Name .... Index Number ....

232/2
PHYSICS
Paper 2
Nov. 2016
2 hours

Candidate's Signature.......................................

Date ....**Turn over**

THE KENYA NATIONAL EXAMINATIONS COUNCIL
Kenya Certificate of Secondary Education
PHYSICS
Paper 2
(THEORY)
2 hours

Instructions to candidates

(a) *Write your name and index number in the spaces provided above.*
(b) *Sign and write the date of examination in the spaces provided above.*
(c) *This paper consists of two sections; A and B.*
(d) *Answer all the questions in sections A and B in the spaces provided.*
(e) *All workings must be clearly shown in the spaces provided in this booklet.*
(f) *Non programmable silent electronic calculators may be used.*
(g) **This paper consists of 15 printed pages.**
(h) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.**
(i) *Candidates should answer the questions in English.*

For Examiner's Use Only

Section	Question	Maximum Score	Candidate's Score
A	1–13	25	
B	14	10	
	15	9	
	16	12	
	17	11	
	18	13	
Total Score		80	

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SECTION A: (25 marks)

*Answer **all** the questions in this section in the spaces provided.*

1. **Figure 1** shows a ray of light incident on a mirror, at an angle of 45°. Another mirror is placed at an angle of 45° to the first ones as shown.
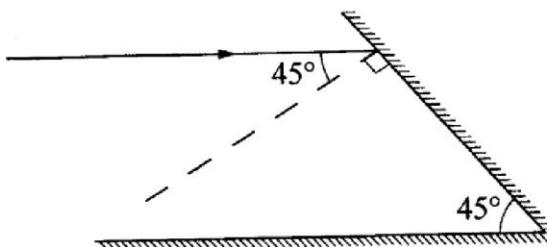
Figure 1

Sketch the patch of the ray until it emerges. (2 marks)

2. An unmagnetized steel rod is clamped facing North-South direction and then hammered repeatedly for some time. When tested, it is found to be magnetized. Explain this observation. (2 marks)

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3. **Figure 2** shows a solenoid carrying an electric current.
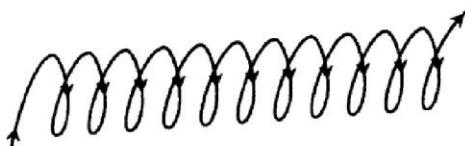
Figure 2

Sketch the magnetic field pattern inside and at the ends of the solenoid. (1 mark)

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4. **Figure 3** shows how the displacement of a point varies with time as a wave passes it.
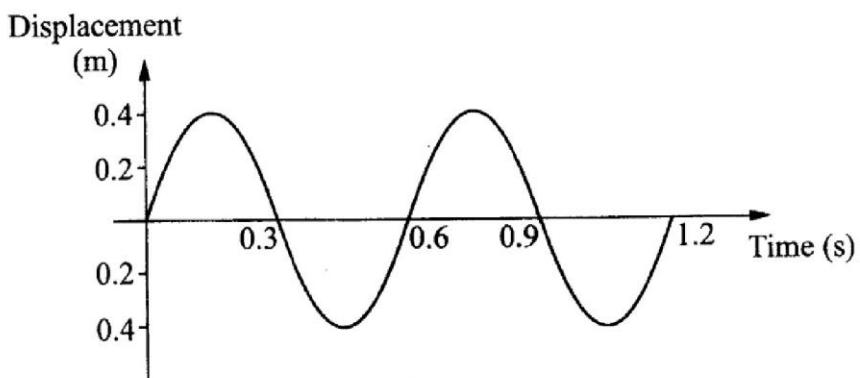
Figure 3

On the same diagram, draw a wave which passes the point with half the amplitude and twice the frequency of the one shown. (2 marks)

5. State the reason why a convex mirror is preferred over a plane mirror for use as a driving mirror. (1 mark)

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6. **Figure 4** shows straight waves incident on a diverging lens placed in a ripple tank to reduce its depth. Complete the diagram to show the waves in both the shallow region and beyond the lens. (2 marks)

Figure 4

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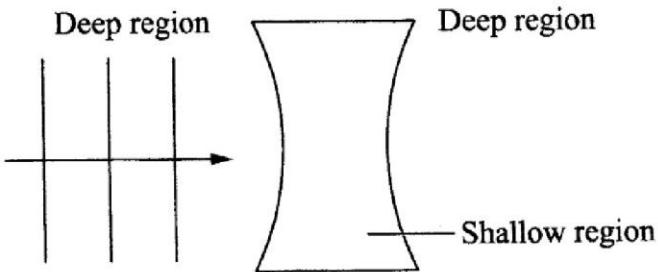
7. **Figure 5** shows the cross-section of a dry cell. Use the information on the figure to answer **Question 7**.
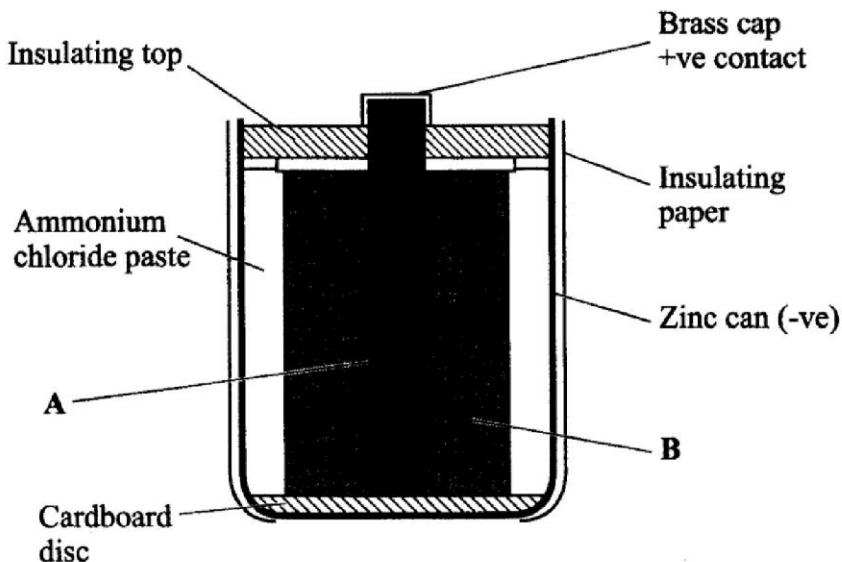
Figure 5

(a) Name the parts labelled **A** and **B**. (2 marks)

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(b) State the use of the manganese (IV) oxide in the cell. (1 mark)

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8. The following is part of a radioactive series.

$$^{234}_{83}Bi \xrightarrow{\beta} {}^{a}_{84}X \longrightarrow {}^{230}_{b}Y$$
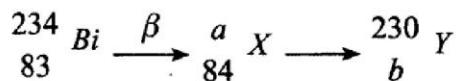
Determine the values of a and b (2 marks)

$a = $ ...., $b = $ ....

9. Draw a ray diagram to show how a ray of light may be totally internally reflected two times in an isosceles right-angled glass prism. (Assume that the critical angle of glass is 42°.) (2 marks)

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10. **Figure 6** shows a narrow beam of X-rays passing between two metal plates in air. The plates are connected in series with a switch, a cell and a milliameter.
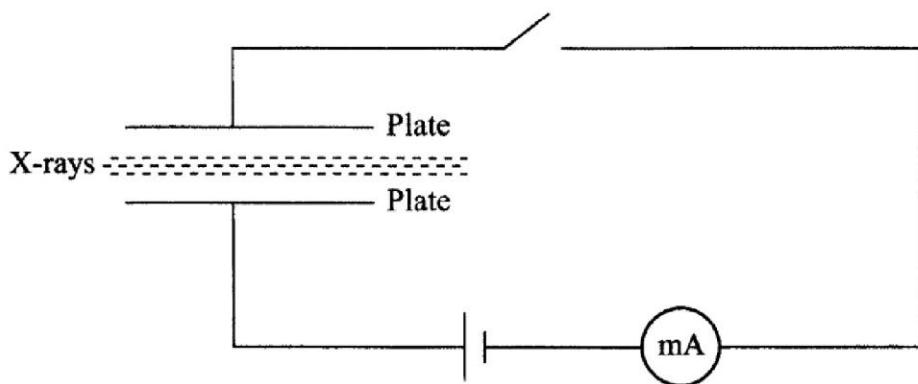
Figure 6

It is observed that when the switch is closed a current flows in the milliameter. Explain this observation. (2 marks)

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11. A heater of resistance R_1 is rated P watts, V volts while another of resistance R_2 is rated 2P watts, V/2 volts. Determine R_1/R_2. (2 marks)

12. When a germanium crystal is doped with arsenic, it becomes an N-type semi-conductor. Explain how this change occurs. (2 marks)

(Number of electrons in the outermost shell for germanium = 4, Arsenic = 5)

13. A boy standing in front of a cliff blows a whistle and hears the echo after 0.5 s. He then moves 17 metres further away from the cliff and blows the whistle again. He now hears the echo after 6.0 s. Determine the speed of the sound. (2 marks)

SECTION B: (55 marks)

*Answer **all** the questions in this section in the spaces provided.*

14. (a)   **Figure 7** shows a simple electric bell circuit.
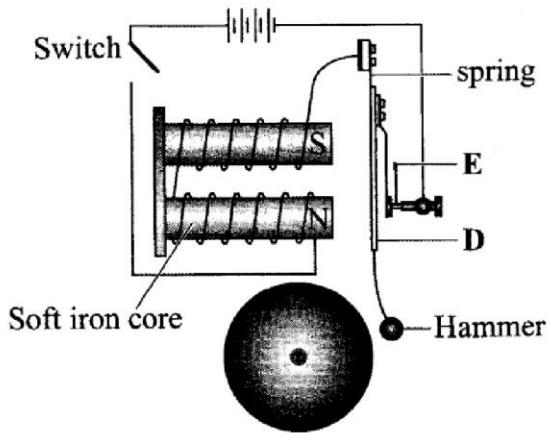
Figure 7

   (i)   Name the parts labelled:

   I.   **D** .... (1 mark)

   II.   **E** .... (1 mark)

   (ii)   When the switch is closed, the hammer hits the gong repeatedly. Explain why:

   I.   the hammer hits the gong.   (2 marks)

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   II.   the hammer hits the gong repeatedly.   (2 marks)

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(b) An electric bulb is rated 60 W, 240 V. Determine:

(i) the current that flows through it when it is connected to a 240 V supply.

(2 marks)

(ii) the resistance of the bulb (2 marks)

15. **Figure 8** shows two coils **A** and **B** placed close to each other. **A** is connected to a steady direct current (d.c.) supply and a switch, **B** is connected to a sensitive galvanometer.
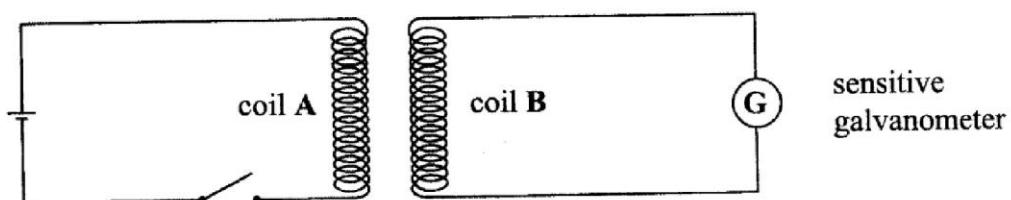
Figure 8

(a) (i) The switch is now closed. State the observation made on the galvanometer.

(1 mark)

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(ii) Explain what would be observed if the switch is then opened. (1 mark)

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(b) The primary coil of a transformer has 1000 turns and the secondary coil has 200 turns. The primary coil is connected to a 240 V alternating current (a.c.) mains supply.

(i) Explain how an e.m.f. is induced in the secondary coil. (2 marks)

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(ii) Determine the secondary voltage. (2 marks)

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(iii) Determine the efficiency of the transformer given that the current in the primary coil is 0.20 A and in the secondary coil is 0.80 A. (3 marks)

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16. (a) **Figure 9**, shows a circuit that may be used to charge a capacitor.
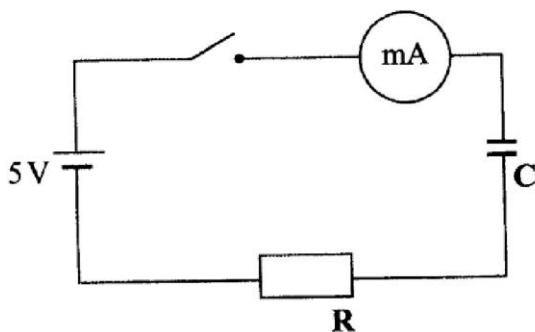
Figure 9

(i) State the observation on the milliameter when the circuit is switched on. (1 mark)

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(ii) Explain the observation in a (i) above. (2 marks)

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(b)　The circuit in **Figure 9** is left on for duration of time. State the value of potential difference (p.d.) across

　　(i)　the resistor **R**;　　　　　　　　　　　　　　　　　　　　(1 mark)

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　　(ii)　the capacitor **C**;　　　　　　　　　　　　　　　　　　　(1 mark)

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(c)　Sketch the graph of potential difference **V** across **R** against time.　　(1 mark)

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(d)　**Figure 10** shows three capacitors connected to a 10 V battery.
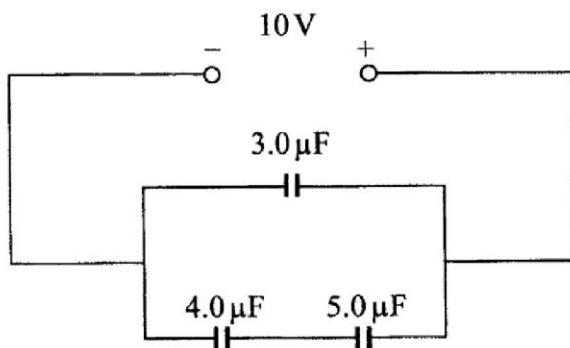
Figure 10

Calculate:

    (i)   the combined capacitance of the three capacitors   (3 marks)

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    (ii)   the charge on the $5.0\mu F$ capacitor.   (3 marks)

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17.   (a)   When a radiation was released into a diffusion chamber, short thick tracks were observed. State with a reason, the type of radiation that was detected.   (2 marks)

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(b)   The half-life of an element X is 3.83 days. A sample of this element is found to have an activity of 1.0×10^3 disintegrations per second at a particular time. Determine its activity rate after 19.15 days.   (3 marks)

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(c)   State what is meant by an extrinsic semi-conductor.   (1 mark)

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(d)   **Figure 11** shows a depletion layer in an unbiased **p–n** junction.
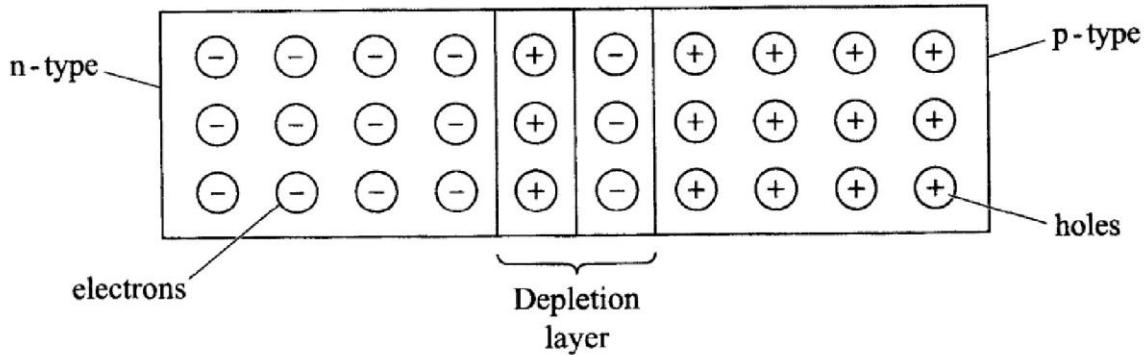
Figure 11

State how a battery can be used to make the depletion layer narrower.   (1 mark)

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(e)   **Figure 12** shows an incomplete circuit of a full wave rectified.
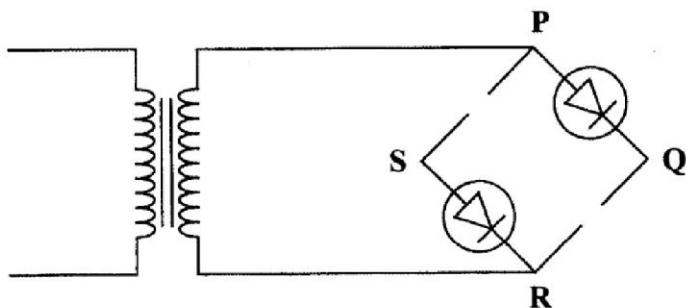
Figure 12

Draw in the **Figure 12** two more diodes to complete the circuit.   (2 marks)

(ii)   Show on the **Figure 12** the points across which the output of the rectifier should be obtained.   (2 marks)

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18.   (a)   State **one** factor that affects the speed of sound in a solid.   (1 mark)

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(b)   An observer stands half-way between two vertical cliffs that are L metres apart. He strikes a gong and measures the time interval, t, between the echoes heard from the two cliffs. He moves a further 10m and again strikes the gong and measures the time interval between the echoes. The process is repeated several times. The graph in **Figure 13** shows the relation between the time interval, t and the distance, x, from the centre.

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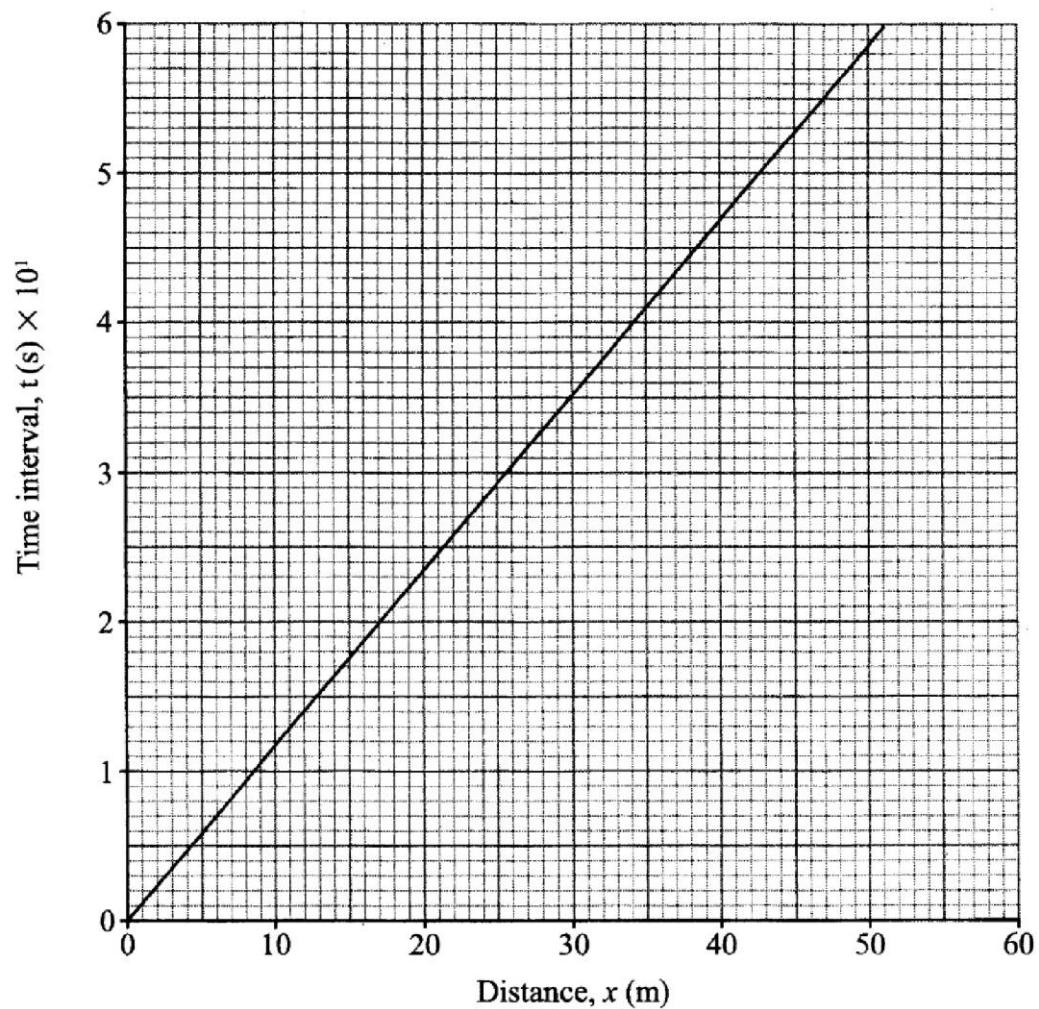
Figure 13

(i) From the graph, determine the value of x for which the time interval was 0.55 seconds. (1 mark)

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(ii) Given that $t = 4x/v$, where v is the speed of sound in air, determine the value of v from the graph. (3 marks)

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(iii) If the maximum time measured by the observer was $t = 4.75\,s$, determine the distance L between the cliffs. (3 marks)

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(c) A search boat uses a signal of frequency $6.0 \times 10^4\,Hz$ to detect a sunken ship directly below. Two reflected signals are received; one after 0.1 seconds from the sunken boat and the other after 0.14 seconds from the sea bed. If the sea bed is 98 m below the boat, determine:

(i) the speed of the signal in water. (3 marks)
(You may use the value of v of (ii) on page 14).

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(ii) the depth of the sunken ship below the boat. (2 marks)

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