

**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.*

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***Section I** is compulsory. Attempt **any four** questions from **Section II**.**The intended marks for questions or parts of questions are given in brackets [ ].*

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**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]



- (d) What is meant by the statement, '*the critical angle for diamond is  $24^\circ$* '?  
How is the critical angle of a material related to its refractive index? [2]
- (e) A block of wood of volume  $25 \text{ cm}^3$  floats in water with  $20 \text{ cm}^3$  of its volume immersed. Calculate:-
- (i) the density and
- (ii) 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  $2.0\Omega$  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**

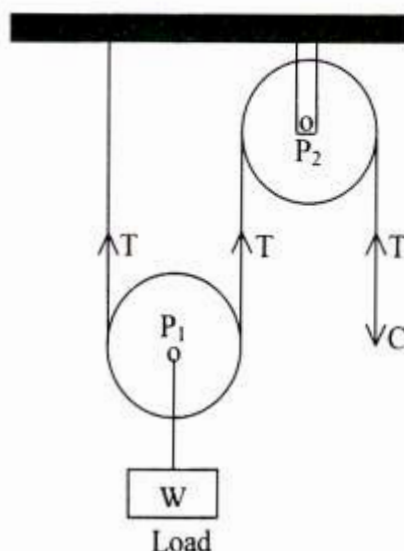
- (a) State the energy change which takes place when a magnet is moved inside a coil having a galvanometer at its ends. Name this phenomenon. [2]
- (b) Draw a labelled diagram of an A.C. generator. [2]
- (c) Calculate the heat energy that will be released when  $5.0 \text{ kg}$  of steam at  $100^\circ\text{C}$  condenses to form water at  $100^\circ\text{C}$ . Express your answer in S.I. unit. (Specific latent heat of vaporization of steam is  $2268 \text{ kJ/kg}$ .) [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]
- (c)



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

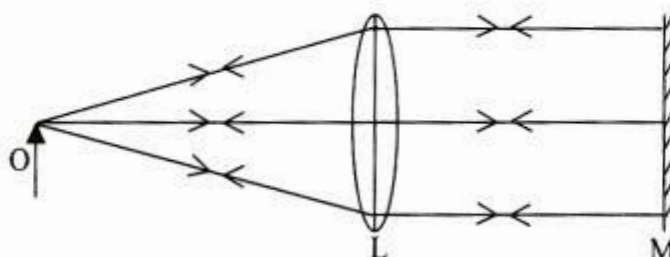
- (i) State the function of the fixed pulley  $P_2$ .  
(ii) If the free end of the string moves through a distance  $x$ , find the distance by which the load  $W$  is raised.  
(iii) Calculate the force to be applied at  $C$  to just raise the load  $W = 20 \text{ kgf}$ , neglecting the weight of the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



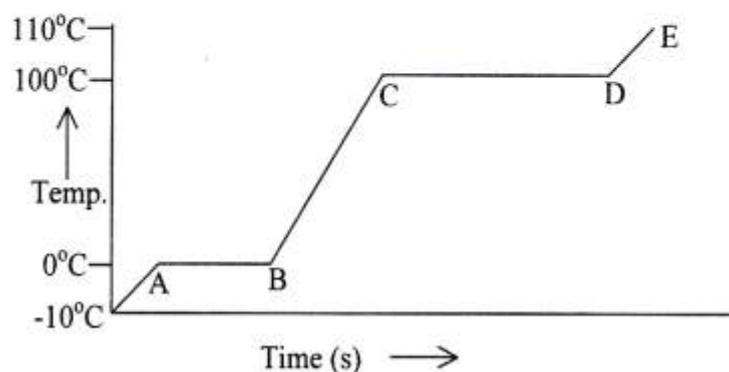
- State the magnification of the image formed.
  - Write two characteristics of the image formed.
  - What is the name given to the distance between the object and optical centre of the lens in the above diagram? [3]
- (b) (i) A glass slab is placed over a page on which the word VIBGYOR is printed with 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:-



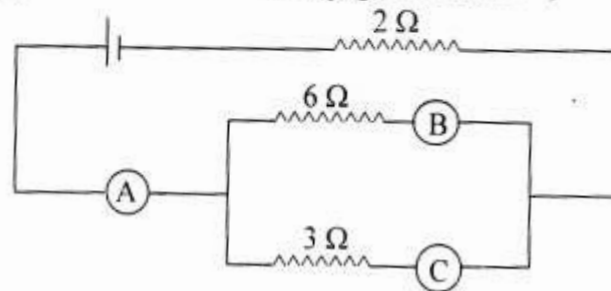
- (i) What are represented by AB and CD? [3]
- (ii) What conclusion can you draw regarding the nature of ice from the above graph?
- (c) If there is no heat loss to the surroundings, the heat released by the condensation of  $m_1$  g of steam at  $100^\circ\text{C}$  into water at  $100^\circ\text{C}$  can be used to convert  $m_2$  g of ice at  $0^\circ\text{C}$  into water at  $0^\circ\text{C}$ .
- (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.
- (ii) State one use of radioisotopes. [3]
- (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]