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## **ICSE 2009 : 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.

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)

#### Question 1.

- (a) If 'm' is the mass of the body, 'v' its velocity and 'p' the momentum then write a relationship between change in momentum, mass and velocity of the body when
- v is almost equal to c, the velocity of light.
  - v is very- very less as compared to c, the velocity of light. [2]
- (b) (i) With reference to the terms mechanical advantage, velocity ratio and efficiency of a machine, name the term that will not change for a machine of a given design.
- (ii) Define the term stated by you in part (i). [2]
- (c) What is the S.I. unit of energy? How is the electron volt (eV) related to it? [2]
- (d) State the energy changes that take place in the following when they are in use:
- a photovoltaic cell.
  - an electromagnet. [2]
- (e) A body of mass 5 kg is moving with a velocity of  $10 \text{ ms}^{-1}$ . What will be the ratio of its initial kinetic energy and final kinetic energy, if the mass of the body is doubled and its velocity is halved? [2]

#### Question 2.

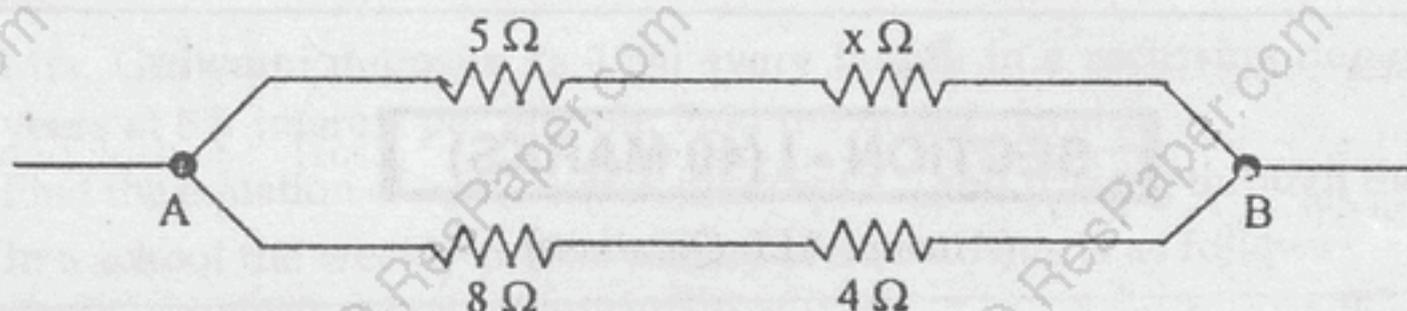
- (a) A ray of light strikes the surface of a rectangular glass block such that the angle of incidence is (i)  $0^\circ$  (ii)  $42^\circ$ . Sketch a diagram to show the approximate path taken by the ray in each case as it passes through the glass block and emerges from it. [2]
- (b) State the conditions required for total internal reflection of light to take place. [2]
- (c) Copy and complete the following table: [2]

Type of lens	Position of Object	Nature of Image	Size of Image
Convex	At F		
Concave	At infinity		

- (d) (i) Why is white light considered to be polychromatic in nature ?  
 (ii) Give the range of the wavelength of those electromagnetic waves which are visible to us. [2]
- (e) An ultrasonic wave is sent from a ship towards the bottom of the sea. It is found that the time interval between the sending and the receiving of the wave is 1.5 second. Calculate the depth of the sea if the velocity of sound in sea water is  $1400 \text{ ms}^{-1}$ . [2]

### Question 3.

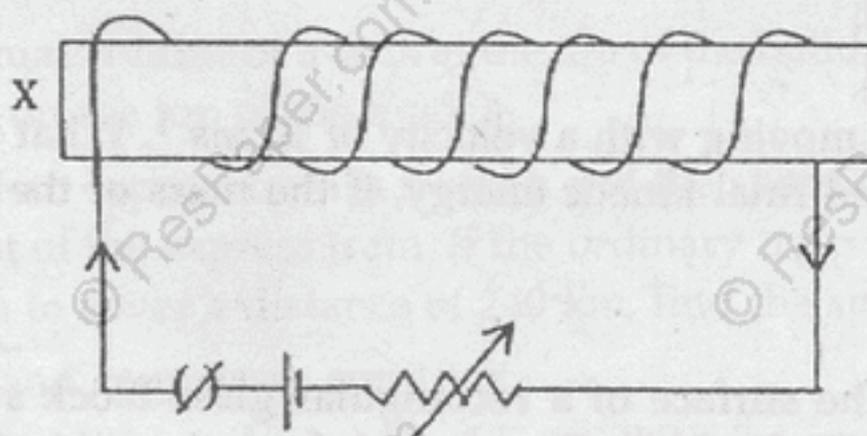
- (a) A stringed musical instrument, such as the Sitar, is provided with a number of wires of different thicknesses. Explain the reason for this. [2]
- (b) What is meant by noise pollution ? Write the name of one source of sound that causes noise pollution. [2]
- (c) The equivalent resistance of the following circuit diagram is  $4 \Omega$ . Calculate the value of  $x$ . [2]



- (d) An electric heater is rated  $1000 \text{ W} - 200 \text{ V}$ . Calculate :  
 (i) the resistance of the heating element.  
 (ii) the current flowing through it. [2]
- (e) (i) Give two characteristic properties of copper wire which make it unsuitable for use as fuse wire.  
 (ii) Name the material which is used as a fuse wire ? [2]

### Question 4.

- (a) The figure below shows an electromagnet.



- (i) What will be the polarity at the end X ?  
 (ii) Suggest a way by which the strength of the electromagnet referred to in the question, may be increased. [2]
- (b) Why do pieces of ice added to a drink cool it much faster than ice cold water added to it ? [2]
- (c)  $40 \text{ g}$  of water at  $60^\circ \text{C}$  is poured into a vessel containing  $50 \text{ g}$  of water at  $20^\circ \text{C}$ . The final temperature recorded is  $30^\circ \text{C}$ . Calculate the thermal capacity of the vessel. (Take specific heat capacity of water as  $4.2 \text{ Jg}^{-1} \text{ }^\circ \text{C}^{-1}$ ). [2]

- (d) Give two important precautions that should be taken while handling radioactive materials. [2]
- (e) (i) What is the name given to atoms of a substance which have the same atomic number but different mass numbers? [2]
- (ii) What is the difference in the atomic structures of such atoms? [2]

### SECTION - II (40 MARKS)

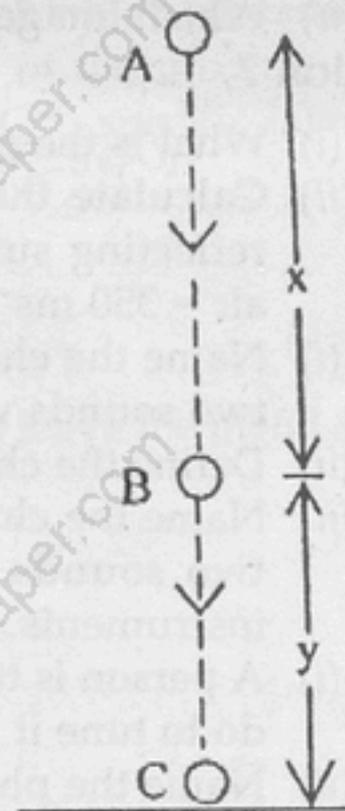
(Attempt any FOUR Questions)

#### Question 5.

- (a) 6.4 kJ of energy causes a displacement of 64 m in a body in the direction of force in 2.5 seconds. Calculate (i) the force applied (ii) power in horse power (hp). (Take 1 hp = 746 W). [3]
- (b) A pulley system comprises two pulleys, one fixed and the other movable.
- (i) Draw a labelled diagram of the arrangement and show clearly the directions of all the forces acting on it.
- (ii) What change can be made in the movable pulley of this system to increase the mechanical advantage of the system? [3]

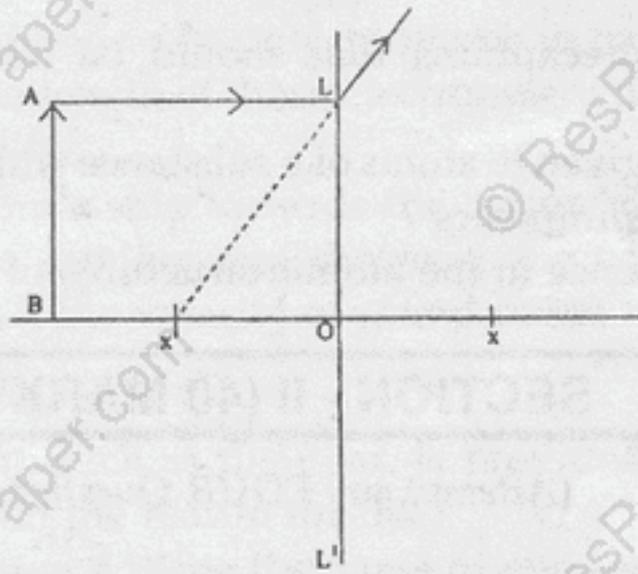
- (c) An object of mass 'm' is allowed to fall freely from point A as shown in the figure. Calculate the total mechanical energy of the object at :

- (i) Point A
- (ii) Point B
- (iii) Point C
- (iv) State the law which is verified by your calculations in parts (i), (ii) and (iii). [4]

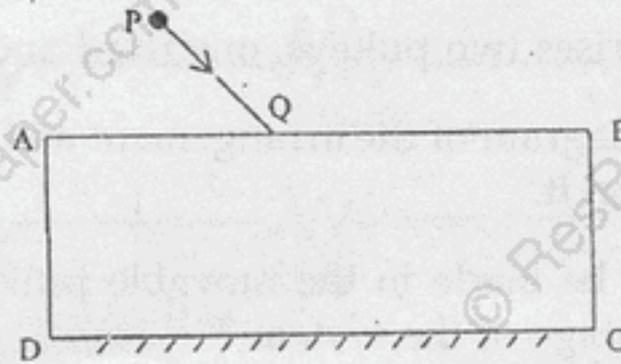


#### Question 6.

- (a) How does the value of angle of deviation produced by a prism change with an increase in the :
- (i) value of angle of incidence
- (ii) wavelength of incident light? [3]
- (b) (i) Copy and complete the diagram to show the formation of the image of the object AB. [3]
- (ii) What is the name given to x? [3]



- (c) (i) The diagram below shows a ray of white light PQ coming from an object P and incident on the surface of a thick glass plane mirror. Copy the diagram and complete it to show the formation of three images of the object P as formed by the mirror.



- (ii) Which image will be the brightest image ?

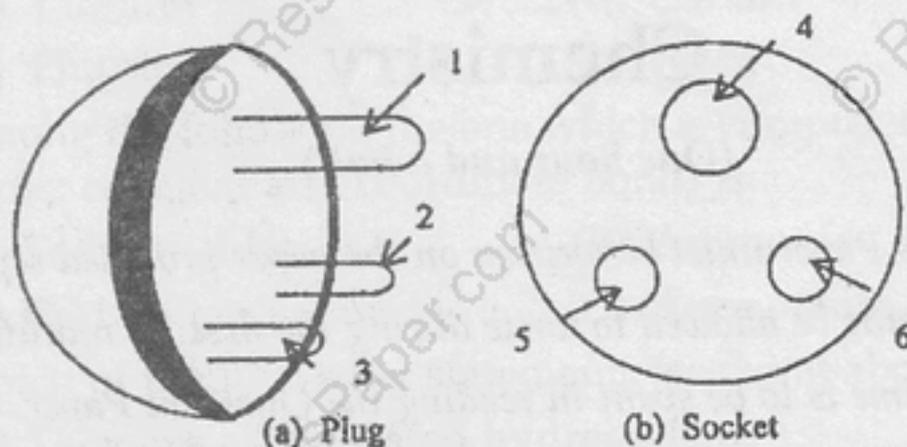
[4]

### Question 7.

- (a) (i) What is the principle on which sonar is based ?  
 (ii) Calculate the minimum distance at which a person should stand in front of a reflecting surface so that he can hear a distinct echo. (Take speed of sound in air =  $350 \text{ ms}^{-1}$ .) [3]
- (b) (i) Name the characteristic of sound which enables a person to differentiate between two sounds with equal loudness but having different frequencies.  
 (ii) Define the characteristic named by you in (i).  
 (iii) Name the characteristic of sound which enables a person to differentiate between two sounds of the same loudness and frequency but produced by different instruments. [3]
- (c) (i) A person is tuning his radio set to a particular station. What is the person trying to do to tune it ?  
 (ii) Name the phenomenon involved, in tuning the radio set.  
 (iii) Define the phenomenon named by you in part (ii). [4]

### Question 8.

- (a) (i) State Ohm's Law.  
 (ii) Diagrammatically illustrate how you would connect a key, a battery, a voltmeter, an ammeter, an unknown resistance R and a rheostat so that it can be used to verify the above law ? [3]
- (b) (i) Draw a neat and labelled diagram to show the structure of an a.c. generator.  
 (ii) State the energy conversion taking place in the generator when it is working. [3]
- (c) (i) The diagrams (a) and (b) given below are of a plug and a socket with arrows marked as 1, 2, 3 and 4, 5, 6 respectively on them. Identify and write Live (L), Neutral (N) and Earth (E) against the correct number.



- (ii) Calculate the electrical energy consumed when a bulb of 40 W is used for 12.5 hours everyday for 30 days. [1]

### Question 9.

(a) State in brief, the meaning of each of the following :

(i) The heat capacity of a body is  $50 \text{ J } ^\circ\text{C}^{-1}$ .

(ii) The specific latent heat of fusion of ice is  $336000 \text{ J kg}^{-1}$ .

(iii) The specific heat capacity of copper is  $0.4 \text{ J g}^{-1} ^\circ\text{C}^{-1}$ . [3]

(b) (i) What is the principle of method of mixtures ?

(ii) Name the law on which this principle is based. [3]

(c) Calculate the amount of ice which is required to cool 150 g of water contained in a vessel of mass 100 g at  $30 ^\circ\text{C}$ , such that the final temperature of the mixture is  $5 ^\circ\text{C}$ . (Take specific heat capacity of material of vessel as  $0.4 \text{ J g}^{-1} ^\circ\text{C}^{-1}$ , specific latent heat of fusion of ice =  $336 \text{ Jg}^{-1}$ , specific heat capacity of water =  $4.2 \text{ J g}^{-1} ^\circ\text{C}^{-1}$ ). [4]

### Question 10.

(a) (i) What is meant by free electrons ?

(ii) Why are they generally not able to leave the metallic surface ?

(iii) Suggest one way by which these electrons could be made to leave the metal surface. [3]

(b) In a cathode ray tube why is the :

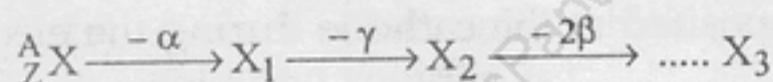
(i) filament made of tungsten ?

(ii) cathode plate coated with oxide of barium or strontium ?

(iii) thick glass screen coated with barium platinocyanide ? [3]

(c) A nucleus  ${}^A_Z\text{X}$  emits an alpha particle followed by  $\gamma$  emission; thereafter it emits two  $\beta$  particles to form  $\text{X}_3$ .

(i) Copy and complete the values of A and Z for  $\text{X}_3$  :



(ii) Out of alpha ( $\alpha$ ), beta ( $\beta$ ) and gamma ( $\gamma$ ) radiations -

1. which radiation is the most penetrating ?

2. which radiations are negatively charged ? [4]