1408/312
PHYSICS TECHNIQUES
June/July 2017
Time: 3 hours

Scan

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

PHYSICS TECHNIQUES

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
Non-programmable scientific calculator;
*This paper consists of **TWO** sections; **A** and **B**.*
*Answer **ALL** the questions in section **A** and any **TWO** questions from section **B**.*
Maximum marks for each part of a question are indicated.
Candidates should answer the questions in English.

This question paper consists of 5 printed pages.

Candidates must check the question paper to ascertain that all the pages are printed and that no questions are missing.

Turn over

SECTION A (60 marks)

*Answer **ALL** the questions in this section.*

1. Name one instrument used to measure each of the following parameters:

   (a) mass;
   (b) volume;
   (c) time interval;
   (d) thickness of leaflet in a textbook. (4 marks)

2. (a) State the Hooke's Law. (2 marks)

   (b) Explain why, heating of a liquid decreases its surface tension. (2 marks)

3. A block of wood density 0.5 of gcm^{-3} floats in ethanol of density 0.8 gcm^{-3}. Determine the fraction of the wood which is below the surface of the liquid. (4 marks)

4. Give **four** reasons why water is not a suitable thermometric liquid. (4 marks)

5. A convex lens of focal length 10.0 cm forms an inverted image 15.0 cm from the lens.

   Calculate:

   (a) object distance from lens; (3 marks)

   (b) magnification. (1 mark)

6. (a) Differentiate between magnetic flux and magnetic flux density. (2 marks)

   (b) Explain why pure iron rather than steel is used as a core of an electromagnet. (2 marks)

7. (a) Define capacitance. (1 mark)

   (b) Give any **three** factors that influence the capacitance of parallel plates capacitor. (3 marks)

8. (a) What is the meaning of "secondary cells"? (2 marks)

   (b) Give any **two** types of secondary cells. (2 marks)

9. **Figure 1** is a circuit diagram consisting of: a diode, an a.c voltage source, a resistor and two cathode ray oscilloscopes. (CRO1 and CRO2).

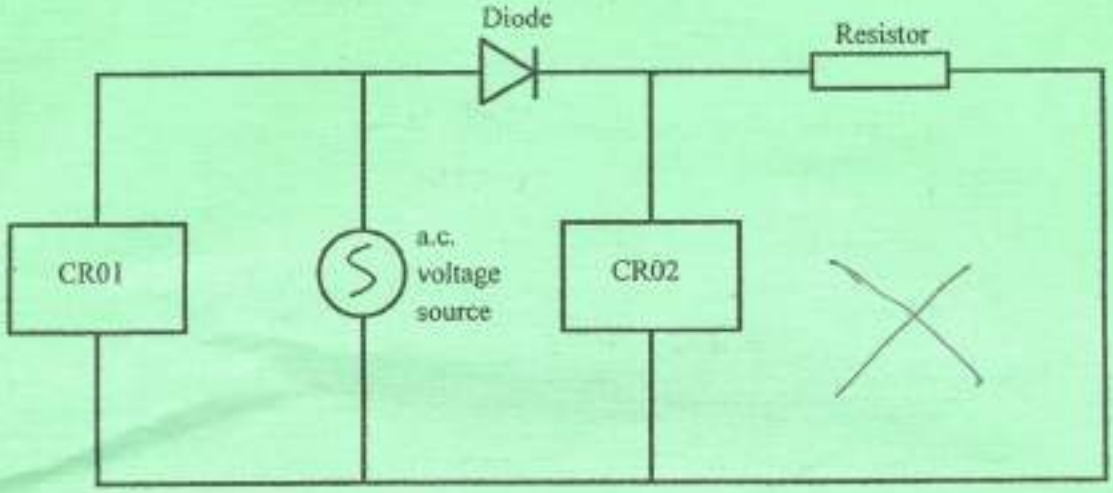

Fig. 1

Sketch the voltage waveform observed in each oscilloscope. (4 marks)

10. A wave travels with a wavelength of 0.8 metres and a period of 0.1 second. Calculate its:

(a) frequency in Hertz;
(b) speed in metres per second. (4 marks)

11. The mass of a radioisotope in a sample is detected to be 4.0 grams. If the half-life of the isotope is 8 days, determine the duration of time taken for the mass to reduce to 0.5 grams. (4 marks)

12. The water pressure at a point on the sea bed is measured as 3,090 KPa. Given that the density of sea water is 1,030 Kgm^{-3}, determine the depth of the sea at that point. (4 marks)

13. (a) Differentiate between hard and soft X-rays. (2 marks)

(b) State **two** applications of X-rays in medical field. (2 marks)

14. An electric heater rated 50 watts is used to heat a metal block of 2.5 Kg, in 5 minutes and a temperature rise of 12°C is produced. Assuming no heat is lost, calculate the specific heat capacity of the metal. (4 marks)

15. The mass of a density bottle is 20.0 g when empty, 44.0 g when full of water and 35.6 when full of another liquid. Calculate the density of the liquid. (4 marks)

SECTION B (40 marks)

*Answer any **TWO** questions from this section.*

16. (a) (i) State the **three** principle modes of heat transfer. (3 marks)

(ii) Explain how loss of heat due to each mode in 16(a)(i) above, is minimized in a vacuum flask. (3 marks)

(b) **Figure 2** shows a circuit powered by a battery of emf 5.0 volts, with internal resistance, r. It also contains loads of resistance 10 Ω, 12 Ω and 24 Ω. V is a voltmeter, while A_1 and A_2 are ammeters.

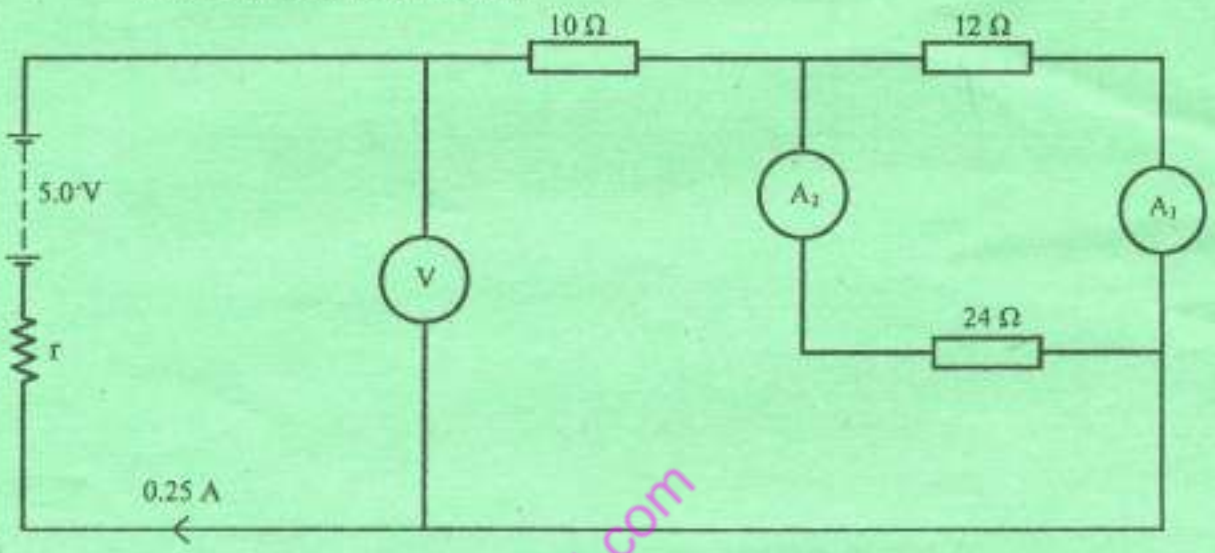

Fig. 2

Determine the:

(i) reading in V; (6 marks)
(ii) reading A_1; (4 marks)
(iii) reading in A_2; (2 marks)
(v) value of r. (2 marks)

17. (a) Define the following terms:

(i) intrinsic semiconductor;
(ii) extrinsic semiconductor;
(iii) p-type semiconductor;
(iv) n-type semiconductor. (4 marks)

(b) A model hydraulic system has the smaller piston, A of diameter 1.0 cm and the larger piston, B of diameter 5.0 cm. A force of 50 N is applied on A. Calculate the force produced on B. (5 marks)

(c) Using a schematic diagram, explain how the astronomical telescope works. (11 marks)

18. (a) Differentiate between thermionic and photoelectric emission. (4 marks)

(b) A beaker of negligible heat capacity contains 200 g of water at 20°C. 30 g of ice at its melting point of 0°C is added to the water and then stirred until the ice is completely melted. Determine:

(i) the amount of heat needed to melt the ice.

(ii) the lowest temperature of the mixture assuming no heat is lost or gained form the surrounding.
(Take specific heat capacity of water as 4.2 J g^{-1} K^{-1} and specific latent heat of fusion of ice as 336 Jg^{-1}) (8 marks)

(c) **Figure 3** is a triangular prism, PQR; made of glass of refractive index 1.5. A ray of light is incident on face PQ.

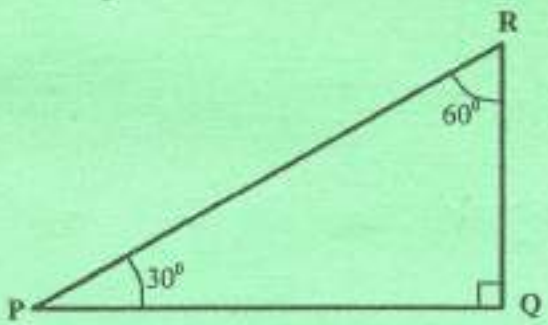

Fig. 3

(i) Calculate the critical angle of the prism. (3 marks)

(ii) Illustrate the path followed by the ray indicating the value of the angle between the ray and each face of the prism. (5 marks)

19. (a) (i) Using a schematic diagram, outline the main features of a cathode ray oscilloscope. (5 marks)

(ii) Outline the function of each of the parts in 19(a)(i) above. (5 marks)

(b) Explain how a transistor can be used as:

(i) a switch;
(ii) an amplifier. (6 marks)

(c) Determine the values of A and Z in each of the following nuclear reactions:

(i) $^{14}_{7}N + ^{A}_{2}M \longrightarrow ^{17}_{Z}O + ^{1}_{1}H$

(ii) $^{14}_{6}C \longrightarrow ^{17}_{7}N + ^{A}_{Z}P$ (4 marks)

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