Sample Paper 6

ICSE Class X 2023-24

Physics

Science Paper - 1

Time: 2 Hours **Max. Marks: 80**

General Instructions:

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

SECTION - A

(Attempt all questions from this Section.)

QUESTION 1.

Choose the correct answers to the questions from the given options. [15]

(Do not copy the questions, write the correct answer only.)

(i) Find the resultant moment of couple if two equal forces each of 6N are acting at a distance of 3cm each from the centre.

(a) 3.6 Nm (b) 0.36 Nm
(c) 360 Nm (d) 36 Nm

(ii) In an oscillating pendulum the ..... energy is maximum at extremes.

(a) vibrational (b) gravitational potential
(c) kinetic (d) potential

(iii) The total work done on a particle is equal to the change in its kinetic energy

(a) only if elastic force alone acts on it (b) always, if force is conservative
(c) only if gravitational force alone acts on it (d) None of the above

(iv) Heavy stable nuclei have more neutrons than protons. This is because of the fact that

(a) electrostatic force between protons are repulsive
(b) neutrons decay into protons through beta decay
(c) neutrons are heavier than protons
(d) nuclear forces between neutrons are weaker than that between protons

(v) **Assertion :** If ρ_1 and ρ_2 be the resistivity of the materials of two resistors of resistances R_1 and R_2 respectively and $R_1 > R_2$.

Reason : The resistance $R = \rho\frac{l}{A} \Rightarrow \rho_1 > \rho_2$ if $R_1 > R_2$

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

(vi) A ray incidence is i and angle of refraction is r, then $\frac{\sin i}{\sin r}$ is equal to

(a) $\frac{n_2}{n_1}$ (b) $\frac{n_1}{n_2}$
(c) n_1 (d) n_2

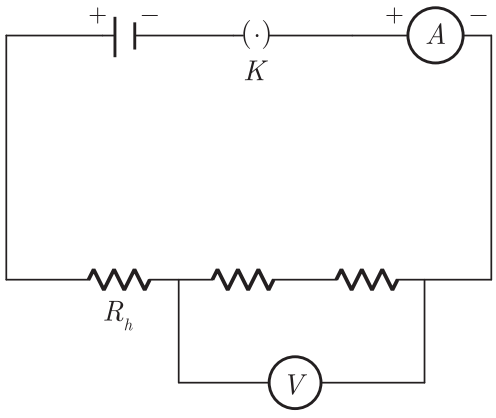
(vii) The repetition of sound heard in a cave or empty room is a case of .....
(a) superposition (b) echo
(c) reverberation (d) interpolation

(viii) An enemy plane is at a distance of 300 km from a radar. In how much time the radar will be able to detect the plane ? Take velocity of radio waves as 3×10^8 ms^{-1}.

(a) 4×10^{-3} s (b) 5×10^{-3} s
(c) 2×10^{-3} s (d) 3×10^{-3} s

(ix) Calculate potential difference at the ends of a power source which, supplies current to a 4 ohm resistance wire for 20 minutes and raises temperature of 400 g of water through 20°C.
(a) 2.00 V (b) 3.80 V
(c) 10.5 V (d) 5.60 V

(x) To determine the equivalent resistance of two resistors when connected in series, a student arranged the circuit components as shown in the diagram. But he did not succeed to achieve the objective.



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Which of the following mistakes has been committed by him in setting up the circuit?
(a) Position of ammeter is incorrect.
(b) Terminals of ammeter are wrongly connected.
(c) Position of voltmeter is incorrect.
(d) Terminals of voltmeter are wrongly connected.

(xi) A solid of mass 150 g at 200°C is placed in 0.4 kg of water at 20°C till a constant temperature is attained. If the S.H.C. of the solid is 0.5 Jg^{-1} K^{-1}, find the resulting temperature of the mixture.
(a) 37.7°C (b) 27.7°C
(c) 47.7°C (d) 57.7°C

(xii) A solid of mass 150 g at 200°C is placed in 0.4 kg of water at 20°C till a constant temperature is attained. If the S.H.C. of the solid is 0.5 Jg^{-1} K^{-1}, find the resulting temperature of the mixture.
(a) 37.7°C (b) 27.7°C
(c) 47.7°C (d) 57.7°C

(xiii) A liquid of mass 0.2 kg and temperature 135°C is cooled to 25°C. If the specific heat capacity of liquid is 750 Jkg^{-1} $°C^{-1}$, find the heat energy given out.
(a) 16500 J (b) 12000 J
(c) 8000 J (d) 20000 J

(xiv) Distorted image of a face of a person sitting in front of a camp fire is because of the phenomenon of

(a) diffusion (b) total internal reflection
(c) refraction (d) winds blowing

(xv) Consider the following statements in context with the sign conventions for spherical lens and choose the incorrect one
I. All the distances are measured from the pole of the lens.
II. The distances measured against the direction of incident light are taken as negative.
III. The distances measured downward and perpendicular to the principal axis are taken as negative.
(a) Only II (b) Only I
(c) III only (d) All are incorrect

QUESTION 2.

(i) What is the efficiency of an ideal machine? [3]

(ii) A 50 cm uniform ruler is freely pivoted at 15 cm mark which balances horizontally when an object of weight 40 dyne is hung from the 2 cm mark. [2]
(a) Draw a force diagram of the arrangement and
(b) Calculate the weight of the ruler. Also calculate the force with which pivot is pressed.

(iii) A barrel of 50 kg is raised up on a 10 m long inclined plane by an effort of 25 N. Calculate (a) the vertical height through which barrel rises (b) gradient of inclined plane. $\left(\text{Takeg} = 10\ \text{m s}^2\right)$ [2]

(iv) A body is acted upon by a force. State two conditions under which the work done could be zero. [2]

(v) (a) State the principle of conservation of energy. [2]
(b) Name the form of energy which a body may possess even when it is not in motion.

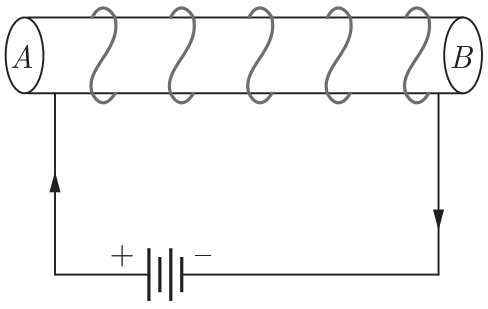
(vi) Two lamps one rated 100 W, 220 V and the other rated 60 W, 220 V are connected in parallel to a 220 V supply. What current is drawn from the supply line? [2]

(vii) (a) What are mechanical waves? [2]
(b) Name one property of waves that do not change when the wave passes from one medium to another.

QUESTION 3.

(i) State the dependence of angle of deviation : [2]
(a) On the refractive index of the material of the prism.
(b) On the wavelength of light.

(ii) You have been provided with a solenoid AB. [2]



(a) What is the polarity at end A ?
(b) Give one advantage of an electromagnet over a permanent magnet.

(iii) Why it is more economical to transmit electrical energy at high voltage and low current? [2]

(iv) 40 g of water at 60°C is poured into a vessel containing 50 g of water at 20°C. The final temperature recorded is 30°C. Calculate the thermal capacity of the vessel. [2]
(Take specific heat capacity of water as $4.2\,\mathrm{J\,g^{-1}\,^{\circ}C^{-1}}$).

(v) What do you mean by mass number. Are these quantities conserved in a radioactive β-decay ? [2]

SECTION - B

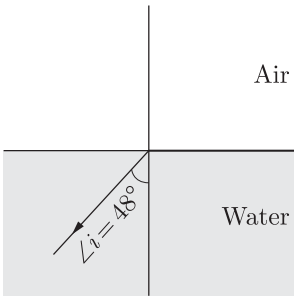
(Attempt any four questions.)

QUESTION 4.

(i) Light passes through a rectangular glass slab and through a triangular glass prism. In what way does the direction of the two emergent beams differ and why ? [3]

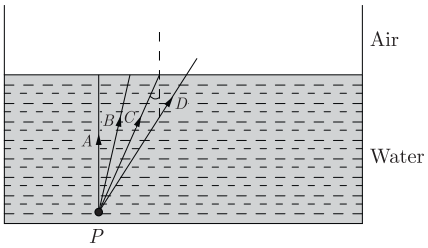
(ii) Draw a ray diagram to illustrate how a ray of light incident obliquely on one face of a rectangular glass slab of uniform thickness emerges parallel to its original direction. Mention which pairs of angles are equal. [3]

(iii) A ray of light travels from water to air as shown in the diagram given below : [4]



(a) (i) Copy the diagram and complete the path of the ray. Given the critical angle for water is 48°.
(ii) State the condition so that total internal reflection occurs in the above diagram.

(b) The diagram below shows a point source P inside a water container. Four rays A, B, C, D starting from the source P are shown upto the water surface.

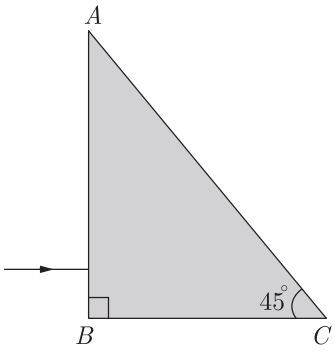


(i) Show in the diagram the path of these rays after striking the water surface. The critical angle for water air surface is 48°.
(ii) Name the phenomenon which the rays B and D exhibit.

QUESTION 5.

(i) A candle of size 2.0 cm is placed at 0.25 m from the eye lens. Its image is formed on the retina which is 25 mm behind the eye lens. Find the size of the image. [3]

(ii) The diagram given below shows a right-angled prism with a ray of light incident on the side AB. (The critical angle for glass is 42°) [3]

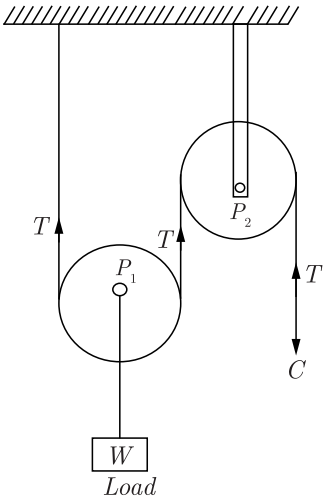


(a) Copy the diagram and complete the path of the ray of light in and out of the glass prism.
(b) What is the value of the angle of deviation shown by the ray?

(iii) (a) (i) What is meant by Resonance ? [4]
(ii) State two ways in which Resonance differs from Forced vibrations.
(b) (i) A man standing between two cliffs produces a sound and hears two successive echoes at intervals of 3 s and 4 s respectively. Calculate the distance between the two cliffs. The speed of sound in the air is 330 ms^{-1}.
(ii) Why will an echo not be heard when the distance between the source of sound and the reflecting surface is 10 m?

QUESTION 6.

(i) Consider the combination of a movable Pulley P_1 with a fixed pulley P_2 used for lifting a load w. [3]



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(a) What is the function of the fixed pulley P_2 ?
(b) If the free end of the string moves through a distance y, find the distance by which the load w is raised.
(c) Calculate the force to be applied at C to just raise the load $w = 30$ kgf, neglecting the weight of the pully P_1 and friction.

(ii) A machine is operated by an effort of 80 N acting downward and moving through a downward displacement of 0.15 m. The load of mass 10 kg, is raised up by 10 cm. Calculate the M.A., V.R., work input, useful work output and efficiency. (Take $g = 10\,\text{ms}^{-2}$) [3]

(iii) A boy pulls a toy car with a force of 50 N through a string which makes an angle of 30° with the horizontal, so as to move the toy by a distance of 1 m in the horizontal direction. If the string were inclined at an angle of 45° with the horizontal, how much pull would he apply along the string in order to move it through the same distance of 1 m ? (Given $\cos 30^\circ = 0.8667$, $\cos 45^\circ = 0.7071$) [4]

QUESTION 7.

(i) (a) When a tuning fork [vibrating] is held close to ear, one hears a faint hum. The same [vibrating tuning fork] is held such that its stem is in contact with the table surface, then one hears a loud sound. Explain. [3]
(b) A man standing in front of a vertical cliff fires a gun. He hears the echo after 3.5 seconds. On moving closer to the cliff by 84 m, he hears the echo after 3 seconds. Calculate the distance of the cliff from the initial position of the man.

(ii) (a) An element ${}^{A}_{Z}\text{S}$ decays to ${}^{222}_{85}\text{R}$ after emitting 2 α-particles and 1 β-particle. Find the atomic number and atomic mass of the element S. [3]
(b) A radioactive substance is oxidized. Will there be any change in the nature of its radioactivity ? Give a reason for your answer.

(iii) (a) In what way does an 'ideal machine' differ from a 'Practical machine' ? [4]
(b) Can a simple machine act as a force multiplier and a speed multiplier at the same time?

QUESTION 8.

(i) (a) Name the device used to increase the voltage at a generating station. [3]
(b) At what frequency is A.C. supplied to residential houses?
(c) Name the wire in a household electrical circuit to which the switch is connected.

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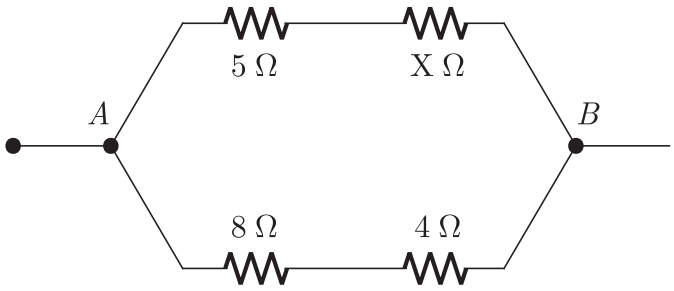
(ii) In nuclear reaction ${}^{27}_{12}\text{Mg} \xrightarrow{-\beta} \text{Al} \xrightarrow{-\gamma}$ [3]

(a) ${}^{27}_{12}\text{Mg}$ emits a β-particle and is transformed to aluminium. What is the mass number and the atomic number of aluminium?

(b) Aluminium emits a γ ray. What is the resulting nucleus?

(iii) (a) The equivalent resistance of the following circuit diagram is $4\,\Omega$. Calculate the value of x. [4]



(b) An electric heater is rated 1000 W - 200 V. Calculate:

(a) the resistance of the heating element.

(b) the current flowing through it.

QUESTION 9.

(i) Steam at 100°C is passed over 1000 g of ice at 0°C. After sometime, 600 g of ice at 0°C is left and 450 g of water at 0°C is formed. Calculate the specific latent heat of vaporisation of steam. [3]

(Given : specific heat capacity of water $= 4200\,\text{J/kg}\,^\circ\text{C}$ and specific latent heat of fusion of ice $= 336000\,\text{J/kg}$.)

(ii) List three differences between boiling and evaporation. [3]

(iii) (a) (i) Name the waves used for echo depth sounding. [4]

(ii) Why are the waves mentioned by you not audible to us?

(b) (i) What is an echo?

(ii) State two conditions for an echo to take place.

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