength of the wave now absorbed by the panel increased to 6×10^{-7} m, but the emitted wavelength remains at $\lambda_2 = 6.5 \times 10^{-5}$ m. What fraction of E_1, the original energy transferred, is now transferred to the solar panel? **(4 marks)**

[Speed of light, $c = 3.0 \times 10^8$ m s^{-1}]

Total 15 marks

Write your answer to Question 4 here.

Write your answer to Question 4 here.

Write your answer to Question 4 here.

5. (a) With the aid of a diagram, describe an experiment that may be used to investigate the relationship between current, I, and potential difference, V, for a filament lamp. Sketch your expected result. **(6 marks)**

(b) The power supply shown for the circuit in Figure 4 provides a current of 1 mA to the rest of the circuit.

(i) Assuming negligible losses in the connecting wires, calculate the required potential difference of the supply. **(5 marks)**

(ii) Calculate the current in the 5 kΩ resistor. **(3 marks)**

(iii) If the 2 kΩ resistor burns out, what current now flows in the 5 kΩ resistor? **(1 mark)**

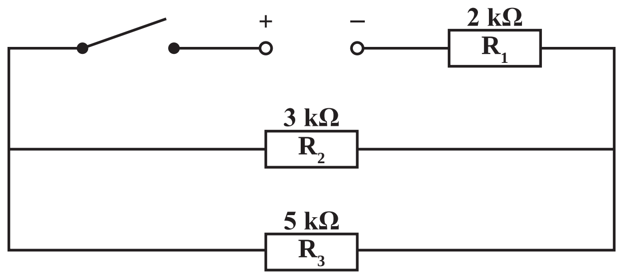

Figure 4

Total 15 marks

Write your answer to Question 5 here.

Write your answer to Question 5 here.

Write your answer to Question 5 here.

6. (a) A nucleus of a radioactive isotope radium $^{226}_{86}$Ra emits an α-particle (alpha-particle) when it decays to a nucleus of the element radon, Rn.

(i) Write the equation representing this decay process. **(3 marks)**

(ii) How many neutrons are in the $^{226}_{86}$Ra nucleus? **(2 marks)**

(b) Explain why an atom is normally neutral and stable. **(4 marks)**

(c) What are ‘isotopes’? **(2 marks)**

(d) Figure 5 shows the structure of the atom of an element X:

n: neutrons p: protons e: electrons

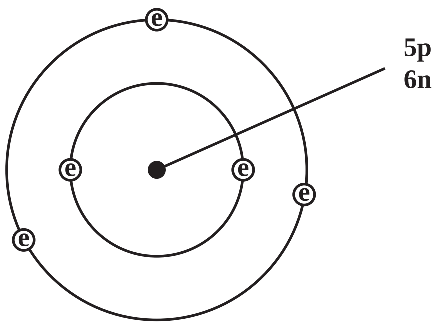

Figure 5

(i) State the mass number, atomic number and the charge on the nucleus of this atom.

(ii) Write the symbol for another possible isotope of X. **(4 marks)**

Total 15 marks

Write your answer to Question 6 here.

Write your answer to Question 6 here.

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238032**

FORM TP 2014023

JANUARY 2014

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
2. ALL WORKING MUST BE SHOWN in this booklet, since marks will be awarded for correct steps in calculations.
3. Answer ALL questions.
4. The use of a silent, non-programmable calculator is permitted.
5. Mathematical tables are provided.
6. You are advised to take some time to read through the paper and plan your answers.

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Answer ALL questions.

You MUST write your answers in this answer booklet.

1. (a) Paul was asked to find the density of the material of a dollar coin. He obtained the thickness, *t*, diameter, *d*, and the mass, *m*, using the instruments shown in Figures 1–3. He noted that the mass measurer had a zero error of –0.1g.

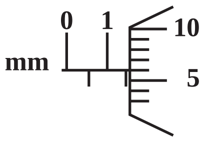

Figure 1

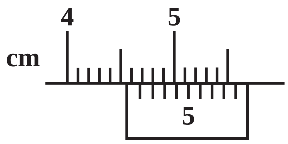

Figure 2

Figure 3

t = ...

d = ...

m = ...

(i) Record his readings for *t*, *d* and *m* in the spaces provided above. **(6 marks)**

(ii) Use the readings to find the density of the material. [$\pi = 3.14$]

(5 marks)

(b) (i) In a related experiment, the student was asked to find the density of the material of a large irregular solid. He used a triple beam balance as shown in Figure 4.

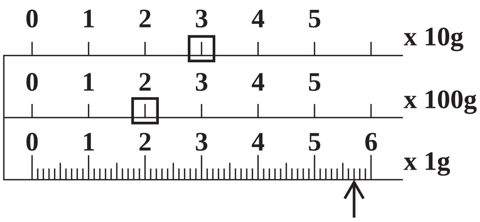

Figure 4

Record his reading in the space provided below.

Mass = ... **(3 marks)**

(ii) Describe a method he could use to find its volume and hence the density.

(5 marks)

(c) Which of the instruments shown in Figures 5 and 6 has an analogue scale?

Figure 5

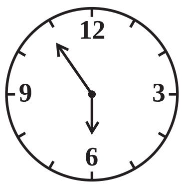

Figure 6

Enter in box.

Analogue scale: Figure ☐ **(1 mark)**

Total 20 marks

GO ON TO THE NEXT PAGE

2. (a) In an experiment to determine the melting point of naphthalene, a group of fourth form students set up the apparatus as shown in Figure 7.

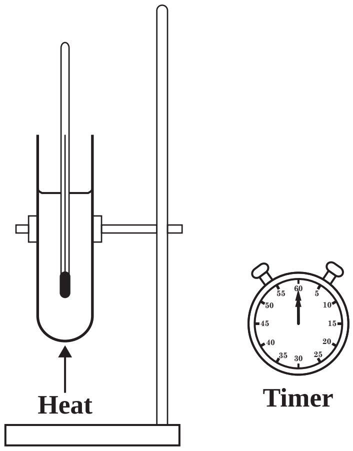

Figure 7

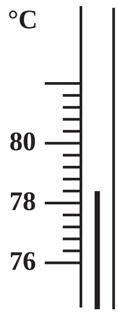

Figure 8

(i) State TWO precautions the students should take when conducting this experiment.

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(2 marks)

(ii) With a beginning temperature of 90°C, as the naphthalene cooled, the temperature was recorded every minute until it reached about 60°C. At time t = 20 minutes, the thermometer reading shown in Figure 8 was read.

Record the reading shown in Figure 8 in Table 1.

TABLE 1

θ / °C	90.0	86.0	82.0	81.0	79.6	79.0	78.8	78.8	79.0	79.0	78.8	78.6	78.8	78.8
t/min	0	1	2	3	4	5	6	7	8	9	10	11	12	13

θ / °C	78.8	79.0	78.8	78.6	78.8	78.6		77.6	76.0	75.0	72.0	70.0
t/min	14	15	16	17	18	19	**20**	21	22	23	24	25

(1 mark)

(b) Plot a graph of temperature against time on page 5. Begin the temperature scale at 50°C.
(8 marks)

GO ON TO THE NEXT PAGE

(c) Use the graph to determine the melting point of naphthalene.

(2 marks)

(d) (i) The mass of naphthalene used was 25 g and its specific latent heat was 150 J g^{-1}. Calculate how much heat was lost during the change of phase.

(3 marks)

(ii) If the rate at which it loses heat is constant, calculate how much heat was lost in the period 12 min to 17 min.

(3 marks)

Total 19 marks

NOTHING HAS BEEN OMITTED.

3. Margaret was given three identical sealed matchboxes each containing an unknown solid. She was asked to design an experiment to determine which box contained a magnet. She needs your help.

Design an experiment to help Margaret find which box contained the magnet.

Your answer should include:

(a) A list of apparatus

(b) A description of the procedure

(c) An account of how the observations would be used to conclude which box contained the magnet

(a) Apparatus

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(2 marks)

(b) Procedure

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(5 marks)

(c) Use of observations to make a conclusion

(2 marks)

Total 9 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

FORM TP 2014100

TEST CODE **01238020**

MAY/JUNE 2014

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of two sections: A and B.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section.
3. Do NOT write in the margins.
4. Section B consists of THREE questions. Candidates must attempt ALL questions in this section.
5. All answers MUST be written in this answer booklet.
6. All working MUST be CLEARLY shown.
7. The use of silent, non-programmable calculators is permitted, but candidates should note that the use of an inappropriate number of figures in answers will be penalized.
8. Mathematical tables are provided.
9. If you need to re-write any answer and there is not enough space to do so on the original page, you must request extra lined pages from the invigilator. **Remember to draw a line through your original answer and correctly number your new answer in the box provided**.
10. **If you use extra pages you MUST write your registration number and question number clearly in the boxes provided at the top of EVERY extra page.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

“*”Barcode Area”*”
Sequential Bar Code

SECTION A

Answer ALL questions.

You MUST write your answers in this answer booklet.

1. A Form Four class was given a School-Based Assessment activity on the change of phase of a substance while it is cooling. The class presented the results shown in Table 1.

TABLE 1

Temperature, θ/°C	90.0	74.5	70.0	70.0	70.0	70.0	65.0	57.5
Time, t/mins	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0
Point on graph	A		B			C		D

(a) Plot, on page 3, a graph of Temperature (θ/°C) versus Time (t/mins). Begin both axes at the origin and insert the letters A, B, C and D on the graph. **(7 marks)**

(b) Using a dotted line on the graph, determine the melting point of the substance that was heated.

(2 marks)

(c) (i) In what state is the substance as it moves between points B and C?

....

....

(1 mark)

(ii) Explain why the temperature was constant between B and C.

....

....

(1 mark)

GO ON TO THE NEXT PAGE

“*”Barcode Area”*”

(d) (i) State the phase of the substance at C.

(1 mark)

(ii) Describe what is happening to the substance between C and D.

(1 mark)

(e) If 15 g of the substance was cooled from 90.0°C to 57.5°C, calculate the heat, in kilojoules, which was lost in this activity.

[Specific Heat Capacity of Substance = 1763 Jkg^{-1} K^{-1}]
[Specific Latent Heat of Fusion of Substance = 215 000 Jkg^{-1}.] **(8 marks)**

(f) Complete Table 2 to show the symbols and SI units for the physical quantities given.

TABLE 2

Physical Quantity	Symbol	SI Unit
Heat Capacity		
Specific Latent Heat of Vapourisation		

(4 marks)

Total 25 marks

GO ON TO THE NEXT PAGE

“*”Barcode Area”*”

NOTHING HAS BEEN OMITTED.

2. (a) The unit of energy, the Joule, has two equivalent derived units.

(i) In Figure 1, indicate inside the bubbles, two equivalent derived units for the Joule.

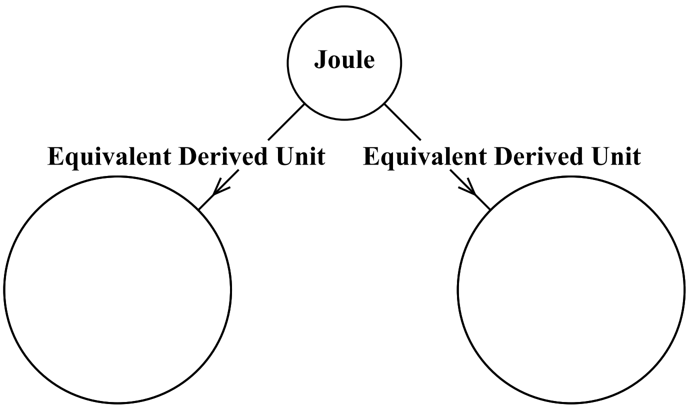

Figure 1.

(2 marks)

(ii) Solar energy is one of the popular alternative sources of energy. State ONE application of solar energy.

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(1 mark)

(iii) State ONE advantage of using solar energy in the Caribbean.

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(1 mark)

(iv) A variety of alternative energy technologies are being used in the Caribbean and globally. Other than solar energy, complete Table 3 to show three other types of alternative energy technologies and their sources.

TABLE 3

Alternative Energy	Source
(1)	
(2)	
(3)	

(3 marks)

GO ON TO THE NEXT PAGE

“*”Barcode Area”*”

(b)

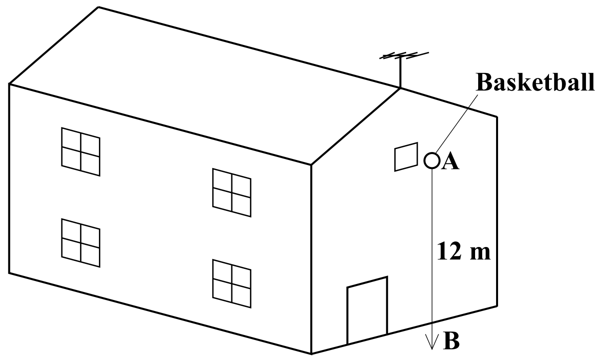

Figure 2.

A basketball of mass 0.44 kg was dropped vertically from rest at A, 12 m from the ground as seen in Figure 2. Calculate the

(i) gravitational potential energy of the ball at the point of release, A.

(3 marks)

(ii) final velocity of the ball on reaching the ground 1.56 seconds later (assume no loss of energy as the ball falls).

(3 marks)

(iii) ball's momentum when it hits the ground.

[Acceleration due to gravity, g, = 9.8 m s^{-2}] **(2 marks)**

Total 15 marks

GO ON TO THE NEXT PAGE

“*”Barcode Area”*”

3. (a) (i) State the equation for the general gas law for an ideal gas.

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(1 mark)

(ii) State the meaning of EACH symbol stated in the equation in (a) (i).

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(4 marks)

(b) (i) A car tyre is pumped to a pressure of 2×10^5 $N\ m^{-2}$ in the morning when the temperature is 23°C. Later in the day, the temperature rises to 34°C. Calculate the new pressure in the tyre. The volume of air is kept constant.

(5 marks)

(ii) Using the kinetic theory of matter, explain why the increase in pressure occured.

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(2 marks)

(iii) Calculate the ratio of new volume to old volume $\left(\frac{V_2}{V_1}\right)$ for the tyre, if the pressure is held constant while the temperature rises from 23°C to 34°C.

(3 marks)

Total 15 marks

SECTION B

AnswerALL questions.

4. (a) State the laws of refraction. **(6 marks)**

(b) Figure 3 shows the clown fish, Nemo, looking at point B. It sees the fisherman's net appearing as if it were at A.

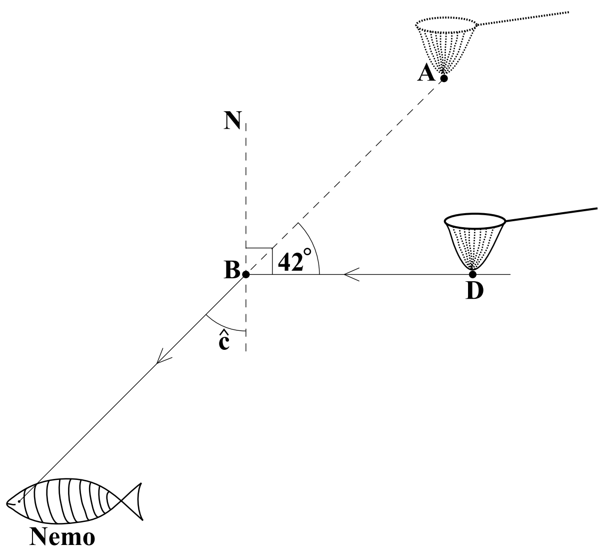

Figure 3.

(i) Calculate angle c, given that angle ABD is 42°. **(3 marks)**

(ii) Given that angle c is the critical angle for the air–water boundary, calculate the refractive index of the water. **(3 marks)**

(iii)

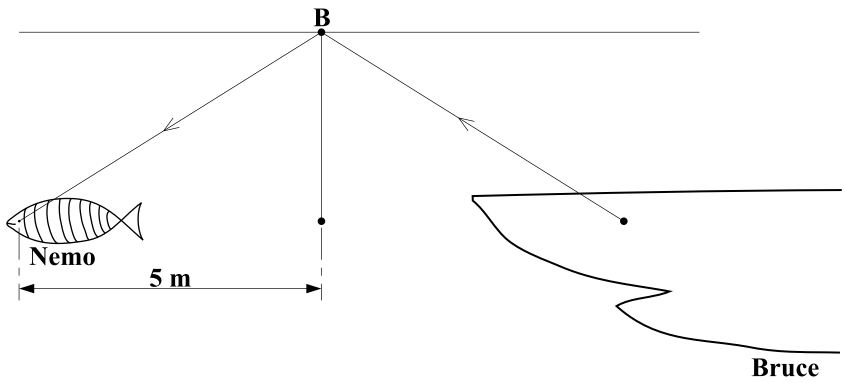

Figure 4.

Nemo swims away and his eye is now a horizontal distance of 5 metres from point B. Looking at point B he no longer sees the net but now sees Bruce, the shark.

If Bruce is at the same depth as Nemo, how far away is Bruce's eye from Nemo's eye. Explain your result. **(3 marks)**

Total 15 marks

Write your answer to Question 4 here.

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"*"Barcode Area"*"

Write your answer to Question 4 here.

GO ON TO THE NEXT PAGE

"*"Barcode Area"*"

Write your answer to Question 4 here.

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5. (a) Climate change is a major issue facing the global community. The average person can make a positive difference by conserving existing energy sources.

Describe THREE ways in which this can be done. State clearly what **form** of energy is conserved in EACH case. **(6 marks)**

(b) Home owner, Rasheed, is going on a two–week vacation. He has decided to leave on a 60W incandescent light bulb for security reasons.

(i) Calculate the total energy in kW h that the bulb will consume during the two–week period. **(4 marks)**

(ii) Given that Rasheed's electricity rate is $0.26 per kWh, calculate his electricity charges for the bulb for the two weeks. **(1 mark)**

(iii) During the two–week period, 15.5 kWh of energy was lost as heat from the bulb. Determine the efficiency of the bulb. **(4 marks)**

Total 15 marks

Write your answer to Question 5 here.

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Write your answer to Question 5 here.

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Write your answer to Question 5 here.

6. (a) In 20 days, the activity of a sample of Bismuth decreases to one-sixteenth of its original activity.

(i) Define the term 'half-life'. **(2 marks)**

(ii) Calculate the half-life of Bismuth. **(4 marks)**

(b) Radioisotopes have many useful applications, but overexposure is a health hazard.

State TWO useful applications of radioisotopes and TWO precautions to be taken when handling radioisotopes. **(4 marks)**

(c) During the fission of 1 kg of Uranium –235, 6.7×10^{10} J of energy is released and there is a change in its mass.

Calculate the new mass. **(5 marks)**
[$c = 3 \times 10^8$ m s^{-1}]

Total 15 marks

Write your answer to Question 6 here.

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Write your answer to Question 6 here.

Write your answer to Question 6 here.

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END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238032**

FORM TP 2014101

MAY/JUNE 2014

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. You MUST use this answer booklet when responding to the questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.

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3. Do NOT write in the margins.

4. Answer ALL questions.

5. The use of silent, non-programmable calculators is permitted.

6. Mathematical tables are provided.

7. You are advised to take some time to read through the paper and plan your answers.

8. If you need to re-write any answer and there is not enough space to do so on the original page, you must request extra lined pages from the invigilator. **Remember to draw a line through your original answer and correctly number your new answer in the box provided**.

9. **If you use extra pages you MUST write your registration number and question number clearly in the boxes provided at the top of EVERY extra page.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Answer ALL questions.

You MUST write your answers in this answer booklet.

1. A teacher did a demonstration to show that temperature remains constant during a phase change. She heated 20 g of ice at –10°C for 20 minutes and the students read the thermometers at different intervals. Some of their observations are shown in Figure 1 below

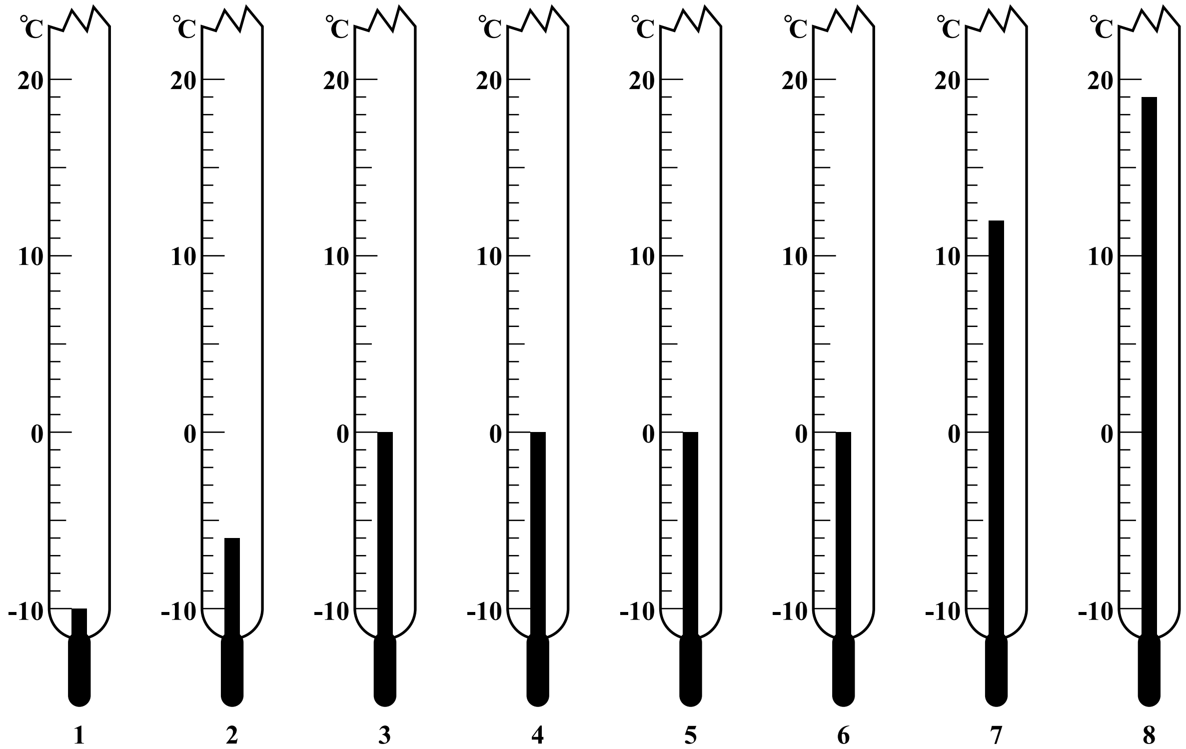


Figure 1.

(a) (i) Record the readings in Table 1 below.

TABLE 1

Intervals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Temperature, θ/°C								
Time, t/s	0.0	10.0	25.0	75.0	125.0	250.0	280.0	305.0

(8 marks)

(ii) Plot a graph, on page 3, of Temperature (θ/°C) versus Time (t/s). **(6 marks)**

GO ON TO THE NEXT PAGE

GO ON TO THE NEXT PAGE

(b) How much time did the change of phase take?

(2 marks)

(c) How much heat is absorbed during the change of phase?

[Specific Latent Heat of Fusion of Ice = 336 000 JKg^{-1}]

(4 marks)

Total 20 marks

2. (a) In an experiment to investigate the refraction of light through a glass block, a student produced the result shown in Figure 2.

(i) Draw the path taken by the ray through the block.

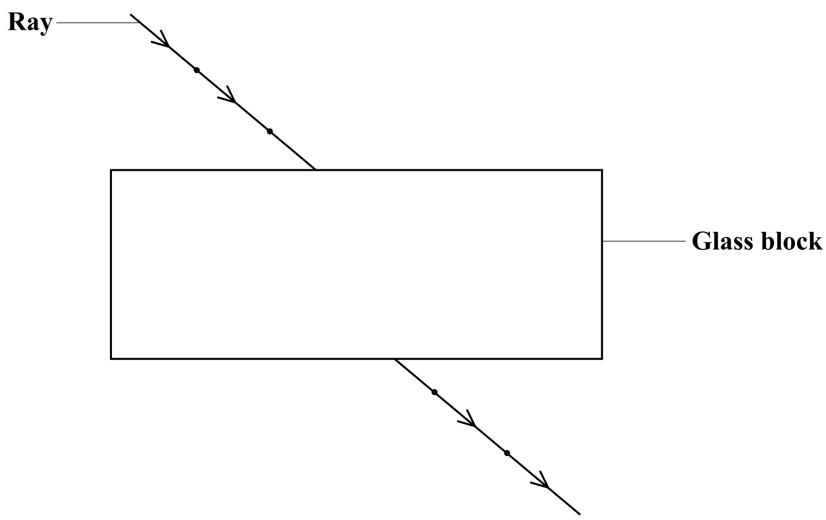
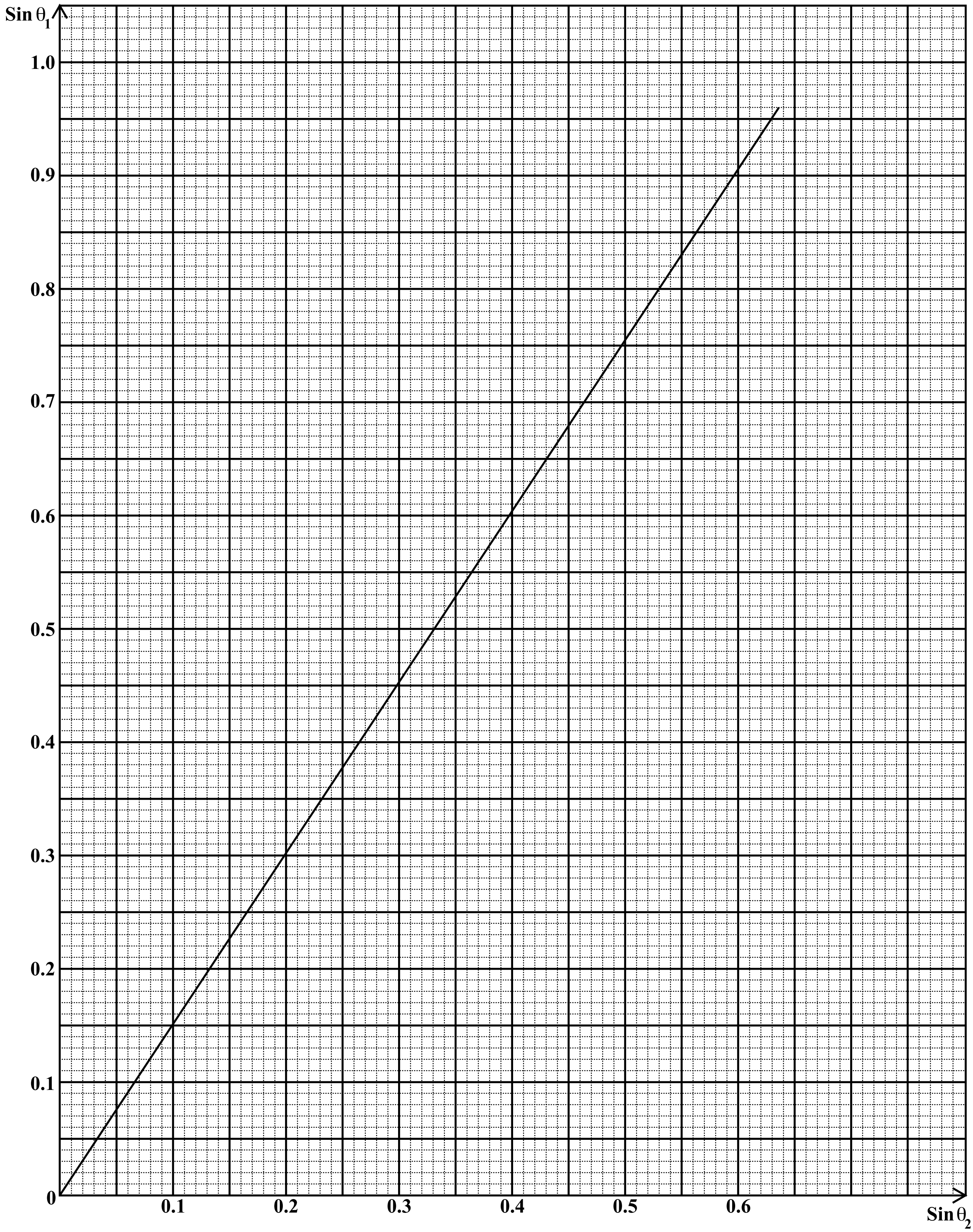


Figure 2.

(1 mark)

He plotted his results on a graph as shown on page 5.



Sin θ_1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0.1
0.2
0.3
0.4
0.5
0.6
Sin θ_2

(ii) Use the graph to complete the table below.

	Sin θ_1	Sin θ_2
1		0.11
2		0.23
3	0.50	
4		0.43
5	0.77	
6	0.87	
7		

(8 marks)

(iii) State TWO necessary precautions that the student should have taken in conducting the experiment.

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(2 marks)

(iv) Calculate the gradient, *n*, of the graph.

(4 marks)

GO ON TO THE NEXT PAGE

(b) What physical quantity does the gradient represent?

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(1 mark)

(c) It is known that the gradient is related to the speed of light, c_1, in air and the speed of light, c_2, in the glass such that $n = c_1 / c_2$.

If $c_1 = 3 \times 10^8$ m s^{-1}, find the value of c_2.

(3 marks)

Total 19 marks

GO ON TO THE NEXT PAGE

3. Sandy made the following statement: “The resistance of a metallic conductor at a constant temperature is constant as the potential difference across it varies”.

Using the filament of a light bulb, investigate if this statement is true for a range from 1.0V to 2.8V.

Your response should include:

(a) **EITHER**

A list of all the apparatus used

OR

A well-labelled diagram

(b) A description of the procedure

(c) How the data gathered is used to support or reject Sandy’s statement

Write your answers to question 3 here.

(a) Apparatus

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OR

Labelled diagram

(3 marks)

GO ON TO THE NEXT PAGE

(b) Procedure

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(3 marks)

(c) Use of Data to support/reject

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(3 marks)

Total 9 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238020**

FORM TP 2015022

JANUARY 2015

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of two sections: A and B.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section.
3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section.
4. All answers MUST be written in this answer booklet.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
8. Mathematical tables are provided.
9. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
10. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Answer ALL questions.

You MUST write your answers in this answer booklet.

1. A Form 4 Physics student was investigating how the square of the period, T^2, of a simple pendulum varied with its length, l. Her objective was to determine the acceleration due to gravity. Table 1 shows her results.

TABLE 1

Length of Pendulum, *l(m)*	**Time for 20 Oscillations, *t(s)***	**Time for 1 Oscillation (period), *T(s)***	**Period Squared $T^2(s^2)$**
0.20	18.00		
0.30	21.91		
0.40	25.40		
0.50	28.28		
0.60	31.10		
0.70	33.80		

(a) Complete Table 1 to determine values for plotting a graph. **(6 marks)**

(b) On the graph paper provided on page 3, plot a graph of Period Squared (T^2) on the vertical axis versus length (l) on the horizontal axis. Start each axis at zero. **(7 marks)**

(c) Calculate the gradient of this graph.

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(4 marks)

GO ON TO THE NEXT PAGE

(d) The acceleration due to gravity, g, is related to T^2 and l by the equation

$$g = 4\pi^2 \times \frac{1}{\left(\frac{T^2}{l}\right)} \qquad [\pi = 3.14]$$

Use the gradient of the graph to calculate the value of g.

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(4 marks)

(e) Draw a clearly labelled diagram of a simple pendulum as it was used in this investigation.

(4 marks)

Total 25 marks

2. (a) (i) One of the things that physics is concerned with is the study of energy. Complete Table 2 to show two other major forms of energy and ONE example of each.

TABLE 2

Forms of Energy	**Example**
(1) Mechanical	A moving car/object.
(2)	
(3)	

(4 marks)

(ii) State the SI unit of energy.

....

(1 mark)

(iii) Define the SI unit of energy named in (ii) above.

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(2 marks)

(b) A bucket filled with cement of total mass 60 kg is raised vertically 150 m from the ground to the twelfth floor of a building under construction as shown in Figure 1.

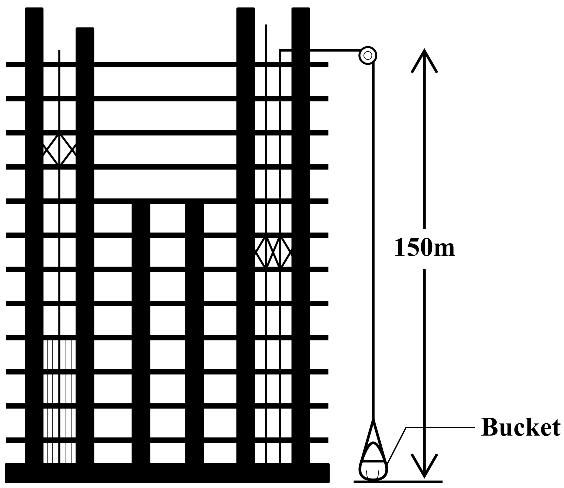

Figure 1

(i) Calculate the amount of energy that was needed to perform this activity. (Assume no frictional forces were present.)

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(3 marks)

(ii) If this activity takes 25 seconds to complete, calculate the power utilized in kilowatts.

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(4 marks)

(iii) If friction was present, what effect if any, would this have on the power needed?

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(1 mark)

(Gravitational field strength, g = 10 N kg^{-1})

Total 15 marks

3. (a) (i) Dr T likes to measure temperatures. From his temperature bag, shown in Figure 2, select the two temperatures to complete Table 3.

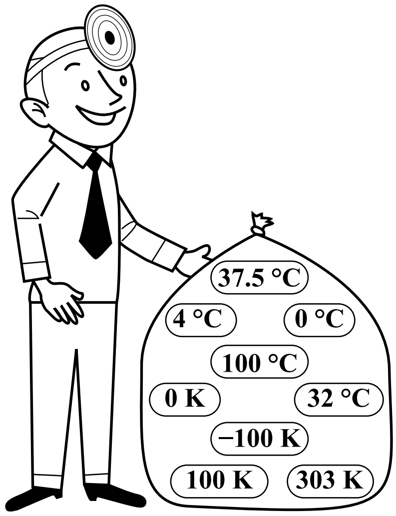

Figure 2

TABLE 3

Temperature – Fixed Points	Value from Dr T's Bag
(1) Upper fixed point	
(2) Lower fixed point	

(2 marks)

(ii) Define the term 'lower fixed point'.

....

....

(1 mark)

(iii) In Table 4, enter the names of two different types of thermometers and the corresponding physical quantity which varies with temperature.

TABLE 4

Type of Thermometer	Physical Quantity
(1)	
(2)	

(4 marks)

(b) A motor car tyre contained a fixed mass of air at 27 °C. Its pressure was 220 kN m^{-2} above atmospheric pressure. After a 60-minute drive, the air pressure rose to 250 kN m^{-2} above atmospheric pressure.

What was the new temperature of the air in the tyre, in degrees Celsius, if the volume of air remained constant?

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(8 marks)

(Atmospheric pressure = 100 k Nm^{-2})

Total 15 marks

SECTION B

Answer ALL questions.

You MUST write your answers in the spaces provided after each question.

4. (a) (i) With the aid of a labelled diagram, state the laws of reflection. **(4 marks)**

(ii) The glare of light from oncoming vehicles when driving on a rainy nights can be annoying. With the aid of a labelled diagram, show how this glare results. **(2 marks)**

Write your answer to Question 4 (a) (i) here.

Diagram for Question 4 (a) (i)

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Write your answer to Question 4 (a) (ii) here.

Diagram for Question 4 (a) (ii)

(b) A pencil is placed in a glass of water and appears to be bent as shown in Figure 3 below.

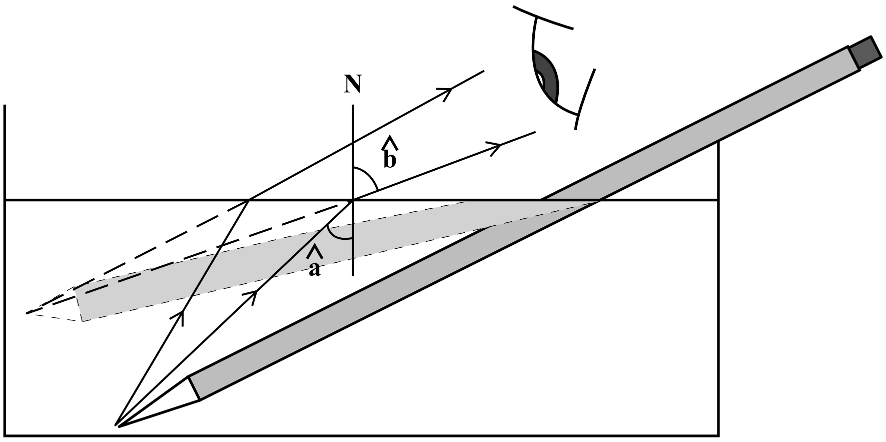

Figure 3

(i) Calculate the refractive index of the water which causes this apparent bending if angle $a = 32°$ and angle $b = 45°$. **(3 marks)**

(ii) If the pencil is now placed in ethanol with a refractive index of 1.36, calculate the new angle b given that angle a in the ethanol remains at 32°. **(4 marks)**

(iii) Does the pencil bend more or less in ethanol than in water? Justify your answer. **(2 marks)**

Write your answer to Question 4 (b) here.

(b) (i) ....

(ii) ....

(iii) ....

Total 15 marks

5. (a) (i) State the formula that relates the potential difference across a metallic conductor at constant temperature to the current through it. **(1 mark)**

(ii) State the formula that expresses the total resistance, R_T, of two resistors, R_1 and R_2 in parallel. **(1 mark)**

Write your answer to Question 5 (a) here.

(a) (i) ....

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(ii) ....

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(b) The brightness of the incandescent bulb in Figure 4 may be increased by varying the rheostat between 0 Ω and 100 Ω. When lit, the bulb operates at 0.30 A and 3.0 V.

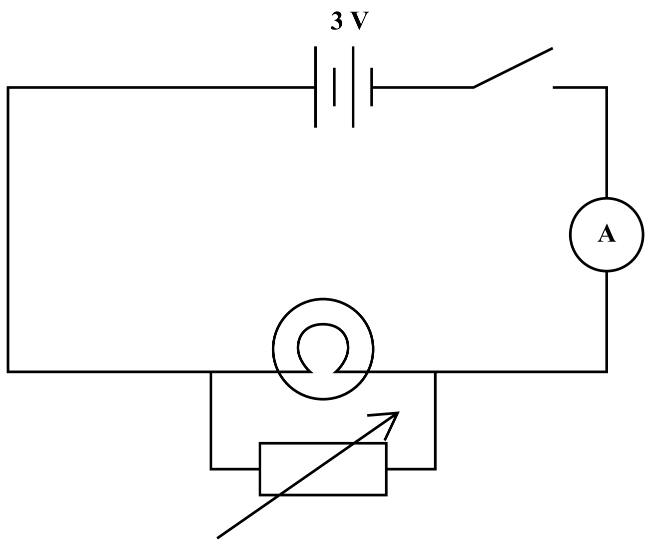

Figure 4

(i) What is the resistance of the bulb? **(2 marks)**

(ii) Assuming the resistance of the bulb remains constant once lit, calculate the ammeter reading if the rheostat is set to 100 Ω. **(4 marks)**

(iii) Is there a danger in reducing the rheostat resistance too much? Explain. **(3 marks)**

(iv) The assumption made in (b) (ii) is incorrect. With the aid of an I–V graph, indicate how the bulb's resistance actually varies with current. **(4 marks)**

Write your answer to Question 5 (b) here.

(b) (i) ....

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(ii) ....

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(iii) ....

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GO ON TO THE NEXT PAGE

(iv)

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Total 15 marks

6. (a) In order to separate the emissions from a radioactive source, they are subjected to a uniform electric field, E, perpendicular to their path as shown in Figure 5.

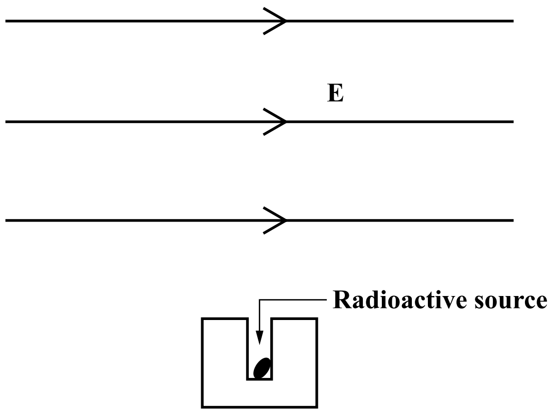

Figure 5

(i) Describe the path of each of the three emissions (α, β and γ) when subjected to a uniform electric field from left if the emissions are projected up towards the top of your page. **(3 marks)**

(ii) If the electric field is replaced by a uniform magnetic field **into the page**, predict the path of the emissions. **(3 marks)**

Write your answer to Question 6 (a) here.

(a) (i) ....

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(ii) ....

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(b) One isotope of lead $^{210}_{82}$Pb, is not stable but can undergo exactly three distinct decays of an alpha or beta particle to become stable lead.

With reference to the information in Table 5, write a possible sequence of three nuclear equations that can result in $^{206}_{82}$Pb (stable lead) from $^{210}_{82}$Pb.

TABLE 5

Element	Atomic Number
Bi	83
Po	84

(6 marks)

Write your answer to Question 6 (b) here.

(b) ....

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GO ON TO THE NEXT PAGE

(c) Calculate the energy given off in a nuclear reaction if the change in mass is 0.2014 u.

(3 marks)

($u = 1.66 \times 10^{-27}$ kg; $c = 3.0 \times 10^{8}$ ms^{-1}).

Write your answer to Question 6 (c) here.

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238032**

FORM TP 2015023

JANUARY 2015

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Candidates must attempt ALL questions.
2. You MUST use this answer booklet when responding to questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.
3. All working MUST be clearly shown.
4. Do NOT write in the margins.
5. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
6. Mathematical tables are provided.
7. You are advised to take some time to read through the paper and plan your answers.
8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
9. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. A group of Physics students was asked to find the focal length of a convex lens, using the formula

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

where f is the focal length and u and v are the object and image distance, respectively.

They estimated the focal length by a rough method and then set up an experiment as shown in Figure 1.

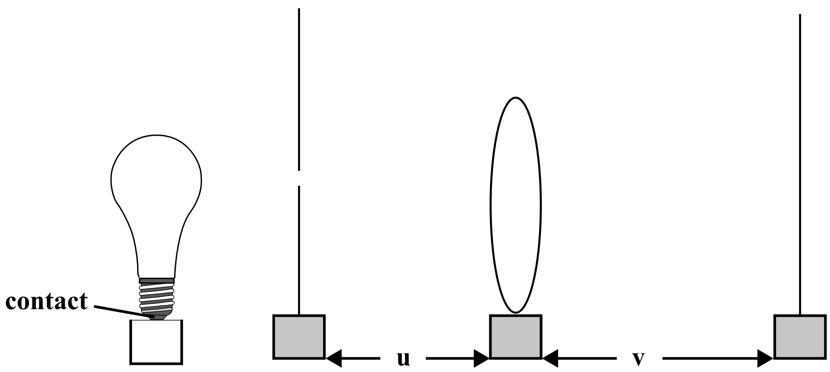

Figure 1

a) Describe the experiment, beginning with how they obtained a rough value for f.

b) Using the sample of their observations recorded below, complete their practical write up.

u = 20 cm, v = 60 cm u = 25 cm, v = 37.5 cm u = 40 cm, v = 40.1 cm
u = 30 cm, v = 31 cm u = 35 cm, v = 36.1 cm

Include in your answer:

(a) The steps taken to obtain a rough value for f.

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(6 marks)

(b) A table of the measurements

(5 marks)

(c) A sample of the calculations

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(5 marks)

(d) A possible source of error and a precaution

Source of error:

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(1 mark)

Precaution:

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(1 mark)

(e) A suitable conclusion

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(1 mark)

Total 19 marks

GO ON TO THE NEXT PAGE

2. Figures 2 and 3 show the mass and volume of a stone being measured using two pieces of apparatus.

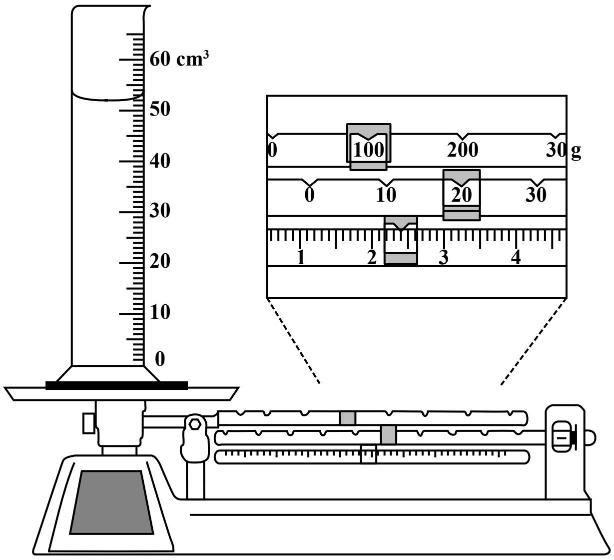

Figure 2

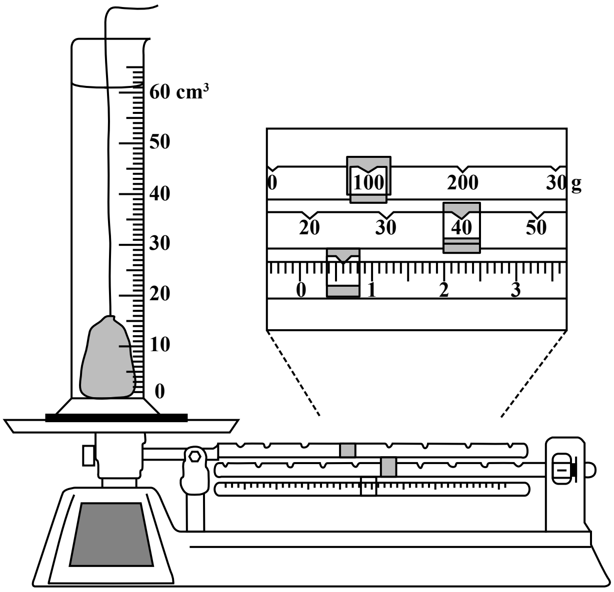

Figure 3

(a) Record the readings on the

(i) measuring cylinders in

Figure 2: .... Figure 3: ....

(2 marks)

(ii) triple beam balances in

Figure 2: .... Figure 3: ....

(2 marks)

(b) Use the readings to calculate the mass and volume of the stone.

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(2 marks)

GO ON TO THE NEXT PAGE

0123803207

(c) In a related activity, Fourth Form Physics students carried out an investigation to find the density of plasticine by comparing the volumes of various masses.

The results are seen in Table 1.

TABLE 1

m/g	10	20	30	40	50	60
V/cm^3	5.0	9.0	14.0	18.5	24.0	28.5

(i) On the graph paper provided on page 7, plot a graph of V/cm^3 (y-axis) against m/g (x-axis). **(7 marks)**

(ii) Determine the slope, S, of the graph.

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(5 marks)

(iii) Use the graph to find the density of plasticine.

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(2 marks)

Total 20 marks

DO NOT WRITE IN THIS AREA

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3. You have been asked to make a simple low cost fuse using low resistance wire. You are given three different pieces of wire of the same length. Plan and design an experiment to determine which one is the best to use.

Your design MUST include:

(a) A list of equipment

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(2 marks)

(b) A circuit diagram

(2 marks)

GO ON TO THE NEXT PAGE

(c) Procedure

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(2 marks)

(d) Interpretation of data

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(2 marks)

(e) Precaution

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(1 mark)

Total 9 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238020**

FORM TP 2015100

MAY/JUNE 2015

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: A and B.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section.
3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section.
4. ALL answers MUST be written in this answer booklet.
5. All working MUST be clearly shown.
6. Do NOT write in the margins.
7. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
8. Mathematical tables are provided.
9. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
10. **If you use the extra page(s), you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Answer ALL questions.

1. The activity of a radioactive sample was measured over a 24-day period. The results are recorded in Table 1.

TABLE 1

Time (*t*) **days**	**Activity *(A)*** **Disintegrations per second**
0	40.0
4	29.5
8	20.0
12	14.0
16	10.0
20	6.5
24	5.0

(a) Plot a graph, **on page 3**, of Activity (A) versus Time (t). **(8 marks)**

GO ON TO THE NEXT PAGE

(b) Using your graph, calculate the **average** half-life of the sample, determined from the average of two or three values.

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(12 marks)

(c) Use the graph to determine the activity of the sample after 25 days.

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(2 marks)

(d) (i) State TWO types of radioactive emissions.

(1) ....

(2) ....

(2 marks)

(ii) Which type of radioactive emission is the **most** dangerous to human tissue?

....

(1 mark)

Total 25 marks

2. (a) This question concerns thermal heat capacities.

(i) In the box below, state the equation that relates C to c.

(1 mark)

(ii) State the name of the physical quantity that each letter represents.

C: ....

....

c: ....

....

(2 marks)

(iii) Distinguish between *'C'* and *'c'*.

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(2 marks)

GO ON TO THE NEXT PAGE

(b) A substance which has a melting point of 80 °C is cooled from 90 °C to a complete solid at its melting point.

Sketch a graph in Figure 1 to represent the statement above.

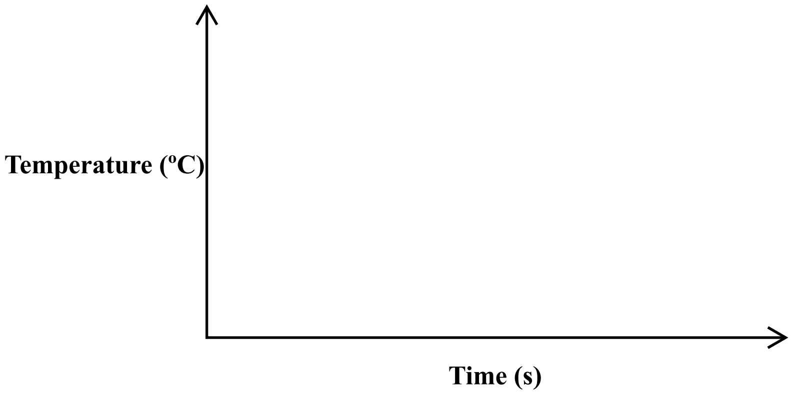

Figure 1

(2 marks)

(c) A physicist converted 2 kg of water at 37 °C to steam at 100 °C.

Assuming no heat is lost, calculate the amount of energy needed

(i) to heat the water to 100 °C

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(4 marks)

(ii) to heat the water from 100 °C to steam at 100 °C.

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(3 marks)

GO ON TO THE NEXT PAGE

(iii) to completely convert the water from 37 °C to steam at 100 °C.

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....

(1 mark)

(Specific heat capacity of water = 4200 J kg^{-1} K^{-1}
Specific latent heat of vaporization of water = 2.3 × 10^6 J kg^{-1})

Total 15 marks

3. (a) (i) Explain what is meant by the term 'electrical resistance'.

....

....

(1 mark)

(ii) Complete Table 2 to provide information regarding electrical meters.

TABLE 2

Meter	**How Connected in a Circuit (Series or Parallel)**	**Resistance (High or Low)**	**Reason for Size of Resistance**
Ammeter			....
Voltmeter			....

(6 marks)

(b) Calculate the reading on EACH of the meters shown in the circuit in Figure 2 when the switch is closed.

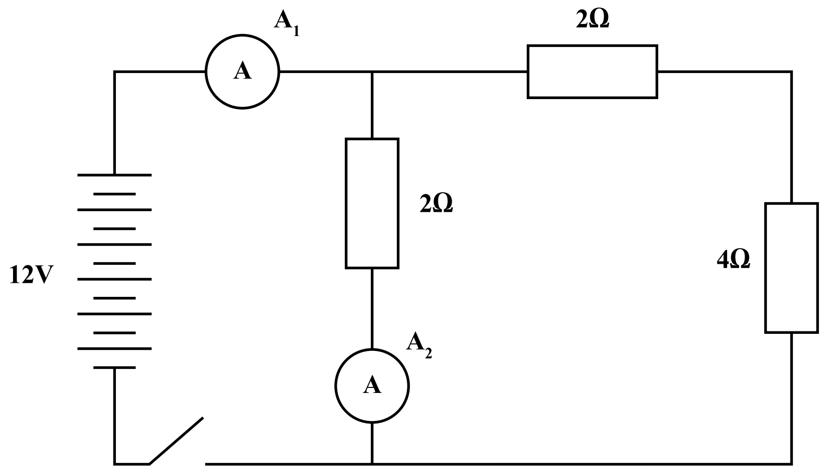

Figure 2

(i) Reading on A_1

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(6 marks)

(ii) Reading on A_2

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(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

SECTION B

Answer ALL questions.

4. (a) State Newton's three laws of motion.

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(6 marks)

(b) In a crash test, a car travelling at a constant velocity of 26 m s^{-1} crashes into a wall and is brought to rest.

(i) Calculate the initial momentum of a 70 kg test dummy in the car before the crash.

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(3 marks)

(ii) Calculate the average force exerted on the dummy by the seatbelt during the crash if the duration of the collision is 0.1 seconds.

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(3 marks)

(iii) With the removal of all protective features, the dummy was subjected to another crash test with the same initial speed. This time it was subjected to a 'lethal' decelerating force of 45 000 N. Calculate the duration of this collision.

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(3 marks)

Total 15 marks

5. (a) (i) Describe how the graph of Volume versus Temperature (in Celsius) of a gas can be used to derive the Kelvin scale?

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(4 marks)

(ii) State the mathematical relationship between the Kelvin and Celsius temperature scales.

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(2 marks)

GO ON TO THE NEXT PAGE

(b) A piston traps a mass of gas in a cylinder. At 25 °C, the pressure of the gas is 5 atmospheres when its volume is 50 ml.

(i) Calculate the volume of the gas if its pressure drops to 1 atmosphere at constant temperature.

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(4 marks)

(ii) After resetting the piston, the gas returns to its initial pressure and volume. If the volume is now fixed while the gas is heated to 60 °C, calculate the final pressure of the gas.

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(5 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

6. (a) (i) Copy Figure 3 and draw the ray shown as it emerges on the other side of the lens and its relation to the focus. Show the principal axis and the focal length.

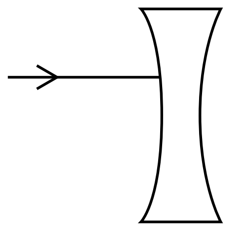

Figure 3

Space for diagram.

(5 marks)

(ii) Write, in words or symbols, the formula for the magnification of an object.

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(1 mark)

(b) An object *AB* is placed 20 cm in front of a converging lens of focal length F, 10 cm as seen in Figure 4.

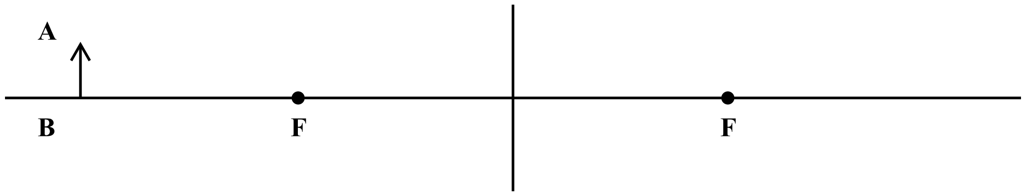

Figure 4

(i) Calculate the position of the image formed and state on what side of the lens it is located.

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(5 marks)

(ii) Calculate the magnification of the image formed.

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(3 marks)

(iii) Is the image formed real or virtual?

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(1 mark)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. $\boxed{}$

TEST CODE **01238032**

FORM TP 2015101

MAY/JUNE 2015

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Candidates MUST attempt ALL questions.
2. ALL answers MUST be written in this answer booklet.
3. All working MUST be clearly shown.
4. Do NOT write in the margins.
5. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
6. Mathematical tables are provided.
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DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

0123803203

Answer ALL questions.

1. You have been asked to determine the resistance of a resistor, R_1, at a constant temperature.

You are provided with the following apparatus:

- 1 unknown resistor, R_1.
- 1 ammeter (0A – 1A)
- 1 voltmeter (0V – 5V)
- 1 rheostat (0Ω – 100Ω)
- 2 new 2.5 V cells in cell holder or 5 V DC power supply.
- 1 switch and 8–10 pieces of connecting wires (each approximately 20 cm in length)

(a) (i) Draw a labelled diagram of the circuit used.

(2 marks)

(ii) Using a range of currents from **0.1 A to 1.0 A**, measure the voltage in each case and enter your results in Table 1.

TABLE 1

	Reading 1	Reading 2	Reading 3	Reading 4	Reading 5	Reading 6
I(A)						
V(V)						

(2 marks)

(b) **On page 3**, plot a graph of *I* against *V*. **(7 marks)**

GO ON TO THE NEXT PAGE

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(c) (i) Use the graph to determine the gradient, G, of the graph.

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(6 marks)

(ii) State the value of V when I is 0.45 A.

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(1 mark)

(d) From the gradient obtained in (c) (i), determine the resistance of the resistor labelled R_1.

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....

(3 marks)

Total 21 marks

2. A Physics teacher asked her students to find the average mass of a coin, given 8 similar coins and a beam balance. The procedure they used was to measure the mass, in grams, of one coin, then add each coin and find the new total mass.

(a) State TWO likely sources of error and ONE precaution.

Error 1: ....

....

Error 2: ....

....

Precaution: ....

....

....

....

(3 marks)

(b) The students plotted a graph of their results which is shown **on page 7**. Use the graph to construct a table of results for at least six entries.

(7 marks)

(c) Use the point (1.5, 6.4) and one other from the graph to find the gradient of the line.

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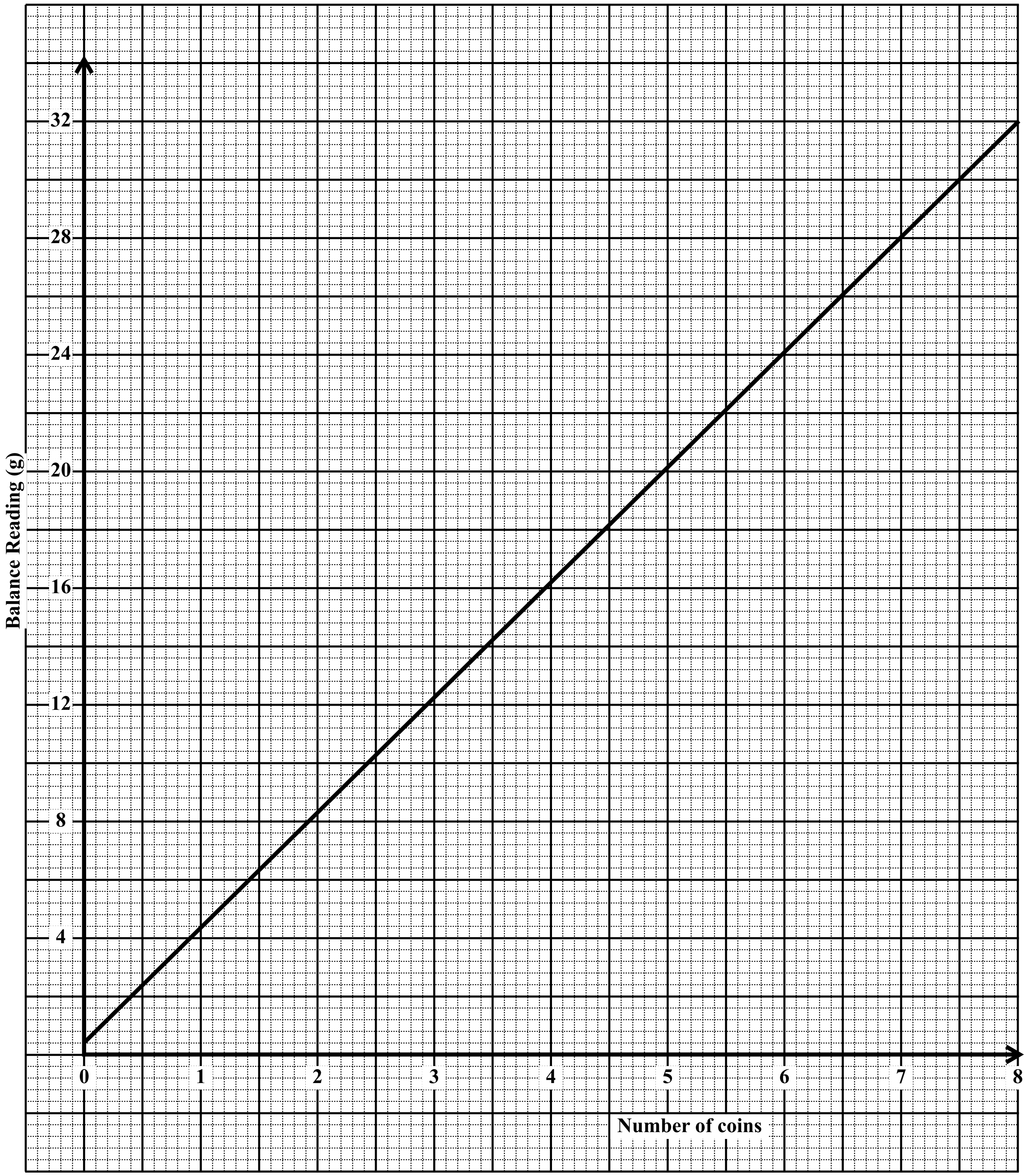
(4 marks)


Balance Reading (g)
32
28
24
20
16
12
8
4
0
1
2
3
4
5
6
7
8
Number of coins

(d) The graph shows that the balance had a zero error. How can you tell?

....

....

(1 mark)

(e) What is the value of the zero error?

....

(1 mark)

(f) Use the gradient obtained from 2 (c) to find the average mass of one coin.

(1 mark)

Total 17 marks

3. Design the construction of a **simple** electromagnet, and then plan and design an experiment to determine TWO features which affect its strength. Include the following in your response:

(a) Details, with diagram(s), of the construction

(4 marks)

(b) Procedure

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(3 marks)

(c) The manipulation of data

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(3 marks)

Total 10 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No.

EXTRA SPACE

If you use this extra page, you MUST write the question number clearly in the box provided.

Question No. $\boxed{}$

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

14 JANUARY 2016 (p.m.)

J1601238020

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE

0	1	2	3	8	0	2	0

SUBJECT PHYSICS – Paper 02

PROFICIENCY GENERAL

REGISTRATION NUMBER

SCHOOL/CENTRE NUMBER					

NAME OF SCHOOL/CENTRE

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH

D	D	M	M	Y	Y	Y	Y

SIGNATURE ____________________

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TEST CODE **01238020**

FORM TP 2016022

JANUARY 2016

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of two sections: A and B.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section.
3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section.
4. All answers MUST be written in this answer booklet.
5. Do NOT write in the margins.
6. All working MUST be clearly shown.
7. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
8. Mathematical tables are provided.
9. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**
10. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Answer ALL questions.

You MUST write your answers in this answer booklet.

1. A motorcar travelled from rest and its velocity over an 80-second period was measured. The results are shown in Table 1.

TABLE 1

Velocity, v (m s^{-1})	0	30	30	30	0
Time, *t* (*s*)	0	20	40	60	80
Point	A	B	C	D	E

(a) **On the grid provided on page 5**, plot the graph of velocity against time. **(7 marks)**

(b) Use the graph to determine EACH of the following:

(i) The acceleration during the interval AB

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(4 marks)

(ii) The velocity of the motorcar after 70 seconds (with the aid of dotted lines)

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(1 mark)

(iii) The total distance travelled over the 80 second period

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(9 marks)

(c) From your graph, describe the velocity of the vehicle over the period BC.

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(1 mark)

(d) This question investigated how velocity varied with time. Define the term 'velocity'.

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(3 marks)

Total 25 marks

GO ON TO THE NEXT PAGE

2. (a) Complete the graphic below by drawing an arrow from each physical quantity to its respective unit.

Physical Quantity	**Unit**
Density	N m
Moment	N s
Linear Momentum	kg m^{-3}

(2 marks)

(b) Complete the following statements.

(i) Kinetic energy is defined as ....

....

(1 mark)

(ii) The potential energy of a body is defined as ....

....

(1 mark)

(iii) The formula for the change in gravitational potential energy is ....

....

(1 mark)

(iv) Waterfalls are commonly found across the Caribbean. Describe the energy changes taking place in a waterfall.

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(2 marks)

(c) A pendulum swings from A through B to C and returns to A as seen in Figure 1.

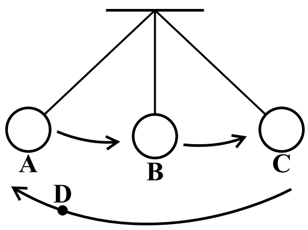

Figure 1

A and C are the furthest points with B being the midpoint.

State the type of energy that exists at

(i) A ....

....

(1 mark)

(ii) B ....

....

(1 mark)

(iii) C ....

....

(1 mark)

(iv) Another point D, is situated midway between A and B.

If the pendulum is returning to A to complete an oscillation, explain which type of energy is increasing and why.

At D, the type of energy increasing is ....

....

Reason: ....

....

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(2 marks)

(d) Netball is a popular sport played across the Caribbean.

If a netball has a mass of 0.4 kg and a velocity of 5 m s^{-1}, calculate its kinetic energy.

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(3 marks)

Total 15 marks

3. (a) Table 2 shows the type of thermometer, design feature and the reason for the design feature. Complete the table by inserting the appropriate information.

TABLE 2

Type of Thermometer	Design Feature	Reason For Design Feature
Mercury-in-glass laboratory thermometer	Narrow bore	
	Constriction in bore	Retaining a measured temperature
Thermocouple		Ability to measure rapidly changing temperatures

(3 marks)

(b) Define the upper and lower fixed points on the Celsius temperature scale and state their respective values on that scale.

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(4 marks)

(c) Figure 2 shows a sealed flask which contains a fixed mass of gas held at constant volume.

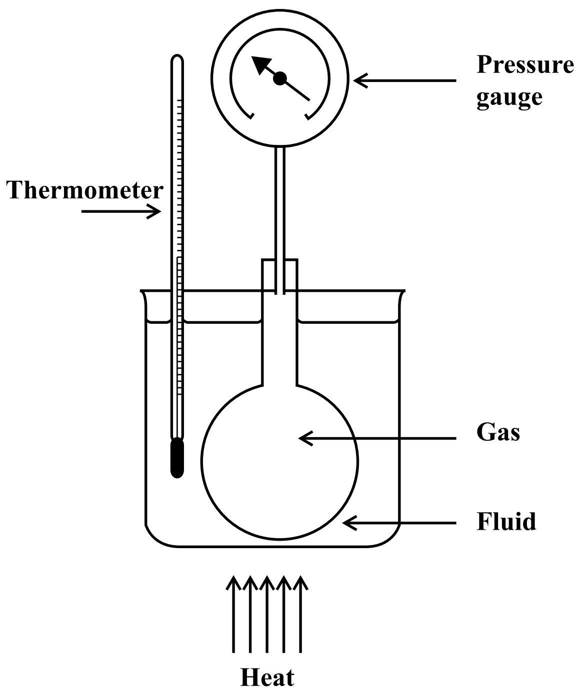

Figure 2

When heated, the temperature and pressure of the gas increase as shown in Table 3.

TABLE 3

Pressure (Pa)	Temperature (°C)	Temperature (K)
1.1×10^5	35	
1.2×10^5	63	
1.3×10^5	91	

(i) Complete Table 3 by converting the temperatures to Kelvin. **(3 marks)**

(ii) Is the ‘Pressure Law’ supported by this set of data? Explain.

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(5 marks)

Total 15 marks

SECTION B

Answer ALL questions.

You MUST write your answers in this answer booklet.

4. (a) (i) "The angle of incidence is equal to the angle of reflection". This is one of the laws of reflection. State the other law.

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(3 marks)

(ii) State THREE properties of the image in a plane mirror.

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(3 marks)

(b) Figure 3 shows a car located 5 m behind a truck which is 8 m long. Assume the external mirror for the truck is a plane mirror and is in line with the front of the truck.

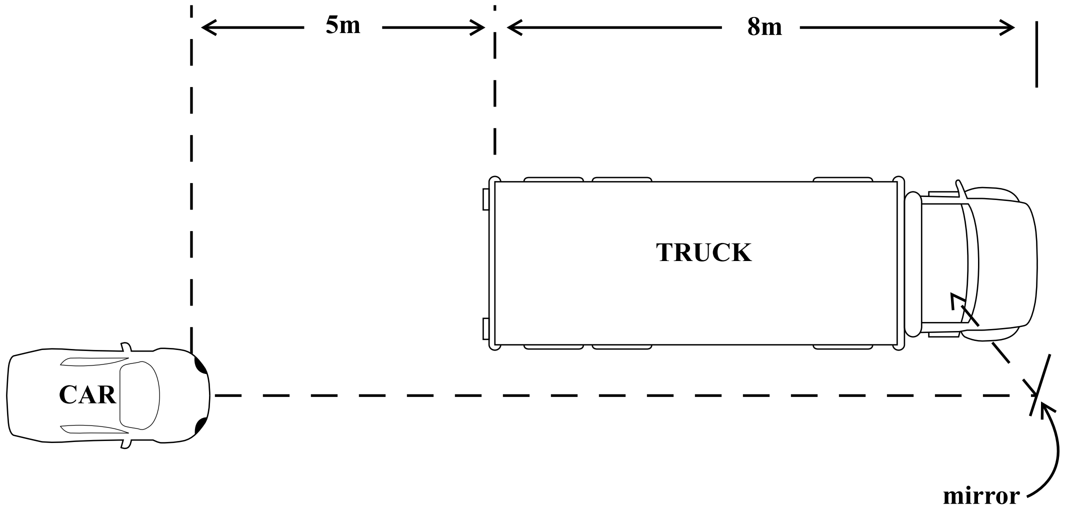

Figure 3

(i) Calculate the image distance of the car as seen by the truck driver.

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(2 marks)

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DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(ii) State a reason why the sign shown in Figure 4 is more likely to be posted at the back of a truck rather than a car.

Figure 4

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(2 marks)

GO ON TO THE NEXT PAGE

(c) A ray of light passes through a block of material as shown in Figure 5.

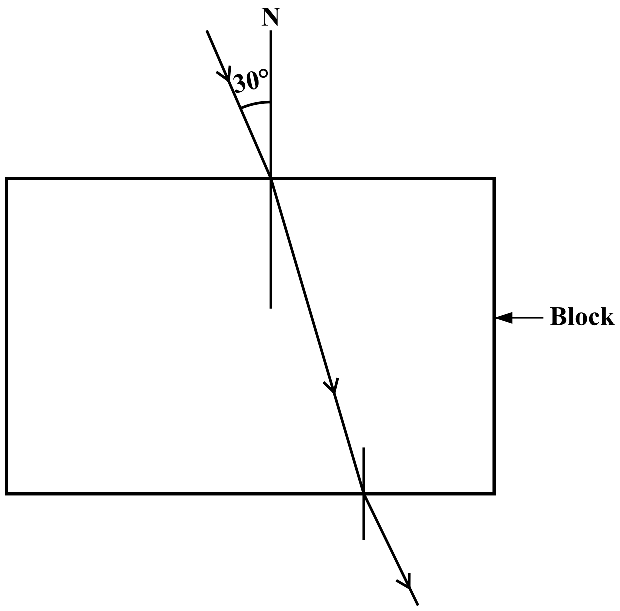

Figure 5

(i) If the refractive index of the material is 1.3, calculate the angle of refraction in the material given that the angle of incidence is 30°.

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(4 marks)

(ii) If the refractive index of the material increased, why would the lateral displacement of the ray increase also?

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(1 mark)

Total 15 marks

GO ON TO THE NEXT PAGE

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5. (a) A converging lens can be used to form real or virtual images.

(i) With reference to the focal lengh of the lens, describe the object distance required to produce EACH type of image.

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(2 marks)

(ii) State the orientation of EACH image so produced.

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(2 marks)

(iii) Complete the ray diagram shown in Figure 6.

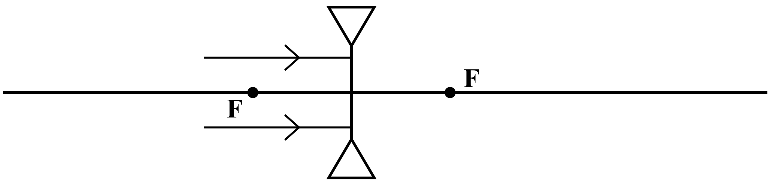

Figure 6

(2 marks)

(b) (i) Calculate the magnification where a lens produces an image height of 3.6 mm for an object 2.4 mm in height.

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(3 marks)

(ii) For the same magnification, calculate the image distance given that the object distance is 20 cm.

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(3 marks)

(iii) Calculate the focal length of this lens.

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(3 marks)

Total 15 marks

6. (a) Scientists use symbols when dealing with circuit diagrams in electricity. An electric circuit is displayed in Figure 7.

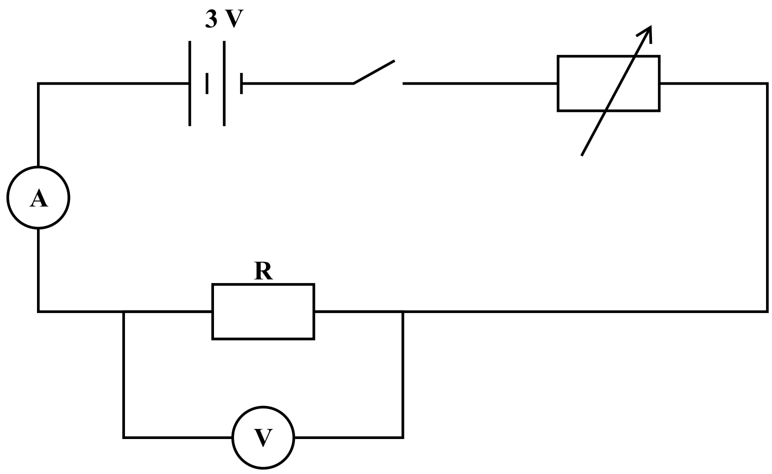

Figure 7

Write a description of this circuit in the space provided.

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(6 marks)

(b) A Physics class was given a circuit diagram as shown in Figure 8. Use Figure 8 to answer the three questions posed to the class.

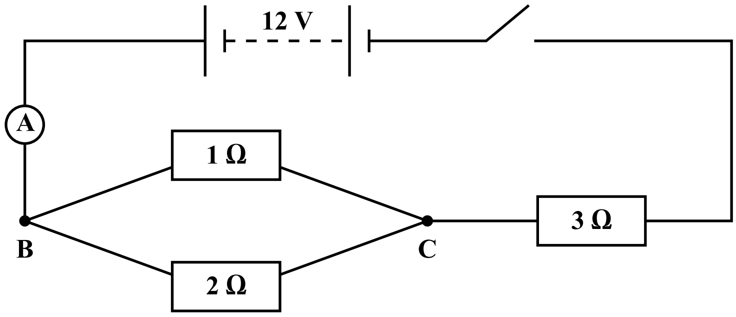

Figure 8

(i) Given that the formula for the equivalent resistance of two resistors R_1 and R_2 in parallel is $R = \frac{R_1R_2}{R_1 + R_2}$, calculate the equivalent resistance across BC.

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(2 marks)

(ii) Calculate the current flowing in the closed circuit.

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(4 marks)

GO ON TO THE NEXT PAGE

(iii) When the current in (b) (ii) flows, what is the power dissipated in the 3Ω resistor?

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(3 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

CARIBBEAN EXAMINATIONS COUNCIL

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

18 JANUARY 2016 (a.m.)

J1601238032

FILL IN ALL THE INFORMATION REQUESTED CLEARLY IN CAPITAL LETTERS.

TEST CODE

0	1	2	3	8	0	3	2

SUBJECT PHYSICS – Paper 032

PROFICIENCY GENERAL

REGISTRATION NUMBER

SCHOOL/CENTRE NUMBER					

NAME OF SCHOOL/CENTRE

CANDIDATE'S FULL NAME (FIRST, MIDDLE, LAST)

DATE OF BIRTH

D	D	M	M	Y	Y	Y	Y

SIGNATURE ____________________________________

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FORM TP 2016023

JANUARY 2016

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of THREE questions. Candidates must attempt ALL questions.

2. You MUST use this answer booklet when responding to questions. For each question, write your answer in the space provided and return the answer booklet at the end of the examination.

3. All working MUST be clearly shown.

4. Do NOT write in the margins.

5. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.

6. Mathematical tables are provided.

7. You are advised to take some time to read through the paper and plan your answers.

8. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet. **Remember to draw a line through your original answer.**

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DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

Attempt ALL questions.

You MUST write your answers in this answer booklet.

1. You are provided with the following apparatus:

- Materials labelled A, B, C, D and E
- 8 pieces of conducting wire
- Cell
- Switch
- Low-voltage lamp
- Ammeter
- Voltmeter
- Resistor, **R**

(a) (i) You are required to set up the circuit as shown in Figure 1.

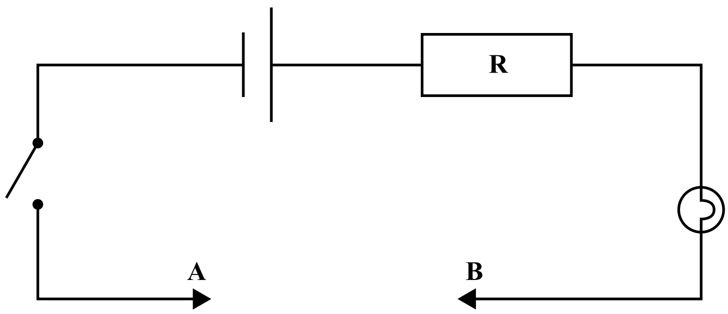

Figure 1

(2 marks)

(ii) Describe how you would use the circuit to test the materials as either a conductor or insulator.

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(3 marks)

(iii) Execute your plan as described in (a) (ii) and state your observations.

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(2 marks)

(iv) Based on your observations, classify the materials A, B, C, D and E as either conductor or insulator.

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(4 marks)

(v) Outline ONE precaution taken.

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(1 mark)

(b) Draw a circuit diagram to show how an ammeter and voltmeter can be connected, showing correct polarity, to find the resistance of the resistor, **R**.

(6 marks)

(c) Figure 2 shows an ammeter (A) and a voltmeter (V) that are correctly connected in 1 (b).

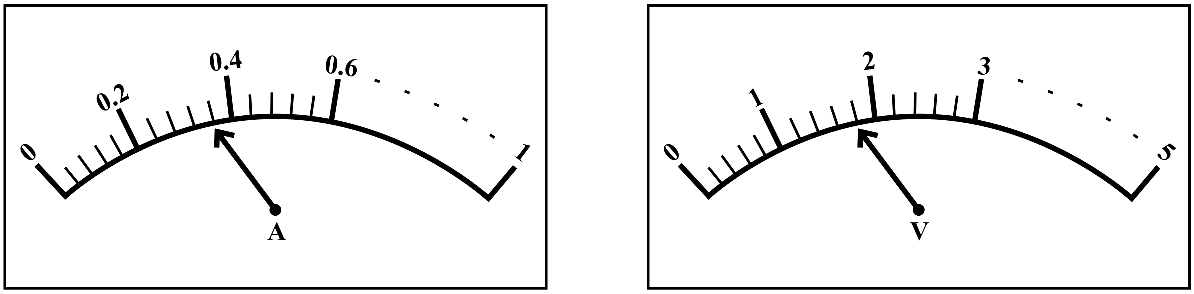

Figure 2

(i) Determine the readings of the ammeter and voltmeter.

I = ...

V = ...

(2 marks)

(ii) Use the readings in (c) (i) to calculate the resistance of R.

Calculation:

(4 marks)

Total 24 marks

GO ON TO THE NEXT PAGE

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2. (a) Table 1 shows the relationship between the period, T, and the length, I, of a simple pendulum.

TABLE 1

Period *T/s*	0.63	0.90	1.10	1.25	1.52	1.59
Length *I/m*	0.10	0.20	0.30	0.50	0.60	0.70

On the graph paper provided on page 9, plot a graph of *T/s* against *I/m*. **(8 marks)**

(b) Use the graph to explain

(i) what effect, if any, the length has on the period of the pendulum

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(2 marks)

(ii) whether the period is proportional to the length.

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(2 marks)

(c) **Using the graph on page 9**, determine the period for a 0.25 m long pendulum.

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(2 marks)

Total 14 marks

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3. Plan and design an experiment to demonstrate that heat flows at different rates through different metals.

Your design MUST include:

(a) A list of equipment

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(2 marks)

(b) A diagram

(2 marks)

(c) Procedure

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(2 marks)

(d) Expected results

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(2 marks)

(e) Interpretation of expected results

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(1 mark)

(f) Precaution

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(1 mark)

Total 10 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238020**

FORM TP 2016100

MAY/JUNE 2016

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION

PHYSICS

Paper 02 – General Proficiency

2 hours 30 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. This paper consists of TWO sections: A and B.
2. Section A consists of THREE questions. Candidates must attempt ALL questions in this section.
3. Section B consists of THREE questions. Candidates must attempt ALL questions in this section.
4. ALL answers MUST be written in this answer booklet.
5. All working MUST be clearly shown.
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7. You may use a silent, non-programmable calculator, but you should note that the use of an inappropriate number of figures in answers will be penalized.
8. Mathematical tables are provided.
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DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

SECTION A

Answer ALL questions.

1. The activity of a radioactive sample was measured over a six-hour period. The results are recorded in Table 1.

TABLE 1

Time (*t*) in hours	**Activity *(A)* Disintegrations per second**
0	80.0
1	50.0
2	34.5
3	20.0
4	13.0
5	7.5
6	5.0

(a) Using the grid **on page 5**, plot a graph of Activity (*A*) versus Time (*t*). **(8 marks)**

(b) (i) From your graph, determine the half-life of the sample.

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(5 marks)

(ii) Using your graph, determine a more accurate value of the half-life of the sample.

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(6 marks)

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(c) From your graph, and using dotted lines, determine how long it takes for the activity of the sample to be reduced to 10 disintegrations per second, from its original activity level.

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(2 marks)

(d) State ONE reason why a line drawn through all the points would not form a perfectly smooth curve.

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(1 mark)

(e) All elements including radioactive substances have an 'atomic number' and 'mass number'. Explain what the two terms mean.

Atomic number: ....

....

Mass number: ....

....

(2 marks)

(f) In medicine, Iodine–123, $\left({}^{123}_{53}\mathrm{I}\right)$ is used to check a patient's thyroid function. What does '123' represent?

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(1 mark)

Total 25 marks

2. (a) Complete the bubbles in Figure 1 by inserting the SI unit which matches EACH of the physical quantities.

Physical Quantity	**SI Unit (Word or symbol)**
Force →	
Linear momentum →	

Figure 1

(2 marks)

(b) (i) State Newton's third law of motion.

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(3 marks)

(ii) A Caribbean airplane on its way from the Piarco International Airport to the Grantley Adams International Airport flies horizontally in mid-flight.

With the aid of a diagram, and using Newton's third law of motion, explain how this happens.

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(4 marks)

(c) (i) Define the term 'linear momentum'.

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(2 marks)

(ii) An 8 kg ball travelling to the east at 10 ms^{-1}, collides with a 2 kg ball travelling to the west with a velocity of 5 ms^{-1}. After the collision, they move together.

Determine the final velocity of the balls. **Assume that there are no resistive forces.**

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(4 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

"*"Barcode Area"*"
Sequential Bar Code

3. (a) State, in words, the quantity EACH symbol represents in the equation $E_H = mc\Delta\theta$. State the SI unit of EACH quantity as well.

E_H: ....

....

c: ....

....

$\Delta\theta$: ....

....

(6 marks)

(b) What does the symbol 'l' in the equation $E_H = ml$ represent?

....

....

(1 mark)

(c) In an experiment to determine the specific latent heat of fusion of ice using a container with negligible heat capacity, a student obtained the following data:

Initial temperature of water = 30 °C
Final temperature of water + melted ice = 20 °C
Initial mass of water = 100 g
Final mass of water plus melted ice = 110 g

(i) Calculate the heat lost by the water.

(3 marks)

(ii) Calculate the heat gained by the melted ice.

(2 marks)

(iii) Assuming the heat lost by the water is equal to the heat gained by the ice, calculate the specific latent heat of fusion of ice.

(3 marks)

[Specific heat capacity of water = 4.2 $Jg^{-1}K^{-1}$]

Total 15 marks

SECTION B

Answer ALL questions.

4. (a) List THREE types of electromagnetic waves in order of increasing wavelength. Identify a use of EACH type of wave.

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(6 marks)

(b) Humans can 'see' electromagnetic radiation only between the wavelengths of about 4×10^{-7} m and 7×10^{-7} m. This is called the visible part of the spectrum.

A rattlesnake can detect e.m. radiation of frequency 3.5×10^{14} Hz and a honeybee can detect e.m. radiation of 1×10^{15} Hz.

Calculate the wavelengths corresponding to EACH frequency.

(5 marks)

(c) Thunder is heard 2.3 seconds after a flash of lightning is seen. If the lightening strike is 750 m away, calculate the speed for this event.

(4 marks)

[Speed of light, $c = 3 \times 10^{8}$ ms^{-1}]

Total 15 marks

GO ON TO THE NEXT PAGE

5. (a) (i) How does the electric current in a metal differ from that in an electrolyte? Compare EACH with 'conventional current'.

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(4 marks)

(ii) State which of these two media (metal and electrolyte) has similar current flow to that in a semiconductor. Give a reason for your answer.

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(2 marks)

(b) The makers of a popular cellphone have upgraded its battery capacity from 4320 C to 9000 C.

(i) If the standard charger can deliver a current of 0.6A, how much more time will it take to charge the new battery than the old battery?

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(7 marks)

(ii) In order to maintain a competitive edge, the cellphone maker needs to keep the same charging time for the new model the same as the old model. What must be the current rating on a new charger to accomplish this?

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(2 marks)

Total 15 marks

GO ON TO THE NEXT PAGE

6. (a) A student was given a sample of candle wax in a test tube located in a water bath. She was asked to demonstrate that temperature remains constant during a phase change.

Describe the procedure she should use.

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(6 marks)

(b) In Dominica, hydroelectricity is used to supply energy on a large scale.

(i) Describe how electricity is generated using the process of hydroelectricity.

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(3 marks)

(ii) Discuss the rationale for the application of hydroelectricity as a viable alternative energy source in Dominica.

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(6 marks)

Total 15 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.

TEST CODE **01238032**

FORM TP 2016101

MAY/JUNE 2016

C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L

CARIBBEAN SECONDARY EDUCATION CERTIFICATE®
EXAMINATION

PHYSICS

Paper 032 – General Proficiency

Alternative to SBA

2 hours 10 minutes

READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

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DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.

"*"Barcode Area"*"
Sequential Bar Code

Answer ALL questions.

1. In this experiment you are required to investigate how the period of a pendulum varies with its length.

STEP 1: A pendulum of length 0.5 m is set up for you. Time 20 oscillations, t, and find the period, T.

STEP 2: Adjust the length of pendulum for values from 0.20 m to 0.90 m and repeat Step 1, keeping a small angle of swing.

(a) Tabulate your results and add a column to find T^2.

(7 marks)

(b) **On page 5**, plot a graph of T^2 against l. **(7 marks)**

(c) Find the gradient, S, of the graph.

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(6 marks)

GO ON TO THE NEXT PAGE

(d) Describe the relationship between T^2 and l.

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(1 mark)

(e) State ONE precaution when carrying out the experiment.

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(1 mark)

Total 22 marks

NOTHING HAS BEEN OMITTED.

2. A group of students performed an experiment in their science laboratory and plotted the graph on page 9 to show the cooling curve for stearic acid.

(a) Use the graph to tabulate the results showing the temperatures at 0, 2, 5, 10, 20, 30 and 35 minutes.

(10 marks)

(b) Use the graph to determine the time taken for the substance to change its state.

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(4 marks)

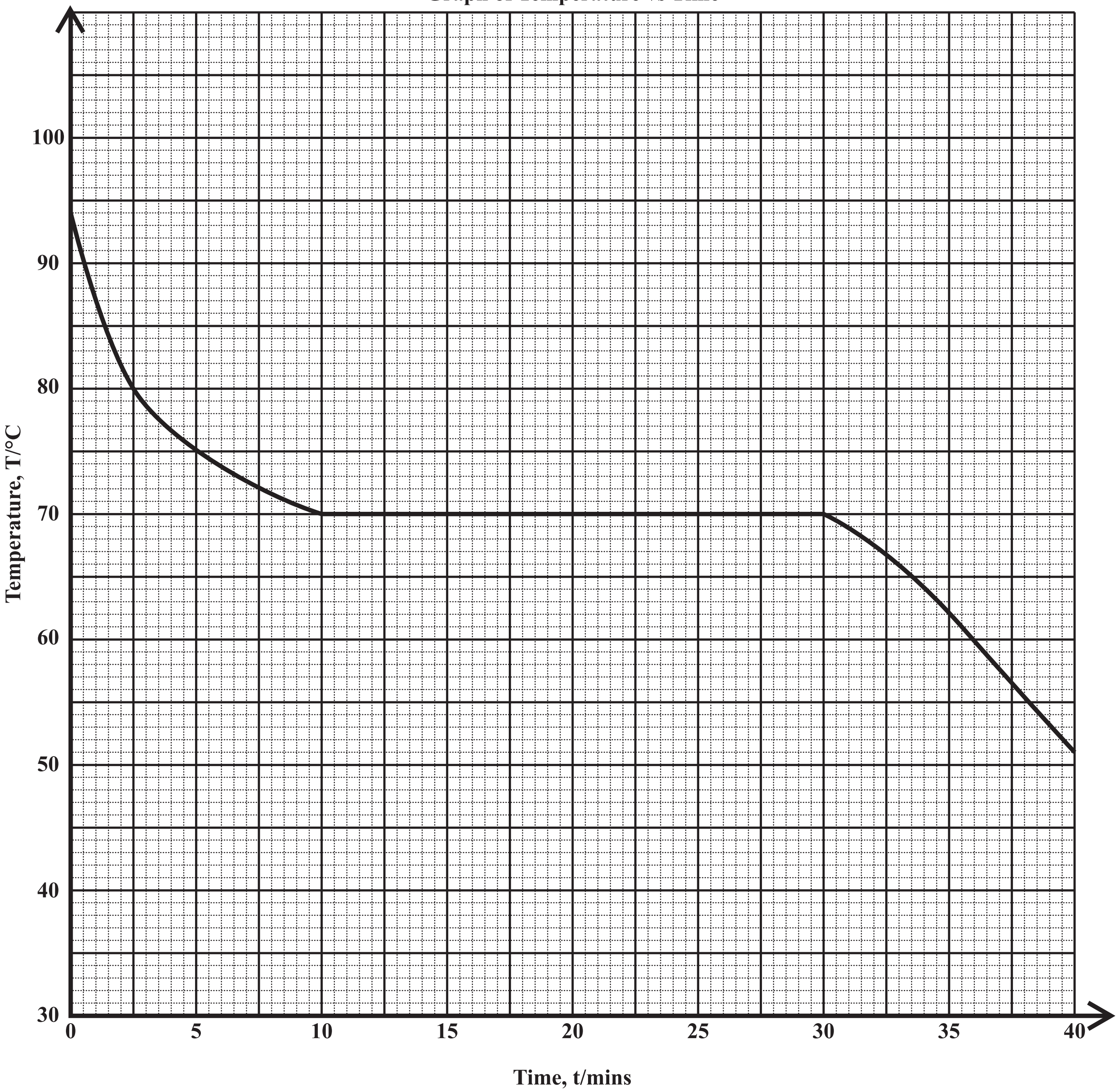
(c) On the graph, show the region where the substance was in

(i) the liquid state only **(1 mark)**

(ii) the solid state only. **(1 mark)**

Total 16 marks

Graph of Temperature vs Time



3. "Pressure at a point in a liquid increases with density."

Plan and design an experiment to investigate the statement above.

In your design include

(a) A clear aim

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(1 mark)

(b) A list of equipment to be used

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(2 marks)

(c) An outline of the method

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(4 marks)

(d) Expected results and interpretation

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(3 marks)

Total 10 marks

END OF TEST

IF YOU FINISH BEFORE TIME IS CALLED, CHECK YOUR WORK ON THIS TEST.