Name: _____ Index No: _____

1408/312
PHYSICS TECHNIQUES
June/July 2012
Time: 3 hour

Candidate's Signature: _____

Date: _____

THE KENYA NATIONAL EXAMINATIONS COUNCIL

SCIENCE LABORATORY TECHNOLOGY CRAFT

PHYSICS TECHNIQUES

3 hours

INSTRUCTIONS TO CANDIDATES

Write your name and index number in spaces provided above.
Sign and write the date of the examination in the spaces provided.
You should have a battery operated scientific calculator for this examination.
*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 as shown.
*Answer each question from section **B** on a fresh page.*

For Examiner's Use Only

Section	Question	Maximum Marks	Candidate's Score
A	1 - 15	60	
B		20	
		20	
		Total Score	

This paper consists of 16 printed pages.

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

Turn over

SECTION A: (60 marks)

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

1. (a) State the laws of refraction. (2 marks)

(a) Calculate the refractive index of air with respect to glass, if the refractive index of glass with respect to air is 1.5. (2 marks)

2. (a) Define the following terms as applied to waves:
(i) amplitude; (1 mark)

(ii) wavelength. (1 mark)

(b) Calculate the speed in S.I. units of a wave, with a wavelength of 0.2 metres and a period of 20 seconds. (2 marks)

3. (a) Define relative density. (1 mark)

(b) Calculate the mass of a spherical ball given that its radius is 1.3 cm and the density of the materials from which it is made is 7.8g cm^{-3}. (3 marks)

4. State any **four** applications of the rays emitted by radio-isotopes. (4 marks)

5. Determine the distance at which an object must be placed so that a convex lens of focal length 12.0 cm produces a real image enlarged **four** times by the ray construction method. (4 marks)

6. (a) Differentiate between hard and soft magnetic materials. (2 marks)

(b) Give an example of each of (a) above. (2 marks)

7. State, with reason(s), the charge on a body if when brought near the cap of a positively charged gold-leaf electroscope causes the divergence of the gold-leaf to increase. (4 marks)

8. (a) State any **two** advantages of secondary cells over primary cells. (2 marks)

(b) Calculate the E.M.F. and internal resistance of a battery formed by connecting two cells, each of E.M.F 1.5V and internal resistance 0.1Ω, in parallel. (2 marks)

9. Calculate the secondary current and the p.d. for an ideal transformer, whose primary coil has 2000 turns and the secondary coil 200 turns, given that the primary p.d. and current are 240V and 0.2A respectively. (4 marks)

10. Calculate the current flowing through the 4Ω resistor in figure 1.

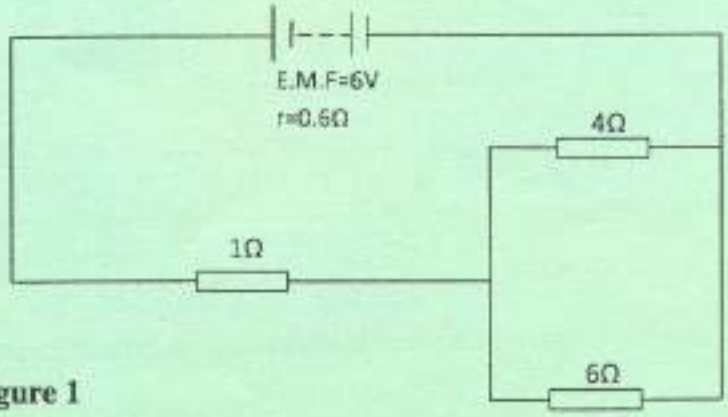

Figure 1

(4 marks)

11. (a) State any **two** advantages of semi-conductor diodes over thermoinic diodes. (2 marks)

(b) Explain why Alpha-rays yield higher ionization in gases than Beta-rays. (2 marks)

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

(b) Calculate the force needed to extend by 5.0 cm, within proportional limit, for a spring of spring constant 0.2N cm^{-1}. (2 marks)

13. With the aid of sketches illustrate how short sightedness can be rectified using lenses. (4 marks)

14. (a) Define pressure. (1 mark)

(b) Calculate, in S.I. units, the pressure exerted on a steel ball immersed 3.0 metres below the surface of a liquid of density 1.05cm^{-3}. (3 marks)

15. (a) State any **two** modes of heat transfer. (2 marks)

(b) Explain why metals are better conductors of heat than non-metals. (2 marks)

SECTION B: (40 marks)

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

16. (a) (i) Calculate the mass of sea water displaced by a floating ship of mass 2000 tonnes.
(Density of sea water = 1030Kg m^{-3}) (4 marks)

(ii) Calculate the volume of brass of density 8.5g cm^{-3}, which must be attached to a piece of wood, of 100g and density 0.2g cm^{-3}, so that the two together just submerges beneath the water.
(take the density of water as 1.0g cm^{-3}). (6 marks)

(b) (i) Calculate the mass of steam condensed if dry steam at 100°C is passed through a calorimeter of heat capacity 400JK^{-1} containing 500g of water at 10°C.
(specific heat capacity of water = 4,200$Jkg^{-1}K^{-1}$)
(specific latent heat of vaporization of water = 2,260,000JKg^{-1}) (8 marks)

(ii) State possible sources of error in the result in b(i) above. (2 marks)

17. (a) In an experiment to determine the e.m.f **E** and internal resistance **r** of a battery, the battery was connected in series with a variable resistance **R** and an ammeter. As **R** was varied, the current *i* was recorded and the following results were obtained.

R(Ω)	0.7	2.5	5.5
i(A)	5.0	2.0	1.0
$\frac{1}{i}$			

(i) Complete the table for $\frac{1}{i}$ (3 marks)

(ii) Plot a graph of $\frac{1}{i}$ against R. (7 marks)

(iii) Determine the values of **E** and **r** using the graph, if i and **R** are related by $\mathbf{E} = i(\mathbf{R} + \mathbf{r})$ (5 marks)

(b) (i) Name the component **A**, **B** and **C** in figure 2. (3 marks)

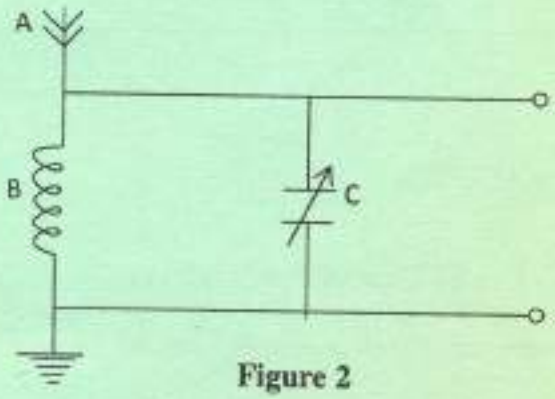

Figure 2

(ii) Explain how the above circuit is operated. (2 marks)

18. (a) A monochromatic light beam of wavelength 6.0×10^{-7}m in air passes from air to glass of refrative index 1.5. Calculate:

(i) the frequency; (2 marks)

(ii) the speed in glass; (2 marks)

(iii) the wavelength in glass. (2 marks)

(speed of light in air is 3.0×10^{8}ms^{-1})

(b) A compound microscope consists of an objective lens of focal length 5.0 cm and an eye piece lens of focal length 8.0 cm separated by a distance of 19.0 cm. It is used to view an object placed 7.5 cm from the objective lens. Calculate:

(i) the distance of the first image formed from the objective lens; (3 marks)

(ii) the distance of the second image formed from the eye piece lens; (5 marks)

(iii) the magnification of the second image formed with respect to the object; (2 marks)

(iv) the magnification of the second image formed with respect to the object. (4 marks)

19. (a) Calculate the fraction of Radium - 226 that remains after 4800 years, given that its half-life is 1600 years. (4 marks)

(b) In figure 3, **L** is a magnetic coil and **R** is a photoresistor whose resistance falls when subjected to light.

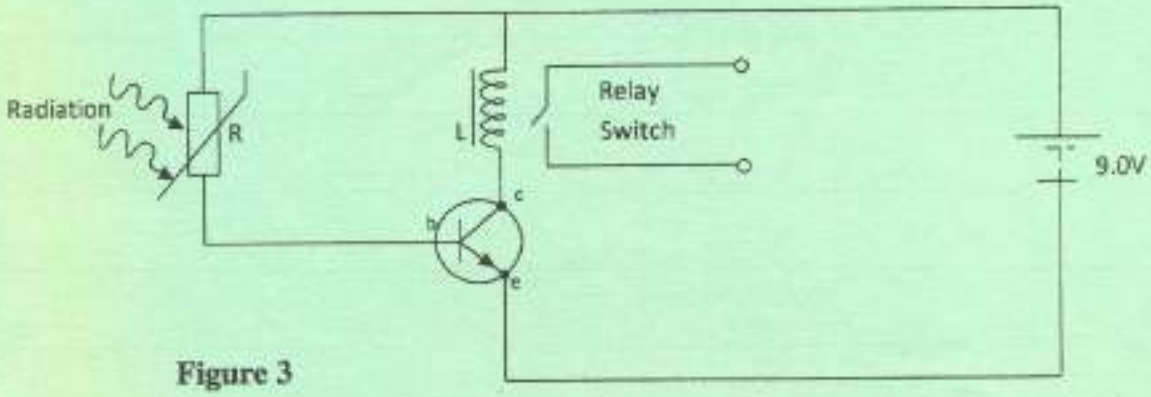

Figure 3

(i) Describe how the switch in the circuit above is operated. (5 marks)

(ii) Calculate the resistance of **R** when the relay switches on, if base current is 20 mA at the instant, and assuming $\mathbf{V_{be}}$ is approximately zero. (2 marks)

(iii) Calculate the magnetic coil current when the relay switch is on. (take current gain as 50). (2 marks)

(c) Figure 4 represents two capacitors in series with a 6V cell

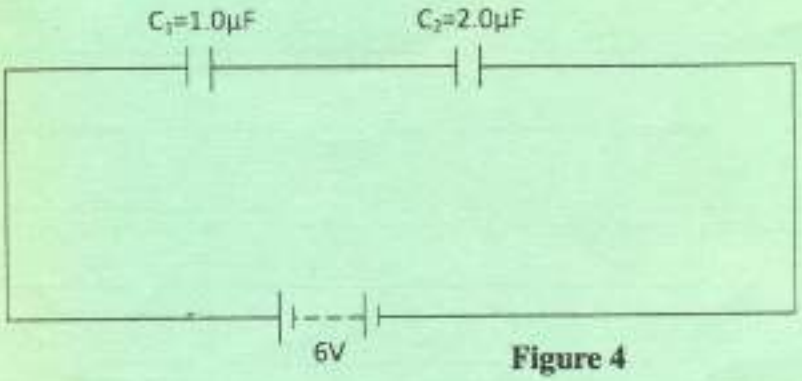

Figure 4

Calculate:

(i) net capacitance in the circuit; (2 marks)

(ii) charge in each capacitor; (1 mark)

(iii) P.d. in each capacitor. (4 marks)