ICSE CLASS 10 EXAMINATION

SAMPLE PAPER 1 · QUESTION PAPER

PHYSICS

(SCIENCE PAPER 1)

Maximum Marks: 80 **Time allowed: Two hours**

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 this Paper is the time allowed for writing the answers.

*4. **Section A** is compulsory. Attempt **any four** questions from **Section B**.*

5. The intended marks for questions or parts of questions are given in brackets [ ].

6. Take g = 10 m s^{-2} and the speed of light in vacuum c = 3 × 10^8 m s^{-1} wherever required. Figures are for completion and labelling on the answer sheet.

SECTION A (40 Marks)

(Attempt all questions from this Section.)

Question 1

Choose the correct answers to the questions from the given options. *(Do not copy the question, write the correct answers only.)* **[15]**

(i) A uniform metre rule is pivoted at its 50 cm mark. A 60 g mass is hung at the 20 cm mark. To balance the rule, a mass hung at the 70 cm mark must be:

(a) 40 g (b) 60 g

(c) 90 g (d) 120 g

(ii) A body of mass 2 kg is thrown vertically upwards with a kinetic energy of 40 J. Taking g = 10 m s^{-2}, the maximum height reached by it is:

(a) 1 m (b) 2 m

(c) 4 m (d) 20 m

(iii) A machine has a velocity ratio of 5 and an efficiency of 80%. Its mechanical advantage is:

(a) 2 (b) 4

(c) 5 (d) 6.25

(iv) The refractive index of glass is 1.5. If the speed of light in air is 3 × 10^8 m s^{-1}, its speed in glass is:

(a) 1.5 × 10^8 m s^{-1} (b) 2 × 10^8 m s^{-1}

(c) 3 × 10^8 m s^{-1} (d) 4.5 × 10^8 m s^{-1}

(v) The critical angle for a transparent medium with respect to air is 30°. The refractive index of the medium is:

(a) 0.5 (b) 1.5

(c) 2 (d) √2

(vi) A convex lens of focal length 10 cm forms a real, inverted image of the same size as the object. The distance of the object from the lens is:

(a) 10 cm (b) 15 cm

(c) 20 cm (d) 40 cm

(vii) The electromagnetic radiation used to check the authenticity of currency notes is:

(a) infrared rays (b) ultraviolet rays

(c) X-rays (d) microwaves

(viii) A sound source has frequency 500 Hz and produces waves of wavelength 0.68 m in air. The speed of sound in air is:

(a) 170 m s^{-1} (b) 340 m s^{-1}

(c) 680 m s^{-1} (d) 735 m s^{-1}

(ix) Assertion (A): An echo cannot be heard in a very small room.

Reason (R): The reflected sound reaches the ear in less than 0.1 s after the original sound and merges with it.

(a) (A) is true and (R) is false.

(b) (A) is false and (R) is true.

(c) Both (A) and (R) are true, and (R) is the correct explanation for (A).

(d) Both (A) and (R) are true, but (R) is not the correct explanation for (A).

(x) Three resistors of 2 Ω, 3 Ω and 6 Ω are connected in parallel. Their equivalent resistance is:

(a) 1 Ω (b) 2 Ω

(c) 5.5 Ω (d) 11 Ω

(xi) A 12 V cell is connected to a 4 Ω and a 2 Ω resistor in series, as shown in Fig. 1. The ammeter in the circuit reads:

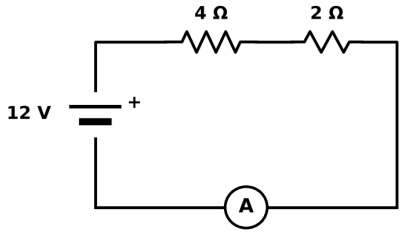


Fig. 1

(a) 0.5 A (b) 2 A

(c) 3 A (d) 6 A

(xii) In a household circuit, the fuse is connected in the:

(a) neutral wire (b) live wire

(c) earth wire (d) both live and neutral wires

(xiii) A step-down transformer has 400 turns in the primary coil and 100 turns in the secondary coil. If the primary voltage is 220 V a.c., the secondary voltage is:

(a) 55 V (b) 110 V

(c) 220 V (d) 880 V

(xiv) The heat energy required to raise the temperature of 100 g of water by 10 °C is (specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$):

(a) 420 J (b) 2100 J

(c) 4200 J (d) 42000 J

(xv) A uranium nucleus $^{238}_{92}U$ emits one α-particle. The number of neutrons in the daughter nucleus is:

(a) 142 (b) 144

(c) 146 (d) 148

Question 2

(i) Complete the following by choosing the correct answers from the bracket: **[6]**

(a) Work done by the centripetal force on a body moving in uniform circular motion is _____ [*zero / maximum*].

(b) The power of a convex lens of focal length 20 cm is _____ dioptre [*+5 / +0.5*].

(c) The speed of sound in air _____ with an increase in temperature [*increases / decreases*].

(d) In a step-up transformer, the current in the secondary coil is _____ than that in the primary coil [*less / greater*].

(e) The material of a fuse wire has a _____ melting point [*high / low*].

(f) In β-decay, the mass number of the nucleus _____ [*changes / remains the same*].

(ii) Match the phenomenon in **Column A** with its example in **Column B**. **[2]**

Column A	**Column B**
(a) Total internal reflection	1. Sparkling of a diamond
(b) Scattering of light	2. Formation of a rainbow
	3. Blue colour of the sky

(iii) Fig. 2 shows the graphs of potential difference (V) against current (I) for two conductors P and Q. **[2]**

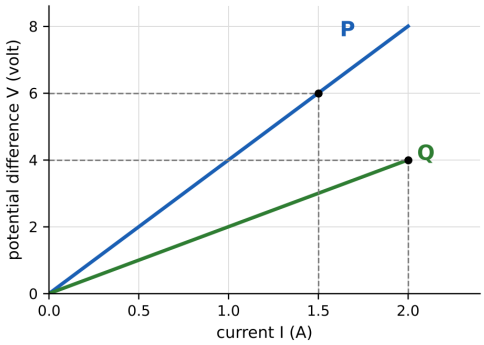


Fig. 2

(a) Which conductor has the greater resistance?

(b) Calculate the resistance of conductor Q.

Question 3

(i) A force of 30 N acts perpendicular to a door at a distance of 0.5 m from the hinge, as shown in Fig. 3. (a) Calculate the moment of the force about the hinge. (b) At what distance from the hinge should a force of 50 N act on the door, in the opposite sense, to just balance it? **[2]**

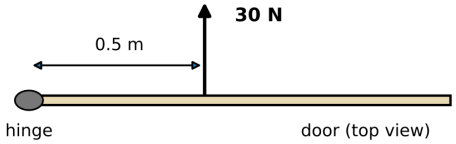


Fig. 3

(ii) A pump raises 120 kg of water through a height of 10 m in 20 s. Calculate (a) the work done by the pump and (b) the power of the pump. **[2]**

(iii) Fig. 4 shows a load of 1000 N raised along an inclined plane of length 5 m and height 1 m by an effort of 250 N applied along the plane. Calculate (a) the velocity ratio and (b) the efficiency of the plane. **[2]**

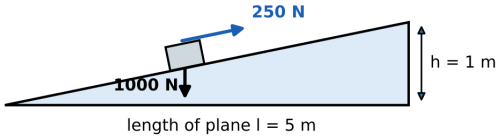


Fig. 4

(iv) An electric iron is rated 1000 W, 220 V. It is used for 3 hours every day. Calculate (a) the electrical energy consumed in 30 days in kWh and (b) the cost of this energy at ₹ 7 per kWh. **[2]**

(v) (a) Define the specific heat capacity of a substance. (b) Calculate the heat energy required to raise the temperature of 250 g of oil from 20 °C to 60 °C. [Specific heat capacity of oil = 2 J g^{-1} $°C^{-1}$] **[2]**

(vi) (a) Complete the nuclear equation: $^{214}_{84}Po \rightarrow {}^{210}_{82}Pb +$ _____ . (b) Name the radiation, out of α, β and γ, which has the highest penetrating power. **[2]**

(vii) Fig. 5 shows a narrow beam of white light passing through a glass prism and forming a spectrum on a screen. (a) Name the phenomenon in which the beam splits into its colours. (b) Name the colours seen at the ends P and Q of the spectrum. (c) Give the reason for the splitting of white light. **[3]**

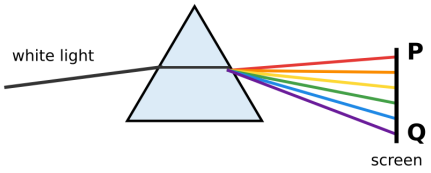


Fig. 5

SECTION B (40 Marks)

(Attempt any four questions from this Section.)

Question 4

(i) Fig. 6 shows a ray AO of light incident on a rectangular glass slab. The angle of incidence is 45° and the angle of refraction is 30°. [sin 45° = 0.707; sin 30° = 0.5] **[3]**

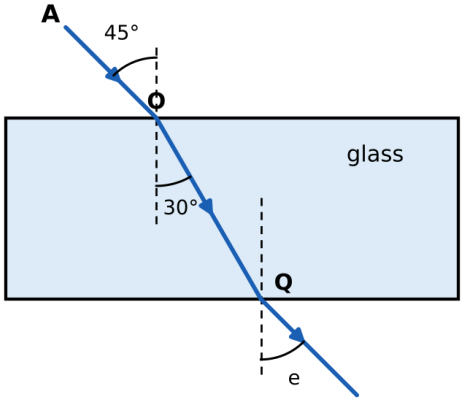


Fig. 6

(a) Calculate the refractive index of glass.

(b) Calculate the speed of light in the glass.

(c) State the value of the angle of emergence e.

(ii) Fig. 7 shows a ray of light entering the face PR of a right-angled isosceles glass prism PQR (refractive index 1.5) along the normal to PR. **[3]**

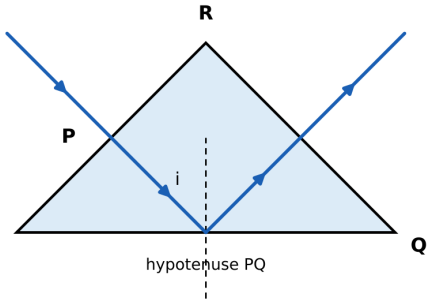


Fig. 7

(a) Calculate the critical angle for glass.

(b) Will the ray undergo total internal reflection at the hypotenuse PQ? Give a reason.

(c) Through what angle is the ray deviated by the prism?

(iii) An object 4 cm high is placed 15 cm in front of a convex lens of focal length 10 cm. Using the lens formula and the Cartesian sign convention, calculate (a) the image distance, (b) the magnification, (c) the height of the image, and (d) state the nature of the image. **[4]**

Question 5

(i) Draw a ray diagram to show the formation of the image of an object placed between the optical centre and the principal focus of a convex lens (as in a magnifying glass). State the nature of the image. **[3]**

(ii) A solid of mass 200 g is heated by a 100 W heater (no heat loss). Fig. 8 shows the variation of its temperature with time. **[3]**

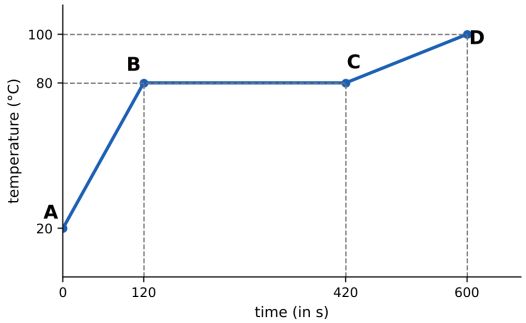


Fig. 8

(a) State the melting point of the solid.

(b) Calculate the specific heat capacity of the solid in J g^{-1} $°C^{-1}$.

(c) Calculate the specific latent heat of fusion of the solid in J g^{-1}.

(iii) A copper calorimeter of mass 50 g contains 150 g of water at 20 °C. A metal block of mass 200 g and specific heat capacity 0.5 J g^{-1} $°C^{-1}$, heated in an oven, is quickly transferred into the water and the temperature of the water rises to 30 °C. [Specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$; of copper = 0.4 J g^{-1} $°C^{-1}$] Calculate (a) the heat gained by the water, (b) the heat gained by the calorimeter, (c) the total heat lost by the block, and (d) the initial temperature of the block. **[4]**

Question 6

(i) Fig. 9 shows a uniform metre rule of weight 120 gf pivoted at the 40 cm mark. A weight W suspended at the 0 cm mark keeps it horizontal. **[3]**

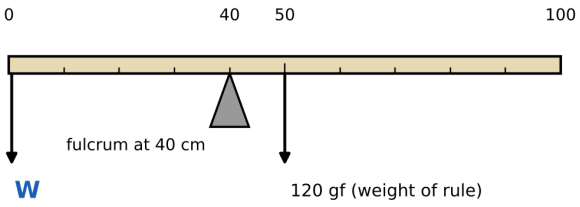


Fig. 9

(a) Name the principle used to find W.

(b) Calculate W.

(c) Calculate the reaction of the pivot on the rule.

(ii) A ball of mass 0.5 kg is dropped from a height of 20 m. Calculate (a) its potential energy at the top, (b) its kinetic energy just before it hits the ground, stating the principle used, and (c) its speed on reaching the ground. **[3]**

(iii) Fig. 10 shows a block and tackle system used to raise a load of 400 N by applying an effort E of 125 N. **[4]**

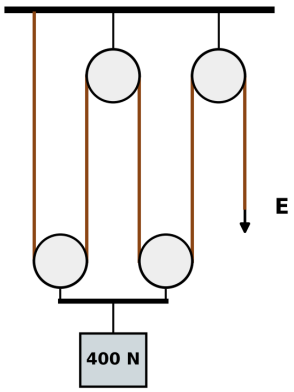


Fig. 10

(a) State the velocity ratio of the system.

(b) Calculate the mechanical advantage.

(c) Calculate the efficiency of the system.

(d) If the load rises by 0.5 m, calculate the energy wasted in overcoming friction.

Question 7

(i) A boy stands between two parallel walls, nearer to the left wall, as shown in Fig. 11. When he claps, he hears the first echo after 1.2 s and the second echo after 2.0 s. [Speed of sound in air = 330 m s^{-1}] **[3]**

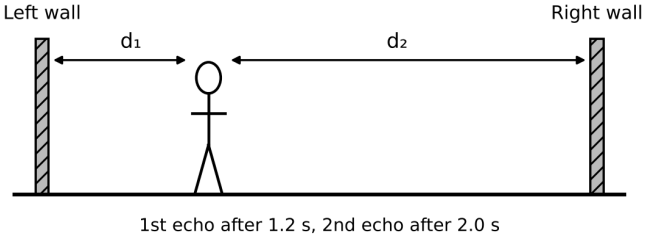


Fig. 11

(a) Calculate d_1.

(b) Calculate d_2.

(c) Calculate the distance between the two walls.

(ii) Fig. 12 shows the displacement–time graphs of two sound waves X and Y displayed on the same screen of an oscilloscope with the same time scale. The frequency of Y is 128 Hz. **[3]**

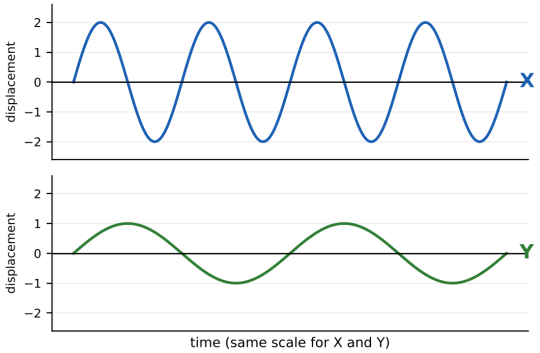


Fig. 12

(a) Which sound is louder? Give a reason.

(b) Which sound has the higher pitch?

(c) Find the frequency of X.

(iii) A ship sends an ultrasonic pulse vertically down to the sea bed and receives the echo after 0.8 s, as shown in Fig. 13. [Speed of sound in sea water = 1500 m s^{-1}] (a) What are ultrasonic waves? (b) Calculate the depth d of the sea at that place. (c) Why is an ultrasonic wave, and not an audible sound wave, used for this purpose? (d) State one use of ultrasound in medicine. **[4]**

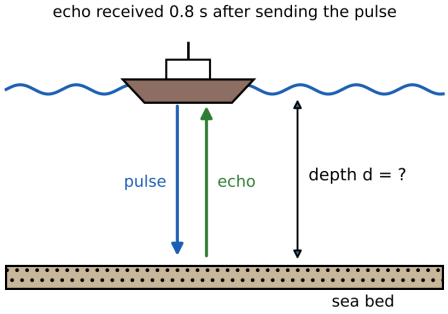


Fig. 13

Question 8

(i) In the circuit of Fig. 14 the cell has negligible internal resistance. **[3]**

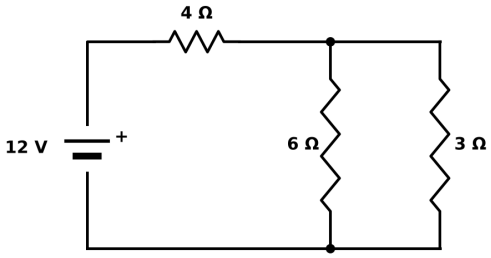


Fig. 14

(a) Calculate the equivalent resistance of the 6 Ω and 3 Ω resistors.

(b) Calculate the total current drawn from the cell.

(c) Calculate the potential difference across the 3 Ω resistor.

(ii) A metal-bodied electric heater rated 1.65 kW, 220 V is connected as shown in Fig. 15. (a) Calculate the current it draws normally. (b) Which fuse should be used in its circuit: 5 A, 10 A or 15 A? Give a reason. (c) Name the wire X that connects the metal body to the ground and state its purpose. **[3]**

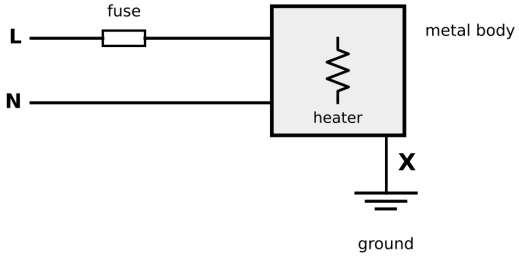


Fig. 15

(iii) Wires P and Q are made of the same material. P has length L and radius r; Q has length 2L and radius 2r. (a) Compare the resistances $R_P : R_Q$. (b) If they are connected in parallel across a battery, compare the currents $I_P : I_Q$. (c) If they are connected in series, compare the power dissipated in P and in Q. (d) Compare their resistivities. **[4]**

Question 9

(i) Fig. 16 shows a straight conductor placed between the poles of a magnet. The current in the conductor is directed into the plane of the paper. **[3]**

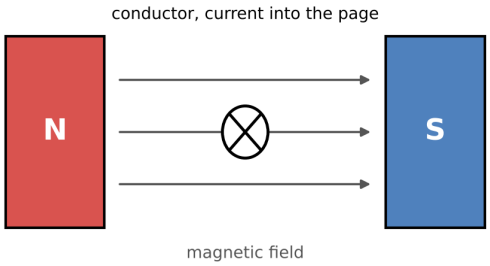


Fig. 16

(a) State the direction of the force on the conductor.

(b) Name the rule used to find this direction.

(c) What happens to the direction of the force if both the current and the magnetic field are reversed?

(ii) An ideal step-down transformer, shown in Fig. 17, is used to operate a 12 V, 36 W lamp from a 240 V a.c. supply. Calculate (a) the ratio of the number of turns in the secondary to that in the primary, (b) the current in the secondary coil, and (c) the current in the primary coil. **[3]**

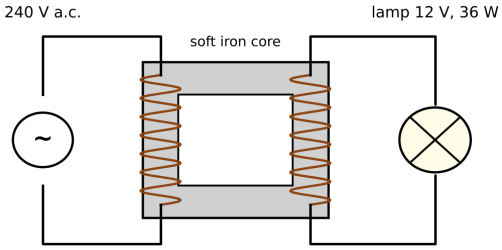


Fig. 17

(iii) Fig. 18 shows a graph of the number of neutrons against the number of protons for four nuclei A, B, C and D. A changes to B, B to C and C to D by the emission of one particle each. The mass number of A is 238. **[4]**

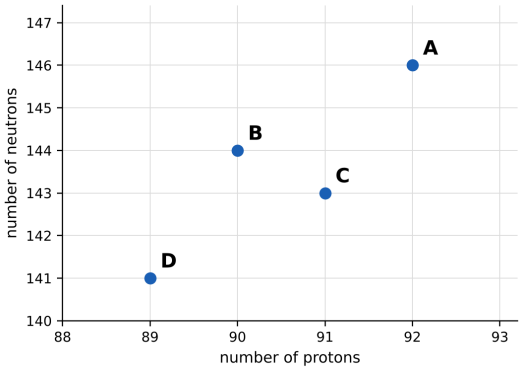


Fig. 18

(a) Name the particle emitted when A changes to B and write the nuclear equation (use A and B as symbols).

(b) Name the particle emitted when B changes to C. Give a reason.

(c) Name the particle emitted when C changes to D.

(d) Name two nuclei in the graph which are isobars.

— End of Question Paper —