

PHYSICS

SCIENCE Paper – 1

(Two hours)

Answers to this Paper must be written on the paper provided separately.

*You will **not** be allowed to write during the first 15 minutes.*

This time is to be spent in reading the Question Paper.

The time given at the head of this Paper is the time allowed for writing the answers.

Section I is compulsory. Attempt **any four** questions from **Section II**.

The intended marks for questions or parts of questions are given in brackets [].

SECTION I (40 Marks)

*Attempt **all** questions from this Section.*

Question 1

- (a) A brass ball is hanging from a stiff cotton thread. Draw a neat labelled diagram showing the forces acting on the brass ball and the cotton thread. [2]
- (b) The distance between two bodies is doubled. How is the magnitude of gravitational force between them affected? [2]
- (c) Why is a jack screw provided with a long arm? [2]
- (d) If the power of a motor be 100 kW, at what speed can it raise a load of 50,000 N? [2]
- (e) Which class of lever will always have $MA > 1$ and why? [2]

Question 2

- (a) Define heat capacity and state its SI unit. [2]
- (b) Why is the base of a cooking pan generally made thick? [2]
- (c) A solid of mass 50 g at 150°C is placed in 100 g of water at 11°C , when the final temperature recorded is 20°C . Find the specific heat capacity of the solid. [2]

(Specific heat capacity of water = $4.2 \text{ J/g}^{\circ}\text{C}$)

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Turn over

- (d) How is the refractive index of a material related to: [2]
- (i) real and apparent depth?
 - (ii) velocity of light in vacuum or air and the velocity of light in a given medium?
- (e) State the conditions required for total internal reflection of light to take place. [2]

Question 3

- (a) Draw a ray diagram to show the refraction of a monochromatic ray through a prism when it suffers minimum deviation. [2]
- (b) The human ear can detect continuous sounds in the frequency range from 20 Hz to 20,000 Hz. Assuming that the speed of sound in air is 330 ms^{-1} for all frequencies, calculate the wavelengths corresponding to the given extreme frequencies of the audible range. [2]
- (c) An enemy plane is at a distance of 300 km from a radar. In how much time the radar will be able to detect the plane? Take velocity of radiowaves as $3 \times 10^8 \text{ ms}^{-1}$. [2]
- (d) How is the frequency of a stretched string related to: [2]
- (i) its length?
 - (ii) its tension?
- (e) Define specific resistance and state its SI unit. [2]

Question 4

- (a) An electric bulb of resistance 500Ω , draws a current of 0.4A. Calculate the power of the bulb and the potential difference at its end. [2]
- (b) State two causes of energy loss in a transformer. [2]
- (c) State two characteristics of a good thermion emitter. [2]
- (d) State two factors upon which the rate of emission of thermions depends. [2]
- (e) When does the nucleus of an atom tend to be radioactive? [2]

SECTION II (40 Marks)

Attempt any *four* questions from this Section

Question 5

- (a) A uniform half metre rule balances horizontally on a knife edge at 29 cm mark [3]
when a weight of 20 gf is suspended from one end.
- (i) Draw a diagram of the arrangement.
 - (ii) What is the weight of the half metre rule?
- (b) (i) A boy uses a single fixed pulley to lift a load of 50 Kgf to some height. [3]
Another boy uses a single movable pulley to lift the same load to the same height. Compare the effort applied by them. Give a reason to support your answer.
- (ii) How does uniform circular motion differ from uniform linear motion?
 - (iii) Name the process used for producing electricity using nuclear energy.
- (c) A pulley system with $VR = 4$ is used to lift a load of 175 kgf through a vertical [4]
height of 15 m. The effort required is 50 kgf in the downward direction.
($g = 10 \text{ N kg}^{-1}$)
Calculate:
- (i) Distance moved by the effort.
 - (ii) Work done by the effort.
 - (iii) M.A. of the pulley system.
 - (iv) Efficiency of the pulley system.

Question 6

- (a) (i) How is the transference of heat energy by radiation prevented in a [3]
calorimeter?
- (ii) You have a choice of three metals A, B and C, of specific heat capacities $900 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$, $380 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$ and $460 \text{ J kg}^{-1} \text{ } ^\circ\text{C}^{-1}$ respectively, to make a calorimeter. Which material will you select? Justify your answer.

- (b) Calculate the mass of ice needed to cool 150g of water contained in a calorimeter of mass 50g at 32°C such that the final temperature is 5°C . [3]

Specific heat capacity of calorimeter = $0.4 \text{ J/g}^{\circ}\text{C}$

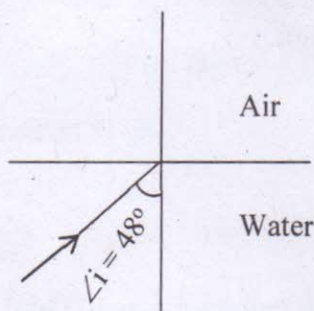
Specific heat capacity of water = $4.2 \text{ J/g}^{\circ}\text{C}$

Latent heat capacity of ice = 330 J/g

- (c) (i) Name the radiations which are absorbed by greenhouse gases in the earth's atmosphere. [4]
- (ii) A radiation X is focused by a particular device on the bulb of a thermometer and mercury in the thermometer shows a rapid increase. Name the radiation X.
- (iii) Name two factors on which the heat energy liberated by a body depends.

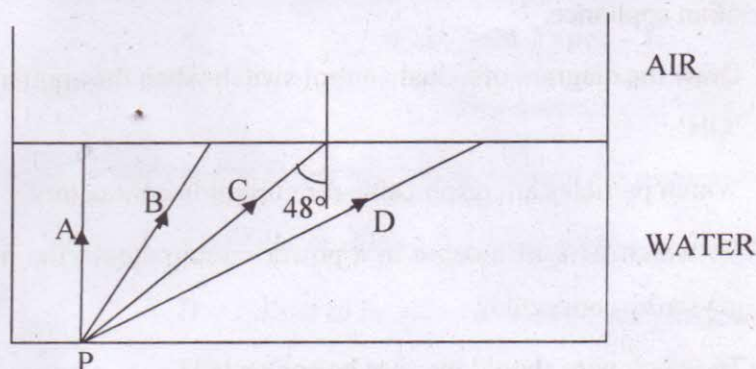
Question 7

- (a) A Lens forms an upright and diminished image of an object when the object is placed at the focal point of the given lens. [3]
- (i) Name the lens.
- (ii) Draw a ray diagram to show the image formation.
- (b) A ray of light travels from water to air as shown in the diagram given below: [3]



- (i) Copy the diagram and complete the path of the ray. Given the critical angle for water is 48° .
- (ii) State the condition so that total internal reflection occurs in the above diagram.

- (c) The diagram below shows a point source P inside a water container. Four rays A, B, C, D starting from the source P are shown upto the water surface. [4]



- (i) Show in the diagram the path of these rays after striking the water surface.
The Critical Angle for water air surface is 48° .
- (ii) Name the phenomenon which the rays B and D exhibit.

Question 8

- (a) Name the factor that determines: [3]
- Loudness of the sound heard.
 - Quality of the note.
 - Pitch of the note.
- (b) (i) What are damped vibrations? [3]
- (ii) Give one example of damped vibrations.
- (iii) Name the phenomenon that causes a loud sound when the stem of a vibrating tuning fork is kept pressed on the surface of a table.
- (c) (i) A wire of length 80 cm has a frequency of 256 Hz. Calculate the length of a similar wire under similar tension, which will have frequency 1024 Hz. [4]
- (ii) A certain sound has a frequency of 256 hertz and a wavelength of 1.3 m.
- Calculate the speed with which this sound travels.
 - What difference would be felt by a listener between the above sound and another sound travelling at the same speed, but of wavelength 2.6 m?

Question 9

- (a) (i) Name the colour code of the wire which is connected to the metallic body of an appliance. [3]
- (ii) Draw the diagram of a dual control switch when the appliance is switched 'ON'.
- (b) (i) Which particles are responsible for current in conductors? [3]
- (ii) To which wire of a cable in a power circuit should the metal case of a geyser be connected?
- (iii) To which wire should the fuse be connected?
- (c) (i) Explain the meaning of the statement 'current rating of a fuse is 5A'. [4]
- (ii) In the transmission of power the voltage of power generated at the generating stations is stepped up from 11kV to 132kV before it is transmitted. Why?

Question 10

- (a) Answer the following questions based on a hot cathode ray tube. [3]
- (i) Name the charged particles.
- (ii) State the approximate voltage used to heat the filament.
- (iii) What will happen to the beam when it passes through the electric field?
- (b) State three factors on which the rate of emission of electrons from a metal surface depends. [3]
- (c) (i) What are free electrons? [4]
- (ii) Why do they not leave the metal surface on their own?
- (iii) How can they be made to leave the metal surface? (State any two ways)