
SCIENCE

Paper 1 (Physics)

(One hour and a half)

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) Which physical quantity does the electron volt measure? How is it related to the S.I. unit of this quantity? [2]
- (b) What should the angle between force and displacement be to get the
 - (i) minimum work;
 - (ii) maximum work? [2]
- (c) State Newton's second law of motion. [2]
- (d) The work done by the heart is 1 Joule per beat. Calculate the power of the heart if it beats 72 times in one minute. [2]
- (e) Mention two properties of a wave: one property which varies and the other which remains constant when the wave passes from one medium to another. [2]

Question 2

- (a) Explain briefly what causes the twinkling of stars at night. [2]
 - (b) State two advantages of an aneroid barometer. [2]
 - (c) Explain why a gas bubble released at the bottom of a lake grows in size as it rises to the surface of the lake. [2]
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This Paper consists of 7 printed pages and 1 blank page.

Turn over

- (d) What is meant by the statement, '*the critical angle for diamond is 24°* '? How is the critical angle of a material related to its refractive index? [2]
- (e) A block of wood of volume 25 cm^3 floats in water with 20 cm^3 of its volume immersed. Calculate:-
- the density and
 - the weight of the block of wood. [2]

Question 3

- (a) Name any two electromagnetic waves which have a frequency higher than that of violet light. State one use of each. [2]
- (b) State two ways by which the frequency of transverse vibrations of a stretched string can be decreased. [2]
- (c) Why does the temperature of the surroundings start falling when the ice of a frozen lake starts melting? [2]
- (d) Four resistances of 2.0Ω each are joined end to end to form a square ABCD. Calculate the equivalent resistance of the combination between any two adjacent corners. [2]
- (e) In a three-pin plug, why is the earth pin made *longer* and *thicker* than the other two pins? [2]

Question 4

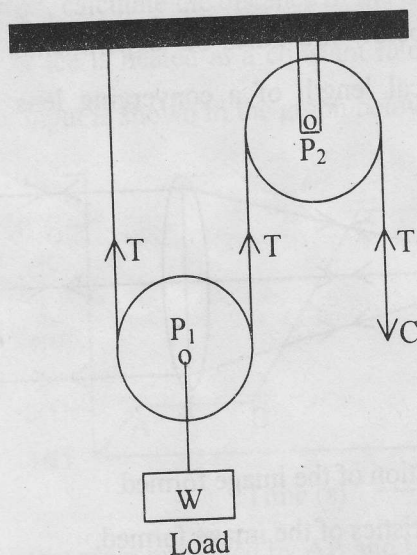
- (a) State the energy change which takes place when a magnet is moved inside a coil having a galvanometer at its ends. Name this phenomenon. [2]
- (b) Draw a labelled diagram of an A.C. generator. [2]
- (c) Calculate the heat energy that will be released when 5.0 kg of steam at 100°C condenses to form water at 100°C . Express your answer in S.I. unit. (Specific latent heat of vaporization of steam is 2268 kJ/kg .) [2]
- (d) How many alpha and beta particles are emitted when Uranium nucleus ${}^{238}_{92}\text{U}$ decays to Lead ${}^{206}_{82}\text{Pb}$? [2]
- (e) With the help of an equation, state the mechanism of energy production in a nuclear fusion reaction. [2]

SECTION II (40 Marks)

Attempt any **four** questions from this Section.

Question 5

- a) (i) State the law of conservation of energy.
- (ii) Name the chief energy transformation that occurs
- (1) in a Loudspeaker;
 - (2) in an Electrical cell (Primary).
- [3]
- b) (i) Define an *Inclined plane*.
- (ii) Draw a labelled sketch of a class II lever. Give one example of such a lever.
- [3]



The above figure shows the combination of a movable pulley P_1 with a fixed pulley P_2 used for lifting up a load W .

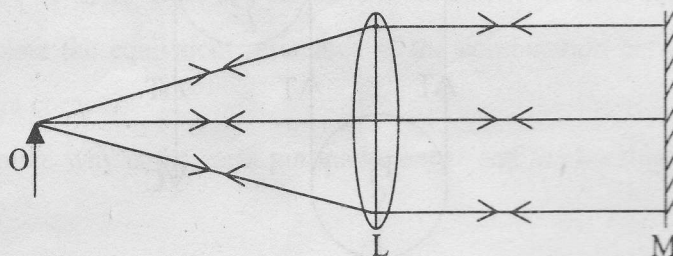
- (i) State the function of the fixed pulley P_2 .
 - (ii) If the free end of the string moves through a distance x , find the distance by which the load W is raised.
 - (iii) Calculate the force to be applied at C to just raise the load $W = 20 \text{ kgf}$, neglecting the weight of the pulley P_1 and friction.
- [4]

Question 6

- (a) Water falls from a height of 50 m. Calculate the rise in the temperature of water when it strikes the bottom.
($g = 10 \text{ ms}^{-2}$; Specific heat capacity of water = $4200 \text{ J/kg}^\circ\text{C}$) [3]
- (b) Draw a labelled diagram of a common hydrometer and state the principle used in its working. [3]
- (c) A solid body weighs 2.10 N in air. Its relative density is 8.4. How much will the body weigh if placed:-
- in water;
 - in a liquid of relative density 1.2 ? [4]

Question 7

- (a) The ray diagram given below illustrates the experimental set up for the determination of the focal length of a converging lens using a plane mirror.

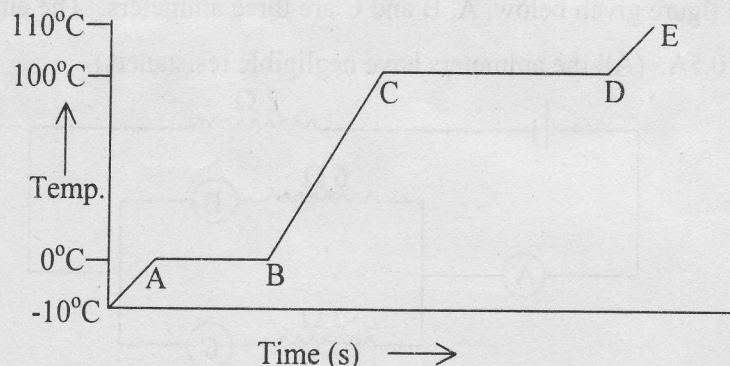


- State the magnification of the image formed.
 - Write two characteristics of the image formed.
 - What is the name given to the distance between the object and optical centre of the lens in the above diagram? [3]
- (b) (i) A glass slab is placed over a page on which the word VIBGYOR is printed with each letter in its corresponding colour.
- Will the image of all the letters be in the same place?
 - If not, state which letter will be raised to the maximum.
Give a reason for your answer.
- (ii) What will be the colour of an object which appears green in white light and black in red light? [3]

- (c) (i) What is meant by refraction?
- (ii) Express the refractive index n of a medium:-
- (1) in terms of the velocity of light;
 - (2) in terms of the angle of incidence i in air and the angle of refraction r in a denser medium.
- (iii) If a ray of light passes from medium I to medium II without any change of direction, what can be said about the refractive indices of these media (angle i is not 0)?
- [4]

Question 8

- (a) A radar is able to detect the reflected waves from an enemy aeroplane, after a time interval of 0.02 milliseconds. If the velocity of the waves is $3 \times 10^8 \text{ ms}^{-1}$, calculate the distance of the plane from the radar. [3]
- (b) A piece of ice is heated at a constant rate. The variation of temperature with heat input is shown in the graph below:-



- (i) What are represented by AB and CD?
 - (ii) What conclusion can you draw regarding the nature of ice from the above graph?
- [3]
- (c) If there is no heat loss to the surroundings, the heat released by the condensation of m_1 g of steam at 100°C into water at 100°C can be used to convert m_2 g of ice at 0°C into water at 0°C .
- (i) Find:-
- (1) the heat lost by steam in terms of m_1 .
 - (2) the heat gained by ice in terms of m_2 .

- (ii) Form a heat equation and find the ratio of $m_2 : m_1$ from it.
 (Specific latent heat of vaporization of steam = 2268 kJ/kg;
 Specific latent heat of fusion of ice = 336 kJ/kg.
 Specific heat capacity of water = 4200 J/kg°C).

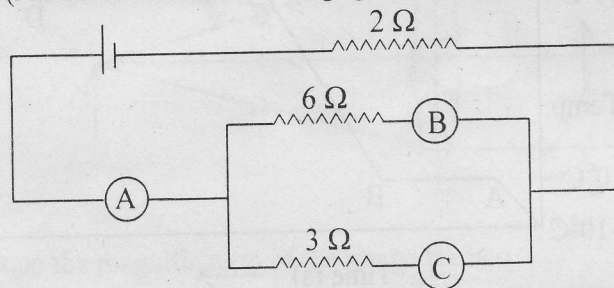
[4]

Question 9

- (a) An electrical appliance is rated 1500 W, 250 V. This appliance is connected to 250 V mains.

Calculate:-

- (i) the current drawn,
 - (ii) the electrical energy consumed in 60 hours,
 - (iii) the cost of electrical energy consumed at Rs. 2.50 per KWH. [3]
- (b) (i) State the function of a split ring in a D.C. motor.
 (ii) Mention two reasons why a soft iron core is used within the coil of a moving coil galvanometer. [3]
- (c) In the figure given below, A, B and C are three ammeters. The ammeter B reads 0.5A. (All the ammeters have negligible resistance.)



Calculate:-

- (i) the readings in the ammeters A and C.
- (ii) the total resistance of the circuit.

[4]

Question 10

- (a) State the functions of the following in a nuclear reactor:-
- (i) Moderator,
 - (ii) Control rods,
 - (iii) Coolant.

[3]

- (b) (i) Mention two important precautions that should be taken while handling radioactive materials. [3]
- (ii) State one use of radioisotopes.
- (c) (i) Draw a labelled diagram of a hot cathode ray tube.
- (ii) Why are materials of low work function preferred as thermionic cathode materials?
- (iii) Write an equation to show the fission of a nucleus of U^{235} with the production of three neutrons. [4]