

**ICSE Board  
Class X Physics  
Silver Series  
Sample Paper - 4**

**Time: 1½ hrs**

**Total Marks: 80**

**General Instructions:**

1. Answers to this paper must be written on the paper provided separately.
2. You will **not** be allowed to write during the first **15** minutes. This time is to be spent in reading the question paper.
3. The time given at the head of paper is the time allotted for writing the answers.
4. Attempt **all** questions from **Section I** and **any four** questions from **Section II**.
5. The intended marks of questions or parts of questions are given in brackets [ ].

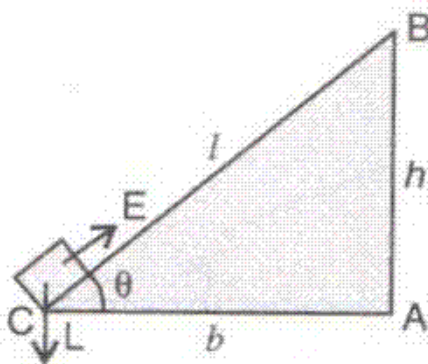
**Section I (40 Marks)**

**Attempt all questions from this section**

**Question 1**

**[10]**

- (a) Two bodies of equal masses are kept at heights of 20 m and 30 m. What is the ratio of their potential energies?
- (b) Why does a jack screw have a long arm?
- (c) In a single fixed pulley, the actual mechanical advantage is less than 1 and velocity ratio is 1, still it is widely used. Give two reasons for the same.
- (d) Draw a labelled diagram of a block and tackle system of pulleys of velocity ratio 5.
- (e) State the expression for mechanical advantage and velocity ratio if the effort  $E$  is applied parallel to the inclined plane and the load moves from  $C$  to  $B$  along the plane.



**Question 2**

**[10]**

- (a) The string of a violin (G chord) has a fundamental frequency of 196 Hz. What are the frequencies of the second and fourth harmonics?
- (b) Write the necessary conditions for total internal reflection.
- (c) A ray of light falls normally on one face of a prism of angle  $45^\circ$ . If the critical angle of the material of the prism is  $45^\circ$ , trace the course of rays.
- (d) Mention the factors on which the angle of deviation of a prism depends.
- (e) If rays of red, green, violet and yellow lights are allowed to fall on a prism, for which colour will the angle of deviation be maximum and for which colour will it be minimum?

**Question 3**

**[10]**

- (a) A convex lens forms a virtual image of an object. Where is the object placed? Answer in terms of focal length.
- (b) Draw a graph between displacement from the mean position and the time for a body executing free vibrations in
  - i. Vacuum
  - ii. Medium
- (c) The top of a lake gets frozen at a place where the surrounding air is at a temperature of  $-20^\circ\text{C}$ . What will be the temperature of the layer of water in contact with the lower surface of the ice block and the bottom of the lake?
- (d) Two bodies at different temperatures of  $T$  and  $T'$  are brought in thermal contact, both bodies will necessarily attain the mean temperature  $(T + T')/2$ . If not, why?
- (e) Is it necessarily true that two cells jointly give more current in a given conductor than that produced by one cell?

**Question 4**

**[10]**

- (a) Why is it more economical to transmit electrical energy at high voltage and at a low current?
- (b) A current  $i$  is flowing through a resistor  $R$  connected to a primary cell of emf  $V$ . Now, if the resistance is reduced to half, what will be the value of the current through the resistor?
- (c) In a coil carrying current, how will you determine the polarity by seeing the direction of the current? Explain.
- (d) A nucleus contains no electrons, but it can emit them. How?
- (e) What is the use of coated tungsten?

**Section II (40 Marks)**

**Attempt *any four* questions from this section**

**Question 5**

**[10]**

- (a) Explain the law of conservation of energy by giving the example of a body falling from a height  $h$ .
- (b) A boy of mass 80 kg runs up a flight of 50 stairs, each measuring 0.20 m in 20 s. Calculate:
  - i. Work done by the boy
  - ii. Gain in potential energy by the boy
- iii. Power developed by the body (in kilowatts and horsepower).  
(Take  $g = 10 \text{ ms}^{-2}$  and  $1 \text{ HP} = 746 \text{ W}$ )
- (c) What happens to the kinetic energy when
  - i. Mass of the body is doubled at constant velocity
  - ii. Velocity of the body is doubled at constant mass
  - iii. Mass of the body is doubled, but the velocity is reduced to half

**Question 6**

**[10]**

- (a)
  - i. The position of the optic axis  $OO'$  and the paths of the incident ray  $AB$  and the emergent ray  $BC$  are known. Find by construction the position of the lens and position of the main foci.



- ii. Why does the setting or rising Sun appear to be oval?
  - iii. Is it possible to photograph a virtual image?
- (b) Why do laundries use indigo blue?
- (c) Name two experimental methods of determining the focal length of a convex lens.

**Question 7**

**[10]**

- (a) Are echoes and resonant vibrations the same phenomena?  
A radar is able to detect the reflected waves from an enemy aeroplane after a time interval of 0.02 ms. If the velocity of the waves is  $3 \times 10^8 \text{ ms}^{-1}$ , calculate the distance of the plane from the radar.
- (b) Calculate the ratio between the energy  $Q_1$  required to boil 10 kg of water at  $100^\circ\text{C}$ , and the energy  $Q_2$  required to raise the temperature of 10 kg of water from  $0^\circ\text{C}$  to  $100^\circ\text{C}$ . (Take the latent heat of steam as  $2268 \text{ J/g}$  and the average specific heat of water between  $0^\circ\text{C}$  and  $100^\circ\text{C}$  as  $4.2 \text{ J/g K}$ .)
- (c) A calorimeter contains 400 g of water at a temperature of  $5^\circ\text{C}$ . 200 g of water at a temperature of  $10^\circ\text{C}$  and 400 g of ice at a temperature of  $-60^\circ\text{C}$  are then added to it. If the final temperature of the mixture is  $-9^\circ\text{C}$ , calculate the amount of water converted to ice.  
Given: Specific heat capacity of water =  $1000 \text{ cal kg}^{-1} \text{ K}^{-1}$   
Specific latent heat of fusion of ice =  $80 \times 1000 \text{ cal kg}^{-1}$   
Specific heat capacity of ice =  $500 \text{ cal kg}^{-1} \text{ K}^{-1}$

**Question 8**

**[10]**

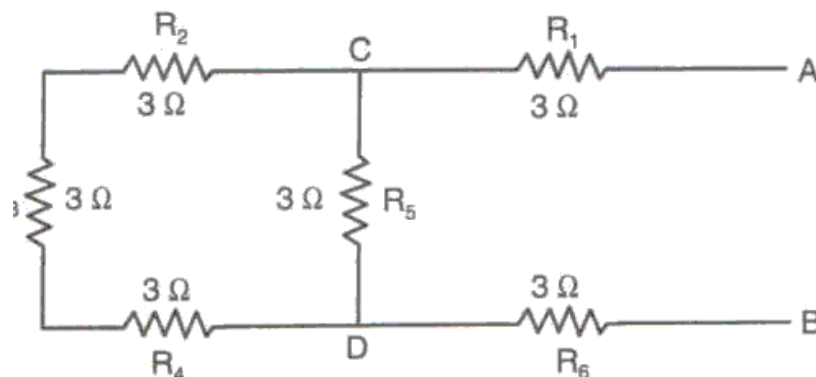
- (a) A boy has a wooden block in both hands. He claps the blocks together with a regular gap between claps so that each clap coincides with the echo of the last clap returning from a wall. The distance between the boy and the wall is 100 m. Time noted for 50 claps is 29 s. Calculate the speed of sound.
- (b) Does a person standing on the bank of a river appear taller or shorter than his actual height when obliquely viewed by a fish under water? Draw a ray diagram supporting your answer.
- (c) 65 g of ice at  $0^\circ\text{C}$  is added to 150 g of water at  $50^\circ\text{C}$  and the final steady temperature is  $10^\circ\text{C}$ . Find the value of the specific latent heat of fusion of ice.

**Question 9**

**[10]**

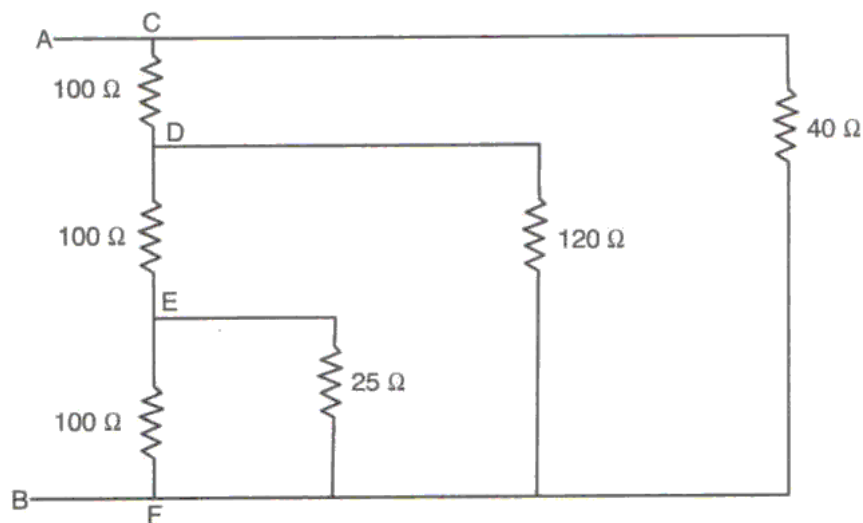
- (a) A table lamp of power 60 W consumed 9 (commercial) units of electricity in April.  
For how many hours per day, on an average, was the lamp in use?

(b)



For the combination of resistors shown in the figure, find the equivalent resistance between (i) C and D (ii) A and B.

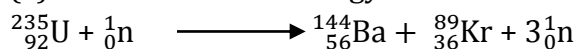
- (c) Find the effective resistance between A and B.



**Question 10**

**[10]**

(a) Find the nuclear energy obtained in the given fission reaction of  ${}^{235}_{92}\text{U}$ .



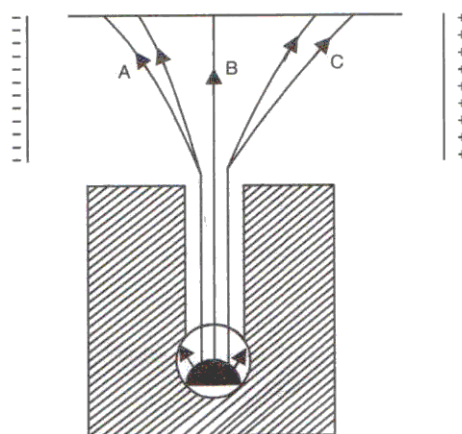
Mass of neutron =  $1.6905 \times 10^{-27}$  kg

Mass of  ${}^{235}_{92}\text{U}$  =  $3.9332 \times 10^{-25}$  kg

Mass of  ${}^{144}_{56}\text{Ba}$  =  $2.4081 \times 10^{-25}$  kg

Mass of  ${}^{89}_{36}\text{Kr}$  =  $1.4880 \times 10^{-25}$  kg.

(b) Name the rays A, B and C from the figure below.



(c) Find the mass of an electron, proton and neutron in terms of amu and MeV.

Mass of electron =  $9.1091 \times 10^{-31}$  kg

Mass of proton =  $1.6725 \times 10^{-27}$  kg

Mass of neutron =  $1.6748 \times 10^{-27}$  kg