FORM TP 2019100

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MAY/JUNE 2019

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 SIX questions in TWO sections. Answer ALL questions.
2. Write your answers in the spaces provided in this booklet.
3. Do NOT write in the margins.
4. Where appropriate, ALL WORKING MUST BE SHOWN in this booklet.
5. You may use a silent, non-programmable calculator to answer questions, but you should note that the use of an inappropriate number of figures in answers will be penalized.
6. 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.**
7. **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.**

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

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NOTHING HAS BEEN OMITTED.

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SECTION A

Answer ALL questions.

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

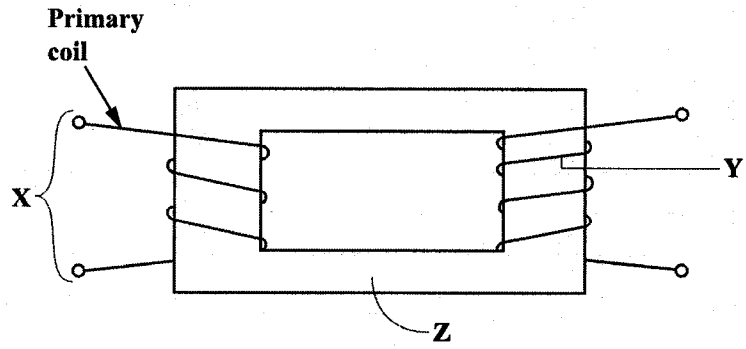


Figure 1. Transformer

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. **(8 marks)**

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

(4 marks)

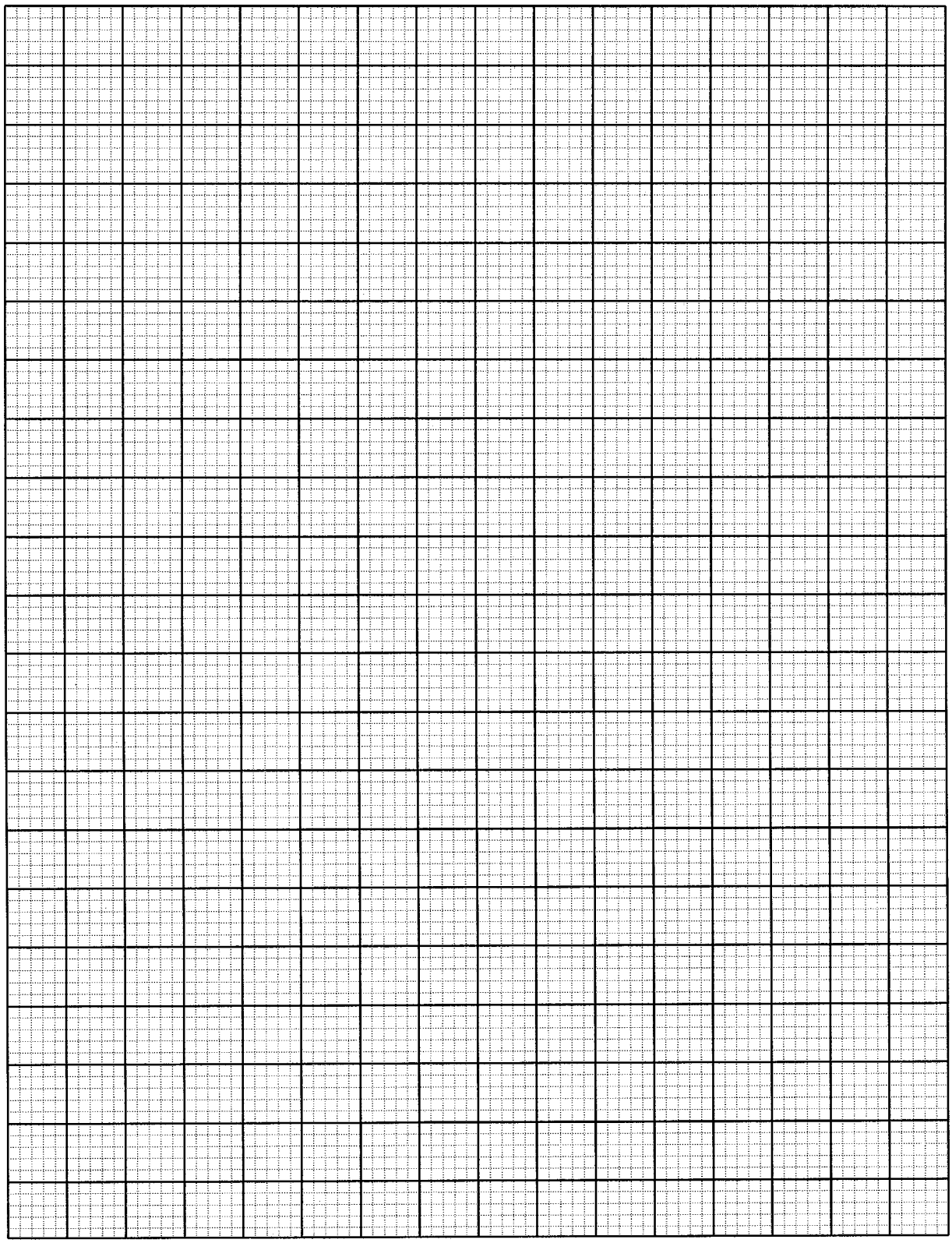


Figure 2. Graph of V_s against V_p.

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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, $N_p = 85$

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(4 marks)

(ii) the current in the secondary coil, I_S, if the current in the primary coil $I_p = 1.8$ A

(3 marks)

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

(3 marks)

Total 25 marks

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NOTHING HAS BEEN OMITTED.

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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)	kg m^{-3}
(iii)	N
Pressure	(iv) ..... (v) .....

(5 marks)

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

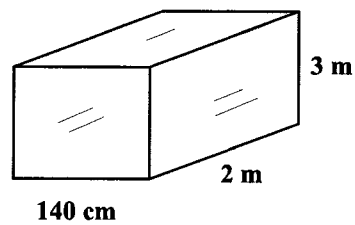


Figure 3. Concrete block

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

(4 marks)

(ii) Define the term 'pressure'.

.....

.....

.....

.....

(2 marks)

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

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(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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(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.

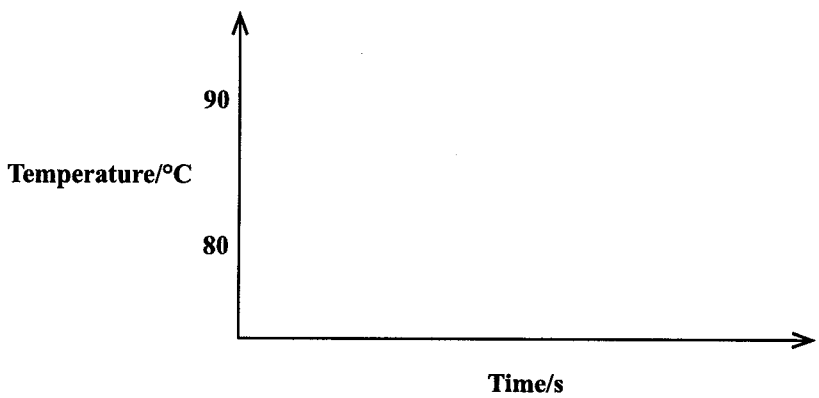


Figure 4. Cooling curve

(2 marks)

(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^{-1} K^{-1})
(Specific latent heat of vaporization of water, l_v, = 2.3 × 10^6 J K^{-1})

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

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(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)

(b) Figure 5 shows an incomplete ray diagram.

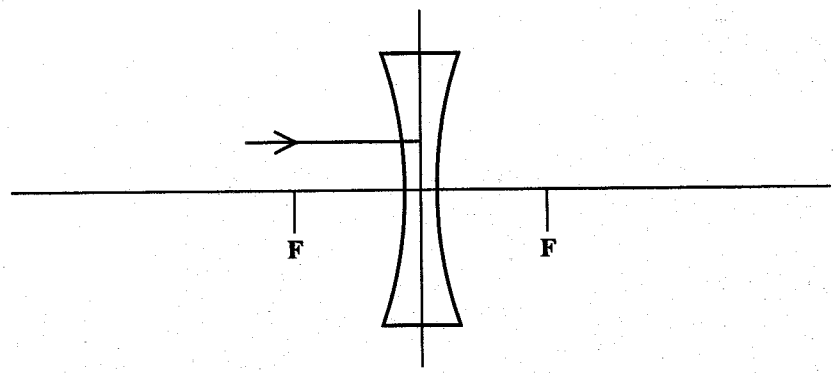


Figure 5. Incomplete ray diagram

(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)

(ii) magnification of the image formed.

(3 marks)

Total 15 marks

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5. (a) A semiconductor diode is used in a half-wave rectification. Using the axes on Figure 6, sketch the *I–V* graph for the semiconductor diode.

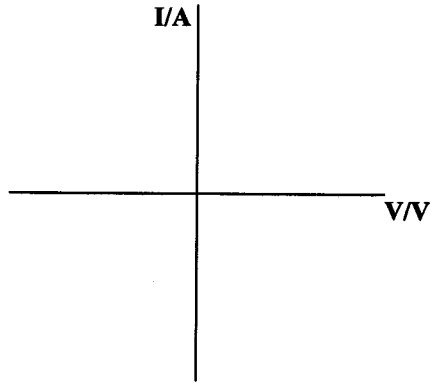


Figure 6. I–V graph for a semiconductor diode

(2 marks)

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(b) Complete the truth table shown in Table 3 for a NAND gate.

TABLE 3: NAND GATE

Input		Output
A	B	C
0	0	
0	1	
1	0	
1	1	

(4 marks)

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(c) Figure 7 shows three resistors in series of values 2Ω, 5Ω and 10Ω.

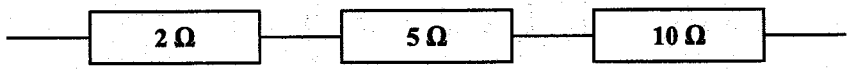


Figure 7. Resistors in series

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

(2 marks)

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

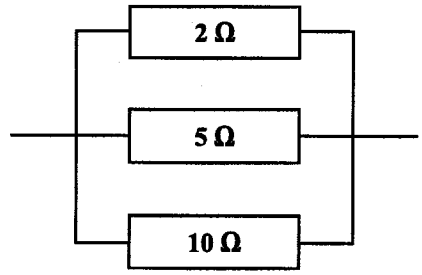


Figure 8. Resistors in parallel

Calculate the equivalent resistance of the resistors in Figure 8.

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(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.

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(3 marks)

Total 15 marks

NOTHING HAS BEEN OMITTED.

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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.

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(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'.

.....

.....

.....

.....

(2 marks)

(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^{-2})

(4 marks)

Total 15 marks

END OF TEST

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

0 1 2 3 8 0 2 0 2 3