

1904/103
PHYSICS TECHNIQUES I
June/July 2020
Time: 3 hours



THE KENYA NATIONAL EXAMINATIONS COUNCIL
CRAFT CERTIFICATE IN SCIENCE LABORATORY TECHNOLOGY
MODULE I

PHYSICS TECHNIQUES I

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:

Answer booklet;

Non-programmable scientific calculator.

The paper consists of TWO sections; A and B.

Answer ALL questions in Section A and any TWO questions from Section B in the answer booklet provided.

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

Maximum marks for each part of a question are indicated.

Candidates should answer the questions in English.

This paper consists of 6 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 questions in this section.

1. List **four** apparatus for measuring volume. (4 marks)
2. State the SI units and symbols of each of the following quantities:
 - (a) temperature; (1 mark)
 - (b) electric current; (1 mark)
 - (c) light intensity; (1 mark)
 - (d) amount of substances. (1 mark)
3. (a) Explain why the following statement is incorrect:
"The weight of the science laboratory student is 75 kg". (2 marks)
(b) Using kinetic theory of matter, explain why gases are compressible but not solids or liquids. (2 marks)
4. The extension of a spring balance is 2.0 cm when 5.0 N is hanged from it. Determine the force that produces extension of 25 mm if elastic limit of the spring is not exceeded. (4 marks)
5. (a) Define the term 'density'. (1 mark)
(b) List **three** equivalent expressions for determining the relative density of a substance. (3 marks)
6. (a) State the law of flotation. (2 marks)
(b) A solid object of volume 25 cm^3 has density of 0.8 g/cm^3 . Determine the weight of water displaced when object is floating freely. (Take $g = 10 \text{ N/kg}$) (2 marks)
7. Derive a formula for calculating pressure in liquids at any given point. (4 marks)
8. A woman of 840 N stands upright on a floor. The contact area of her shoes and floor is 420 cm^2 . Determine the pressure exerted on the floor in Pascals. (4 marks)
9. (a) State **two** factors that affect the stability of a body. (2 marks)
(b) Explain why the Bunsen burner has a wide base and very thin at the top. (2 marks)

10. (a) State the law of conservation of linear momentum. (1 mark)
- (b) Two inelastic masses of 16 kg and 4 kg move in opposite directions from each other with velocities of 3 ms^{-1} and 5 ms^{-1} respectively. Determine the resultant velocity on collision if they stuck together. (3 marks)
11. Define each of the following terms:
- (a) angular displacement; (1 mark)
- (b) angular velocity; (1 mark)
- (c) centripetal force; (1 mark)
- (d) centripetal acceleration. (1 mark)
12. State **four** factors affecting the conductivity of materials. (4 marks)
13. (a) Define the term 'heat capacity'. (1 mark)
- (b) Explain why a burn from steam is more severe than one from water boiling at the same temperature. (3 marks)
14. Differentiate between images formed by convex mirrors and plane mirrors. (4 marks)
15. An object is placed 30 cm in front of a concave mirror of focal length 20 cm.
- (a) Determine the position of the image formed. (2 marks)
- (b) State with a reason the nature of the image. (2 marks)

SECTION B (40 marks)

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

16. (a) A gas occupies a volume of 4.0 litres at 20°C when the pressure is 76 cm of mercury. The temperature and pressure are increased to 80°C and 180 cm of mercury respectively. Calculate the new volume of the gas. (5 marks)
- (b) Define each of the following terms:
- (i) upthrust force;
 - (ii) apparent weight;
 - (iii) true weight. (3 marks)
- (c) A ray of light passes from air into a liquid at an angle of 50° and is refracted through an angle of 30° . Determine:
- (i) the refractive index of the liquid;
 - (ii) the speed of light into the liquid.
- (Take speed of light in air $= 3 \times 10^8 \text{ m/s}$). (4 marks)
- (d) Marine material of density 8.5 g/cm^3 is attached to a piece of wood of mass 100 g and density 0.2 g/cm^3 . Calculate the volume of material that must be attached to the wood to make them submerge beneath the liquid of density 1.2 g/cm^3 . (8 marks)

17. (a) Table I shows the results of an experiment on verification of Snell's law using a transparent material block.

Table I

Angle of incidence	24°	28°	33°	38°	41°	45°
Sin i						
Angle of refraction	16°	18°	21°	27°	26°	28°
Sin r						

- (i) Copy the table and indicate the values of sin i and sin r. (4 marks)
- (ii) Plot the graph of sin i (Y-axis) against sin r. (6 marks)
- (iii) From the graph, identify the reading that was incorrectly recorded. (1 mark)
- (iv) Using the graph, determine the refractive index of the material. (2 marks)
- (v) Determine the angle of refraction when the angle of incidence is 36°. (1 mark)
- (b) State the second and the third Newton's laws of motion. (2 marks)
- (c) A satellite takes 84 minutes to revolve around the earth once in a circular orbit of radius 8,000 kilometres. Calculate its:
- (i) angular velocity; (2 marks)
- (ii) centripetal acceleration. (2 marks)

18. (a) 2000 cm^3 of saturated solution of relative density of 1.2 is mixed with 1000 cm^3 of water. Determine the density of the mixture in kg/m^3 .
(Density of water = 1 g/cm^3). (6 marks)

(b) List **three** applications of heat transfer. (3 marks)

(c) Dry steam is passed into a well-lagged copper can of mass 250 g containing 400 g of water and 50 g of ice at 0°C . The mixture is well stirred and the steam supply cut off when the temperature of the can and its contents reaches 20°C .

(i) Determine the mass of steam. (10 marks)

(ii) State **one** assumption on the calculation. (1 mark)

Take: Specific heat capacities of water and copper as 4.2 J/gK and 0.4 J/gK respectively.

Specific latent heats of steam and ice is 2260 J/g and 336 J/g .

19. (a) (i) Define the term 'atmospheric pressure' and state its SI unit. (2 marks)

(ii) The air pressure at the foot and top of a mountain is 760 mm and 650 mm of mercury respectively. Determine its height in kilometres. (7 marks)

(b) (i) Define the term 'surface tension'. (2 marks)

(ii) Explain how impurities affect surface tension. (4 marks)

(c) Define each of the following terms as used in materials:

(i) strength;

(ii) stiffness;

(iii) ductility;

(iv) brittleness;

(v) elasticity.

(5 marks)

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