

Name \_\_\_\_\_

Index No. \_\_\_\_\_

1408/312

PHYSICS TECHNIQUES

June/July 2014

Time: 3 hours

Candidate's Signature \_\_\_\_\_

Date \_\_\_\_\_



THE KENYA NATIONAL EXAMINATIONS COUNCIL

## CRAFT CERTIFICATE IN SCIENCE LABORATORY TECHNOLOGY

PHYSICS TECHNIQUES

3 hours

## INSTRUCTIONS TO CANDIDATES

Write your name and index number in the spaces provided above.

Sign and write the date of the examination in the spaces provided above.

You should have a Scientific Calculator (battery operated) for this examination.

This paper consists of TWO Sections: A and B.

Answer ALL the questions in Section A in the spaces provided and any TWO questions from Section B in the spaces provided after question 19.

Each question in Section A carries 4 marks while each question in Section B carries 20 marks.

Do NOT remove any pages from this booklet.

Candidates should answer the questions in English.

For Examiner's Use Only

## SECTION A

Question	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTAL SCORE
Candidate's Score																

## SECTION B

Question	16	17	18	19	TOTAL SCORE	GRAND TOTAL
Candidate's 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.

**SECTION A: (60 marks)**

*Answer ALL the questions in this Section in the spaces provided.*

1. Derive the SI units for the following: (4 marks)

(a) density;

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(b) pressure.

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2. Explain the difference between solids and gases. (4 marks)

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3. The wavelength of a colour of light was recorded as 390 nanometers. Determine the frequency of the colour. (4 marks)

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4. An ammeter gives a full scale deflection for a current of 0.3 A and its coil resistance is  $0.4 \Omega$ . Show how it can be adapted to give a full scale deflection of 2.5 A. (4 marks)

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5. State any **four** uses of a capacitor. (4 marks)

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6. An immersion heater is immersed in water at  $100^{\circ}\text{C}$ . After 10 minutes 0.5 kg of water is found to have converted in to vapour. If the latent heat of vaporization of water is  $2.26 \times 10^6 \text{ Jkg}^{-1}$ , determine the power of the immersion heater. (4 marks)

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7. Describe how a body can be charged negatively by induction. (4 marks)

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8. Define the following terms:

(a) radius of curvature;

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(b) focal length of a lens;

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(c) magnification in lenses;

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(d) power of lenses.

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(4 marks)

9. Two identical bodies heated to different temperatures are allowed to cool in same environment. Compare rate of cooling. (4 marks)

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10. (a) Sketch a one diode circuit diagram that can be used to achieve half-wave rectification. (3 marks)

- (b) Explain the expected output signal in (a) above. (1 mark)

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11. An object is placed 20 cm from a diverging lens of focal length 25 cm. Determine:

- (a) position of image; (3 marks)

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- (b) nature of image. (1 mark)

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12. Electrons are accelerated from rest on to a target in a hot cathode vacuum tube by a potential difference of 35 volts. Determine the velocity of the electrons on reaching the target. (*mass of electron =  $9.0 \times 10^{-31}$  kg, charge of electron =  $1.6 \times 10^{-19}$  C*) (4 marks)

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13. Explain how the following parameters of an X-ray can be varied during production:
- (a) wavelength; (2 marks)
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- (b) intensity. (2 marks)
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14. (a) Draw a sketch diagram showing the essential features of a voltage step-down transformer. (3 marks)
- (b) Indicate any relationship between the features in (a) above. (1 mark)
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15. Differentiate between alpha and gamma radiation (4 marks)
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**SECTION B: (40 marks)**

*Answer any TWO questions from this Section in the spaces provided after question 19.*

16. (a) A solid is found to weight 15 N in air and 12 N when fully submerged in a fluid. The volume of the fluid it displaces is 20 cm<sup>3</sup>. Determine:
- (i) upthrust on the solid; (1 mark)
- (ii) weight of fluid displaced by solid; (1 mark)
- (iii) density of solid; (5 marks)
- (iv) density of the fluid; (3 marks)
- (v) relative density of the solid; (2 marks)
- (vi) relative density of fluid. (2 marks)

- (b) Determine the resultant capacitance in the combination circuit shown below: (6 marks)

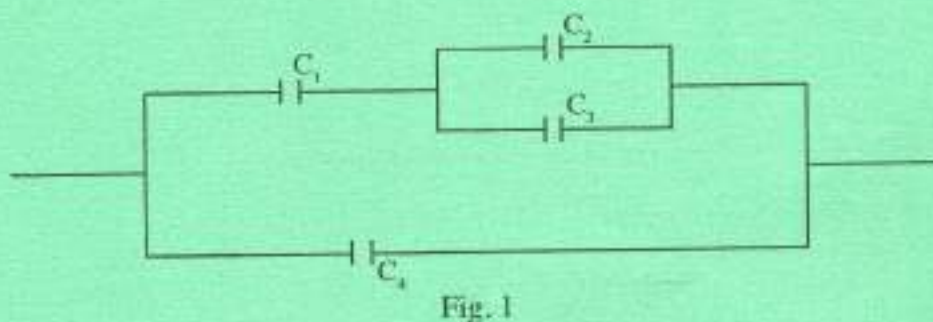


Fig. 1

Where  $C_1 = 1 \mu\text{F}$ ,  $C_2 = 2 \mu\text{F}$ ,  $C_3 = 3 \mu\text{F}$ ,  $C_4 = 4 \mu\text{F}$

17. (a) A liquid X was put in U-tube containing water and the level of water changed as shown in figure 2:

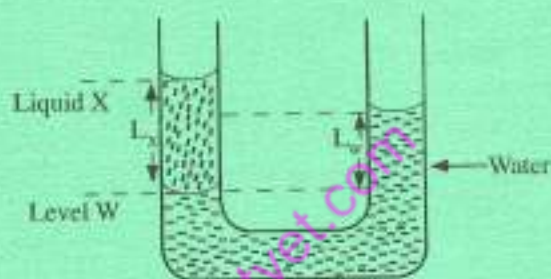


Fig. 2

Determine:

- the pressure at level W using the liquid X; (2 marks)
  - the pressure at level W using the water; (2 marks)
  - using the information in (i) and (ii) determine the relative density of liquid X. (4 marks)
- (b) State the relationship between specific heat capacity and heat capacity. (2 marks)
- (c) With the aid of a diagram, explain how a piece of iron bar can be magnetized using a d.c. power supply and copper wire. (5 marks)
- (d) In a building, 3 devices rated 250 watts operate for 2 hours a day for 4 days in a week, while 6 bulbs rated 75 watts operate for 3 hours each day in a week. If the cost of power is Ksh 10.00 per kilowatt hour. Determine the amount to be paid in one week (5 marks)



18. (a) State the difference between an extrinsic and intrinsic semi conductor. (2 marks)
- (b) (i) By means of a sketch graph, illustrate the characteristics of a diode. (6 marks)
- (ii) Explain the main features of the graph in (i) above. (4 marks)
- (c) Sketch a transfer characteristic graph for a bipolar transistor. (3 marks)
- (d) Given a resistance wire of diameter 3.0 mm and resistivity  $1.5 \times 10^{-6} \Omega\text{m}$ . Determine the:
- (i) length of wire that would make a resistance of 60  $\Omega$ ; (3 marks)
- (ii) diameter of the wire with equal length that would have a resistance of 120  $\Omega$ . (2 marks)
19. (a) The objective lens of a compound microscope has a focal length of 0.40 cm while that of the eye piece lens is 3.0 cm. The two lenses are separated by a distance of 20.0 cm. If the object was placed 0.5 cm from the objective lens, determine:
- (i) magnification of objective lens; (4 marks)
- (ii) position of final image from eyepiece lens; (4 marks)
- (iii) magnification of the eyepiece lens; (3 marks)
- (iv) total magnification of the microscope. (3 marks)
- (b) A radioactive element  ${}^A_Z\text{X}$  decays by emission of two alpha particles followed by beta particle and gamma rays. Identify the mass number and atomic number of the resulting element. (5 marks)
- (c) State **one** use of radioisotopes. (1 mark)