1904/103
PHYSICS TECHNIQUES I
Oct./Nov. 2018
Time: 3 hours

THE KENYA NATIONAL EXAMINATIONS COUNCIL

CRAFT CERTIFICATE IN SCIENCE AND LABORATORY TECHNOLOGY

MODULE I

PHYSICS TECHNIQUES I

3 hours

INSTRUCTIONS TO CANDIDATES

You should have the following for this examination:
Answer booklet;
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**.*
*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 5 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.*

1. Name any **four** basic quantities and their SI units. (4 marks)

2. Explain why some liquids spread over a solid surface while others do not. (4 marks)

3. (a) A force vector has a magnitude of 800 N and a direction of 40° North of East. Determine the magnitude and direction of the components of the force that points along the North - South line and along the East-West line. (2 marks)

   (b) Express a pressure of 560 mmHg in Nm^{-2}. (2 marks)

4. A piece of meat weighs 50 N. Determine the reading of the spring balance when pulled:

   (a) upwards by a pulley at a rate of 3.0 m/s^2. (2 marks)

   (b) downwards at a rate of 3.0 m/s^2. (2 marks)

5. (a) Determine the momentum and kinetic energy of a car of mass 3.0×10^3 kg travelling at 20 m/s. (2 marks)

   (b) Determine the factor by which the kinetic energy changes if the speed is doubled. (2 marks)

6. (a) State Hooke's law. (1 mark)

   (b) A spring has a spring constant of 3.0 N/cm. Determine the force needed to,

   (i) stretch the spring by 50 mm from its unstretched length. (2 marks)

   (ii) compress the spring by 50 mm. (1 mark)

7. Explain why a lead brick weighs less on the moon than on the earth but the density of lead is the same in both places. (4 marks)

8. The weight of a metal block in air is 10.84 N when completely submerged in water it weighs 8.86 N. Determine the density of the metal block. (4 marks)

9. (a) Define surface tension. (1 mark)

   (b) Atmospheric pressure above a swimming pool changes from 755 mmHg to 765 mmHg. Determine the change in force at the bottom of the pool measuring 15 m x 20 m. (3 marks)

10. Differentiate between constructive and destructive interference in light waves. (4 marks)

11. Determine the percentage by which the length of a steel beam increases when the temperature changes from that on a cold winter day (-20° F) to that on a hot summer day (110° F). (4 marks)

12. An object is placed at a distance of 30 cm from a concave spherical mirror of focal length 15.0 cm. Determine:

(a) position of image; (2 marks)
(b) magnification for the object. (2 marks)

13. The temperature of an electric oven is 180° C. Temperature at outer surface is 70° C and surface area is 7.8 m^3. An insulating material of thickness 2.0 cm and thermal conductivity 0.05 $W\ m^{-1}K^{-1}$ is used. Determine the amount of energy transferred in 5 hours. (4 marks)

14. Determine the final temperature if a 0.1 kg of aluminium at 50° C and 0.25 kg of water at 85° C are put in 0.2 kg copper cup at 20° C assuming no loss of heat. (4 marks)

15. State the factors that necessitated the ban of polythene bags in Kenya. (4 marks)

SECTION B (40 marks)

Answer any TWO questions from this section.

16. (a) An image of an object is upright and magnified 2.5 times when the object if placed 20 cm from a lens. Determine:

(i) position of image; (2 marks)
(ii) focal length of the lens. (2 marks)

(b) A small fish is swimming at a depth d(cm) below the surface of a pond. Determine,

(i) the apparent depth of fish as viewed vertically from above. (2 marks)

(ii) real depth, if apparent depth is 10 cm. (2 marks)
(Refractive index for water = 1.33)

(c) A square water bed of side 3.0 m is filled to a depth of 50.0 cm. Determine:

(i) its weight; (4 marks)
(ii) the pressure that the water bed exerts on the floor. (2 marks)
(density of water = 1000 kgm^{-3})

(d) A 100 kg man jumps from a building situated 50 m above a catching net. Assuming air resistance exerts a 120 N force on the man as he falls, determine his velocity first before he hits the net. (6 marks)

17. (a) Figure 1 shows one metre uniform plank of weight 20 grams at equilibrium.

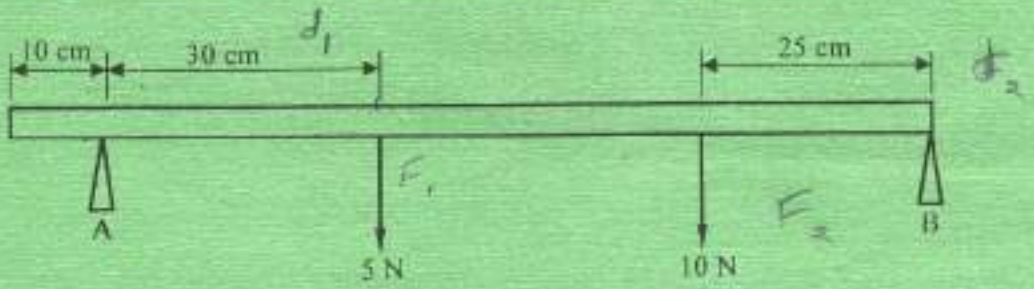

Fig. 1

Determine the forces acting at supports A and B. (8 marks)

(b) A body A of mass 2.5×10^3 kg moving to the East at 10 m/s collides head on and sticks together with a body B of mass 1.5×10^3 kg moving westwards at 10 m/s.
Determine the:

(i) speed of entangled bodies after collision. (4 marks)

(ii) change in the velocity of each body. (2 marks)

(iii) change in kinetic energy of the system of both bodies. (6 marks)

18. (a) Differentiate the **three** states of matter. (6 marks)

(b) A vertical steel beam supports a load of 1×10^5 N. If the length of the beam is 5.0 m and its cross sectional area is 1×10^{-2} m^2, determine:

(i) the distance the beam is compressed along its length; (2 marks)

(ii) minimum load in newtons the steel beam supports before failing.
(Young modulus for steel = 1.2×10^{11} Nm^{-2}) (6 marks)

(c) A 10 kg block of ice at 0° C is added to an insulated container partially filled with 20 kg of water at 60° C. Determine the final temperature, neglecting the heat capacity of the container.
Latent heat of fusion for water = 3.3×10^5 Jkg^{-1}. (6 marks)

19. (a) Figure 2 shows a pendulum bob of mass 2 kg attached to a string 1 m long and made to revolve in a horizontal circle of radius 50 cm.

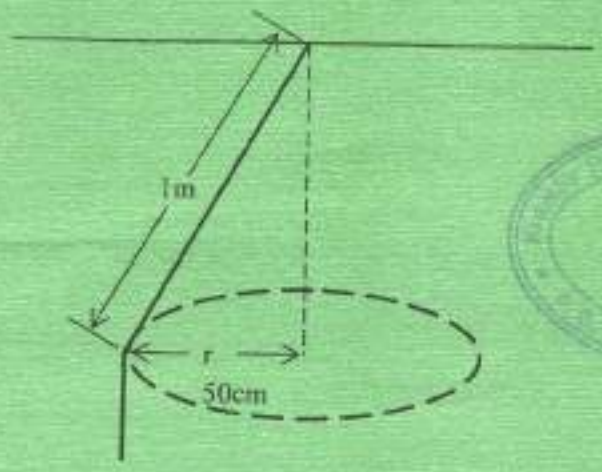

Fig. 2

Determine the:

(i) tension in the string; (4 marks)

(ii) instantaneous linear velocity of bob along the circumference; (3 marks)

(iii) angular velocity of the pendulum; (4 marks)

(iv) period of motion. (2 marks)

(b) (i) A wire of radius 0.4 mm is extended by 0.1% of its length when it supports a load of 1 kg. Calculate Young modulus for the material of the wire. (3 marks)

(ii) State Boyle's law of gases; (1 mark)

(iii) Sketch a graph to represent Boyle's law. (3 marks)

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