

Mid Term III Examinations 2019

S.3 Physics Paper Two

Time: 2¼ Hours

INSTRUCTIONS TO CANDIDATES

- Answer **any five** questions.
- These values of physical quantities may be useful to you.
- Acceleration due to gravity, g $= 10 \text{ ms}^{-2}$
- Speed of sound in air $= 340 \text{ ms}^{-1}$
- Specific heat capacity of ice $= 2,100 \text{ Jkg}^{-1} \text{ K}^{-1}$
- Specific latent heat of ice $= 3.36 \times 10^5 \text{ Jkg}^{-1}$
- Specific heat capacity of water $= 4.2 \times 10^3 \text{ Jkg}^{-1} \text{ K}^{-1}$
- Refractive index of air $= 1$

1.(a) (i) Explain what is meant by moment of a **force** (1 mark)

(ii) State the principle of **moments** (1 mark)

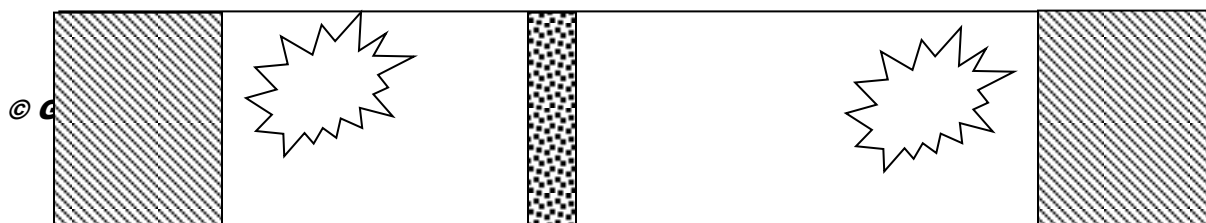
(b) A uniform rod of 1m long of mass 50g is supported horizontally on two knife edges, placed 10 cm from its ends. What will be the reaction at these supports when a 100g mass is suspended 10cm from the mid-point of the rod?

(3 marks)

(c) Explain how you would determine the mass of a metre rule (5 marks)

(d) (i) Explain what is meant by a **centre of gravity** and **stable equilibrium**.

(2 marks)



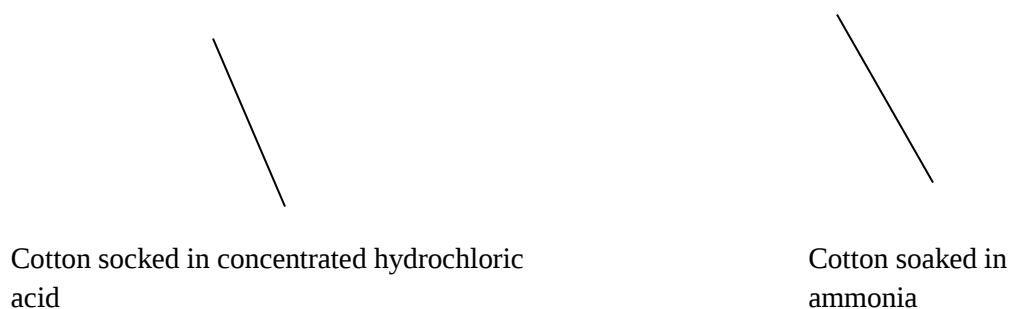


Fig. 1

e) The figure 1 above shows a simple experiment to demonstrate diffusion.

- i) State what is observed. (1mark)
- ii) Explain the observation. (3marks)

2. (a) State **Archimedes principle**.

(1mark)

(b) A cube of side 5cm weighs 18.7N. Calculate; (4 marks)

- i) the density of the material of which the cube is made.
- ii) Its apparent weight when completely immersed in a liquid of density 0.8gcm^{-3} .

c)i)A pulley system of velocity ratio 4 is used to raise a load. Find how far the load is raised if the effort moves down by 4m.

(2 marks)

ii) Calculate the effort required to raise a load of 800N if the mechanical advantage of the system is 4. (3 marks)

iv) Calculate the efficiency of the system. (2 marks)

c) Give two reasons why the efficiency of a machine is always less than 100% (2 marks)

d) A girl of mass 50 kg runs up a flight of steps in 10 seconds. Given that each step is 0.30m high, determine the power developed by the girl.

(2 marks)

3. (a) (i) State the **laws of refraction** of light. (2 marks)

(ii) Describe an experiment to determine the refractive index of a rectangular glass block.

(5 marks)

(b) Light travelling from air is incident on an air water boundary at an angle of 60 degrees. It then travels through water and meets glass at an angle **P** and emerges at an angle **Q** from the normal. If the refractive index of water and glass is 1.33 and 1.5 respectively, find the angles P and Q.

(4 marks)

(c) Define the following terms as applied to convex mirrors (2 marks)

(i) Principal focus

(ii) Centre of curvature

(d) An object is placed between the pole and the principal focus of a concave mirror. Draw a ray diagram to show the nature of the image formed giving its characteristics. (3 marks)

4.(a) With the aid of a labeled diagram, describe an experiment to verify Charles' law (6 marks)

(b) A cylinder with a movable piston contains 125cm^3 of air at a temperature of 47°C . Calculate the volume of the gas if it is cooled to -23°C at constant pressure (3 marks)

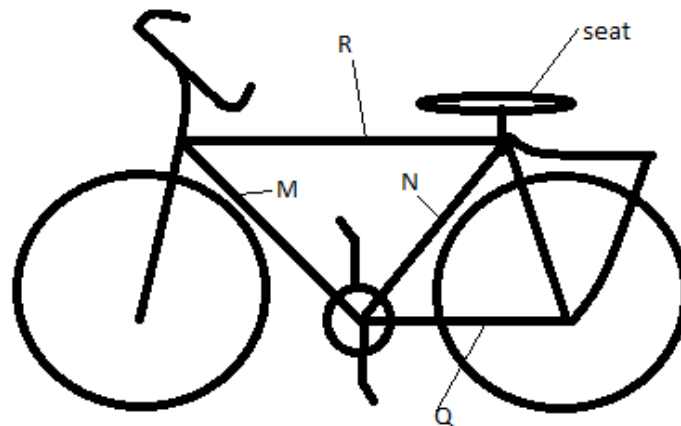
(c) i) Differentiate between conduction and convection. (2 marks)

ii) Why are car radiator fins painted black (2 marks)

- d) Explain how a vacuum flask minimises heat losses
(3 marks)

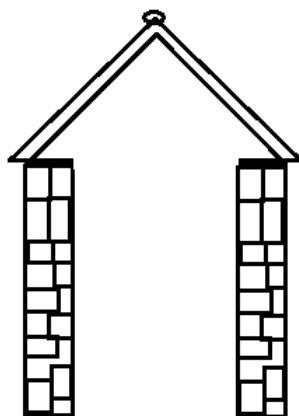
5.(a) Define the term **strain** and **stress** (2 marks)

- b) The diagram below shows a bicycle.



Which of the parts, labeled M, N, Q and R, would be;

- i) In tension (2 marks)
 - ii) In compression when a heavy person sits on the **seat**? (2 marks)
- c) Give four reasons why bicycle frames are made of hollow cylindrical structures.(4 marks)
- d) Explain why the lower part of the second floor of a building is made of reinforced concrete while the upper part is not reinforced.
(3 marks)
- e) The figure below shows part of a roof structure.



i) Copy the diagram and on it show how the structure can be strengthened by using two other girders.

(2 marks)

ii) Label one tie and one strut on your diagram (1 mark)

6. (a) (i) State the fundamental **law of electrostatics**. (1 mark)

(ii) Differentiate between a **conductor** and an **insulator**. (2 marks)

(b) Draw a well labeled diagram of a gold leaf electroscope. (3 marks)

(c) Explain the effects of the following.

(i) rubbing a glass rod with silk. (2marks)

(ii) rubbing two similar glass rods together
(2marks)

d) Describe how two identical metal balls may be charged positively and simultaneously by induction.

(4 marks)

e) Two charged rods, one with positive charges and the other negatively charged are brought parallel and close to each other. With the aid of a diagram, show the electric field pattern. (2 marks)

7a) Define the term **pressure**. (1 mark)

b) i) Explain why mountain climbers are likely to experience nose bleeding when at the top of a mountain.

(2 marks)

c) A mountaineer records the air pressure at the base X of mountain Rwenzori to be 1420mm of mercury and the top Y as 660mm of mercury. Given that the average density of air is 1.02 kgm^{-3} and the density of mercury is 13600 kgm^{-3} . Calculate the height of the mountain.

(4 marks)

d) With the aid of a diagram, describe how a simple barometer works.

(5marks)

e) A garage lift has input and output pistons of diameters 20cm and 60cm respectively. The lift is used to lift up a car of weight $1.4 \times 10^4 \text{ N}$. Calculate.

i) the force on the input piston. (2 marks)

ii) the pressure applied to the input piston. (2 marks)

END