

SECTION A

Answer ALL questions.

1. (a) Figure 1 is a diagram of a transformer. Name the parts labelled X, Y and Z.

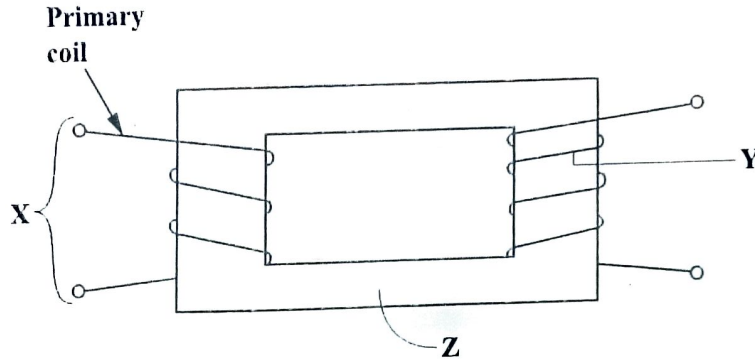


Figure 1. Transformer

X .....

Y .....

Z .....

(3 marks)



The transformer shown in Figure 1 was tested and the values for the primary voltage,  $V_p$ , and the secondary voltage,  $V_s$ , were obtained. The data is shown in Table 1 below.

**TABLE 1: VALUES FOR PRIMARY AND SECONDARY VOLTAGE**

Primary Voltage, $V_p/V$	Secondary Voltage, $V_s/V$
1.5	14
3.0	26
5.0	45
6.0	53
7.5	67
8.0	72

- (b) Using the grid on page 7, plot a graph of  $V_s$  against  $V_p$ .
- (c) Determine the gradient,  $S$ , of the graph.

(8 marks)

(4 marks)

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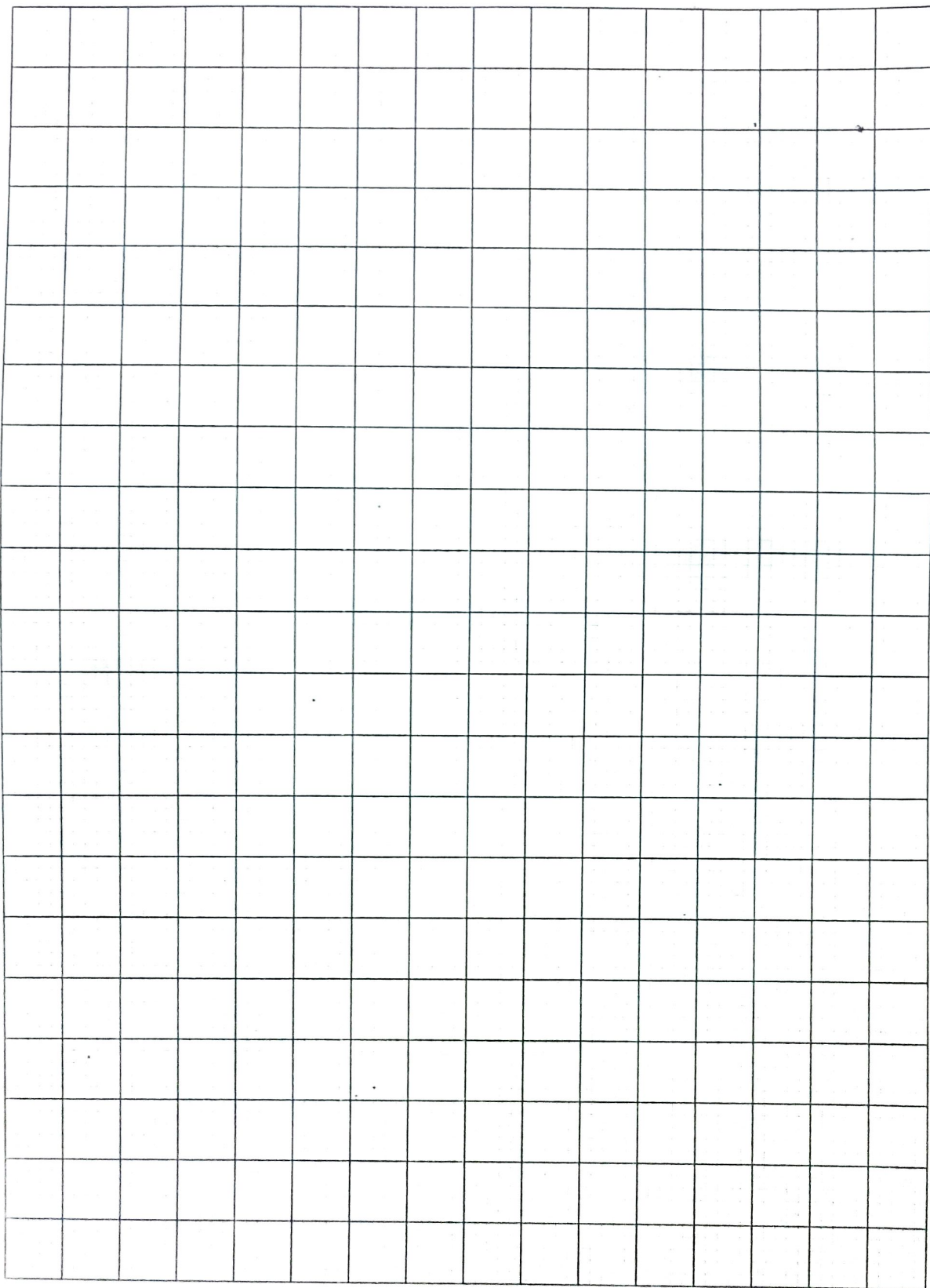


Figure 2. Graph of  $V_s$  against  $V_p$ .

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(d) Use the gradient,  $S$ , to calculate

(i) the number of turns in the secondary coil,  $N_s$ , given that the number of turns in the primary coil,  $N_p = 85$

(4 marks)

(ii) the current in the secondary coil,  $I_s$ , if the current in the primary coil  $I_p = 1.8 \text{ A}$

(3 marks)

(iii) the power output,  $P_{\text{out}}$  of the transformer, given that the voltage in the secondary coil,  $V_s = 55 \text{ V}$ .

(3 marks)

Total 25 marks

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2. (a) Complete Table 2 by inserting the appropriate physical quantities and derived SI units.

TABLE 2: PHYSICAL QUANTITIES AND UNITS

Physical Quantity	Derived SI Units
Volume	(i) .....
(ii) .....	$\text{kg m}^{-3}$
(iii) .....	N
Pressure	(iv) .....
	(v) .....

(5 marks)

- (b) The concrete block shown in Figure 3 was made with cement.

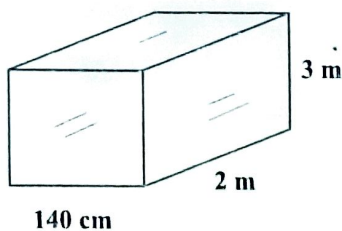


Figure 3. Concrete block

- (i) Calculate the density of the concrete block, given that its mass is 20 160 kg.

(4 marks)

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(ii) Define the term 'pressure'.

.....

.....

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(2 marks)

(iii) Given that  $g = 10 \text{ N kg}^{-1}$ , calculate the pressure exerted on the floor by the base of the concrete block.

(4 marks)

Total 15 marks

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3. (a) (i) Define the term 'heat capacity'.

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.....  
.....

(2 marks)

(ii) Define the term 'specific latent heat of vaporization'.

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.....  
.....  
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(3 marks)

(b) A substance which has a freezing point of 80 °C was cooled from 90 °C to a total solid at its freezing point.

Sketch a graph on Figure 4 to represent the statement above.

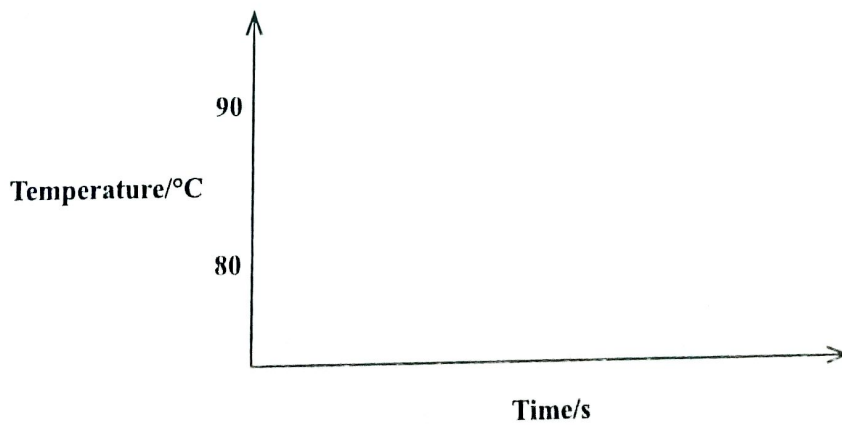


Figure 4. Cooling curve

(2 marks)

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- (c) A student conducted an experiment in which 1.5 kg of water at 30 °C was converted to steam at 100 °C.

Assuming no heat is lost to the surroundings, calculate the amount of energy needed to

- (i) heat the water from 30 °C to 100 °C

(4 marks)

- (ii) convert the water at 100 °C to steam at 100 °C

(3 marks)

- (iii) heat the water from 30 °C to steam at 100 °C.

(1 mark)

(Specific heat capacity of water,  $c$ , = 4200 J kg<sup>-1</sup> K<sup>-1</sup>)  
(Specific latent heat of vaporization of water,  $l_v$ , =  $2.3 \times 10^6$  J K<sup>-1</sup>)

**Total 15 marks**

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**SECTION B**

**Answer ALL questions.**

4. (a) (i) State THREE features of an image produced in a plane mirror.

Feature 1

.....  
.....

Feature 2

.....  
.....

Feature 3

.....  
.....

(3 marks)

- (ii) Explain why the word POLICE is painted in this manner at the front of some emergency vehicles.

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(3 marks)

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- (b) Figure 5 shows an incomplete ray diagram.

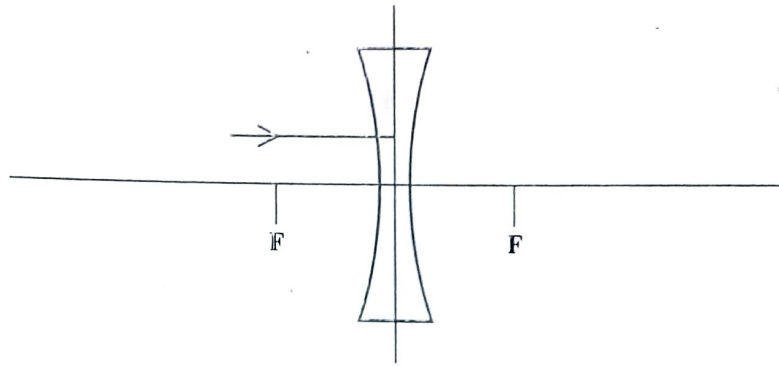


Figure 5. Incomplete ray diagram

- (i) Complete the ray diagram to show the path of the emerging ray after it passes through the lens. (2 marks)
- (ii) On the diagram, label the focal length,  $f$ . (1 mark)
- (c) An object  $AB$  was placed 15 cm in front of a converging lens of focal length 5 cm. Calculate the
- (i) image distance

(3 marks)

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(ii) magnification of the image formed.

(3 marks)

Total 15 marks

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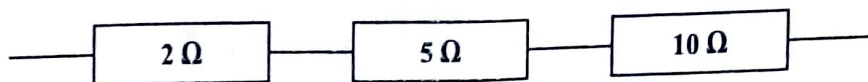
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- (c) Figure 7 shows three resistors in series of values  $2\Omega$ ,  $5\Omega$  and  $10\Omega$ .



**Figure 7. Resistors in series**

- (i) Calculate the equivalent resistance of the resistors shown in Figure 7.

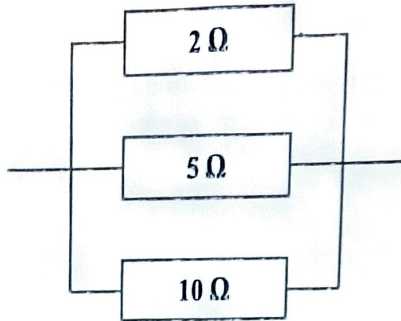
**(2 marks)**

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- (ii) The resistors are placed in parallel as shown in Figure 8.



**Figure 8. Resistors in parallel**

Calculate the equivalent resistance of the resistors in Figure 8.

(4 marks)

- (iii) The resistors in Figure 8 were connected in a circuit to a 6 V power supply. Calculate the total current flowing through the circuit.

(3 marks)

**Total 15 marks**

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6. (a) Lithium -7 is an isotope of lithium. The mass number is 7 and the atomic number is 3.

(i) Use the information given above to determine the number of protons and neutrons present in an atom of lithium -7.

Protons .....

Neutrons .....

(2 marks)

(ii) Draw a clearly labelled diagram of the structure of the lithium -7 atom.

(4 marks)

(b) In four days, the activity of a sample of lithium decreases to one-sixteenth of its original activity.

(i) Define the term 'half-life'.

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(2 marks)

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(ii) Calculate the half-life of lithium.

(3 marks)

(c) Calculate the energy given off in a nuclear reaction if the change in mass is 0.2014 u.  
( $u = 1.66 \times 10^{-27}$  kg,  $c = 3.0 \times 10^8$  ms<sup>-2</sup>)

(4 marks)

Total 15 marks

END OF TEST

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



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