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ICSE 2005 : SCIENCE Paper 1 (Physics)

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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.

*Attempt **all** questions from **Section I** and **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?

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

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)

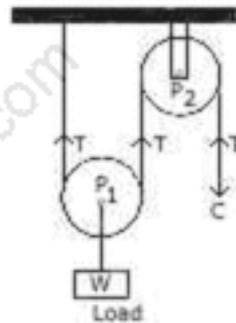
Attempt any **four** questions from this Section.

Question 5 [3]

- (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).

- (b) (i) Define an *Inclined plane*.
 (ii) Draw a labelled sketch of a class II lever. Give one example of such a lever.

(c) The alongside 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 C , 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.

Question 6

- (a) Water falls from a height of 50 m. Calculate the rise in the temperature of water when it strikes the bottom. [3]
 ($g = 10 \text{ ms}^{-2}$ Specific heat capacity of water = $4200 \text{ J/kg}^\circ\text{C}$)

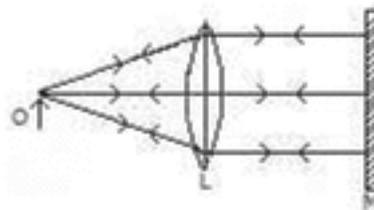
- (b) Draw a labelled diagram of a common hydrometer and state the principle used in its working. [3]

- (c) A solid body weighs 2.10 N in air. Its relative density is 8.4. How much will the body weigh if placed:

- (i) in water;
 (ii) in a liquid of relative density 1.2?

Question 7 [3]

- (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.



- (i) State the magnification of the image formed.
 (ii) Write two characteristics of the image formed.
 (iii) What is the name given to the distance between the object and optical centre of the lens in the diagram?

- (b) (i) A glass slab is placed over a page on which the word VIBGYOR is printed with each letter in its corresponding colour.

(1) Will the image of all the letters be in the same place?

(2) 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?

(c) (i) What is meant by refraction?

(ii) Express the refractive index n of a medium:

(1) in terms of the velocity of light;

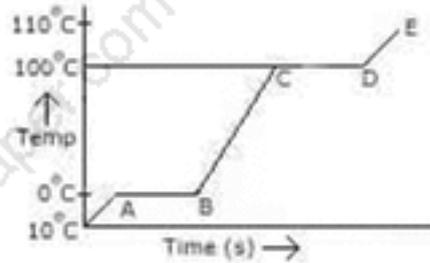
(2) in terms of the angle of incidence i in air and the angle of refraction r in a denser medium.

(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)?

Question 8 [3]

(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.

(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 alongside graph ?

(c) If there is no heat loss to the surroundings, the heat released by the condensation of $m_2 \text{g}$ 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 = $4200 \text{ J/kg}^\circ\text{C}$).

Question 9

[3]

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

(i) the current drawn,

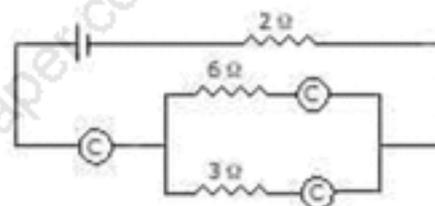
(ii) the electrical energy consumed in 60 hours,

(iii) the cost of electrical energy consumed at Rs. 2.50 per KWH.

(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.

(c) In the figure given alongside, A, B and C are three ammeters. The ammeter B reads 0.5 A . (All the ammeters have negligible resistance.)



Calculate:

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

Question 10

[3]

(a) State the functions of the following in a nuclear reactor:-

- (i) Moderator,
- (ii) Control rods,
- (iii) Coolant.

(b) (i) Mention two important precautions that should be taken while handling radioactive materials.
(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.