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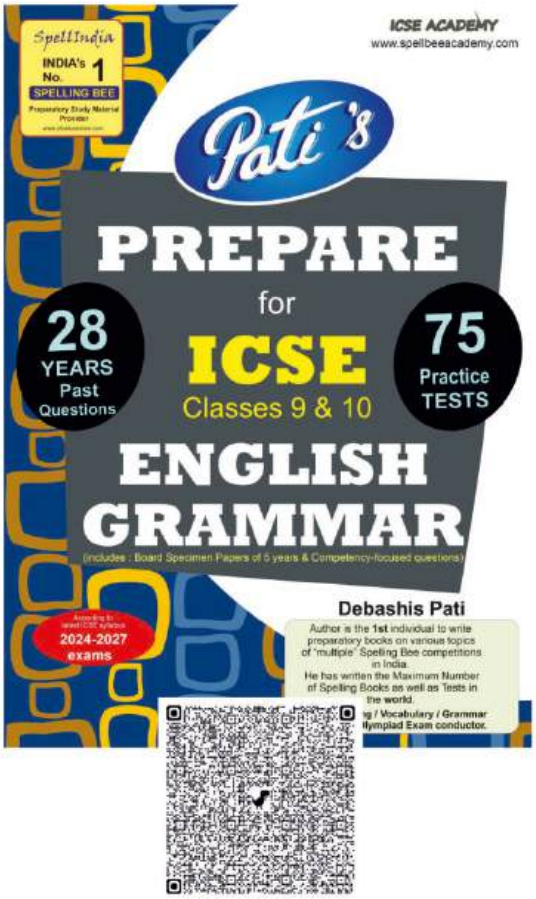

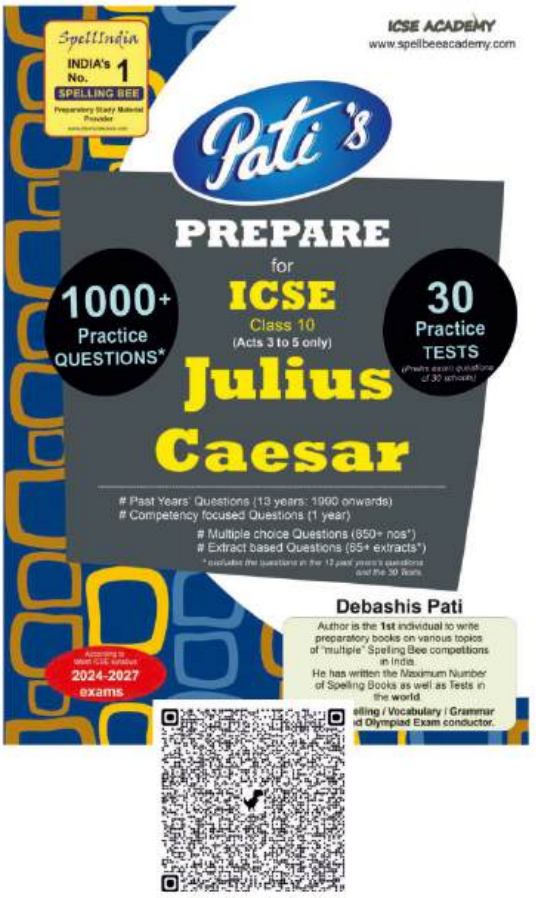

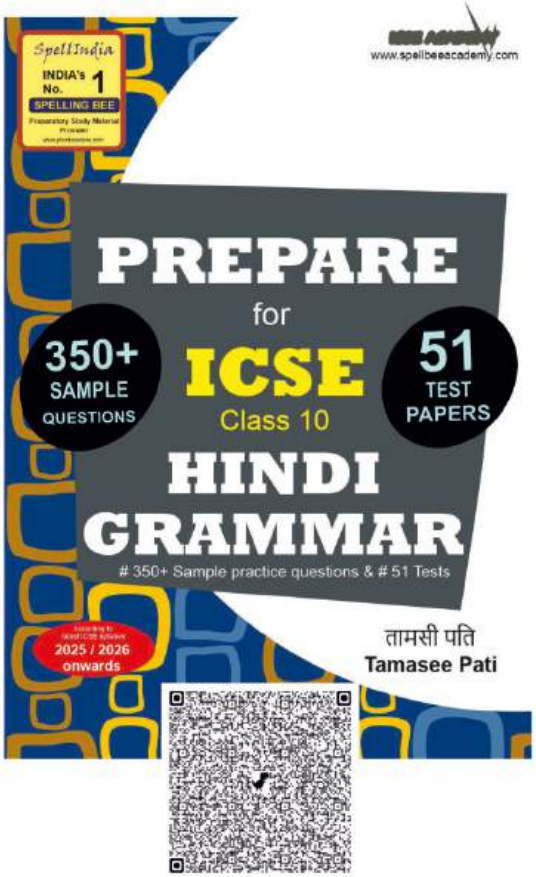

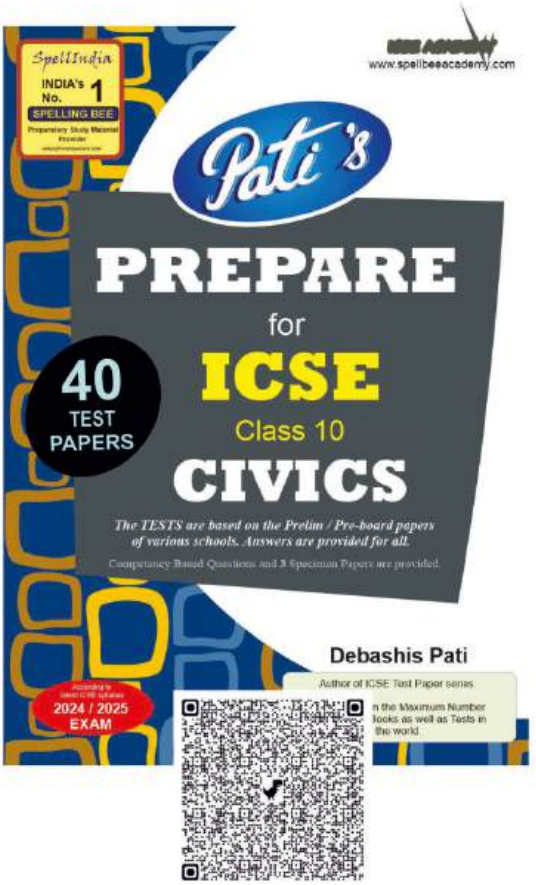

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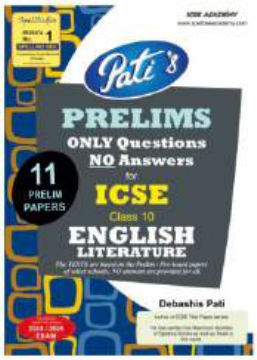

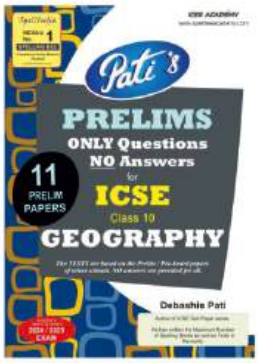

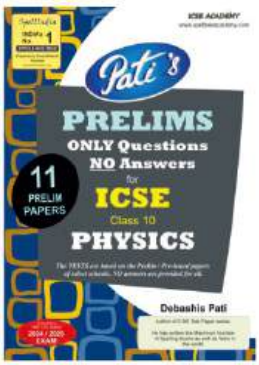

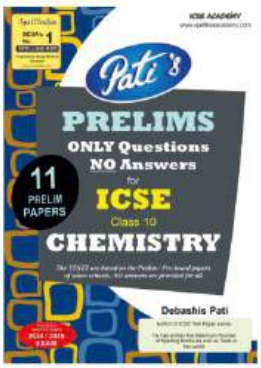

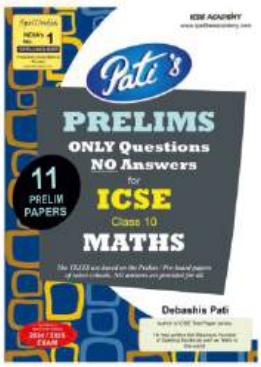

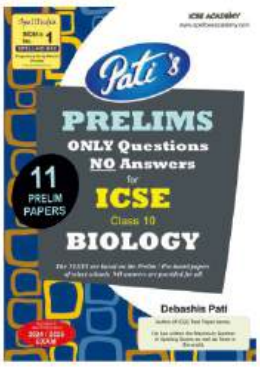

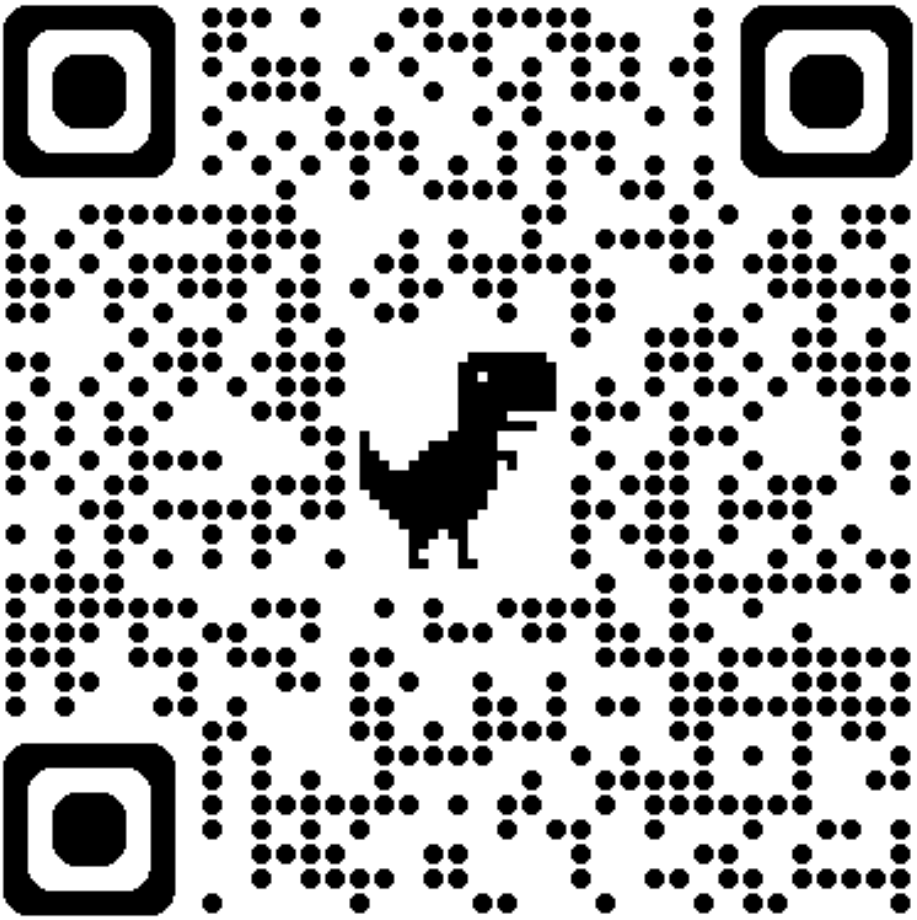

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KARNATAKA ICSE SCHOOLS ASSOCIATION
ICSE STD. X Preparatory Examination 2026

Subject : PHYSICS

Duration: 2 Hour **Maximum Marks: 80** Date:23-01-2026

General Instructions

Answers to this paper must be written on the paper provided separately.

You will not be allowed to write during the rst 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 A is compulsory. Attempt any **four** questions from **Section B**.

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

SECTION A (40 Marks)

(Attempt all questions from this Section)

Question 1

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

(i) A uniform metre scale of weight W is balanced at the 40 cm mark when a weight of 20 gf is suspended at the 10 cm mark. The value of W is:

(a) 40 gf

(b) 60 gf

(c) 20 gf

(d) 80 gf

(ii) If the kinetic energy of a body increases by 300%, its momentum will increase by:

(a) 100%

(b) 200%

(c) 300%

(d) 50%

(iii) A light ray enters a glass slab (= 1 5) from air. If the speed of light in air is 3 10^8 m/s, the time taken by the light to cross the glass slab of thickness 2 cm is:

(a) 10 ^{10} s

(b) 10 ^{8} s

(c) 0 67 10 ^{10} s

(d) 1 5 10 ^{10} s

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(iv) A coolie carrying a load on his head walks on a level road. He then climbs up a slope. The work done by him against gravity is zero:

(a) In both cases

(b) Only when walking on the level road

(c) Only when climbing the slope

(d) In neither case

(v) Which of the following statements is true regarding a block and tackle system?

(a) The weight of the movable block reduces the M.A.

(b) The weight of the movable block increases the M.A.

(c) Friction between the pulleys increases the V.R.

(d) The number of strands supporting the load determines the M.A. exactly in an actual machine.

(vi) When a ray of light passes through a prism, the angle of incidence i is such that the angle of emergence e is equal to i. In this position:

(a) The refracted ray inside the prism is parallel to the base (for an equilateral prism).

(b) The angle of deviation is maximum.

(c) The angle of refraction at the rst face is equal to the angle of prism.

(d) Dispersion is zero.

(vii) A pendulum A of length L and another pendulum B of length $4L$ are suspended from the same support. If A is set into vibration:

(a) B will vibrate with the same amplitude as A.

(b) B will remain stationary.

(c) B will vibrate with a very small amplitude.

(d) B will vibrate with resonance.

(viii) The graph of voltage (V) vs current (I) for a non-ohmic conductor is:

(a) A straight line passing through the origin.

(b) A curve passing through the origin.

(c) A straight line with a negative slope.

(d) A straight line parallel to the I-axis.

(ix) Three identical bulbs are connected in series to a battery. If one bulb fuses and the circuit is reconnected with the remaining two bulbs, the brightness of the remaining bulbs will:

(a) Decrease

(b) Increase

(c) Remain the same

(d) Become zero

(x) A current-carrying solenoid behaves like a bar magnet. The polarity of the face of the solenoid depends on:

(a) The strength of the current.

(b) The number of turns per unit length.
(c) The direction of current ow.
(d) The material of the core.

(xi) A radioactive nucleus emits a beta particle. The daughter nucleus has:

(a) The same atomic number but dierent mass number.
(b) One proton more and one neutron less than the parent.
(c) One proton less and one neutron more than the parent.
(d) The same mass number and same atomic number.

(xii) Specic heat capacity of substance A is 380 J/kg C and substance B is 420 J/kg C. If both are supplied with the same amount of heat and have the same mass:

(a) A will show a greater rise in temperature.
(b) B will show a greater rise in temperature.
(c) Both will show the same rise.
(d) A will melt rst.

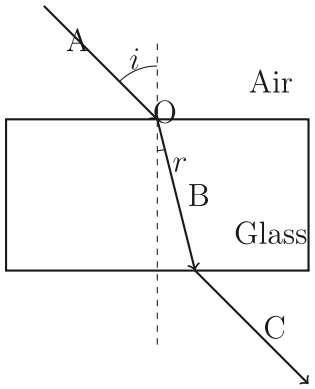
(xiii) The color of a star indicates its:

(a) Distance from the earth
(b) Velocity
(c) Temperature
(d) Size

(xiv) Which of the following is NOT a property of magnetic eld lines?

(a) They form continuous closed loops.
(b) They crowd near the poles.
(c) Two eld lines can intersect at the neutral point.
(d) They start from the North pole and end at the South pole outside the magnet.

(xv) The diagram below shows a ray of light AO incident on a rectangular glass block.



If the angle of incidence i is increased, the lateral displacement of the emergent ray will:

(a) Increase
(b) Decrease

(c) Remain same

(d) First increase then decrease

Question 2

(i) Complete the following by choosing the correct answers from the bracket: [5]

(a) If the refractive index of a medium decreases, the critical angle for that medium _____. (Increases / Decreases / Remains same)

(b) In a single movable pulley system, if the weight of the pulley is considered, the mechanical advantage is _____ 2. (Greater than / Less than / Equal to)

(c) High voltage power transmission is used to minimize _____ loss. (Current / Power / Voltage)

(d) The penetration power of -radiation is _____ times that of -particles. (10 / 100 / 1000)

(e) When ice melts at 0 C, its volume _____. (Increases / Decreases / Remains constant)

(ii) A uniform metre scale of weight 10 gf is pivoted at the 0 cm mark. What moment of force must be applied to keep it horizontal? [2]

(iii) A ray of light incident at an angle of 48 on a prism of refracting angle 60 suers minimum deviation. Calculate the angle of minimum deviation. [2]

(iv) Why does the lament of an electric bulb have a high resistance and high melting point? [2]

(v) Why are Ice cubes preferred to ice cold water in cool drinks? [2]

(vi) State two safety precautions to be taken while handling radioactive substances. [2]

Question 3

(i) Dene Couple. Calculate the moment of a couple consisting of two forces of 15 N each separated by a perpendicular distance of 0.5 m. [2]

(ii) The wavelength of a sound wave is 50 cm. Calculate its frequency if the speed of sound is 330 m/s. Is this sound audible to humans? [2]

(iii) State the energy changes in an oscillating simple pendulum involving friction (damping). [2]

(iv) Calculate the total resistance between points A and B if two resistors of 6 are connected in parallel, and this combination is connected in series with a 3 resistor. [2]

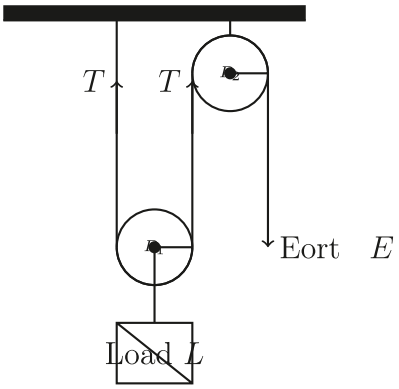
(v) State two ways to increase the speed of rotation of a D.C. motor. [2]

SECTION B (40 Marks)

*(Attempt any **four** questions from this Section)*

Question 4

(i) Study the diagram of the pulley system shown below:



(a) Name the type of pulley system shown.

(b) What is the Velocity Ratio (V.R.) of this system?

(c) If the eciency is 80%, calculate the Eort required to lift a load of 400 N.

[3]

(ii) A ball of mass 50 g is thrown vertically upwards with a velocity of 20 m/s.

(a) Calculate the maximum height attained.

(b) Calculate the potential energy at the highest point.

(c) At what height will its kinetic energy be equal to its potential energy? ($g = 10$ m/s^2)

[3]

(iii) A uniform metre rule of weight 100 gf is pivoted at its center. A 200 gf weight is suspended at the 10 cm mark.

(a) In which direction will the rule tilt?

(b) Where should a 150 gf weight be suspended to balance the rule?

(c) Calculate the resultant moment if the 150 gf weight is removed.

[4]

Question 5

(i) An object is placed at a distance of 30 cm from a convex lens of focal length 20 cm.

(a) Calculate the image distance.

(b) Find the magnication.

(c) If the object is moved 15 cm towards the lens, what will be the nature of the new image?

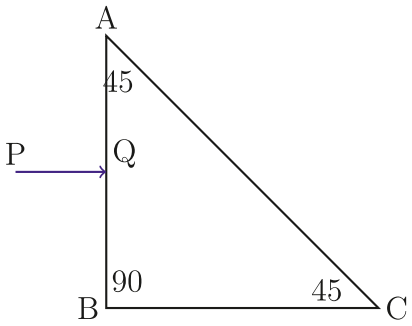
[3]

(ii) (a) Dene Refractive Index in terms of the speed of light.

(b) A coin at the bottom of a beaker containing water (= 4 3) appears to be raised by 3 cm. Find the real depth of water.

[3]

(iii) Refer to the diagram given below. A ray of light PQ is incident normally on the face AB of a glass prism (= 1 5) having angles 45 90 45 .



(a) Copy and complete the path of the ray until it emerges from the prism.

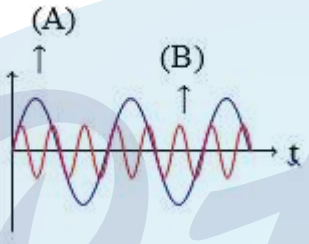
(b) Calculate the angle of deviation.

(c) Name a device where such an action of the prism is used.

[4]

Question 6

(i) The displacement-time graphs for two sound waves A and B are shown below:



(a) Which wave has a higher pitch? Give a reason.

(b) Which wave is louder? Give a reason.

(c) If the time period of wave A is 0.02s, what is its frequency?

[3]

(ii) (a) Why does the smoke from a fire look white?

(b) The ratio of amplitudes of two waves is 3:5. What is the ratio of their intensities (loudness)?

[3]

(iii) (a) A wire stretched between two xed supports is plucked. Name the type of vibrations produced.

(b) Resonance is a special case of forced vibrations. Explain why.

(c) A tuning fork of frequency 256 Hz resonates with a sonometer wire of length 20 cm. If the length of the wire is increased to 40 cm (keeping tension constant), will resonance occur? Justify.

[4]

Question 7

(i) A battery of electromotive force (emf) 12 V and internal resistance 2 is connected in series with two resistors of 4 and 6 .

(a) Draw the circuit diagram to represent this arrangement.

(b) Calculate the current in the circuit.

(c) Calculate the terminal voltage of the battery.

[3]

(ii) (a) An electric geyser is rated 2000 W, 220 V. Calculate the monthly cost of using it for 30 minutes daily at 5 per unit. (1 month = 30 days).

(b) Why is the earth pin thicker and longer than the other pins in a three-pin plug?

[3]

(iii) (a) Draw a circuit diagram to show how a staircase lamp is controlled by two switches (Dual Control Switch).

(b) State two advantages of connecting appliances in parallel.

[4]

Question 8

(i) A piece of ice of mass 50 g at 10 C is heated to convert it into water at 20 C. Calculate the total heat energy supplied. (Specic heat capacity of ice = 2 1 J/g C, Sp. latent heat of fusion = 336 J/g, Sp. heat capacity of water = 4 2 J/g C). [3]

(ii) (a) Dierentiate between Heat Capacity and Specic Heat Capacity.

(b) Why are burns caused by steam more severe than those caused by boiling water at the same temperature?

[3]

(iii) 40 g of water at 60 C is poured into a calorimeter of mass 50 g at 20 C. The nal temperature is 50 C. Calculate the specic heat capacity of the material of the calorimeter. (Sp. heat capacity of water = 4200 J kg^{1} K^{1}). [4]

Question 9

(i) (a) A radioactive nucleus emits a beta particle. Does its mass number change? Explain.

(b) Which part of the atom emits radioactive radiation?

(c) Why are lead boxes used to store radioactive materials?

[3]

(ii) Complete the following nuclear reactions:

(a) $_{92}U^{238}$ $_{90}Th^{234}$ +

(b) $_{11}Na^{24}$ $_{12}Mg^{24}$ +

[3]

(iii) (a) Dierentiate between nuclear ssion and nuclear fusion.

(b) State one safety precaution while establishing a nuclear power plant.

(c) Name the moderator used in a nuclear reactor.

[4]

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KARNATAKA ICSE SCHOOLS ASSOCIATION

ICSE STD. X Preparatory Examination 2025

Subject: PHYSICS - DETAILED SOLUTION SET

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

SECTION A (40 Marks)

Question 1 (MCQs) [15 Marks]

(i) **(b) 60 gf.**

Pivot at 40 cm Load (20 gf) at 10 cm Weight of scale W acts at 50 cm

Clockwise Moment = Anti-Clockwise Moment

$$W \quad (50 \ 40) = 20 \quad (40 \ 10)$$

$$W \quad 10 = 20 \quad 30$$

$$10W = 600 \ \ \mathbf{W = 60} \text{ gf}$$

(ii) **(a) 100%.**

Reasoning: Kinetic Energy $K = \frac{p^2}{2m}$ $p =$ $\overline{2mK}$. *If* K *increases by* 300%, *new* $K = 4K$.

$$p = \sqrt{2m(4K)} = 2 \ \ \overline{2mK} = 2p$$

Momentum doubles, which corresponds to a 100% *increase.*

(iii) **(a)** 10^{10} **s.**

$$\text{Speed in medium } v = \frac{c}{} = \frac{3 \quad 10^{\ 8}}{1 \ \ 5} = 2 \quad 10^{\ 8} \text{ m/s}$$

$$\text{Time } t = \frac{\text{Distance}}{v} = \frac{0 \ \ 02 \text{ m}}{2 \quad 10^{\ 8} \text{ m/s}} = \mathbf{10^{10}} \text{ s}$$

(iv) **(b) Only when walking on the level road.**

Reasoning: Work done against gravity is $W = mgh$. *On a level road, the vertical displacement* h *is zero, so* $W = 0$. *While climbing a slope,* $h > 0$, *so work is done.*

(v) **(a) The weight of the movable block reduces the M.A.**

Reasoning: In a pulley system, the effort must lift the load ***plus*** *the weight of the movable block. This increases the required effort, thereby reducing the Mechanical Advantage* ($MA = Load \ \ Effort$).

(vi) **(a) The refracted ray inside the prism is parallel to the base.**

Reasoning: The condition $i = e$ *corresponds to the angle of **Minimum Deviation**. For an equilateral prism in this position, the refracted ray travels parallel to the base.*

(vii) **(c) B will vibrate with a very small amplitude.**

Reasoning: Since the lengths are different (L *vs* $4L$*), their natural frequencies are different (*$f \quad 1 \quad \overline{L}$*). Therefore, resonance does not occur. B executes forced vibrations with a small amplitude.*

(viii) **(b) A curve passing through the origin.**

Reasoning: For non-ohmic conductors (like a filament lamp), resistance increases with temperature, causing the V-I graph to be a curve rather than a straight line.

(ix) **(b) Increase.**

Reasoning: In a series circuit, removing one bulb reduces the total resistance ($R_{total} = 2R$ instead of $3R$). This increases the current ($I = V \ R_{total}$), so the remaining bulbs glow brighter.

(x) **(c) The direction of current flow.**

*Reasoning: According to the **Clock Face Rule**: A face with clockwise current acts as a South Pole, and a face with anti-clockwise current acts as a North Pole.*

(xi) **(b) One proton more and one neutron less.**

Reasoning: In Beta decay ($_1 \quad ^0$), a neutron inside the nucleus transforms into a proton and an electron. Thus, the atomic number (Z) increases by 1.

(xii) **(a) A will show a greater rise in temperature.**

Reasoning: Temperature rise $T = Q \ (mc)$. Since Q and m are constant, T is inversely proportional to specific heat capacity c. Substance A has a lower c ($380 < 420$), so it heats up faster.

(xiii) **(c) Temperature.**

Reasoning: According to Wiens Displacement Law, the color (wavelength of maximum emission) of a star depends directly on its surface temperature.

(xiv) **(c) Two field lines can intersect at the neutral point.**

*Reasoning: Magnetic field lines **never** intersect. If they did, it would imply two different directions of the magnetic field at the same point, which is physically impossible.*

(xv) **(a) Increase.**

Reasoning: The lateral displacement d is given by $d = \frac{t \sin(ir)}{\cos r}$. As the angle of incidence i increases, the value of d also increases.

Question 2 [10 Marks]

(i) **Fill in the blanks:**

(a) **Increases**. (Refractive index $= 1 \ \sin C$. If decreases, C must increase).

(b) **Less than**. (Due to the weight of the movable pulley and friction).

(c) **Power** (or Heat/Energy). ($P_{loss} = I^2R$; high voltage reduces current I, minimizing loss).

(d) **100**. (The penetration power ratio : : is roughly 1 : 100 : 10000).

(e) **Decreases**. (Water contracts when ice melts; ice is less dense than water).

(ii) **Calculation:** Pivot at 0 cm. Weight of rule $W = 10$ gf acts at its Center of Gravity (50 cm).

$$\begin{aligned} \text{Moment} &= \text{Force} \quad \text{Perpendicular Distance} \\ &= 10 \text{ gf} \quad (50 \ 0) \text{ cm} \\ &= 10 \quad 50 \end{aligned}$$

$$\textbf{Moment} = \textbf{500} \text{ gf cm (Clockwise)}$$

(iii) **Calculation:** Given $A = 60$ $i = 48$. At minimum deviation, $i = e$.

$$\begin{aligned} A + \ _{min} &= i + e \\ A + \ _{min} &= 2i \\ 60 \ + \ _{min} &= 2(48 \ ) = 96 \\ \ _{min} &= 96 \quad 60 \\ \ _{\mathbf{min}} &= \mathbf{36} \end{aligned}$$

(iv) **High Resistance:** To generate a large amount of heat ($H \quad I^2Rt$) so that the electrical energy is effectively converted into light and heat.
High Melting Point: To prevent the filament from melting at the very high operating temperatures (approx 2500 C).

(v) Every gram of ice at 0 C absorbs an additional heat energy of 336J to convert itself to 1 gram of water at 0 C. Therefore ice cubes cool the drinks effectively by absorbing heat to melt

(vi) 1. Wear **lead-lined aprons** and lead gloves to protect the body from radiation.
2. Handle radioactive sources using **long-handled tongs** to maximize the distance from the source.

Question 3 [10 Marks]

(i) **Couple:** Two equal and opposite parallel forces, not acting along the same line, form a couple.

$$\begin{aligned} \text{Moment of Couple} &= \text{Force} \quad \text{Couple Arm} \\ &= 15 \text{ N} \quad 0\,5 \text{ m} \\ \mathbf{Moment} &= \mathbf{7\,5} \text{ Nm} \end{aligned}$$

(ii) **Calculation:** Wavelength $= 50$ cm $= 0\,5$ m. Speed $V = 330$ m/s.

$$\begin{aligned} f = \frac{V}{\ } = \frac{330}{0\,5} \\ \mathbf{f = 660} \text{ Hz} \end{aligned}$$

Yes, this sound is **audible** to humans (Audible range: 20 Hz to 20,000 Hz).

(iii) 1. There is a continuous interchange between **Kinetic Energy** and **Potential Energy**.
2. The total **Mechanical Energy decreases** gradually as it is converted into Heat Energy due to friction (damping) at the support and air resistance.

(iv) **Calculation:** Step 1: Parallel combination of two 6 resistors.

$$\frac{1}{R_p} = \frac{1}{6} + \frac{1}{6} = \frac{2}{6} \qquad R_p = 3$$

Step 2: Series combination of R_p and the 3 resistor.

$$R_{total} = R_p + 3 \ = 3 + 3 = \quad \mathbf{6}$$

(v) 1. Increasing the **strength of the current** flowing through the coil.
2. Increasing the **number of turns** in the coil.

SECTION B (40 Marks)

Question 4 [10 Marks]

(i) (a) **Single Movable Pulley system** (specifically, one fixed and one movable pulley).

(b) **Velocity Ratio (V.R.) = 2** (Since the load is supported by two segments of rope).

(c) **Calculation:**

$$\text{Efficiency} = \frac{\text{M.A.}}{\text{V.R.}}$$
$$0\ 8 = \frac{\text{M.A.}}{2} \quad \text{M.A.} = 1\ 6$$
$$\text{M.A.} = \frac{\text{Load}}{\text{Effort}}$$
$$1\ 6 = \frac{400}{E} \quad E = \frac{400}{1\ 6}$$
$$\mathbf{E = 250}\ \text{N}$$

(ii) (a) **Maximum Height:** At max height, final velocity $v = 0$.

$$v^2 = u^2\ \ 2gh$$
$$0 = (20)^2\ \ 2(10)h$$
$$20h = 400$$
$$\mathbf{h = 20}\ \text{m}$$

(b) **Potential Energy:**

$$PE = mgh$$
$$= 0\ \ 05\ \text{kg}\quad 10\quad 20 \quad \text{(Note: 50g} = 0\ \ 05\text{kg)}$$
$$\mathbf{PE = 10}\ \text{J}$$

(c) **Height where KE = PE:** Total Energy $E = 10$ J. If $KE = PE$, then $2PE = E$.

$$2(mgh\ ) = 10$$
$$2(0\ \ 05\quad 10\quad h\ \ ) = 10$$
$$1\quad h\ \ = 10$$
$$\mathbf{h\ = 10}\ \text{m}$$

(iii) (a) **Pivot:** 50 cm. **Load:** 200 gf at 10 cm.

$$\text{Moment} = 200\quad (50\ \ 10) = 200\quad 40 = 8000\ \text{gf cm (Anti-clockwise)}$$

The rule will tilt **Anti-clockwise** (Left side goes down).

(b) **Balancing:** To balance, we need a Clockwise Moment of 8000 gf cm. Weight to be used = 150 gf. Let distance be d from pivot.

$$150\quad d = 8000\ \ d = \frac{8000}{150} = 53\ \ 33\ \text{cm}$$

Position on scale $= 50 + 53\ \ 33 = 103\ \ 33$ cm. Since the scale is only 100 cm long, it is **impossible** to balance the rule with this weight.

(c) **Resultant Moment:** If the 150 gf weight is removed, only the 200 gf load acts. Resultant Moment = **8000 gf cm Anti-clockwise**.

Question 5 [10 Marks]

(i) (a) **Given:** $u =$ 30 cm, $f = +20$ cm (Convex lens).

$$\frac{1}{v} \quad \frac{1}{u} = \frac{1}{f}$$

$$\frac{1}{v} \quad \frac{1}{30} = \frac{1}{20}$$

$$\frac{1}{v} = \frac{1}{20} \quad \frac{1}{30} = \frac{3 \quad 2}{60} = \frac{1}{60}$$

$$\mathbf{v} = \mathbf{+60} \text{ cm}$$

(b) **Magnification:**

$$m = \frac{v}{u} = \frac{60}{30} = \mathbf{2}$$

(c) **New Position:** New $u =$ (30 15) = 15 cm. Since the object distance (15 cm) is less than the focal length (20 cm), the image formed is **Virtual, Erect, and Magnified**.

(ii) (a) **Refractive Index:** The ratio of the speed of light in a vacuum (or air) to the speed of light in the given medium. ($= c \ v$).

(b) **Real Depth:**

$$\text{Shift} = \text{Real Depth} \quad \left(1 \quad \frac{1}{}\right)$$

$$3 = \text{RD} \quad \left(1 \quad \frac{3}{4}\right)$$

$$3 = \text{RD} \quad \left(\frac{1}{4}\right)$$

$$\mathbf{RD} = \mathbf{12} \text{ cm}$$

(iii) (a) **Ray Path:** 1. Ray enters face AB normally (90 to surface), so it travels undeviated. 2. It strikes the hypotenuse face AC at an angle of incidence $i = 45$. 3. Since $i(45\ ) >$ Critical Angle $C($ 42), **Total Internal Reflection** occurs. 4. The ray reflects downwards at 90 , hits face BC normally, and emerges undeviated.

(b) **Deviation:** The angle of deviation $= \mathbf{90}$.

(c) **Device:** **Periscope**.

Question 6 [10 Marks]

(i) (a) **Wave B**. It has a higher frequency (more waves in the same time interval t). Pitch is directly proportional to Frequency.

(b) **Wave A**. It has a larger amplitude (vertical displacement). Loudness is proportional to Amplitude squared.

(c) **Frequency:**

$$f = \frac{1}{T} = \frac{1}{0\ 02} = \mathbf{50} \text{ Hz}$$

(ii) (a) The molecules of smoke are bigger than the wave length of light, so they scatter lights of all colous equally and therefore the smoke appears white.

(b) **Ratio of Intensities:**

$$\frac{I_1}{I_2} = \frac{a_1^2}{a_2^2}$$
$$= \frac{3^2}{5^2}$$
$$\textbf{Ratio} = \mathbf{9 : 25}$$

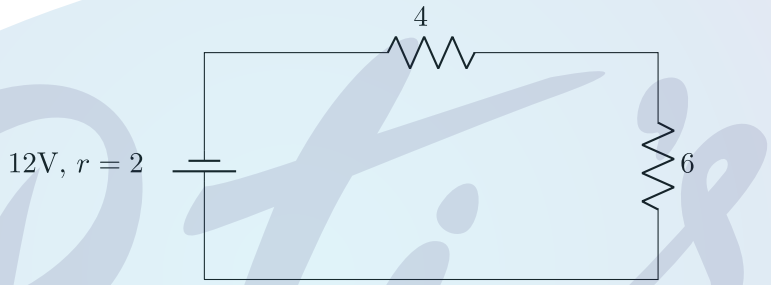
(iii) (a) **Transverse Vibrations** (or Damped Vibrations if amplitude is decreasing).

(b) **Resonance:** A special case of forced vibration where the frequency of the external periodic force is **exactly equal** to the natural frequency of the body, causing it to vibrate with maximum amplitude.

(c) **No Resonance.** Natural frequency f $\frac{1}{L}$. If length L doubles (20 40), frequency halves (256 128 Hz). Since Driving Frequency (256 Hz) = Natural Frequency (128 Hz), resonance will not occur.

Question 7 [10 Marks]

(i) (a) **Circuit Diagram:**



(b) **Current:** Total Resistance $R_{tot} = R_1 + R_2 + r = 4 + 6 + 2 = 12$.

$$I = \frac{}{R_{tot}} = \frac{12}{12} = \mathbf{1}\ \text{A}$$

(c) **Terminal Voltage:**

$$V = \ Ir = 12\ (1\ \ 2) = 12\ 2 = \mathbf{10}\ \text{V}$$

(ii) (a) **Cost Calculation:** Time $t = 30$ min $= 0\ 5$ h. Days $= 30$. Total Time $= 0\ 5\ \ 30 =$ 15 hours. Energy $E = P\ \ t = 2$ kW 15 h $= 30$ kWh. Cost $= 30\ \ 5 =$ **150** Rupees.

(b) **Thicker:** To reduce resistance and carry large fault currents safely to the ground. **Longer:** To ensure the Earth connection is made first (for safety) and broken last.

(iii) (a) **Diagram:** A circuit diagram showing a bulb connected between two **2-way (SPDT) switches**. The mains phase line connects to the common of one switch, the neutral to the bulb, and the strappers connect the L1 and L2 terminals of both switches.

(b) 1. Independent operation (switching one off doesnt affect others).
2. All appliances receive the same mains voltage.

Question 8 [10 Marks]

(i) **Calculation:** 1. Heat to raise ice 10 C to 0 C: $Q_1 = 50\ \ 2\ 1\ \ 10 = 1050$ J. 2. Heat to melt ice: $Q_2 = 50\ \ 336 = 16800$ J. 3. Heat to raise water 0 C to 20 C: $Q_3 = 50\ \ 4\ 2\ \ 20 = 4200$ J.

$$Q_{total} = 1050 + 16800 + 4200 = \mathbf{22\ \ 050}\ \text{J}$$

(ii) (a) **Heat Capacity:** Heat required to raise the temperature of a *given mass* of a body by 1 C.
Specific Heat Capacity: Heat required to raise the temperature of a *unit mass* of a substance by 1 C.

(b) Steam at 100 C contains extra **Latent Heat of Vaporization** (2260 J/g) compared to boiling water at 100 C. This extra energy causes more severe burns.

(iii) **Calorimetry Principle: Heat Lost = Heat Gained**

$$m_w c_w(T_h \;\; T \;\; _{mix}) = m_c c_c(T_{mix} \;\; T \;\; _c)$$
$$0 \;\; 04 \;\; 4200 \;\; (60 \;\; 50) = 0 \;\; 05 \;\; c \;\; _c \;\; (50 \;\; 20)$$
$$168 \;\; 10 = 0 \;\; 05 \;\; 30 \;\; c \;\; _c$$
$$1680 = 1 \;\; 5c_c$$
$$c_c = \frac{1680}{1 \;\; 5}$$
$$\mathbf{c_c = 1120} \text{ J kg}^{\mathbf{1}} \;\; \text{K}^{\mathbf{1}}$$

Question 9 [10 Marks]

(i) (a) **Mass Number (A) remains unchanged.** A neutron changes into a proton ($n \;\; p + e \;\;$), so the total number of nucleons remains the same.

(b) **Gamma Radiation ().** (It is an electromagnetic wave).

(c) Lead has a very high density and high atomic number, making it an excellent absorber of radioactive radiation, thus shielding the surroundings.

(ii) (a) $_{92}\text{U}^{238} \;\; _{90}\text{Th}^{234} + \mathbf{_2He^4}$ (-particle).

(b) $_{11}\text{Na}^{24} \;\; _{12}\text{Mg}^{24} + \mathbf{_1} \;\; ^{\mathbf{0}}$ (-particle).

(iii) (a) **Fission:** Splitting of a heavy nucleus into lighter nuclei.
Fusion: Combining of two light nuclei to form a heavier nucleus.

(b) Thick concrete shielding walls around the reactor. (Or use of control rods).

(c) **Graphite** or Heavy Water (D_2O).

ICSE ACADEMY

2

This solved paper

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ICSE Schools Association

2025

ICSE ACADEMY

KARNATAKA ICSE SCHOOLS ASSOCIATION

ICSE STD. X Preparatory Examination 2

Subject: PHYSICS (SCIENCE PAPER 1)

Maximum Marks: 80 **Time Allowed : Two hours** **Date: _____**

General Instructions

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 A** is compulsory. Attempt any four questions from **Section B.
The intended marks for questions or parts of questions are given in [ ].
Write neatly and legibly.

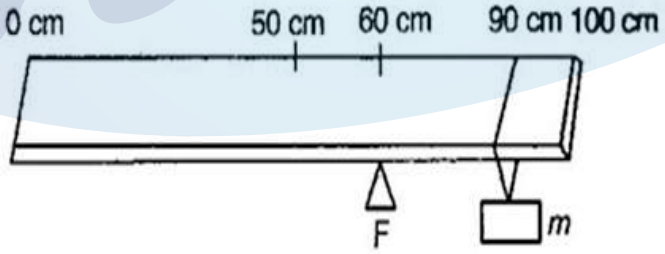
SECTION - A

(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 meter rule of weight 1.04 N balances at the 60 cm mark when a weight **m** is placed at 90 cm mark. What is the value of **m**?



(a) 1.04 N
(b) 0.347N
(c) 0.693N
(d) 0.578N

ii) Two objects of masses 2 g and 4 g have same kinetic energy. What will be the ratio of their linear momentum?
(a) 2:1
(b) 1:$\sqrt{2}$
(c) 1:2
(d) 1:16

iii) A device based upon conversion of light into electricity is:
- (a) Electric heater
- (b) Electric bulb
- (c) Photocell
- (d) Thermocouple

iv) Select the incorrect statement from the following:
- (a) A machine acts as a force multiplier as well as a speed multiplier simultaneously
- (b) A machine is used in changing the point of application of effort to a convenient point
- (c) A machine is used in changing the direction of effort to a convenient direction
- (d) A machine is used for obtaining gain in speed

v) Focal length of a convex lens will be maximum for:
- (a) Green light
- (b) Red light
- (c) Blue light
- (d) Violet light

vi) A, B and C are three optical media of respective critical angles C_1, C_2 and C_3. Total internal reflection occurs from A to B and also from B to C but not from C to A. Then the correct relation between the critical angles is:
- (a) $C_1 < C_2 < C_3$
- (b) $C_3 < C_1 < C_2$
- (c) $C_3 < C_2 < C_1$
- (d) $C_2 < C_3 < C_1$

vii) A coil is held in a magnetic field, such that plane of the coil is at right angles to that of the plane of permanent magnet. The force experienced by the coil on the passage of electric current will be:
- (a) Maximum
- (b) Zero
- (c) Weak
- (d) None of these

viii) What will be the wavelength of sound waves of frequency 550 Hz, if these waves are travelling with a speed of about 330 m/s?
- (a) 0.6 m
- (b) 1.67 m
- (c) 0.6 cm
- (d) 16.7 m

ix) Which one of the following statements is correct?

(a) Live wire has zero potential
(b) Fuse is connected with a neutral wire
(c) Potential of earth and neutral wire is always the same
(d) Neutral wire is used to prevent electric shock

x) **Assertion (A)**: The product of resistivity and conductivity of a conductor depends on the material of conductor.
Reason(R): Because each of resistivity and conductivity depends on the material of the conductor.

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

xi) Two metallic wires made from copper have same length but the radius of wire **1** is half of that of wire **2**. The resistance of wire **1** is R. If both the wires are joined together in series, the total resistance becomes:

(a) 5 R
(b) $\frac{5R}{4}$
(c) 4R
(d) $\frac{1}{2}$R

xii) Which of the following parameters remain constant in primary and secondary coils of a step up transformer?

(a) Power
(b) Current
(c) Voltage
(d) Both (a) and (b)

xiii) Amount of heat energy required to melt 200 g of ice at $0\ ^0$C is:
[Specific latent heat of ice =336000 J kg^{-1}]

(a) 6720J
(b) 672000J
(c) 67200J
(d) 67.2J

xiv) Two sounds S1 and S2 are produced by loudspeakers. The amplitude and frequency of each sound wave is given in the table.

	Amplitude	Frequency
S_1	1.3	480
S_2	2.0	240

(a) S_2 is louder and has a higher pitch
(b) S_2 is louder and has a lower pitch
(c) S_2 is quieter and has a higher pitch
(d) S_2 is quieter and has a lower pitch

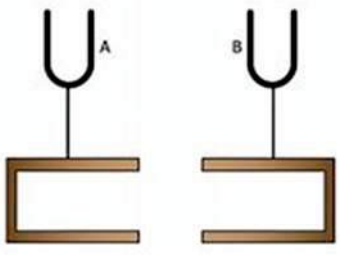
xv) A radioactive element forms its own isotope after 3 consecutive disintegrations. The particles emitted are:
(a) 2 α particles and 1 β particle
(b) 2 β particles and 1 γ particle
(c) 2 β particles and 1 α particle
(d) 3 β particles

Question 2

i) Complete the following by choosing the correct answers from the bracket: [6]
(a) To an Astronaut in a space ship, the earth appears ------. (black/blue/red)
(b) For a fuse, higher the current rating ----------(thicker/thinner) is the fuse wire.
(c) The direction of clockwise moment produced by a force is directed ---------- (inwards/outwards/perpendicular) along the axis of rotation.
(d) The type of energy possessed by the bob of a simple pendulum when it is at the mean position is ----------. (potential energy/kinetic energy /potential energy and kinetic energy)
(e) When a boy raises the weight of his body on his toes, the class of lever found in his body is----------. (Class I/Class II/Class III)
(f) The physical quantity remain constant in uniform circular motion is ---------. (velocity/acceleration/speed)

ii) A pulley system has a velocity ratio of 4 and efficiency 60%. Calculate the mechanical advantage. [2]

iii) Two tuning forks A and B of same frequencies are placed on two boxes in adjoining positions. Tuning fork A is set into vibrations. [2]



What would be your observations? State the principle illustrated by the experiment.

Question 3

i) (a) Name the unit of physical quantity obtained by the formula $2K/v^2$ where,
K: Kinetic energy v: Linear velocity [2]
(b) A force F acts on a body and displaces it by a distance S in a direction at angle θ with the direction of force. Write an expression for the work done by the force.

ii) A stone placed at the bottom of a water tank appears raised by 80 cm. If the refractive index of water is 4/3, find the actual depth of water in the tank. [2]

iii) Two resistances when connected in series give 15 Ω resistance and when connected in parallel yield $\frac{10}{3}$ Ω. Calculate the value of two resistances. [2]

iv) Name the coil of which the wire is thicker in a step down transformer. Give reason to your answer. [2]

v) (a) A couple is formed by two equal and opposite forces of 40 N each. The distance between line of action of forces is 5 m. Calculate the moment of couple.
(b) If the point, about which rotation takes place, is shifted, will there be any change in moment of couple.? [2]

vi) (a) Represent the change in the nucleus of a radioactive element when a β -particle emitted. [2]
(b) What is the name given to elements with same mass number and different atomic number?

vii) (a) Two metallic blocks A and B of different metals having their masses in the ratio 2:3 are given same amount of heat. Their temperature rises by same amount. Compare their specific heat capacities. [3]
(b) What do you mean by the statement:
'The specific heat capacity of copper is 0.4 J g^{-1} $°C^{-1}$ '

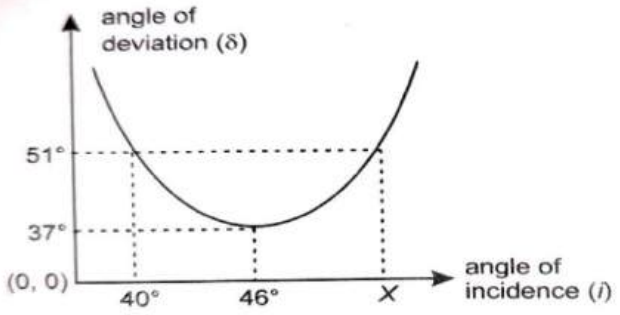
SECTION B

(*Attempt any **four questions** from this Section*)

Question 4

i) A slide projector is being used by your teacher for a presentation in class. [3]
(a) Name the type of lens used in a slide projector.
(b) Construct a ray diagram, to illustrate the formation of the image in a slide projector.

ii) The diagram (not drawn to the scale) below shows the graphical relation between angle of deviation and angle of incidence, when light passes through a triangular prism of angle 62^0 of a certain glass material. [3]



(a) State the angle of minimum deviation of this prism and the corresponding angle of incidence.

(b) Calculate the value of X.

iii) A lens of focal length 20 cm forms an inverted image at a distance 60 cm from the lens. [4]

(a) Identify the lens.

(b) How far is the lens present in front of the object?

(c) Calculate the magnification of the image.

Question 5

i) (a) State the relation between the critical angle and the absolute refractive index of a medium. [3]

(b)The critical angle for glass air interface is 45 ^{0}for yellow light. Will it be equal to, less than or greater than 45 ^{0} for

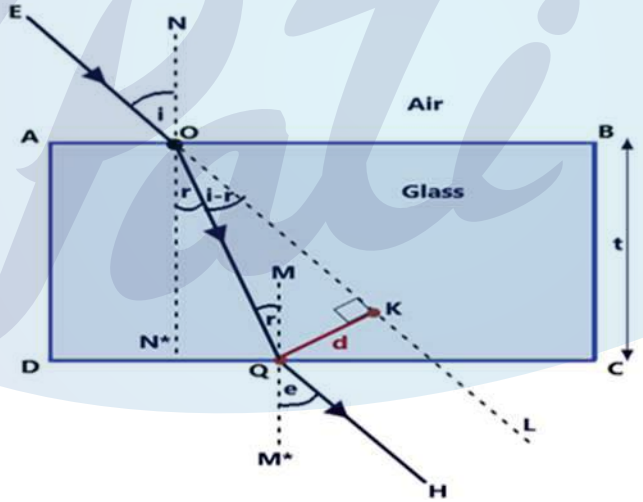
1) red light,
2) blue light?

ii) (a) Which property of light is responsible for the blue color of the sky? [3]

(b) Define the above-mentioned property stated by you.

(c) State the condition required for the occurrence of the phenomena.

iii) A ray of light is incident on a glass slab as shown below: [4]



(a) What is represented by '*d*' shown in the diagram?

(b) Define '*d*'

(c) How is '*d* 'related to the refractive index of the medium?

(d) What will happen to the value of '*d*' as the value of 't' (thickness) increases?

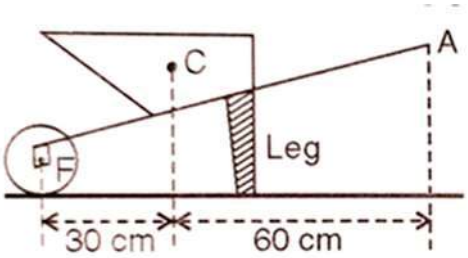
Question 6

i) (a) Write the relation between the commercial unit of electrical energy and the SI unit of energy. [1]

(b) A satellite revolves around a planet in a circular orbit. What is the work done by the satellite at any instant? Give a reason. [2]

ii) A ball is dropped from a height of 10m. If the energy of the ball reduces by 40% after striking the ground, how high can the ball bounce back? [3]
($g = 10\ ms^{-2}$)

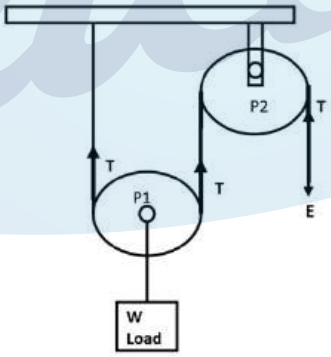
iii) The diagram alongside shows a wheel barrow with C as centre of gravity, such that its leg is in contact with ground. [4]



(a) Name the force acting at C and state its direction.
(b) What is the direction of minimum force at A to keep the leg off the ground? What is this force called?
(c) If the weight of wheel barrow is 10 kgf and it holds 90 kgf of sand, calculate the minimum force to keep the leg off the ground.

Question 7

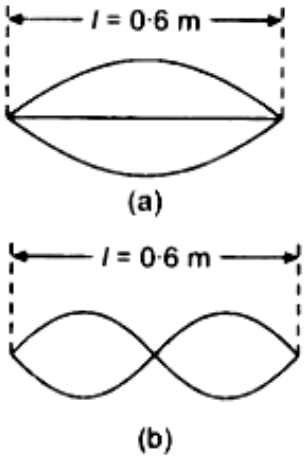
i) The figure below shows the combination of a movable pulley P1 with a fixed pulley P2 used for lifting up a load W. [3]



(a) State the function of the pulley P2.
(b) If the free end of the string moves through a distance x, what is the distance by which the load W is raised?
(c) Calculate the force to be applied at the end of the string to just raise the load W=50 kgf, neglecting the weight of the pulley P1 and friction.

ii) A boy stands in front of a cliff on the other side of a river. He fires a gun and hears an echo after 6 seconds. The boy then moves backward by 170 m and again fires the gun. He hears an echo after 7 seconds. Calculate: [3]
(a) the width of river
(b) the speed of sound

iii) A 0.6 m long stretched wire is made to vibrate in two different modes as shown in figure. [2]



(a) If the frequency of note produced in (b) is n, what is the frequency in case (a)?

(b) In which case is the pitch higher? Give reason.

iv) Arrange α, β and γ rays in ascending order with respect to their: [2]

(a) Biological effect

(b) Ionizing power

Question 8

i) (a) A substance has its specific resistance of order $\mathbf{10^{-5}}$. Identify the substance. [3]

(b) How does its resistivity changes with the rise in temperature?

(c) Name a material which is used for making standard resistor.

ii) (a) What determines the frequency of a.c produced in a generator? [3]

(b) State any two kinds of energy losses in a transformer. How are they minimized?

iii) An electric oven is marked 1000 W-200 V. Calculate: [4]

(a) Resistance of its element.

(b) Energy consumed by the oven in $\frac{1}{2}$ an hour in joules.

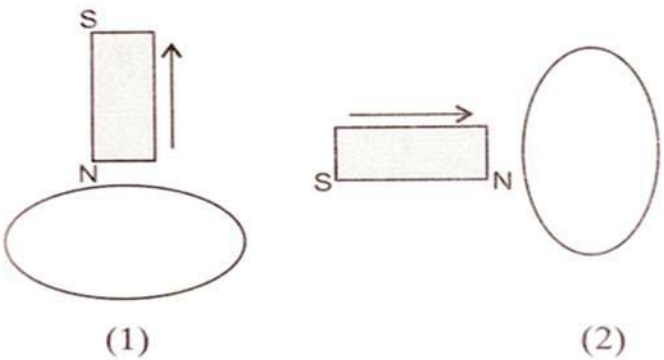
(c) Time in which it will consume 15 kWh of energy.

Question 9

i) (a) Why is the base of a cooking pan made thick and heavy? [3]

(b) State the effect of increase in impurities on the melting point of ice.

ii) (a) Copy the diagram and mark the directions of induced current in the following figures: [3]



(b) Name the law which determines the direction of current induced in the coil.

(c) What is the source of energy associated with the current obtained in part (a).

iii) 104 g of water at 30° C is taken in a calorimeter made of copper of mass 42 g. When a certain mass of ice at 0 ° C is added to it, the final steady temperature of the mixture after the ice has melted, was found to be 10 °C. Find the mass of ice added. [4]

(Specific heat capacity of calorimeter =0.4 J g^{-1} $°C^{-1}$, Specific heat capacity of water = 4.2 J g^{-1} $°C^{-1}$, Latent heat capacity of ice =330 J g^{-1})

End

ICSE ACADEMY

KARNATAKA ICSE SCHOOLS ASSOCIATION

ICSE STD. X Preparatory Examination 2

Subject: PHYSICS (SCIENCE PAPER 1)

Maximum Marks: 80 **Time Allowed : Two hours** **Date: _____**

ANSWER KEY

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 question, write the correct answers only.)

i) (b)0.347 N

ii) (b) 1:√2

iii) (c)Photocell

iv) (a)A machine acts as a force multiplier as well as a speed multiplier simultaneously

v) (b) Red

vi) (a) C1< C2 < C3

vii) (b) zero

viii) (a) 0.6 m

ix) (c)Potential of earth and neutral wire is always the same

x) (d)Assertion is false but reason is true.

xi) (b) 5R/4

xii) (a)Power

xiii) (c)67200J

xiv) (b) S2 is louder and has a lower pitch

xv) (c) 2 beta and one alpha particle

Question 2

i)

(a) blue

(b) thicker

(c) inwards

(d) kinetic energy

(e) class II

(f) speed

ii) Velocity ratio =4

Efficiency =60%

Efficiency =Mechanical advantage /velocity ratio

Mechanical advantage = $4\times\frac{60}{100}$ [1]

=2.4 [1]

iii) Tuning fork B starts vibrating and a loud sound is heard [1]

Resonance [1]

The air column of B starts vibrating with the frequency of fork A. Since the frequency of these vibrations is the same as the natural frequency of the fork B. Then fork B starts vibrating under resonance.

Question 3

i) (a) kilogram [1]

(b)W =F S Cosθ [1]

ii) Let the real depth of the water tank =x cm

Apparent depth =(x-80) cm

μ=Real depth /Apparent depth

$\frac{4}{3}=\frac{x}{x-80}$ [1]

4x -320 =3x

x=320 cm [1]

iii) Let R_1 and R_2 be the value of two resistances

Rs=15 ohm

Rp =$\frac{10}{3}$ohm

$R_1+R_2= 15$ ----------(equ.1)

$\frac{R1R2}{R1+R2}$ =10/3

On solving

$R_1 R_2$ =50 Ohm

$R_2=\frac{50}{R1}$

Substituting in equ.(1)

$R_1+\frac{50}{R1}= 15$

R_1^2 -15 R_1 +50 =0

(R_1-10) (R_1-5) =0

R_1= 10 ohm [1]

$R_1+R_2=15$

10 +R_2 =15

Therefore **R2= 5 ohm** [1]

iv) Secondary coil [1]

Turn ratio n< 1

$n=\frac{Es}{Ep} = \frac{Ip}{Is}$

So current in the secondary coil is more . As more current is passing in the secondary coil ,in order to reduce its resistance and therefore reduce the loss of heat energy in the coil ,secondary coil is thick. [1]

v) (a)Moment of couple =Force x distance between forces.

40 x 5 =200 Nm [1]

(b) **No,** there is no change in the moment of couple because the moment of couple is independent of the reference point. [1]

vi) Inside the nucleus,

a) ${}_0n^1 \longrightarrow {}_1P_1 + {}_{-1}e^0$ [1]

b) Isobars [1]

vii) (a) Q1=Q2

$m_1 c_1 \Delta t = m_2 c_2 \Delta t$

$\frac{c1}{c2} = \frac{m2}{m1} = \frac{3}{2}$ [1]

$c_1:c_2 = 3:2$ [1]

(b) The amount of heat energy required to raise the temperature of one gram of copper by 1^0 C is 0.4 J [1]

Section B

Question 4

i) (a) Convex lens [1]

(b) Ray diagram – [2]

[Position of object between F1 and 2F1 & Magnified, real and inverted image is formed beyond 2F2]

ii) Angle of minimum deviation $=37^0$ [1]

Angle of incidence corresponding to minimum deviation $=46^0$ [1]

For deviation

$\delta = i_1 + i_2 - A$

$51 = 40 + X - 62$

$X = 51 + 22 = 73^0$ [1]

iii) (a) convex lens [1]

(b) f=20 cm v=60 cm

$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\frac{1}{60} - \frac{1}{u} = \frac{1}{20}$

$-\frac{1}{u} = \frac{1}{20} - \frac{1}{60}$ [1]

$-1/u = \frac{3-1}{60} = 2/60 = 1/30$

u= $\mathbf{-30\ cm}$ [1]

magnification = m=$\frac{v}{u} = \frac{60}{-30} =$**-2** [1]

Question 5

i) (a)$\mu = \frac{1}{Sin\ C}$

Sin C =$\frac{1}{\mu}$ [1]

(b) Red light -more than 45 [2]

Blue light -less than 45 ^{0}

ii) (a) Scattering of light [1]

(b) Scattering is the process of absorption and then remission of light energy by the dust particles and air molecules present in air [1]

(c) Size of the air molecules should be smaller than the wavelength of incident light. [1]

iii) (a) Lateral displacement [1]

(b) The perpendicular distance between the path of the emergent ray and the direction of incident ray. [1]

(c) More is the refractive index of the medium, more is the lateral displacement**.** [1]

(d) Lateral displacement increases. [1]

Question 6

i) (a) one kilowatt hour =3.6 × 10 ^{6} J [1]

(b) Zero [1]

Centripetal force on the body at any instant is directed towards the centre of the circular path and displacement is tangent to the circular path

Displacement is **normal** to the direction of force. So, work done is zero [1]

ii) Solution:

Let m be the mass of the ball and height of the ball after rebound be H
Initial Potential energy of the ball =mgh =$m\times 10 \times 10 = 100m$ [1]
Since 100m is the total energy, then the reduced energy is

$=100m - (40\% \text{ of } 100m)$

$=100m - \frac{40}{100}\times 100m$

$=100m - 40m = 60\ m$ [1]

This is the energy of the ball when it bounces back.
Therefore 60m =m g H
$H=\frac{60}{g}=\frac{60}{10}$ = **6 m** [1]

Hence, the ball can bounce back 6 m high

iii) The force acts in vertically downward direction -the force is called weight or gravitational force [1]
The force acts in vertically upward direction at A. The force is called effort. [1]

When the wheel barrow is in equilibrium.

Effort x effort arm =Load x load arm
$E\times (30+60)cm = (10+90)kgf \times 30\ cm$ [1]
$E = \frac{100\ kgf \times 30\ cm}{90\ cm}$ = **33.33 kgf** [1]

Question 7

i) (a) P2 is used to change the direction of effort to a convenient direction [1]

(b) $\frac{x}{2}$ [1]

(c) L = T+T =2T

$\frac{L}{E}=\frac{2T}{2}=2$

$\frac{50kgf}{E}=2$

E=**25 kgf** [1]

ii) Let the width of river be x cm

When the boy stands on the bank of river

V=2d/t

$V=\frac{2x}{6}$----------(equ. 1)

When the boy moves 170m away from the bank
Distance of boy from cliff = x+ 170

Now V=$\frac{2d}{t}$

=$\frac{2(x+170)}{7}$----------(equ.2)

Comparing equations (1) and (2) we get

$\frac{2x}{6}$ =$\frac{2x+340}{7}$ [1]

14x =12x +2040

x=1020 m [1]

Width of the river = x= **1020 m**

Substituting the value of x, we get

V=$\frac{2\times1020}{6}$ = **340m/s** [1]

iii) (a) The frequency of the note produced in (b) is 2 times that produced in (a)

Frequency of note in (a) is ½ n or $\frac{n}{2}$ [1]

(b) Figure (b) [1]

Pitch is directly proportional to the frequency of sound note. The frequency of note in fig.(b) is more than the frequency of note in (a)

iv) a) $\alpha < \beta < \gamma$ [1]

b) $\gamma < \beta < \alpha$ [1]

Question 8

i) (a) Semiconductor (Graphite, Germanium…..) [1]

(b) Specific resistance decreases with increase in temperature [1]

(c) Constantan/Manganin [1]

ii) The number of rotations of the coil in one second(speed of rotation of the coil) [1]

Eddy current loss – lamination of iron core prevents the formation of eddy current [2]

Copper loss or heating in the coil -by taking thick wire for the coil.

Hysterisis loss - the core is made of soft iron [any two]

iii) (a) $P=V^2/R$ or $R= V^2/P$

$\frac{200\times200}{1000}$ = [1]

=40Ω [1]

(b) Energy consumed by oven in joules in 1/2 hour. =P× t

= 1000J/s × 1800 s

= **1800,000 J** [1]

(c) E =P× t

$t=\frac{E}{P} = \frac{15kwh}{1000W}$ **=15 h** [1]

Question 9

i) -To increase its heat capacity, it imparts sufficient heat energy at a slow rate to the food for its proper cooking. [1]

-It keeps the food warm for a longer period [1]

Melting point of ice decreases. [1]

ii) (a) 1.Clockwise 2.Anticlockwise [1]

[Draw the diagram and mark the direction of induced current]

(b) Lenz's law /Fleming's Right hand rule [1]

(c) Mechanical energy spent in moving the magnet is transferred into electrical energy [1]

iii) Solution:

Mass of water = 104g

Temperature of copper =30 ^{0}C

Mass of copper =42 g

Final temperature =10 ^{0} C

By the principle of calorimetry

Heat lost by the hot body =Heat gained by the cold body

$m_w c_w(T_w-T) + m_c c_c (T_w-T)=m_{ice} L + m_{ice}c_w (T-T_{ice})$

(104 ×4.2 ×(30 -10) + 42 ×0.4× (30 -10) =m× 336 + m ×4.2 ×(10 -0) [2]

Mass of ice m = $\frac{8736+336}{336+42}$ [1]

$=\frac{9072}{378}$

= 24 g [1]

End

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ICSE Schools Association

2024

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KARNATAKA ICSE SCHOOLS ASSOCIATION

ICSE STD. X Preparatory Examination 2024

Subject: PHYSICS

Maximum Marks: 80 **Time Allowed: 2 hours** **Date: 29/01/2024**

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Time allowed:Two hours
Answers to this Paper must be written on the paper provided separately.
You will not be allowed to write during first 15 minutes.
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The time given at the head of this Paper is the time allowed for writing the answers.

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

(i) If F represents the force and d represents distance, then the unit of the product of F and d can be:

(a) J

(b) N m

(c) V C

(d) All of these

(ii) 25 J of work is done on a body so that it moves a distance of 5 m. The change in KE of the body is:

(a) 25 kg m^2 s^{-2}

(b) 50 kg m^2 s^{-2}

(c) 125 kg m^2 s^{-2}

(d) 150 kg m^2 s^{-2}

(iii) The energy change in the bob of a simple pendulum when it moves from the mean position to the extreme position is:

(a) KE to PE

(b) PE to KE

(c) Only KE

(d) Only PE

(iv) A ray of light is directed from glass [n = 1.50] to water [n = 1.33]. What can be concluded about their angle of incidence (i) and angle of refraction (r) ?

(a) i always equal to r

(b) i always greater than r

(c) i can be equal to r

(d) i always less than r

(v) A swimming pool with depth **t** is completely filled with water having refractive index **n**. The base of the swimming pool will appear to be shifted to:

(a) T / (1-1/n)

(b) t (1 - 1/n)

(c) t + (1 - 1/n)

(d) t - (1 - 1/n)

(vi) Assertion: Microwaves travel with the speed of light.

Reason: Microwave is an electromagnetic wave.

(a) both assertion and reason are true

(b) both assertion and reason are false

(c) assertion is false but reason is true

(d) assertion is true but reason is false

(vii) A ray of light experiences total internal reflection while entering from medium A to medium B. Then:

option	Refractive index of:	angle of incidence is:
(a)	A is greater than B	less than the critical angle
(b)	A is less than B	equal to the critical angle
(c)	A is greater than B	greater than the critical angle
(d)	A is less than B	equal to the critical angle

(viii) The characteristics of sound which enables to differentiate between two sounds of different waveform is:

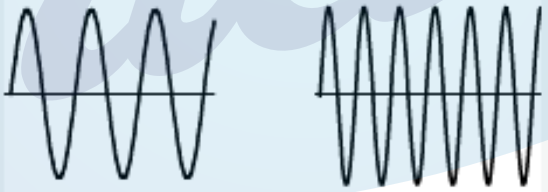
(a) Loudness

(b) Pitch

(c) Quality

(d) Frequency

(ix) The number of vibrations made by two waves M and N, in a given time interval, is represented as shown below.



M N

What can be concluded about M and N?

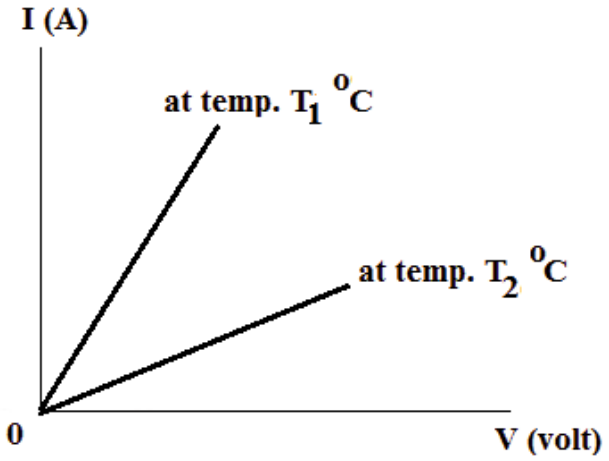
(a) M is louder than N

(b) N is louder than M

(c) M is shriller than N

(d) N is shriller than M

(x) The V-I graph for a conductor at two temperatures- T_1 and T_2- is as shown below.



What can be concluded about T1 and T2?

(a) T1> T2

(b) T1<T2

(c) T1 = T2

(d) Insufficient data to make the conclusion

(xi) Two fuse wires E and F are marked 5A and 15 A respectively. Then:

(a) E is thicker than F

(b) E is thinner than F

(c) E and F are of the same thickness

(d) None of these

(xii) The direction of the induced current in a conductor moving in an external magnetic field can be found out using:

(a) Lenz's law

(b) Fleming's left hand rule

(c) Fleming's right hand rule

(d) Right hand thumb rule

(xiii) During change of state, …….. remains constant.

(a) Temperature and volume

(b) Volume and mass

(c) Mass and temperature

(d) Volume and temperature

(xiv) If P represents the mass of a body, Q and R represents its specific heat capacity and heat capacity respectively, then:

(a) Q = R/P

(b) R = P/Q

(c) P = Q/R

(d) None of these

(xv) α, β and γ are the three radioactive radiations. The correct way to arrange them in the ascending order of their ionization power is:

(a) $\alpha < \beta < \gamma$

(b) $\gamma < \beta < \alpha$

(c) $\beta < \alpha < \gamma$

(d) $\beta < \gamma < \alpha$

Question 2

(i) A metre scale is balanced at its centre of gravity which is found to be at 60 cm mark. Represent this using a neat labelled diagram.
What weight kept at the end of longer arm will balance an object weight 120 gf kept at the other end? [3]

(ii) The centre of gravity of a body depends on two factors. Name them. [2]

(iii) A ball is dropped from a height of 10 m. If acceleration due to gravity at that place is 9.8 m s^{-2}, calculate the velocity with which the ball hits the ground. [2]

(iv) Name the class of lever having a velocity ratio always greater than 1. Give an example for such a lever. [2]

(v) Give two points of differences between free vibrations and damped vibrations. [2]

(vi) How does the internal resistance of a cell depends on:

(a) The temperature of the cell

(b) The concentration of the electrolyte [2]

(vii) A radioactive element E undergoes α disintegration followed by two β disintegrations, to form the final product F. For the element E, the atomic number and mass number are Z and A respectively. Write the values of the atomic number and mass number of the element F. What is the general name given to E and F? [2]

Question 3

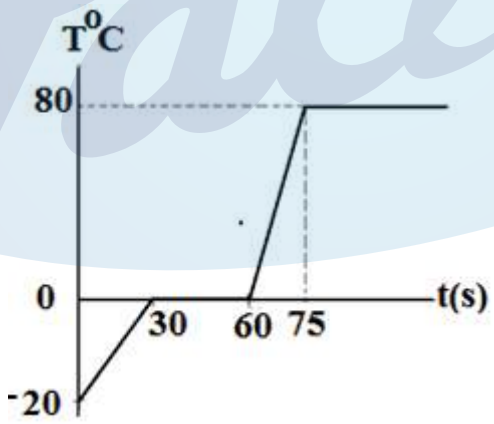
(i) What are the two characteristics required for the material of a fuse wire? [2]

(ii) The earth pin in a 3pin plug is made longer and thicker. Give reason. [2]

(iii) List two ways to increase the force acting on a conductor placed in an external magnetic field B. [2]

(iv) 80 g of material M at 60°C is mixed with 20 g of material N at 30°C.
If the specific heat capacity of N is double than that of M, calculate the resultant temperature of the mixture. [2]

(v) The diagram below shows the heating curve for certain material. [2]



(a) State the time taken by the material to melt completely.

(b) What is the boiling point of this material?

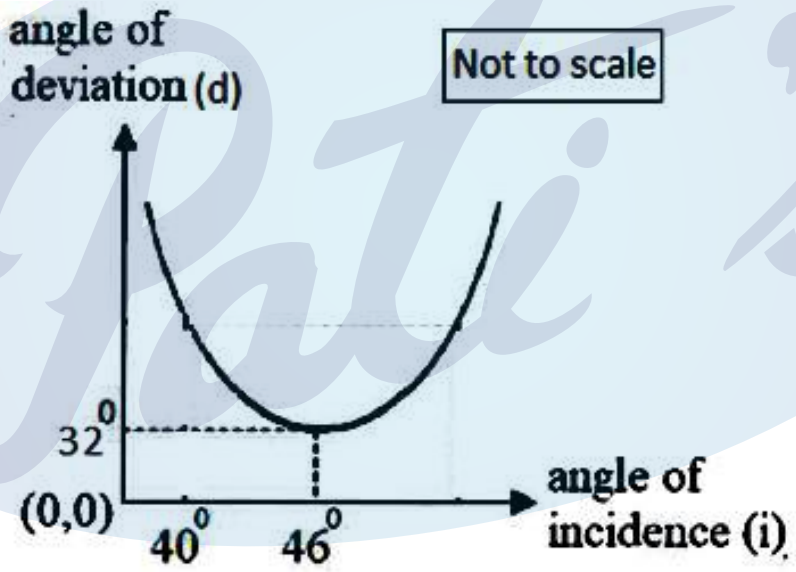
SECTION B

*(Attempt **any four** questions.)*

Question 4

(i) You are provided with a load, three pulleys and one string. Arrange the pulleys such that a minimum effort is applied to lift the load. Represent it in the form of a diagram. Clearly label the diagram. [3]

(ii) The diagram below shows the graphical relation between angle of deviation and angle of incidence, when light passes through a triangular prism with angle of the prism A.

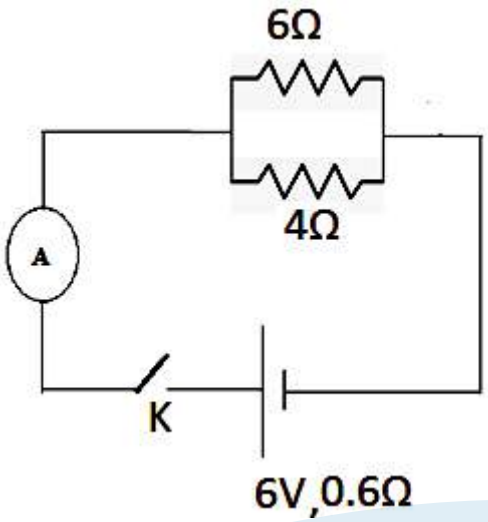


Study the graph and answer the following questions:

(a) Calculate the angle of the prism A. [2]

(b) With reference to the base of the glass prism, what can be predicted about the direction of the refracted ray within the prism, when the angle of deviation is 32°? [1]

iii) Consider the circuit diagram below to answer the questions that follows: [4]



Calculate resistance of the circuit when the key K is:

i) Open.

ii) Closed

iii) What is the reading in the ammeter A?

iv) Current through the 4Ω resistor = _____.

Question 5

(i) (a) Write the equation relating mechanical advantage MA, velocity ratio VR and efficiency η. [1]

(b) Among MA, VR and η, which quantity remains constant for a machine of given design. Give reason for your answer. [2]

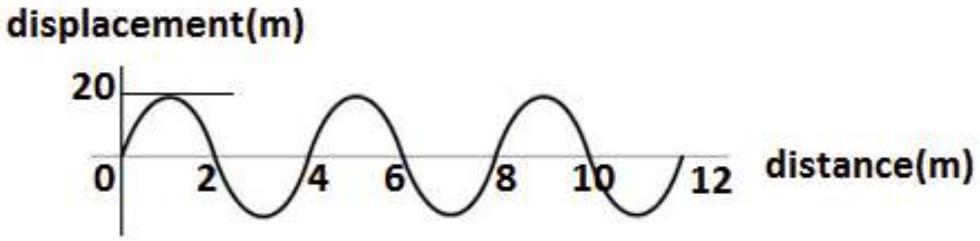
(ii) The specific heat capacities of two liquids L and M are C_L and C_M respectively. C_M is much greater than C_L. [3]

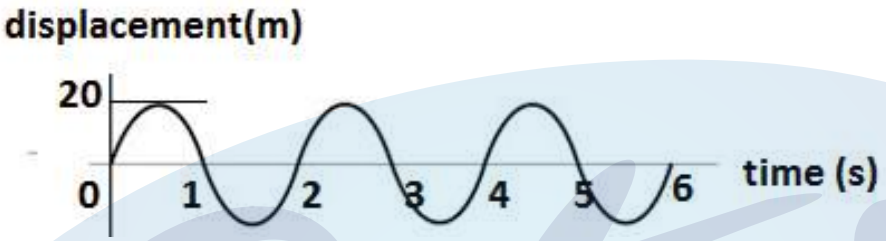
(a) Define specific heat capacity.

(b) Among Land M, identify the liquid that will be preferred as coolant.

(c) Give reason for your choice.

(iii) The displacement-distance graph and the displacement-time graph for a wave is shown below:





Use the graph to calculate the :

(a) wavelength of the wave

(b) frequency of the wave

(c) speed of the wave

(d) amplitude of the wave [4]

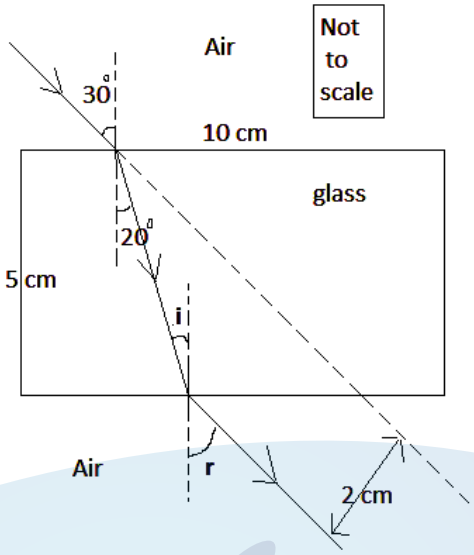
Question 6

(i) A radioactive nucleus undergoes a series of decays according to the sequence:

$X \Rightarrow \beta \Rightarrow X1 \Rightarrow \alpha \Rightarrow X2 \Rightarrow \alpha \Rightarrow X3$

If the mass number and atomic number of X3 are 172 and 69 respectively, what is the mass number and atomic number of X2 , X1 and X? [3]

(ii) A ray of light passes through a glass block as shown below. Predict the possible values for angles i and r. What is the lateral deviation for the ray? [3]



(iii) For a science exhibition, two students A and B brought two similar exhibits. Both the exhibits consist of a coil placed in the magnetic field. Student A rotates the coil and a bulb connected to it glows. Student B passes current through the coil and the coil rotates.

(a) Name the phenomena involved with the exhibit of student A.

(b) State the principle based on which the exhibit of student B works.

(c) List the application of the above exhibits in daily life. [4]

Question 7

(i) A transformer is used to transmit electrical energy from the generating station. A transformer basically consists of a core, primary windings and secondary windings. It is an integral part of many low- power applications. Depending on the necessity, a step-up transformer or a step-down transformer is used in a circuit.

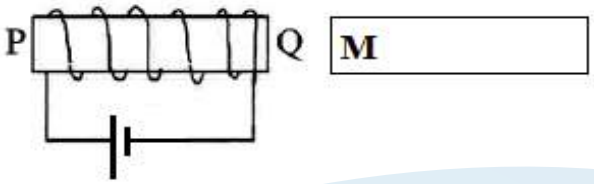
(a) For a step-up transformer, what can be predicted about the thickness of the primary coil with reference to that of the secondary coil.

(b) What is the working principle of a transformer?

(c) The electrical energy transmission from a generating station is at high volt. Why? [3]

(ii) A man is standing at a distance **d** from a cliff. He claps and hears the echo in 3 s. He moves 170 m away from the cliff. At this position, the echo is heard after 4s. Calculate the distance **d**. [3]

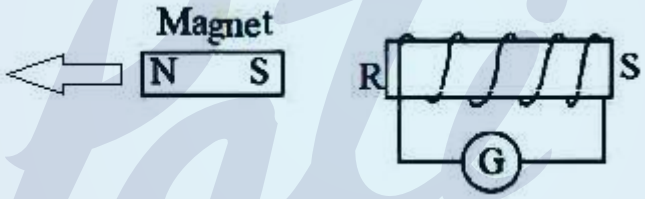
(iii) (a) In the following arrangement, a magnetic material M is attracted towards the coil PQ. Identify the magnetic polarity induced at the end P of the coil. Justify your answer with a suitable reason. [2]



(b) A magnet NS is moved away from the coil RS as shown below.

A deflection is shown in the galvanometer. Give a reason for this phenomena.

Predict the polarity that will be induced at the end R in the arrangement. [2]



Question 8

(i) (a) Give the new convention for the colour code of live wire.

(b) Two components in a circuit are always connected in series with the live wire.

Name them. [3]

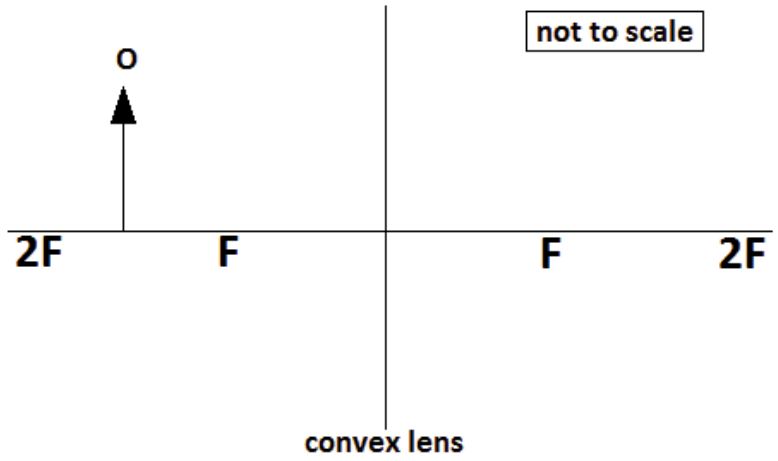
(ii) An object of height 20 cm is placed in front of a lens at a distance of 25 cm. Its virtual, magnified image is formed at a distance of 50 cm.

(a) Identify the type of the lens.

(b) Calculate the size of the image.

(c) The focal length of the lens must be greater than _____ cm [3]

(iii) The diagram below shows an object O placed in front of a convex lens.



Redraw and complete the ray diagram showing the formation of the image. Write any one characteristics of the image formed. [4]

Question 9

(i) (a) Specific latent heat of ice = 336 J g^{-1}. What does this means?

(b) The ice on the top of mountains never melt all together. Why?

(c) We prefer ice to ice-cold water for cooling a drink. Why? [3]

(ii) (a) State one safety precaution in the disposal of nuclear waste.

(b) For a given mass of nuclear fuel, the energy released during a nuclear fusion reaction is more than that during the nuclear fission reaction. Give reason.

(c) Give an example for an internal source and an external source of background radiation. [3]

(iii) (a) A violet ray of light is directed from air to a glass block. The speed of light in air and in glass is 3 x 10^8 ms^{-1} and 2 x 10^8 ms^{-1} respectively.

Calculate the refractive index of glass.

(b) If the wavelength of violet colour is 450 nm in air, calculate its wavelength when it enters the glass block.

(c) What will be the ratio : $\frac{\text{frequency of the violet light in air}}{\text{frequency of the violet light in glass}}$

Give reason for your answer. [4]

KARNATAKA ICSE SCHOOLS ASSOCIATION

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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]

(i) If F represents the force and d represents distance, then the unit of the product of F and d can be:

(a) J

(b) N m

(c) V C

(d) All of these

(ii) 25 J of work is done on a body so that it moves a distance of 5 m. The change in KE of the body is:

(a) 25 kgm^2 s^{-2} [Work- energy theorem]

(b) 50 kg m^2 s^{-2}

(c) 125 kg $m^2 s^{-2}$

(d) 150 kg $m^2 s^{-2}$

(iii) The energy change in the bob of a simple pendulum when it moves from the mean position to the extreme position is:

(a) KE to PE

(b) PE to KE

(c) Only KE

(d) Only PE

(iv) A ray of light is directed from glass [n = 1.50] to water [n = 1.33]. What can be concluded about their angle of incidence (i) and angle of refraction (r) ?

(a) i always equal to r

(b) i always greater than r

(c) i can be equal to r

(d) i always less than r

(v) A swimming pool with depth **t** is completely filled with water having refractive index **n**. The base of the swimming pool will appear to be shifted to:

(a) t/ (1-1/n)

(b) t (1 - 1/n)

(c) t + (1 - 1/n)

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(vi) Assertion: Microwaves travel with the speed of light.

Reason: Microwave is an electromagnetic wave.

(a) both assertion and reason are true

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(vii) A ray of light experiences total internal reflection while entering from medium A to medium B. Then:

option	Refractive index of:	angle of incidence is:
(a)	A is greater than B	less than the critical angle
(b)	A is less than B	equal to the critical angle
(c)	**A is greater than B**	**greater than the critical angle**
(d)	A is less than B	equal to the critical angle

(viii) The characteristics of sound which enables to differentiate between two sounds of different waveform is:

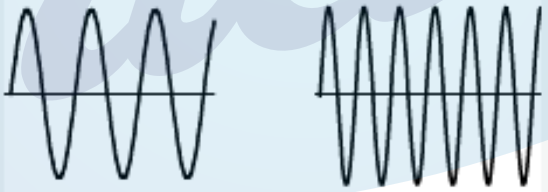
(a) Loudness

(b) Pitch

(c) Quality

(d) Frequency

(ix) The number of vibrations made by two waves M and N, in a given time interval, is represented as shown below.



M **N**

What can be concluded about M and N?

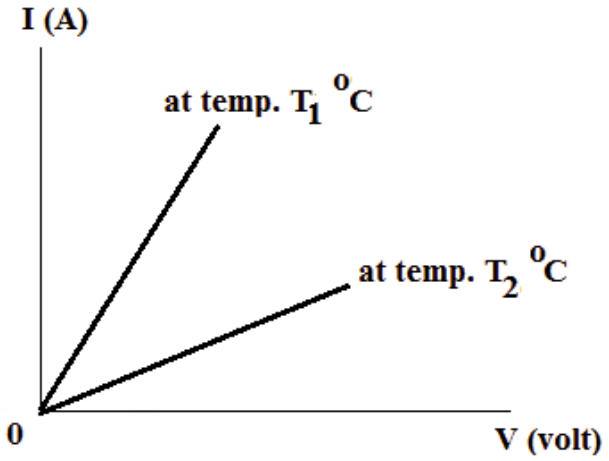
(a) M is louder than N

(b) N is louder than M

(c) M is shriller than N

(d) N is shriller than M

(x) The V-I graph for a conductor at two temperatures- T_1 and T_2- is as shown below.



What can be concluded about T1 and T2?

(a) T1> T2

(b) T1<T2

(c) T1 = T2

(d) Insufficient data to make the conclusion

(xi) Two fuse wires E and F are marked 5A and 15 A respectively. Then:

(a) E is thicker than F

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(a) Lenz's law

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(xiii) During change of state, …….. remains constant.

(a) Temperature and volume

(b) Volume and mass

(c) Mass and temperature

(d) Volume and temperature

(xiv) If P represents the mass of a body, Q and R represents its specific heat capacity and heat capacity respectively, then:

(a) Q = R/P

(b) R = P/Q

(c) P = Q/R

(d) None of these

(xv) α, β and γ are the three radioactive radiations. The correct way to arrange them in the ascending order of their ionization power is:

(a) $\alpha < \beta < \gamma$

(b) $\gamma < \beta < \alpha$

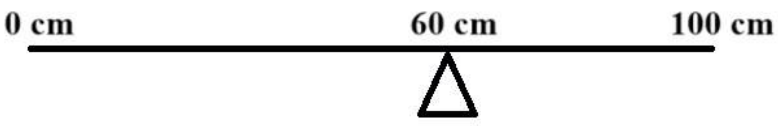
(c) $\beta < \alpha < \gamma$

(d) $\beta < \gamma < \alpha$

Question 2

(i) A metre scale is balanced at its centre of gravity which is found to be at 60 cm mark. Represent this using a neat labelled diagram.

What weight kept at the end of longer arm will balance an object weight 120 gf kept at the other end? [3]



120 * 40 = W x 60 ; W = 2 * 40 = 80 gf

(ii) The centre of gravity of a body depends on two factors. Name them. [2]

Shape of the body ; mass distribution in the body.

(iii) A ball is dropped from a height of 10 m. If acceleration due to gravity at that place is 9.8 m s^{-2}, calculate the velocity with which the ball hits the ground. [2]

$mgh = ½ mv^2$

$m \times 9.8 \times 10 = ½ m \times v^2$ $196 = v^2$; $v = 14$ ms^{-1}.

(iv) Name the class of lever having a velocity ratio always greater than 1. Give an example for such a lever. [2]

Class 2 lever.

(v) Give two points of differences between free vibrations and damped vibrations. [2]

Free vibrations- equal amplitude/no loss of energy/no external force

Damped vibrations- decreasing amplitude/loss of energy/external force

(vi) How does the internal resistance of a cell depends on:

(a) The temperature of the cell - decreases

(b) The concentration of the electrolyte- increases [2]

(vii) A radioactive element E undergoes α disintegration followed by two β disintegrations, to form the final product F. Z and A are the atomic number and mass number of element E. Write the values of the atomic number and mass number of the element F. What is the general name given to E and F? [2]

atomic number Z mass number A- 4 E and F are called isotopes

Question 3

(i) What are the two characteristics required for the material of a fuse wire? [2]

1. High resistivity 2. Low melting point.

(ii) The earth pin in a 3pin plug is made longer and thicker. Give reason. [2]

Longer- to make the earth connection first. Thicker- to prevent coming in contact with the socket for the live wire.

(iii) List two ways to increase the force acting on a conductor placed in an external magnetic field B. [2]

increasing the number of turns/length of the conductor ; increasing the current through the conductor ; increasing the strength of the magnetic field.

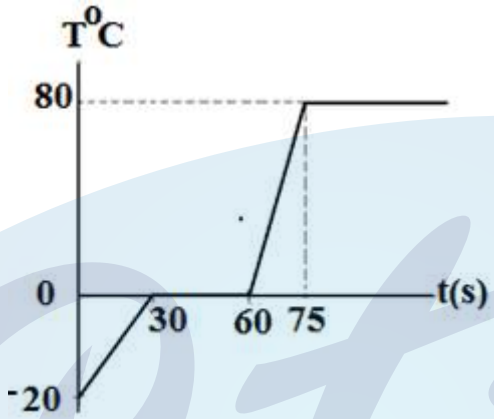
(iv) 80 g of material M at 60°C is mixed with 20 g of material N at 30°C.
If the specific heat capacity of N is double than that of M, calculate the resultant temperature of the mixture. [2]

Heat lost = heat gained

80 x c x [60- t] = 20 x 2 c x [t – 30]

120 - 2 t = t – 30 ; 150 = 3 t ; t = 50°C

(v) The diagram below shows the heating curve for certain material. [2]



(a) State the time taken by the material to melt completely. 60 – 30 = 30 s

(b) What is the boiling point of this material? 80°C

SECTION B

*(Attempt **any four** questions.)*

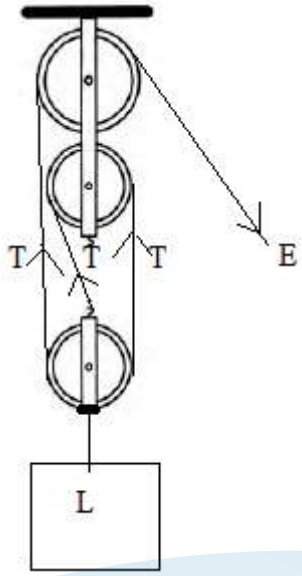
Question 4

(i) You are provided with a load, three pulleys and one string. Arrange the pulleys such that a minimum effort is applied to lift the load. Represent it in the form of a diagram.
Clearly label the diagram. [3]

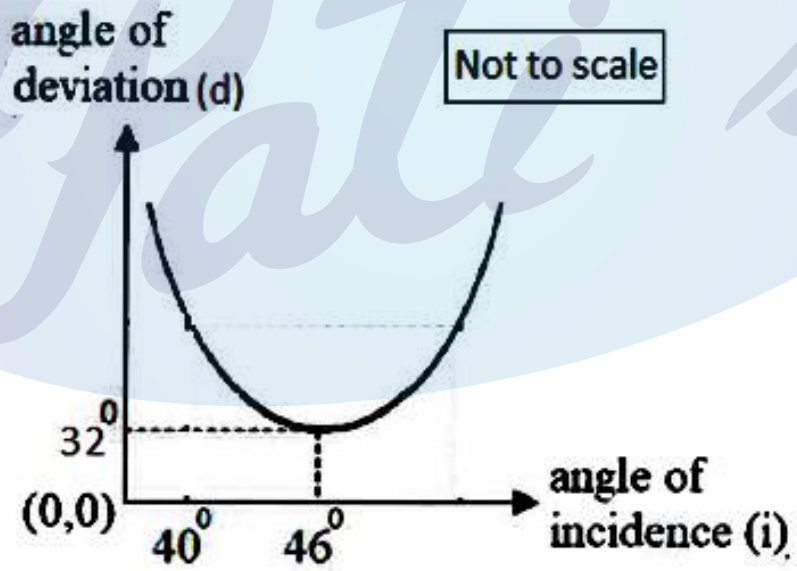
Neat diagram [1]

Correct diagram [1]

Complete diagram [1]



(ii) The diagram below shows the graphical relation between angle of deviation and angle of incidence, when light passes through a triangular prism with angle of the prism A.



Study the graph and answer the following questions:

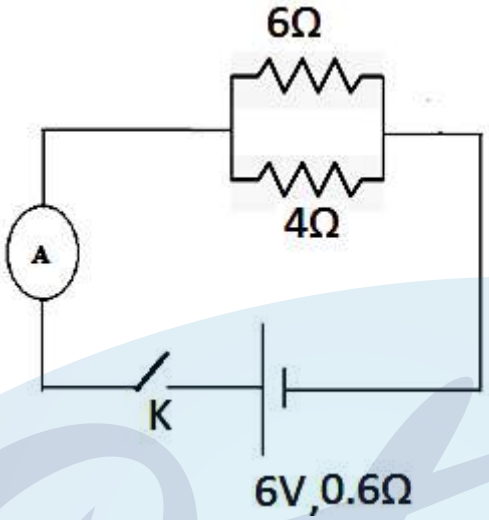
(a) Calculate the angle of the prism A. [2]

D = 32; i1 = i2 = 46 ; A + D = i1 + i2 [1] ; A = 92 – 32 = 60° [1]

(b) With reference to the base of the glass prism, what can be predicted about the direction of the refracted ray within the prism, when the angle of deviation is 32°? [1]

Minimum deviation condition- the refracted ray will pass parallel to the base of the prism. [1]

(iii) Consider the circuit diagram below to answer the questions that follows: [4]



Calculate resistance of the circuit when the key K is:

i) Open. $6 // 4 = 6 \times 4 / 10 = 2.4\ \Omega$ [1]

ii) Closed $2.4 + 0.6 = 3\ \Omega$ [1]

iii) What is the reading in the ammeter A? $I = 6/3 = 2$ A [1]

iv) Current through the 4Ω resistor = $2 \times 6/10 = 1.2$ A. or $V = 6 - 1.2 = 4.8$V ; $I = 4.8/4 = 1.2$ A [1]

Question 5

(i) (a) Write the equation relating mechanical advantage MA, velocity ratio VR and efficiency η. [1]

$\eta = MA/VR$

(b) Among MA, VR and η, which quantity remains constant for a machine of given design. Give reason for your answer. [2]

VR being depending only on the distances, remains constant.

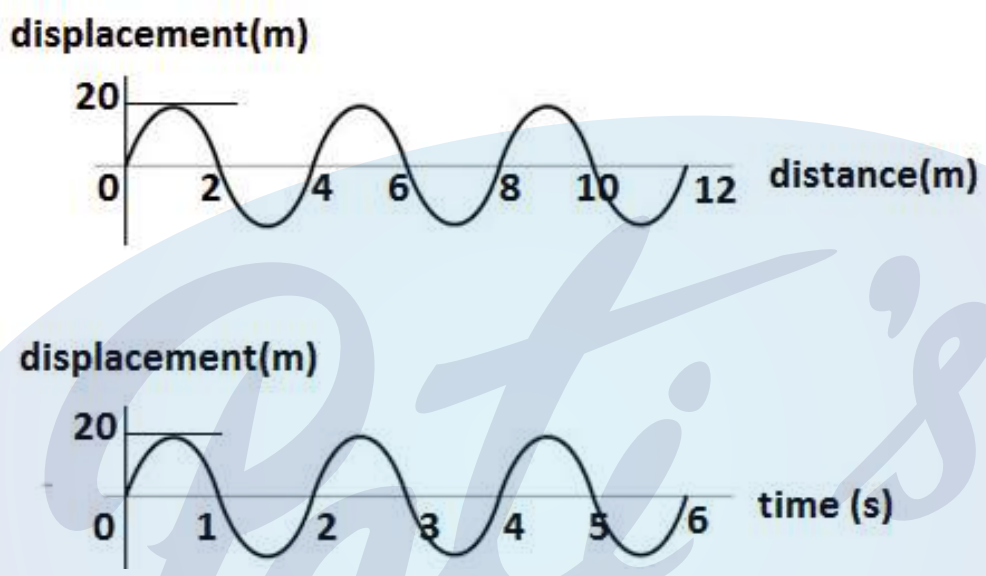
(ii) The specific heat capacities of two liquids L and M are C_L and C_M respectively. C_M is much greater than C_L. [3]

(a) Define specific heat capacity. Amount of heat energy required to raise the temp. of 1 kg of a substance by 1°C

(b) Among Land M, identify the liquid that will be preferred as coolant. M

(c) Give reason for your choice. Liquid with highest specific heat capacity can absorb large amount of heat without much change in its temp.

(iii) The displacement-distance graph and the displacement-time graph for a wave is shown below:



Use the graph to calculate the :

(a) wavelength of the wave 4 m

(b) frequency of the wave ½ = 0.5 Hz

(c) speed of the wave V = 0.5 x 4 = 2 ms^{-1}

(d) amplitude of the wave 20 m [4]

Question 6

(i) A radioactive nucleus undergoes a series of decays according to the sequence:

$X \Rightarrow \beta \Rightarrow X1 \Rightarrow \alpha \Rightarrow X2 \Rightarrow \alpha \Rightarrow X3$

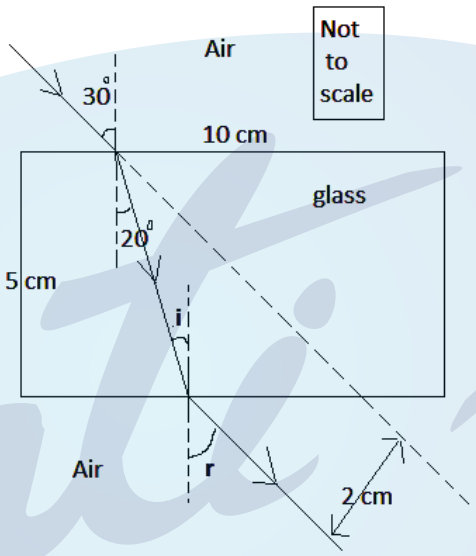
If the mass number and atomic number of X3 are 172 and 69 respectively, what is the mass number and atomic number of X2 , X1 and X? [3]

X2- A - 172+4 = 176 ; Z – 69 + 2 = 71 [1]

X1- A - 176+ 4 = 180 ; Z – 71+2 = 73 [1]

X – A - 180+0 = 180 ; Z - 73 -1 = 72 [1]

(ii) A ray of light passes through a glass block as shown below. Predict the possible values for angles i and r. What is the lateral deviation for the ray? [3]



i= 20°

r = 30°

lateral deviation = 2 cm

(iii) For a science exhibition, two students A and B brought two similar exhibits. Both the exhibits consist of a coil placed in the magnetic field. Student A rotates the coil and a bulb connected to it glows. Student B passes current through the coil and the coil rotates.

(a) Name the phenomena involved with the exhibit of student A.

(b) State the principle based on which the exhibit of student B works.

(c) List the application of the above exhibits in daily life. [4]

(a) Electromagnetic induction

(b) A current carrying conductor when placed in an external magnetic field, experiences a force. [F = B I L]

(c) Exhibit by student A- generator exhibit by student B – electric motor

Question 7

(i) A transformer is used to transmit electrical energy from the generating station. A transformer basically consists of a core, primary windings and secondary windings. It is an integral part of many low- power applications. Depending on the necessity, a step-up transformer or a step-down transformer is used in a circuit.

(a) For a step-up transformer, what can be predicted about the thickness of the wire used in the primary coil with reference to that in the secondary coil.

(b) What is the working principle of a transformer?

(c) The electrical energy transmission from a generating station is at high voltage. Why? [3]

(a) Primary windings are made with thicker wire as it is handling large current. Secondary windings are made using thin wire as the current decreases [with increasing p,d

(b) A transformer works on the principle of electromagnetic induction.

(c) For a given power, a high volt results in low current. This helps to minimize energy loss due to heat, during the electrical energy transmission.

(ii) A man is standing at a distance **d** from a cliff. He claps and hears the echo in 3 s. He moves 170 m away from the cliff. At this position, the echo is heard after 4s. Calculate the distance **d**. [3]

Method 1- time taken by sound to cover 170 m = 4/2 – 3/2 = 2- 1.5 = 0.5 s [1]

So speed = distance/time = 170/0.5 [1] = 340 ms^{-1}. So distance = 340*1.5= 510m [1]

Method 2

Speed of sound, V is the same.

Case 1- V = 2d/3 ……(1)

Case 2- V = 2(d-170)/4 …… (2)

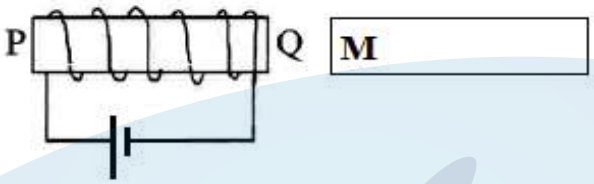
Equating, d/3 = (d-170)/4 [1]

4d = 3d – 510 [1]

d= 510 m.

substituting this is (1), v = 1020/3 = 340 ms^{-1}. [1]

(iii) (a) In the following arrangement, a magnetic material M is attracted towards the coil PQ. Identify the magnetic polarity induced at the end P of the coil. Justify your answer with a suitable reason. [2]

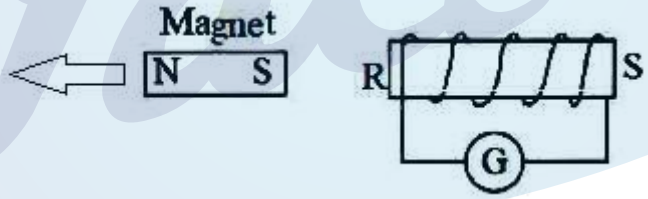


P- current in clockwise direction [1] - South pole [1]

(b) A magnet NS is moved away from the coil RS as shown below.

A deflection is shown in the galvanometer. Give a reason for this phenomena.

Predict the polarity that will be induced at the end R in the arrangement. [2]



Elecctromagnetif induction. [1]

Since the South pole is leaving, North polarity will be at R. [1]

Question 8

(i) (a) Give the new convention for the colour code of live wire.

L- brown ; N- light blue ; E- Green and/or yellow [1]

(b) Two components in a circuit are always connected in series with the live wire.

Name them. [3]

Switch and fuse wire

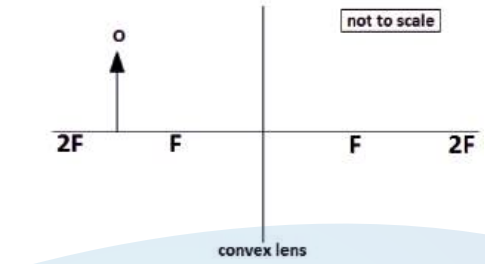
(ii) An object of height 20 cm is placed in front of a lens at a distance of 25 cm. Its virtual, magnified image is formed at a distance of 50 cm.

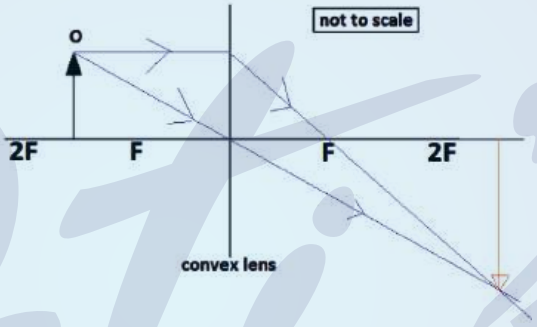
(a) Identify the type of the lens. Convex lens forms a virtual magnified image. [1]

(b) Calculate the size of the image. I/O = 50/25 ; I = 2 x 20 = 40 cm

(c) The focal length of the lens must be greater than 25 cm [3]

(iii) The diagram below shows an object O placed in front of a convex lens.





Redraw and complete the ray diagram showing the formation of the image. Write any one characteristics of the image formed. [4]

Image is real inverted and magnified.

Question 9

(i) (a) Specific latent heat of ice = 336 J g^{-1}. What does this means?

(b) The ice on the top of mountains never melt all together. Why?

(c) We prefer ice to ice-cold water for cooling a drink. Why? [3]

(a) This means, to completely melt 1 g of ice,336 J of energy is needed.

(b) Because each gram of ice needs 336 J of energy to melt and to melt the ice completely, very large amount of energy is required. Heat energy available from the surroundings is very low compared to the energy that is required to melt the ice.

(c) To form the ice from water, 336 J of energy is taken away from the water. So ice will absorb the heat more than that of equal amount of water. Hence its preferred for cooling a drink.

(ii) (a) State one safety precaution in the disposal of nuclear waste.

Used fuel rods should be placed in lead containers, to be disposed in unused mines/water bodies, far from the living area.

(b) For a given mass of nuclear fuel, the energy released during a nuclear fusion reaction is more than that during the nuclear fission reaction. Give reason.

This is because, in a given mass, there are more light nuclei. Each nuclear reaction releases some energy and due to large number of lighter nuclei, the total energy released in a fusion reaction is greater.

(c) Give an example for an internal source and an external source of background radiation. [3]

Internal source - potassium, carbon and radium present inside our body.

External sources - cosmic rays, naturally occurring radioactive elements such as radon and solar radiations.

(iii) (a) A violet ray of light is directed from air to a glass block. The speed of light in air and in glass is 3×10^8 ms^{-1} and 2×10^8 ms^{-1} respectively.

Calculate the refractive index of glass.

$n_g/n_a = c/v$ $\quad n_g/1 = 3/2 = 1.5$

(b) If the wavelength of violet colour is 450 nm in air,

calculate its wavelength when it enters the glass block.

n_g = wavelength in air / wavelength in glass

1.5 = 450/? $\quad$? = 4500/15 = 300 nm

c) What will be the ratio : $\frac{\text{frequency of the violet light in air}}{\text{frequency of the violet light in glass}}$

Give reason for your answer. [4]

Ratio =1

As frequency depends on the source and not in the medium.

ICSE ACADEMY

4

This solved paper

is of Jamnabai Narsee

School, Mumbai

2024-2025

ICSE ACADEMY

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SECOND PRELIMINARY EXAMINATION – JANUARY 2025
PHYSICS

Std.10
Time: 2 hrs.
Marks: 80
Date: 02.01.2025

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

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

This paper consists of 12 printed pages.

SECTION A

(Attempt all questions from this Section.)

Question 1 **[15]**

Choose the correct answers to the questions from the given options.

(i) A boy draws water from a well using a fixed pulley.

The work done by boy is _____.

(a) positive
(b) negative
(c) zero work done
(d) none of these

(ii) Alfiyaa holds a bucket by applying a 10 N force. She then moves a horizontal distance of 5 m and climbs up a vertical distance of 10 m. What is the total work done by Alfiyaa?

(a) 50 J
(b) 100 J
(c) 150 J
(d) 200 J

(iii) Rachael took a thick glass slab whose one opposite parallel face is silvered. She observed that it formed multiple images. This happened on account of _____ .

(a) refraction of light
(b) reflection of light
(c) dispersion of light
(d) both (a) and (b)

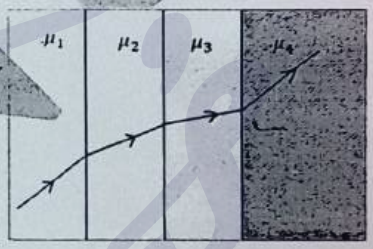
(iv) When a nucleus in an atom undergoes a radioactive decay, then the electronic energy levels of the atom _____ .

(a) change for α – radioactivity, but not for others
(b) change for β – radioactivity, but not for others
(c) change for α and β – radioactivity, but not for γ -radioactivity
(d) do not change for any type of radioactivity

(v) The spectrum (VIBGYOR) of white light can be laterally displaced with 0° deviation using which of the following arrangements?

(a) A single prism with a light ray refracted parallel to its base.
(b) Two prisms of the same refractive index, placed adjacent to each other.
(c) Two prisms of the same refractive index, placed inverted relative to each other.
(d) Three prisms placed alternately.

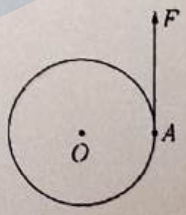
(vi) In Apurva's system, there are four media labelled A, B, C and D with refractive indices $\mu_1 = 1.45$, $\mu_2 = 1.5$, $\mu_3 = 1.55$ and $\mu_4 = 1.45$, respectively. A visible light ray enters from medium A and emerges parallel to its initial direction, as illustrated in the figure.



Which medium has the highest frequency for the visible light ray?

(a) Medium A
(b) Medium C
(c) Medium A and D
(d) Medium A, B, C & D

(vii) The diagram alongside shows a force **F = 5 N** acting at point A produces a moment of force of 6 Nm about point O. What is the diameter of the wheel?



(a) 1.2 m
(b) 2.4 m
(c) 3.4 m
(d) 3.6 m

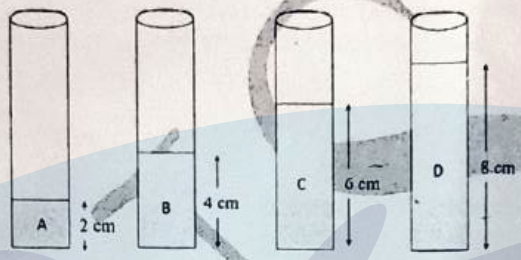
(viii) **Assertion(A):** The efficiency of machine decreases when there is an energy loss due to friction and other factors.
Reason(R): Efficiency is the ratio of useful work output to the total work input including loss.

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

(ix) A new cell is marked 1.5 V when connected to an external resistance, the voltmeter connected to its terminal reads 1.25 V. The drop in potential across the terminals of the cell is due to the _____.

(a) internal resistance of the cell
(b) external resistance
(c) equivalent resistance of the circuit
(d) all of the above

(x) Four identical 10 cm cylinders (A, B, C, and D) are filled with water to varying heights, as shown in the figure.



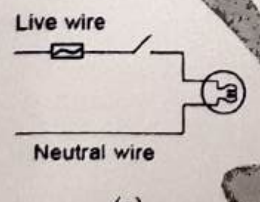
When a vibrating tuning fork is held above cylinder D, a loud sound is heard due to resonance. If the tuning fork is now placed above cylinders A, B and C, which cylinder(s) will also produce the loud sound?

(a) Cylinder A.
(b) Cylinder B.
(c) Cylinder C.
(d) Cylinders A and C.

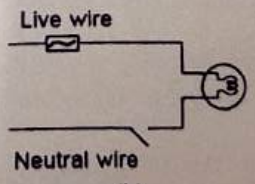
(xi) Large number of thin stripes of black paint are made on the surface of a convex lens of focal length 20 cm to catch the image of a white horse. The image will be:

(a) a white horse with black stripes.
(b) a white horse with reduced brightness.
(c) a completely black horse.
(d) a white horse unaffected by the stripes.

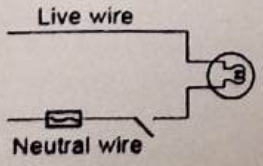
(xii) Which circuit shows the correct and safe position for the fuse and switch?



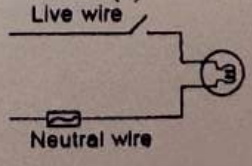
(a)



(b)



(c)



(d)

(xiii) A current-carrying wire, represented by "X" in the **front view**, is placed horizontally between two magnets. The wire experiences a **downward force**, as shown in the adjacent **fig. (1).**

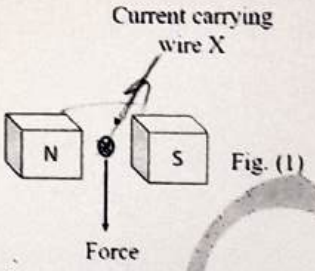


Fig. (1)

If the same wire is positioned **perpendicularly** to the plane of the paper within the field of a U- shaped magnet as shown in the **fig. (2),** what will be the direction of the force acting on the wire?

(a) Upward
(b) Downward
(c) Into the plane of the paper
(d) Out of the plane of the paper

Fig. (2)

(xiv) James takes two blocks, Block 1 and Block 2, made of different metals, and heats them until the temperature of both has increased by 30 °C. He then places both blocks on a desk to cool. Block 2 has a greater **thermal capacity** than Block 1.
Which block loses more energy as it cools to room temperature?
Which block required more energy to raise its temperature by 30°C?

	Lost more energy when cooling	Required more energy to heat up
(a)	block 1	block 1
(b)	block 2	block 2
(c)	block 1	block 2
(d)	block 2	block 1

(xv) Drinks are often cooled by adding ice cubes to them. A delicious mocktail is initially at a temperature of 12 °C when a few ice cubes are added to it.

After some time, some of the ice melts, and the temperature of the cocktail drops to 7 °C.

What is the temperature of the remaining unmelted ice?

(a) 7 °C
(b) 5 °C
(c) 2 °C
(d) 0 °C

Question 2

Complete the following by choosing the correct answers from the bracket. [6]

(i) (a) A block and tackle pulley system consists of 'n' pulleys, with the effort applied in a convenient direction. If the load moves up by a distance (d), the effort end moves through a distance _____. *[n / nd / 2d]*

(b) A spherical air bubble in water will act as _____ lens. *[convex / concave / plano-convex]*

(c) _____ vibrations occur when an object vibrates at its natural frequency without external forces acting after the initial disturbance. *[damped / free / resonant]*

(d) A coil of an alloy _____ is used in electric heater as a resistor. *[tungsten / constantan / nichrome]*

(e) The direction of the magnetic field at the center of a circular coil carrying current in the _____ direction is along the axis of the coil and directed inward, into the plane of the paper. *[clockwise / anticlockwise / radial]*

(f) Fifteen bulbs are connected in series. One bulb is fused and the remaining 14 bulbs are again joined in series and connected to the same supply. The intensity of light will _____ in the room. *[remain constant / increase / decrease].*

(ii) Name the element and kind of nuclear reaction takes place in the following: [2]

(a) in the star

(b) in the nuclear reactor.

(iii) A body of mass 10 kg is kept at a height of 10 m. It is allowed to fall and reach the ground. [2]

(a) What is the total mechanical energy possessed by the body at the height 3 m assuming it is a frictionless medium?

(b) What is the kinetic energy possessed by the body just before hitting the ground?

Question 3

(i) While playing with a convex lens, Rudali observes a printed paper by holding the lens at two different distances: A and B. At distance A, the letters of the printed matter appear magnified, while at position B, the paper begins to burn. [2]

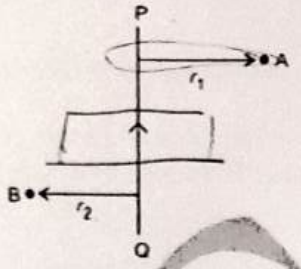
Which of the positions, A or B, is closer to the lens? Why?

(ii) The light bulb in a torch glows when the torch is switched on. This occurs through a sequence of energy transformations. Complete the series of transformations by filling in the blanks: [2]

Energy changes involved:

1. Chemical energy → **2.** _____ → **3.** _____ → **4. Light energy**

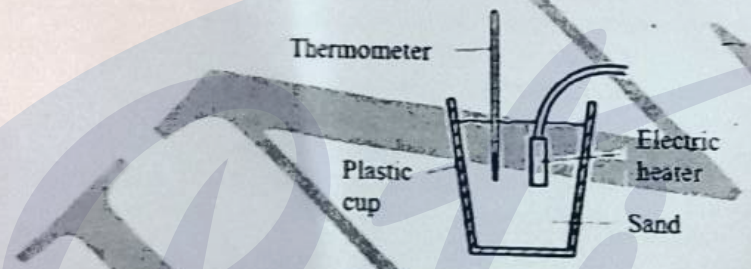
(iii) A current-carrying conductor PQ lies in the plane of the paper, as shown in the figure. Points A and B are located within the magnetic field of the conductor. [2]



(a) At which point does the magnetic field point into the plane of the paper and at which point does it come out of the plane of the paper?

(b) If $r_1 > r_2$, where will the magnetic field strength be greater?

(iv) A plastic cup contains 1000 g of sand, a 50-watt electric heater and a thermometer, as shown in the figure. [2]



If the heater is turned on for 4.2 minutes, raising the sand's temperature from 20 °C to 35 °C, calculate:

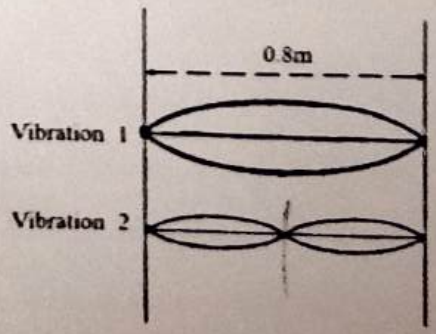
(a) the total energy supplied by the heater.

(b) the specific heat capacity of the sand.

(v) A stretched wire of length 0.8 m is fixed between two rigid supports and vibrates in two different modes, as shown in the figure. [2]

(a) Which vibration will produce a louder sound? Is it vibration 1 or vibration 2?

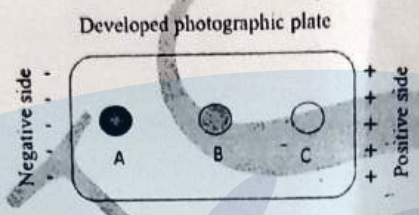
(b) What is the ratio of wavelengths of vibration 1 and vibration 2?



(vi) (a) Name the product of nuclear fission which is utilized to bring about further fission of $^{235}_{92}U$. [2]

(b) Why are gamma rays emitted only in nuclear processes and not in orbital electron transitions?

(vii) The radioactive radiations were allowed to fall on photographic plate, placed in an electric field for few seconds. The photographic plate was developed and three distinct spots (A, B and C) were visible. [3]



Identify radiations responsible for each spot with reasons.

SECTION B

(Attempt any four questions from this Section.)

Question 4

(i) (a) A deep-sea diver tries to spear a fish **underwater** of density 1.025 $g.cm^{-3}$. Should he aim above, below or directly at the fish's observed position to make a direct hit? [3]

(b) If the same diver aims at a bird flying near the water's surface, should he aim above, below, or directly at the bird's observed position? Justify your answer.

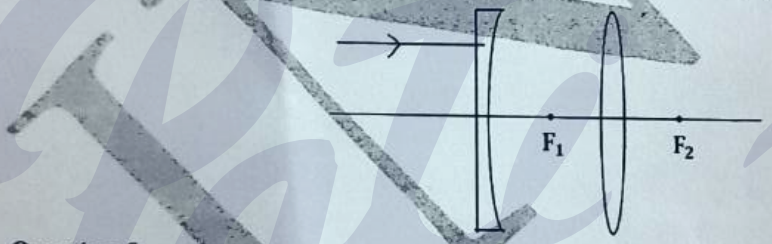
(ii) Prutha saw rays of sunlight entering into a dark room as shown in the figure. She then did something to the air in the room after which she was **NOT** able to see the rays of sunlight in the room. [3]

(a) What could Prutha have done to make the sunlight rays invisible? Justify your answer.

(b) Define the process or phenomenon associated with the case mentioned above in part (a).

(iii) (a) Khushi uses red colour of light to find the refractive index of glass. She then repeats the experiment using green colour of light. Will the refractive index be same or different in two cases? Why? [4]

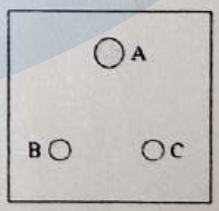
(b) Complete the ray diagram to show the path of a ray that travels parallel to the principal axis, as it enters, passes through, and exits the lens system.



Question 5

(i) Three wires with proper colour coding are connected to the three terminals of a three-pin socket. Match the colour of the wire with the proper terminals A, B and C of the socket. [3]

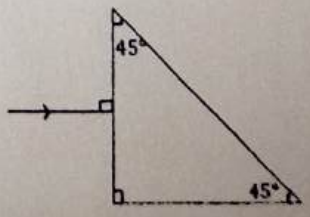
(a) Brown
(b) Green
(c) Light blue



(ii) In the diagram, a narrow beam of white light is incident on a right-angled isosceles prism. [3]

The critical angle of the material of prism for yellow colour of white light is **45°**.

Complete the ray diagram to show the path of Blue, Yellow and Red colours of white light till they emerge out of the prism.



(iii) A student conducted an experiment to study the image formation by a convex lens by placing an object at distances of 25 cm, 30 cm, 40 cm, 60 cm and 120 cm in front of the lens. [4]
For each position of the object, he recorded the image distance(v) from the lens.

However, the recorded image distances 100 cm, 24 cm, 60 cm, 30 cm, and 40 cm were written in the wrong order.

(a) Using the properties of a convex lens, find the correct order of the image distances corresponding to the given object distances and redraw the table with corrected result.

Object distance(u)	Image distance(v)
-25 cm	
-30 cm	
-40 cm	
-60 cm	
-120 cm	

(b) Calculate the focal length of the lens.
(c) What will be the image distance if the object is placed at the distance of 90 cm? Show the necessary calculations.

Question 6

(i) (a) Calculate the height through which a crane can lift a load of 4000 kg, when its motor of 4 HP operates for 10 s. [Take 1 HP = 746 watt, g = 10 $m.s^{-2}$] [3]

(b) A moving body weighing 400 N possesses 500 J of kinetic energy. Calculate the velocity with which the body is moving. [Take g = 10 ms^{-2}]

(ii) Calculate the position of the fulcrum at which a **uniform** meter rule of mass 20 gf can be balanced when three weights 50 gf, 20 gf and 400 gf are applied at 10 cm, 40 cm and 80 cm respectively. [3]

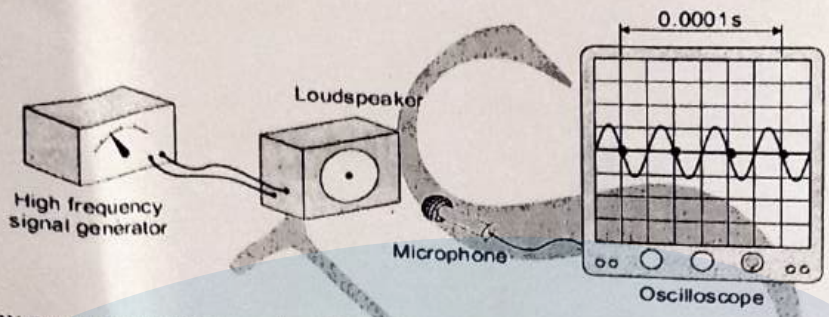
(iii) (a) A body falls freely under gravity from rest. Name the kind of energy it will possess **while falling.** [4]
(b) In a block and tackle system of pulleys, why does the mechanical advantage increase with an increase in the number of pulleys?
(c) Why a ship loaded with light goods is more liable to be over turned than the one loaded with heavy goods?

Question 7

(i) (a) A block and tackle system has 4 **pulleys** with a **velocity ratio** (VR) of 5. [3]
Draw a labelled diagram of the system, clearly indicating the direction of the load, the effort and the components of tension.

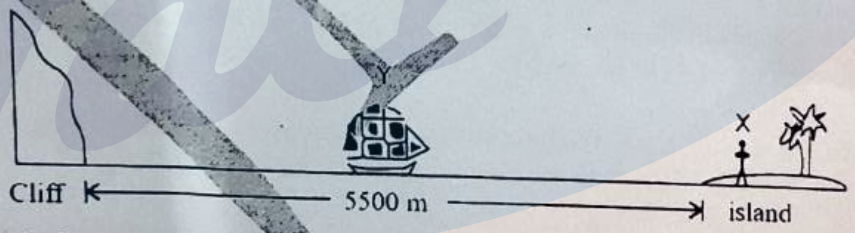
(b) What will be the velocity ratio (V.R.) of the above system if the weight of the movable block is doubled and the efforts are being applied in a **convenient direction**? Will it increase by 1, decrease by 1 or remain the same?

(ii) The diagram shows a microphone being used to detect the output from a loudspeaker. The oscilloscope trace shows the wave pattern produced by the loudspeaker [3]



(a) How many waves are produced by the loudspeaker in 0.0001 seconds?
(b) How many waves are produced by the loudspeaker every second? Assume the input to the loudspeaker does not change.
(c) Explain why a person with normal hearing cannot hear the sound produced by the loudspeaker.

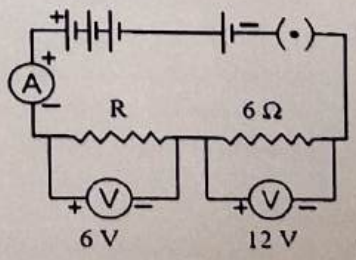
An observer on an island is 5500 m away from a vertical cliff. A ship is anchored between the island and the cliff. When the ship's siren blasts, the observer hears the sound twice with a time gap of 5 seconds. [4]



If the speed of sound is 330 m/s:
(a) Calculate the distance of the ship from the island.
(b) What is the distance of the ship from the cliff?

Question 8

(i) In the given circuit diagram: [3]



(a) Find the potential difference across the battery terminals.
(b) Determine the current measured by the ammeter.
(c) Calculate the resistance R.

(ii) (a) Complete the following radioactive reaction: [3]

$$\,^{\square}_{\square}X \rightarrow \,^{\square}_{\square}Y + \,^{4}_{2}He \rightarrow \,^{234}_{91}Z + \,^{0}_{-1}e$$

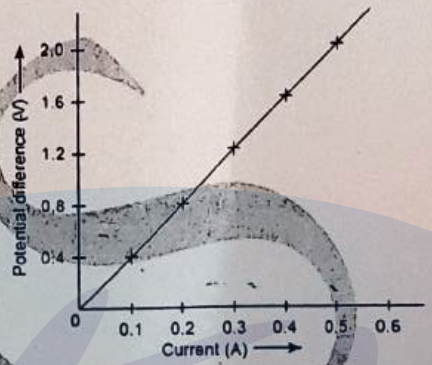
(b) What is the importance of boron and cadmium rods in a nuclear reactor?

(iii) The V- I graph for a nichrome wire is shown below. [4]

(a) What do you infer from this graph?

(b) What conditions must be maintained to ensure accurate observations of the V-I characteristic while verifying it experimentally?

(c) Draw a labelled circuit diagram to obtain the given graph.



Question 9

(i) Calculate the specific heat capacity of 100 g of oil if its temperature rises from 20 °C to 80 °C in 5 minutes. The oil is heated by a nichrome wire connected to a 10 V supply with a current of 1.7 A. [3]

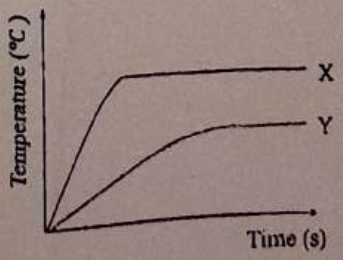
(ii) (a) The melting point of naphthalene is 80 °C and the room temperature is 30 °C. A sample of liquid naphthalene at 100 °C is cooled down to room temperature. [3]

Draw a temperature-time graph to represent this cooling process. In the graph, mark the region that corresponds to freezing.

(b) Albert, Shivani and Myra are analyzing the heating of two beakers, X and Y, each containing **different liquids**. Both beakers contain the **same mass** of liquid and are heated using the same heater set to the same power.

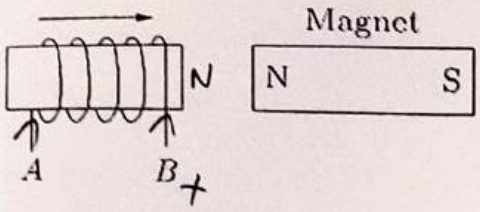
The graph shows how the temperature of each liquid changes with time.
Based on the graph, each student makes the following conclusions:

Albert: X has a higher melting point than Y.
Shivani: Y boils sooner than X.
Myra: X has a lower specific heat capacity than Y.



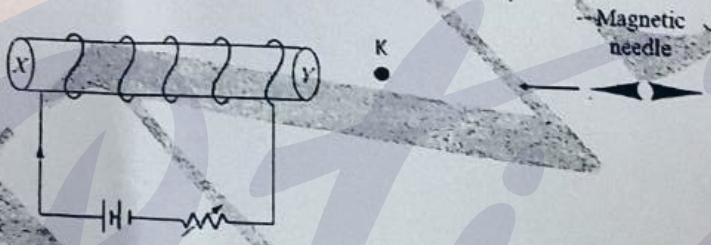
Who is correct and why?

(iii) (a) In the following diagram, an arrow shows the motion of the coil towards the bar magnet. [4]



1. In which direction does the current flow in the coil: from A to B or from B to A?
2. If a galvanometer is connected to a coil at points A and B, how does the galvanometer pointer deflect when the magnet and coil are moved rightward at the speed of 30 m/s?

(b) The figure shows a magnetic compass needle aligning with the geographic north-south direction when placed far from the current-carrying solenoid. Point K lies within the mganetic field of the solenoid.



1. When the compass needle is brought to point K, which pole of the needle will experience a repulsive force?
2. How can the strength of the magnetic field of this solenoid be increased without adding more turns to the coil?

****

Question 1

i) (b) negative
ii) (b) 100 J
iii) (d) both (a) and (b)
iv) (c) change for α and β-radioactivity but not for γ-radioactivity
v) (c) Two prisms of the same refractive index, placed inverted relative to each other.
vi) (d) Medium A, B, C & D
vii) (b) 2.4 m
viii) (c) A is true but R is false.
ix) (a) internal resistance of the cell
x) (b) cylinder B
xi) (b) a white horse with reduced brightness
xii) (a)
xiii) (d) out of the plane
xiv) (b) block 2, block 2
xv) (d) $0°C$

Question 2

i) a) nd
b) concave
c) damped
d) Nichrome
e) Clockwise
f) increase

ii) a) Hydrogen-Nuclear Fusion
b) Uranium-Nuclear Fission

iii) a) Total ME=$10 \times 10 \times 10 = 1000$ J
b) Kinetic energy =1000 J

Question 3

i) Position A in closer to lens because at position B the object is very far from lens such that parallel rays are converging at the paper to burn it

ii) Chemical to Electrical to Heat to Light

iii) (a) At point A magnetic field points into the plane of paper at point B magnetic field comes out of plane of paper

(b) Magnetic field at B will be greater because magnetic field strength of a straight conductor is inversely proportional to distance from the wire

iv) $m = 1kg$
$P = 50W$
$t = 4.2\ min = 252\ s$
$\Delta T = 15℃$

a) $E = P \times t = 50 \times 252 = 12{,}600\ J$

b) $c = \frac{Q}{m\,\Delta T} = \frac{12{,}600}{1 \times 15} = 840\ Jkg^{-1}K^{-1}$

v) a) Vibration 1

b) $\frac{\lambda_1}{\lambda_2} = \frac{2}{1}$

vi) (a) slow moving neutron.

(b) Because gamma says originate from the nucleus when a nucleus is in excited state The transition of orbital electrons does not affect the nucleus

vii) A: alpha particle, because alpha particles being positive, gets deflected towards negative charg

B:- Gammaradiation, because being uncharged, gamma does not get deflected

C:- Beta particles, because being negative in the nature, it deflects towards positive side

Question 4

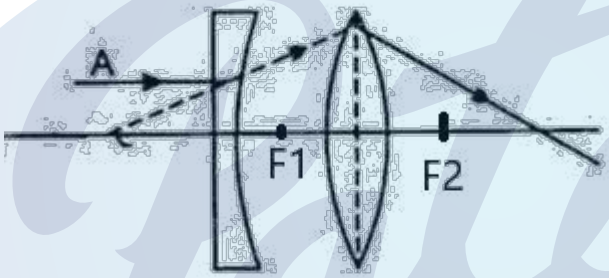
i) (a) He can aim directly at the fish since both the diver & fish are in the same medium (water)

(b) He should aim below the bird because due to refraction of light the bird would appear farther away than it actually is at water-air interface

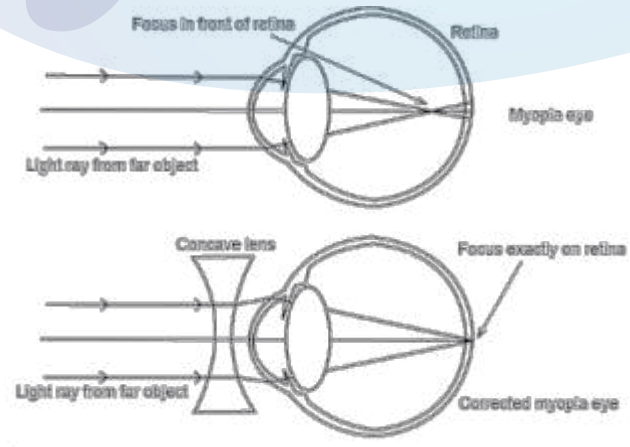
ii) (a) Earlier the sun rays were visible due to it being scattered by particles (dust) in the air. When the dust was caused to settle down there was no scattering and rays were not visible.
(b) Scattering is process of absorption & reemission of light.

iii) (a) The refractive index will be different in both the cases. Refractive index of a medium is different for different colours as the speed of each colour is different.

(b)



HINT for the above question:

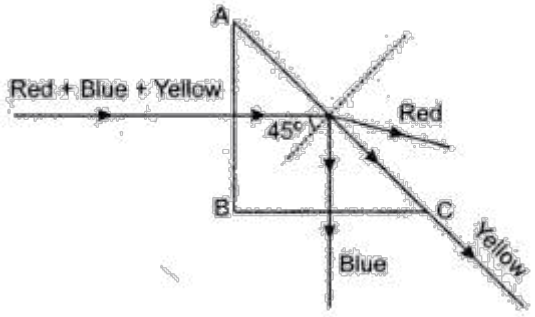


Please note that the myopic eye diagram is not the part of the answer

Question 5

i) A:- Green B:-light Blue C:-Brown

ii) B+Y+R



iii) (a)

Object Distance	Image Distance
-25 cm	100 cm
-30 cm	60 cm
-40 cm	40 cm
-60 cm	30 cm
-120 cm	24 cm

(b) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{100} - \frac{1}{(-25)} = \frac{5}{100} = \frac{1}{20}$

$\therefore f = 20$ cm

(c) $u = -90$ cm

$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\therefore \frac{1}{20} = \frac{1}{v} - \frac{1}{(-90)}$

$v = \frac{180}{7} = 25\frac{5}{7} = 25.71$ cm

Question 6

i) (a)

$P = 4HP = 2984W,$

$t = 10s$

$g = 10\ ms^{-2}$

$m = 4000kg$

$F = mg = 4000 \times 10 = 40000N$

$E = P \times t = 2984 \times 10 = 29840\ J$

$W = F \times s$

$\therefore 29840 = 40000 \times s$

$\therefore s = \frac{29840}{40000} = 0.746\ m$

Ans:- The crane lifts load the through height of $0.746\ m$

(b) $F = 400\ N$

$g = 10\ ms^{-2}$

$\therefore m = 40\ kg$

$KE = 500\ J$

$KE = \frac{1}{2}mv^2$

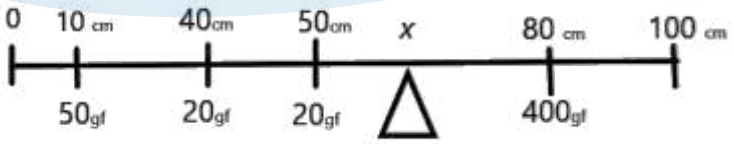
$500 = \frac{1}{2} \times 40 \times v^2$

$v^2 = \frac{500 \times 2}{40} = 25$

$\therefore v = 5\ ms^{-1}$

Ans: Body is moving at velocity of $5\ ms^{-1}$

ii)



As per principle of moments:

Sum of Anticlockwise moments = Sum of clockwise moments

$(x - 10).50 + (x - 40).20 + (x - 50).20 = (80 - x).400$

$50x - 500 + 20x - 800 + 20x - 1000 = 32000 - 400x$

$490x = 34300$

$x = 70\ cm$

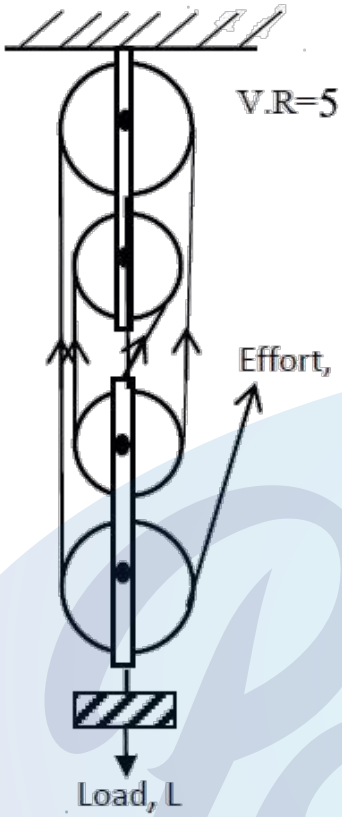
Ans:- the fulcrum should be at $70\ cm$ mark

iii) (a) During the fall it has both Kinetic & Potential energy

(b) The MA isthe number of ropes supporting the moving load. When more pulleys are added number of string supporting the load increases which decreases the amount of force required to move the object.

(c) A Body with lower position of centre of gravity is more stable. A ship loaded with heavier goods has its centre of gravity lower than that of a ship loaded with lighter goods.

i)

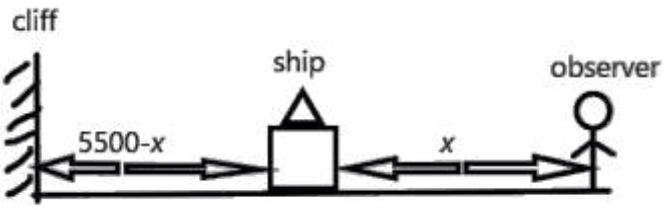


ii) (a) 3 waves

(b) Waves in 1 second = 3x10000= 30,000waves

(c) The audible range of frequency for humans is 20Hz to 20,000 Hz but this sound has frequency of 30,000Hz;hence it cannot be heard

iii)



a) Let the distance between observer & ship =x

Distance between ship & cliff = $5500 - x$

let time at which first sound is heard =t_1

$Speed = \frac{Distance}{Time} \Rightarrow Time = \frac{Distance}{Speed}$

$t_1 = \frac{x}{330}$

let time of which second sound is heard = t_2

$t_2 = \frac{(5500-x)+5500}{330} = \frac{11000-x}{330}$

$\therefore t_2 = t_1 + 5$

$\therefore \frac{11000-x}{330} = \frac{x}{330} + 5$

$\therefore x = 4675 \text{ m}$

The distance of ship from upland is 4675 m

b) Distance between ship & cliff $= 5500 - x = 5500 - 4675 = 825 \text{ m}$

This distance of ship from the cliff is 825 m

Question 8

i) (a) $\text{PD} = 6 + 12 = 18 \text{ V}$

(b) $\text{I} = \frac{\text{V}}{\text{R}} = \frac{12}{6} = 2\text{A}$

(c) $R = \frac{V}{I} = \frac{6}{2} = 3\ \Omega$

ii)

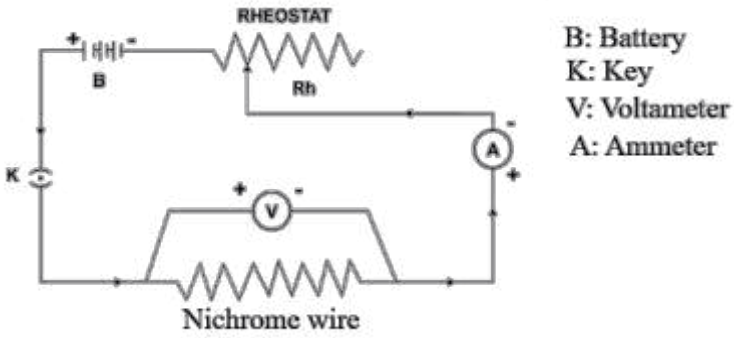
(a) $^{238}_{92}X \xrightarrow{\alpha} {}^{234}_{90}Y + {}^{4}_{2}He^{*} \xrightarrow{\beta} {}^{234}_{91}Z + {}^{0}_{-1}e$

(b) Boron & Cadmium rods absorb the neutron which hit them. so by using Boron & Cadmium rods we can control the number of further fissions which can take place.

iii) (a) Nichrome is ohmic material since the graph is linear indicating that Potential Difference is proportional to current

(b) the temperature & physical conditions of wire must be kept constant

(c)



B: Battery
K: Key
V: Voltameter
A: Ammeter

Question 9

i) $V = 10\ V$

$I = 1.7\ A$

$R = \frac{10}{1.7}\ \Omega$

$t = 5\ min = 300\ s$

$H = I^2Rt = 1.7 \times 1.7 \times \frac{10}{1.7} \times 300 = 5100\ \text{J}$

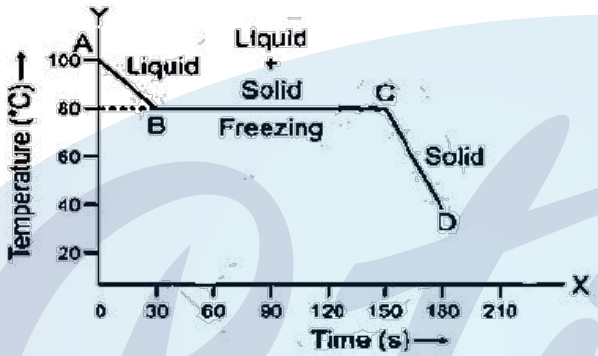
$m = 100\ g$

$\Delta T = 60°\text{C}$

$c = \frac{5100}{100 \times 60} = 0.85\ Jg^{-1}°\text{C}^{-1}$

ii)

(a)



The region BC indicate freezing

(b) X has lower specific heat capacity than Y because for the same heat supplied at same power, liquid Xshows faster rise in temperature than liquid Y

iii) (a) B to A.

If both coil & magnet are moving with same speed in same direction, galvanometer does not deflect

(b)

1. North pole of needle experiences repulsion
2. By increasing the amount of current using wing rheostat

ICSE ACADEMY

5

This solved paper

is of Universal High

School, Mumbai

2024-2025

ICSE ACADEMY

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BOOSTER EXAMINATION - 2024-2025

PHYSICS

Time allowed: Two hours

CLASS X

DATE: 09/12/2024 **MARKS: 80**

Answers to this Paper must be written on the paper provided separately.
You will not be allowed to write during 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 A is compulsory. Attempt any four questions from Section B. The intended marks for questions or parts of questions are given in brackets [ ]

SECTION A

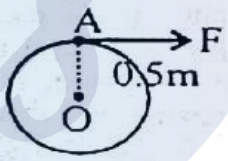
(Attempt all questions from this Section.)

Question 1

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

(i) The diagram alongside shows a force F acting at point A, such that it produces a moment of force of 20 Nm in clockwise direction. Calculate the magnitude of force F.

a) 10 N
b) 30 N
c) 20 N
d) 40 N



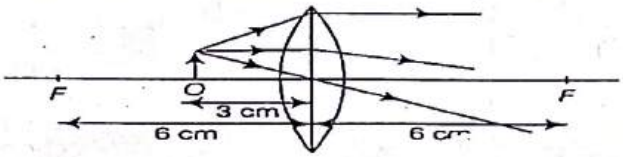
(ii) Diamonds sparkle more than the glass, because they have:

a) both smaller critical angle than the glass and larger critical angle than the glass
b) larger critical angle than the glass
c) smaller critical angle than the glass
d) critical angle plays no role

(iii) **Assertion (A):** In case of refraction of light through glass slab, angle of incidence is equal to angle of emergence.
Reason (R): A glass slab is cuboid made of glass in which refraction occurs twice from the corresponding parallel surfaces.

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

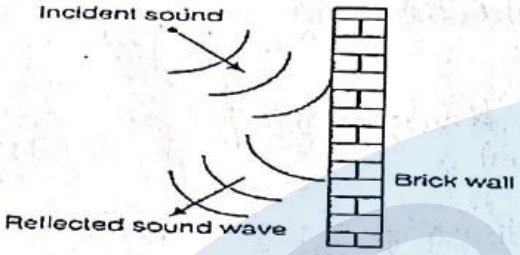
(iv) The diagram shows an object O placed 3 cm away from a converging lens of focal length 6 cm.



What type of image is produced?
a) Real, upright and diminished
b) Virtual, upright and magnified
c) Virtual, inverted and diminished
d) Real, inverted and magnified

(v) Two notes are produced from a flute and piano, such that they have same loudness and same pitch. The notes so produced differ in their:
a) speed
b) waveform
c) frequency
d) wavelength

(vi) A sound wave is reflected from a brick wall. Compared with the incident wave, the reflected wave has

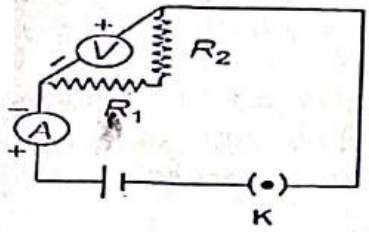


a) a shorter wavelength
b) a greater amplitude
c) the same speed
d) the same velocity

(vii) An electric device gives out 5760 J of heat energy in 1 min, when current flows through it at a p.d. of 24 V. Find the resistance of the device.
a) 5Ω
b) 2Ω
c) 6Ω
d) 3Ω

(viii) **Assertion (A):** In a chain of bulbs, 50 bulbs are joined in series. One bulb is removed now and circuit is completed again. If the remaining 49 bulbs are again connected in series across the same supply, then light gets decreased in the room.
Reason (R): Net resistance of 49 bulbs will be less than 50 bulbs.
a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

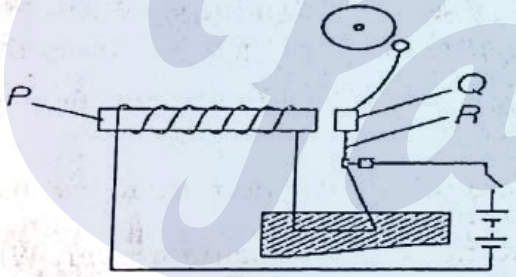
(ix) I. The resistors R_1 and R_2 have not been correctly connected in parallel.
II. The voltmeter has not been correctly connected in the circuit.
III. The ammeter and the key have not been correctly connected in the circuit.



Out of these three, the actual fault in this circuit is/are
a) Only II
b) Only I
c) Both I and II
d) Both II and III

(x) By reversing the direction of current in an electromagnet, the magnetic field produced by it
a) remains unchanged in strength and direction
b) gets reversed in direction
c) decreases in strength
d) increases in strength

(xi) The diagram shows an electric bell.



Which materials would be suitable for the parts labelled P, Q and R?

	P	Q	R
(a)	Soft iron	Brass	Soft iron
(b)	Soft iron	Soft iron	Spring steel
(c)	Soft iron	Brass	Brass
(d)	Spring steel	Soft iron	Spring steel

a) Option (a)
b) Option (b)
c) Option (c)
d) Option (d)

(xii) The base of cooking pans is made thicker and heavy because:
a) it lowers the heat capacity of pan
b) it increases the heat capacity of pan
c) the food does not get charred and keeps hot for long time
d) both it lowers the heat capacity of pan and the food does not get charred and keeps hot for long time

(xiii) Heat energy is given to 80 g of alcohol (sp. heat capacity 2200 J^{-1} Kg^{-1}) when its temperature rises by 20 K. If the same heat energy is given to 200 g of mercury of specific heat capacity 140 J $kg^{-1}K^{-1}$, what is the rise in temperature?
a) 215.7 K
b) 251.7 K
c) 152.7 K
d) 125.7 K

(xiv) The atoms of same element having same atomic number, but different atomic masses are called:
a) isotones
b) both isotopes and isobars
c) isobars
d) isotopes

(xv) A convex lens of focal length 40 cm, a concave lens of focal length 40 cm and a concave lens of focal length 15 cm are placed in contact. The power of the combination in dioptre is
a) 1.5
b) + 6.67
c) + 1.5
d) 6.67

Question 2

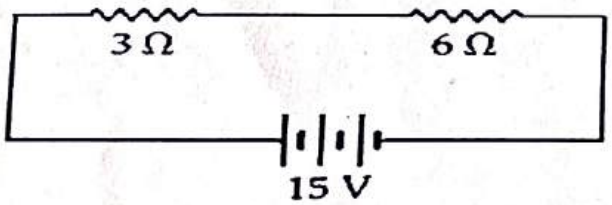
(i) a) Why does a rope walker hold a long pole in his hands?
b) The passengers in a boat are not allowed to stand while crossing a river. Why?
c) The screw drivers have long handles. Why? **[3]**

(ii) How can you define the term **refractive index of a medium**? State whether it can be less than 1 or not? **[2]**

(iii) Give two characteristics of virtual image formed by a concave lens. **[2]**

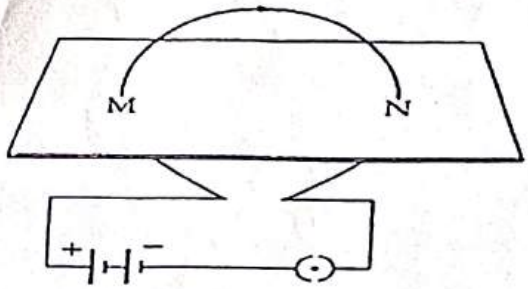
(iv) A radar sends a signal to an aeroplane at a distance 4.5 km away with a speed of $3\times10^{8}ms^{-1}$. After how long is the signal received back from the aeroplane? **[2]**

(v) In the given circuit, find the potential drop on 3Ω resistor **[2]**



(vi) A family uses a light bulb of 100 W, a fan of 100 W, and a heater of 1000 W, each for 8 h a day. If the cost of electricity is₹ 2 per unit, what is the expenditure for the family per day on electricity? [2].

(vii) The diagram given shows a current carrying loop or a circular coil passing through a sheet of cardboard at the points M and N. The sheet of cardboard is sprinkled uniformly with iron fillings.



Copy the diagram and draw the pattern of arrangement of the iron fillings when current is passed through the loop. [2]

Question 3

(i) State the direction of: [2]
a) Centripetal force
b) Centrifugal force.

(ii) Sometimes when a vehicle is driven at a particular speed, a rattling sound is heard.
a) Why this happens? Give the name of the phenomenon taking place?
b) Suggest one way by which the rattling sound could be stopped. [2]

(iii) How does earthing prevent electrical shock? [2]

(iv) Name two factors on which the magnitude of force on a current carrying conductor placed in a magnetic field depends and state how does the force depend on the factors stated by you. [2]

(v) If a liquid A of specific heat capacity 1050 J kg^{-1} K^{-1} and at 90°C is mixed with liquid B of specific heat capacity 2362.5 J kg^{-1} K^{-1} and at 20°C, when the final temperature recorded is 50°C. Determine the ratio of the masses of liquids mixed? [2]

SECTION B

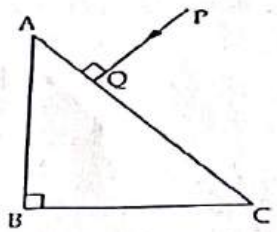
(Attempt any four questions.)

Question 4

(i) 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. [3]

(ii) A 5 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from lens is 30 cm. Determine the [3]
a) position
b) nature
c) size of image formed

(iii)A ray of light PQ is incident normally on the hypotenuse of a right angled prism ABC as shown in the diagram. [4]



a) Copy the diagram and complete the path of the ray PQ till it emerges from the prism.
b) What is the value of the angle of deviation of the ray?
c) Name an instrument where this action of the prism is used.

Question 5

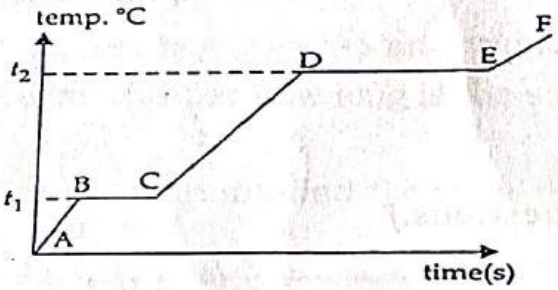
(i) a) Write an expression for the electrical energy spent in the flow of current through an electrical appliance in terms of I, R and t. [3]
b) At what voltage is the alternating current supplied to our houses?
c) How should the electric lamps in a building be connected?

(ii) a) An electrical gadget can give an electric shock to its user under certain circumstance. Mention any two of these circumstances.
b) What preventive measure provided in a gadget can protect a person from an electric shock? [3]

(iii)State two similarities and two differences between a d.c. motor and a.c. generator. [4]

Question 6

(i) a) The diagram below shows the change of phases of a substance on a temperature vs time graph on heating the substance at a constant rate. [3]



b) Why is the slope of CD less than slope of AB?
c) What is the boiling and melting point of the substance?

(ii) A nucleus ${}_{Z}X^{A}$ emits an alpha particle followed by γ - emission, there after it emits two β - particles to form X_3 [3]

a) Copy and complete the value of A and Z for X_3

$$\overset{A}{X}X \xrightarrow{-\alpha} X_1 \xrightarrow{-\gamma} X_2 \xrightarrow{-2\beta} X_3$$

b) Out of α, β and γ radiation.

(i) Which radiation is the most penetrating?

(ii) Which radiations are negatively charged?

(iii) a) Define moment of couple. Write its S.I. units. [4]

b) State two conditions for a body, acted upon by several forces, to be in equilibrium.

Question 7

(i) a) With reference to the direction of action, how does a centripetal force differ from a centrifugal force during uniform circular motion?

b) Is centrifugal force the force of reaction of centripetal force?

d) Compare the magnitudes of centripetal and centrifugal force. [3]

(ii) How does the value of angle of deviation produced by a prism change with an increase in the following. [3]

a) Value of angle of incidence?

b) Wavelength of incident light?

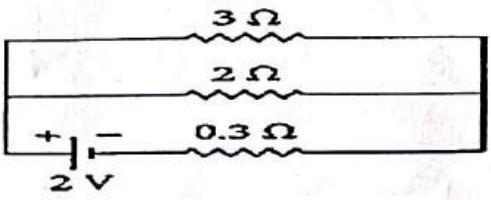
(iii) The diagram below shows the position of an object AB in relation to a convex lens. Draw two rays to locate the position of the image and state the characteristics of the image. [4]

Question 8

(i) Aditi clapped her hands near a cliff and heard the echo after 4 s. What is the distance of the cliff from her, if the speed of sound is taken as 346ms^{-1} ? [3]

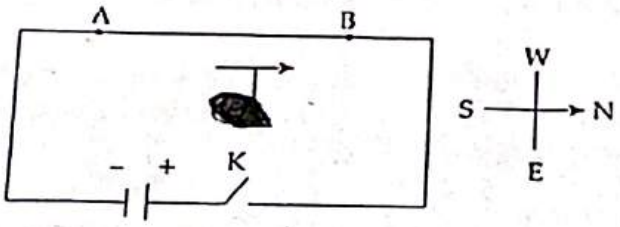
(ii) What is an electrical fuse? State two characteristics of an electrical fuse. [3]

(iii) An electrical circuit was set up as shown. Find the current flowing through each of the resistances in the circuit. [4]



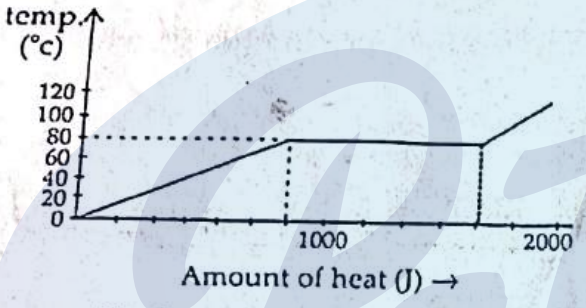
Question 9

(i) The diagram below shows a magnetic needle kept just below the conductor AB which is kept in North - South direction. [3]



a) In which direction will the needle deflect when the key is closed?
b) Why is the deflection produced?
c) What will be the change in the deflection if the magnetic needle is taken just above the conductor AB?

(ii) A substance is in the form of a solid at 0°C. The amount of heat added to this substance and the temperature of the substance are plotted on the following graph [3]



If the specific heat capacity of the solid substance is 500 J/kg°C, find from the graph
a) The mass of the substance
b) The specific latent heat of fusion of the substance in the liquid state.

(iii) An atomic nucleus A is composed of 84 protons and 128 neutrons. The nucleus A emits an alpha particle and is transformed into a nucleus B. [4]
a) What is the composition of B.
b) The nucleus B emits a beta particle and is transformed into a nucleus C. What is the composition of C?
c) What is mass number of the nucleus A?
d) Does the composition of C change if it emits gamma radiations?

Question 1

i) d) $40\ \text{N}$
ii) c) smaller critical angle than glass
iii) a) Both A and R are true and R is the correct explanation of A.
iv) b) Virtual, uprightandmagnified
v) b) waveform
vi) c) same speed
vii) c) 6Ω
viii) d) A is false but R is true
ix) a) Only II
x) b) get reversed in direction
xi) b) soft iron, soft iron, spring steel.
xii) b) it increases the heat capacity of pan
xiii) d) $125.7\ \text{K}$
xiv) d) isotopes
xv) d) -6.67

Question 2

i) a) During rope walking, the walker can adjust the weight of pole on both sides to keep his equilibrium as per the principle of moments & balance his body vertically.

b) Because in standing position, the location of centre of gravity rises upward which makes theboat less stabl e & prone to be & toppled by waves.

c) More the distance (perpendicular) from pivoted point, lesser force is required. so a larger handle is provided in a screw driver

ii) Absolute refractive under of a medium is the ratio of speed of light in air or vacuum to the speed of light in that medium. It cannot be lesser than 1 because speed of light is maximum in air or vacuum.

iii) Images are virtual, erect & diminished

iv) $d = 4500\ \text{m}$

$v = 3 \times 10^8\ \text{ms}^{-1}$

$v = \frac{2d}{t}$

$\therefore t = \frac{2d}{v} = \frac{2\times4500}{3\times10^8} = 3 \times 10^{-5}\text{s}$

Ans. The signal is received back in 3×10^{-5} seconds

v) $R_s = 3 + 6 = 9\Omega$

$V = IR$

$\therefore I = \frac{V}{R} = \frac{15}{9} = \frac{5}{3}\text{A}$

p.d. across 3Ω:

$V = IR = \frac{5}{3} \times 3 = 5\text{V}$

vi) Power of bulb = 100W
Power of fan = 100W
Power of heater = 1000W

Total Power :$\text{P} = 100 + 100 + 1000 = 1200\text{W} = 1.2\text{kW}$

$t = 8h$

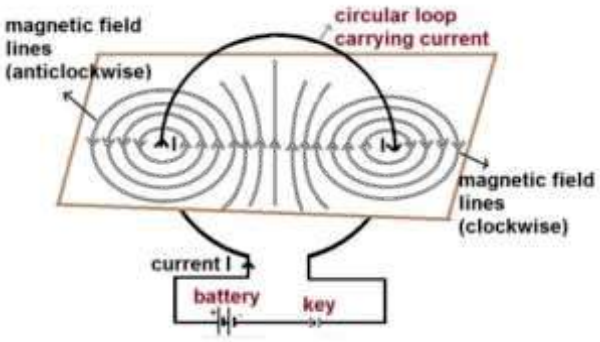
Rate: ₹2 per kWh

$E = P \times t = 1.2 \times 8 = 9.6\ \text{kWh}$

Cost=$9.6 \times 2 = ₹19.2$

Ans. Total cost is₹19.2

vii)



Question 3

i) a) Directed inwards: towards the centre

b) Directed outward: away from the centre

ii) a) The phenomenon is called Resonance.
It occurs when at a particular speed of vehicle, the frequency produced by pistons of the engine match with natural vibrating frequency of body of vehicle, causing it to vibrate with an increased amplitude
b) Change the speed of vehicle

iii) If due to some fault, the current leaks into metal body of appliance, the earth wire conducts the current from appliance's body to the local earthing in ground through earth socket & ring. Thus preventing electrical shock

iv) a) magnitude of current (I): more the magnitude of current more is the force

b) Magnetic field strength (B): make the strength of the magnet, more is the force

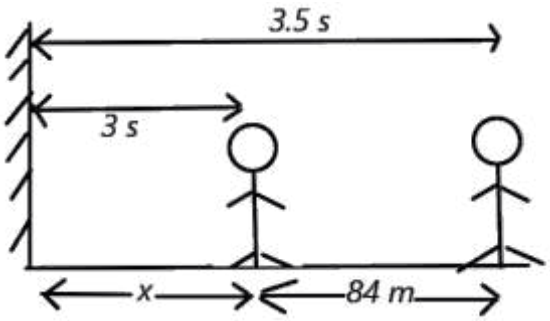
v) $c_A = 1050\ \text{Jkg}^{-1}\text{K}^{-1}$
$\Delta T_A = 40°\text{C}$
$c_B = 2362.5\ \text{Jkg}^{-1}\text{K}^{-1}$
$\Delta T_B = 30°\text{C}$

As per the principle of calorimetry,

$m_A c_A \Delta T_A = m_B c_B \Delta T_B$
$m_A \times 1050 \times 40 = m_B \times 2362.5 \times 30$
$\therefore \frac{m_A}{m_B} = \frac{189}{113}$

Question 4

i)



Echo I:

$v = \frac{2(84+x)}{3.5}$

Echo II:

$v = \frac{2x}{3}$

Comparing equations I & II :-

$\frac{2(84+x)}{3.5} = \frac{2x}{3}$ (Since speed of sound is the same in both cases)

$x = 504 \text{ m}$

Ans: The distance between cliff & initial probation is 588 m

ii) $h_O = 5 \text{ cm}$

$f = 20 \text{ cm}$

$u = -30 \text{ cm}$

a) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\therefore \frac{1}{20} = \frac{1}{v} - \frac{1}{(-30)}$

$\frac{1}{v} = \frac{1}{20} - \frac{1}{30}$

$\therefore v = 60 \text{ cm}$

Ans: Image is located 60 cm behind the lens

b) $m = \frac{v}{u} = \frac{60}{-30} = -2$

The image formed is real, inverted and magnified.

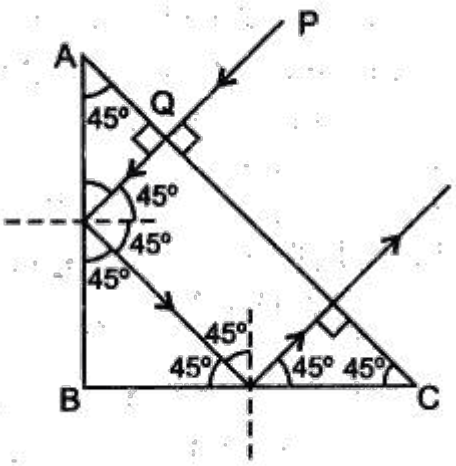
c) $\frac{h_I}{h_O} = \frac{v}{u}$

$\therefore \frac{h_I}{5} = \frac{60}{-30}$

$\therefore h_I = -10 \text{ cm}$

iii)

a)



b) the angle of deviation is 180°

c) this action of prism is used in Binoculars

Question 5

i) a) $E = I^2Rt$

b) 220 V

c) the lamps in a building should be in parallel so that each one has its own current & if one lamp goes off the others are not affected

ii) a)

1. If the user operates the appliance with wet hands.
2. If the appliance h as a faulty or no earthling & current leaks in the metal body of appliance.

b) Earthing is provided in the appliance.

iii)

Similarities between d.c motor and a.c. generator:

1) Both have a coil placed between two opposite magnetic poles
2) Both have carbon brushes in contact with copper rings

Differences:

1) DC motor converts electrical energy into mechanical energy & AC generators convert mechanical energy into electrical energy
2) DC motors has two split rings & AC generator has two complete rings

Question 6

i) b) The specific heat capacity of the substance in liquid state (CD) is more than that in its solid state (AB)

c) Melting Point:- t_1

Boiling Point:- t_2

ii) a) ${}^{A}_{Z}X \xrightarrow{\alpha} {}^{A-4}_{Z-2}X_1^* + {}^{4}_{2}He \xrightarrow{\gamma} {}^{A-4}_{Z-2}X_2 \xrightarrow{2\beta} {}^{A-4}_{Z}X_3 + 2\,{}^{0}_{-1}e$

b) (i) γ radiations are most penetrating

(ii) β particles are negatively charged

iii) a) moment of couple is product of either of the forces and perpendicular distance between the two forces. Its SI unit is $N-m$.

b) 1. The resultant of all the forces acting on the body should be zero.

2. The resultant moment of all the forces acting on a body about a point should be zero

Question 7

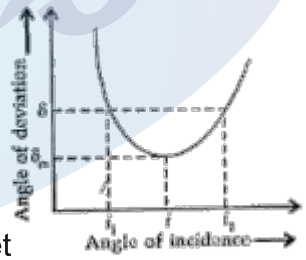
i) a) Centripetal force is directed in ward towards the centre

Centrifugal force is directed outward, away from centre.

b) No

c) the magnitudes of centripetal & centrifugal forces are equal.

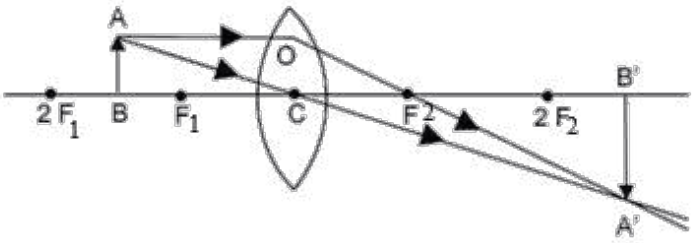
ii) a) Initially on increasing angle of incidence, the angle of deviation decreases till it reaches its lowest value called δ_{min}. After this, on further increasing angle of incidence the angle of deviation starts increasing



b) Angle of deviation is minimum for red colour & maximum for violet colour.

Hence angle of deviation decreases with increase in wavelength of incident light.

iii)



Position of Image: Beyond $2F_2$

Nature:- Real, Inverted, Magnified

Question 8

i) $t = 4\ \text{s}$

$v = 346\ \text{ms}^{-1}$

$\therefore v = \frac{2d}{t}$

$\therefore 346 = \frac{2\times d}{4}$

$\therefore d = 692\ \text{m}$

ii) Electric fuse is a safety device which melts & breaks the circuit if the current exceeds the rated valueof the fuse.

Characteristics:
1) High resistivity
2) Low melting point

iii) $\frac{1}{R_P} = \frac{1}{3} + \frac{1}{2}$

$R_P = \frac{6}{5} = 1.2\Omega$

Total R of circuit= $1.2 + 0.3 = 1.5\Omega$

Total current drawn $= \frac{2}{1.5} = \frac{4}{3} = 1\frac{1}{3} = 1.333\ \text{A}$

1. Current through 0.3Ω Resistor is [1.33A]
voltage across 3Ω & 2Ω

$V = IR$

$V = \frac{4}{3} \times 1.2 = 1.6\ \text{V}$

2. Current in $3\ \Omega$ resistor:-

$I = \frac{V}{R}$

$I = \frac{1.6}{3} = 0.533\ \text{A}$

3.Current in $2\ \Omega$ resistor:-

$I = \frac{V}{R}$

$I = \frac{1.6}{2} = 0.8\ \text{A}$

Question 9

i) a) Towards east
b) Magnetic field is produced around conductor on passing current
c) Needle deflects in opposite direction (Towards west)

ii) a) $m = \frac{Q}{c.\Delta T} = \frac{1000}{80 \times 500} = 0.025 \text{ kg}$
b) $L = \frac{Q}{m} = \frac{1000}{0.025} = 40000 \text{J kg}^{-1}$

iii) a) ${}^{208}_{82}B$: 82 protons & 126 neutrons
b) ${}^{208}_{83}C$:83 protons & 125 neutrons
c) Mass number of A :212
d) No change

ICSE ACADEMY

6

This solved paper

is of St Vincent

School, Asansol

2024-2025

ICSE ACADEMY

ICSE ACADEMY

ST. VINCENT'S HIGH AND TECHNICAL SCHOOL, ASANSOL

MOCK EXAMINATION, 2026

CLASS X

SUBJECT: PHYSICS

Maximum Marks: 80

Time Allowed: Two hours

SECTION A is compulsory. Attempt any four questions from **SECTION B**.

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

SECTION A

(*Attempt **all** questions from this Section*)

Question 1

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

(i) A screw jack is provided with a long arm to:

(a) act as a speed multiplier (b) act as force multiplier

(c) provide sufficient moment of force (d) both (a) and (c).

(ii) A force acts on a body and displaces it by a distance (S) in a direction at an angle θ with the direction of force. What should be the value of θ to get maximum positive work ?

(a) 0° (b) 90° (c) 180° (d) 270°

(iii) A student found the focal length of a convex lens using yellow, green and orange coloured lights.

(a) yellow light gives the highest focal length.

(b) green light gives the highest focal length.

(c) orange light gives the highest focal length.

(d) focal length by all colours are equal.

(iv) Magnification of image of an object kept in between optical centre and first focus (F_1) of a convex lens is:

(a) Sign: Positive; Value : Less than 1. (b) Sign: Positive; Value : More than 1.

(c) Sign: Negative; Value : Equal to 1. (d) Sign: Positive; Value : Equal to 1.

(v) A cylindrical conductor of length 'l' and uniform area of cross-section 'A' has resistance 'R'. The area of cross-section of another conductor of same material and same resistance but of length '2l' is:

(a) A/2 (b) 3A/2 (c) 2A (d) 3A

(vi) Strength of magnetic field produced by a current carrying solenoid does not depend upon:

(a) number of turns in the solenoid. (b) direction of current flowing through it.

(c) radius of solenoid. (d) material of core of the solenoid.

(vii) Three metals A, B and Care supplied with the same quantity of heat. Their mass are the ratio 2:3:4. If they show same rise in temperature, then the ratio of their heat capacities will be:

(a) 1:1:1 (b) 2:3:1 (c) 2:3:4 (d) 4:3:2

(viii) Assertion: Ohm's law is valid for both alternating current and direct current circuits.
Reason: Ohm's law is applicable to circuits with constant resistance, regardless of whether the current is a.c. or d.c.

(a) both assertion and reason are true (b) both assertion and reason are false

(c) assertion is false but reason is true (d) assertion is true but reason is false.

(ix) If a 100 W bulb and a 40 W bulb are in parallel then 100 W bulb glows brighter because:
(a) It has more resistance and the current through them are equal.
(b) It has less resistance and more current passes through it.
(c) It has more resistance and more current passes through it.
(d) It has more potential difference and more current passes through it.

(x) The potential difference across a 4 Ω resistor that produces 100 J of heat per second is:
(a) 5 V (b) 10 V (c) 15 V (d) 20 V

(xi) Out of violet, blue, yellow and red, the critical angle would be least for:
(a) violet (b) blue (c) red (d) yellow

(xii) Which of the following is/are balanced:
A. $^{q-1}_{p-5}P \longrightarrow {}^{q-5}_{p-3}Y + {}^{4}_{2}He$
B. $^{q-4}_{p-4}Z \longrightarrow {}^{q-4}_{p-5}X + {}^{0}_{-1}e$
C. $^{q-1}_{p-5}P \longrightarrow {}^{q-5}_{p-7}R + {}^{4}_{2}He$
D. $^{q-4}_{p-7}S \longrightarrow {}^{q-4}_{p-5}X + {}^{0}_{-1}2e$
(a) only D (b) only C (c) both A & C (d) both C & D

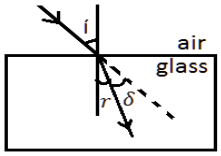
(xiii) Specific latent heat of a substance:
(a) is directly proportional to mass
(b) is inversely proportional to the mass
(c) is directly proportional to the change in the temperature
(d) depends on the material

(xiv) During his experiments with a single movable pulley, a student determined the effort, mechanical advantage and efficiency as X, Y and Z respectively. Subsequently, after lubricating the pulley thoroughly, he recalculated the effort, M.A. and efficiency as X′, Y′ and Z′, respectively. Which of the following relationships accurately represents the scenario?
(a) X′ < X (b) Y′ > Y
(c) both (a) & (b) (d) neither (a) nor (b)

(xv) A car travels with a constant speed of 15 m/s. The car's engine produces a 4000 N pushing force in order to keep the speed constant. How much power is developed by the engine?
(a) 600 W (b) 6000 W (c) 60000 W (d) 600000W

Question 2
(i) Complete the following by choosing the correct answers from the bracket: [6]
(a) If the fulcrum of a third class lever is moved away from the effort then its mechanical advantage will become ..... (more/less) than 1.
(b) Direction of Lorentz force can be found by Fleming's ..... (left/right) hand rule.
(c) An emf is induced in a coil when there is a change in the ..... (voltage/magnetic flux/magnetic force) linked with it.
(d) An element emits twice the number of beta particles than alpha particles. The resulting daughter nucleus is an ..... (isobar/isotope) of the parent.
(e) For a body moving in a circular path, the work done by the centripetal force is ..... (positive/negative/zero)
(f) Greater the wavelength of incident light ..... (greater/less) is lateral displacement when passes through a glass block.

(ii) A ray of light travelling in air is made to incident on a glass slab at an angle of 45°. The light ray is deviated through 15° in glass.
(a) Find the angle of refraction.



(b) Calculate the critical angle for glass air surface. [2]

(iii) State two ways to produce increase output voltage in an a.c generator. [2]

Question 3

(i) State the nature of the vibration (free, damped or resonant) for the given examples:

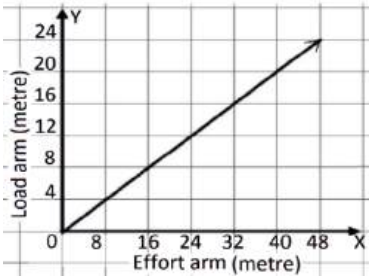
(a) Drilling of the ground vibrates the windows.

(b) Drilling of the ground vibrates the windows with rattling sound. [2]

(ii) The graph shows load against effort for a lever with load and effort on the same side of fulcrum.

(a) Calculate the effort from the graph, if the load is 20 kgf.

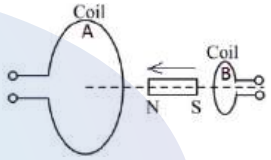
(b) Which class does this lever belong to ? [2]



(iii) A cylindrical bar magnet is kept inbetween two co-axial circular coils as shown in the diagram. The magnet is moved along the axis towards coil A.

(a) State the polarity developed at the right side of coil B.

(b) State the direction of induced current in coil A when seen from left side. [2]



(iv) The given diagram shows a circular loop carrying current I. [2]

(a) State the polarity of the magnetic field produced by the current carrying loop that faces us.

(b) What change in the magnetic field strength of the magnetic field produced by the current carrying loop is observed if the circumference is increased ?

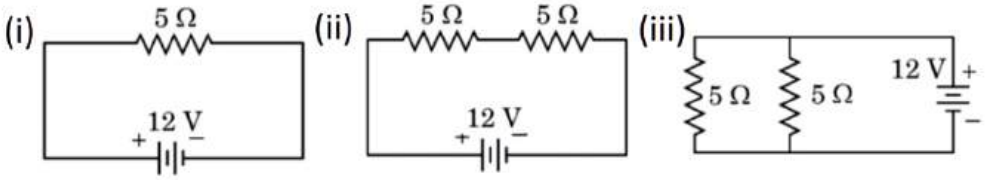
(v) Two bulbs A and B of power 25 W and 40 W respectively, are connected in parallel to a d.c. supply.

(a) Which bulb will have more resistance ?

(b) Which bulb will consume more current ? [2]

(vi) Write two factors on which the internal resistance of a cell depends. Also state how the mentioned factors depend on the internal resistance. [2]

(vii) Consider the following circuits: [3]



In which circuit will the power dissipated be (a) minimum and (b) maximum. Justify your answer.

SECTION B

(*Attempt **any four** questions*)

Question 4. **[3+3+4]**

(i) (a) State work energy theorem. Give its mathematical expression also.

A given force displaces an object through a distance 's' in its own direction and then in a direction inclined at 60° to its own direction. What is the ratio of the work done in the two cases ?

(ii) A uniform metre scale of weight 50 gf is balanced at 30 cm mark when weights of 80 gf and 60 gf act at 5 cm mark and 45 cm mark respectively. (a) What force must be applied at 20 cm mark to balance the metre scale. (b) Draw the diagram of the arrangement.

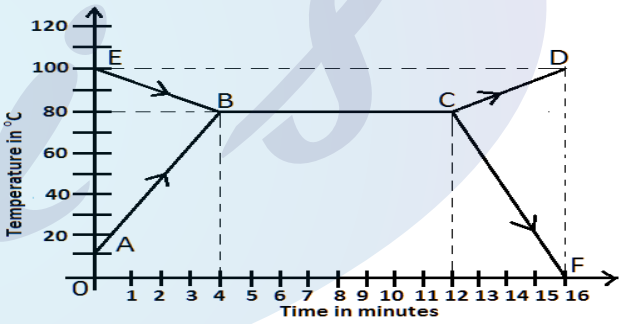
(iii) A block and tackle system has V.R. = 5.
(a) Draw a neat labelled diagram of a system indicating the direction of its load, effort and tension.
(b) If the M.A. of the system is 5 and its efficiency is 80% then what effort is required to lift a load of 200 kgf to a height of 20 m?

Question 5. **[3+3+4]**

(i) A man standing infront of a wall produces a sound and hears an echo after 3 seconds. He walks 'x' m away from the wall and produces the same sound. Now he hears an echo after 5.25 s. The speed of sound in air is 340 ms^{-1}.
(a) Find the distance of the wall from the man before moving away.
(b) Find the distance 'x' he walked away from the wall.
(c) State one use of echo in medical field.

(ii) Draw a ray diagram to show the formation of image, when the object is placed between optical centre and principal focus of a convex lens.

(iii) A graph between time and temperature during heating as well as cooling for a solid substance is shown in the given figure.
Complete the table, using the labels from the figure. The first label is done for you.

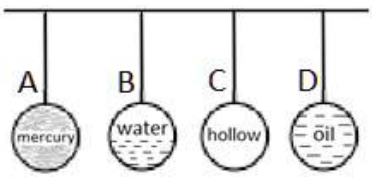


S.No	Description	Label
(a)	The part of the graph which represents the rise in temperature of the solid with gain of heat energy.	AB
(b)	The part of the graph which represents the rise in temperature of the liquid with the gain of heat energy.	.....
(c)	The part of the graph which represents the change in state of the solid to liquid without any rise in temperature.	.....
(d)	The part of the graph which represents the fall in temperature of the gas with the loss of heat energy.	.....
(e)	The part of the graph which represents the fall in temperature of the liquid with the loss of heat energy.	.....

Question 6. **[3+3+4]**

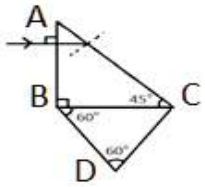
(i) The given diagram shows four pendulums A, B, C and D suspended freely from a rigid rod. A is filled with mercury, B with water, D with oil and C is hollow. Study the given diagram and answer the following:

(a) If pendulum A is initiated into oscillation, which pendulum/s will exhibit the highest amplitude of vibration ?
(b) State the cause for attaining the highest amplitude of vibration.
(c) How many force/s act on the pendulum during such vibration?



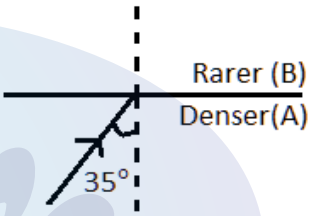
(ii) An object is placed at a distance of 75 cm from a screen. (a) Where a convex lens should be placed so as to obtain a 4 times magnified image of the object on the screen ? (b) Also find the focal length of the lens.

(iii) Two prisms *ABC* and *DBC* are arranged as shown in figure. The critical angles for the two prisms with respect to air are 41° and 45° respectively.
(a) Trace the path of the ray through the combination till it emerges out of the combination.
(b) Mark the necessary angles.

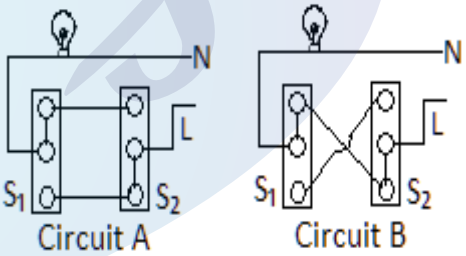


Question 7. **[3+3+4]**

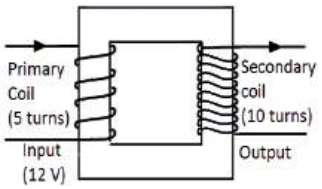
(i) A ray of light travelling through denser medium A strikes the surface at angle of 35° as shown in the diagram. Speed of light in medium A = 1×10^8 ms^{-1} and speed of light in medium B = 2×10^8 ms^{-1}.
(a) Calculate the critical angle of A-B interface.
(b) Determine whether the ray will undergo total internal reflection.
(c) State one factor affecting the critical angle of a given pair of media.



(ii) The diagram below shows a bulb connected by a dual control switches. Observe the diagrams and answer the questions that follow:
(a) Which of the above circuits will be able to switch ON or switch OFF the bulb using both switches ?
(b) At present, in which circuit is the bulb glowing ?
(c) If we interchange the L and N wires in circuit B, will the circuit work ?

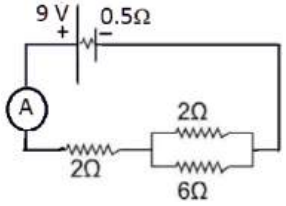


(iii) The given diagram shows a transformer having 5 turns in primary coil and 10 turns in secondary coil. The input voltage is 12 volt. Answer the questions that follow:
(a) Find the turns ratio (n) and name the type of transformer.
(b) Calculate the output voltage of the given transformer.
(c) What is the advantage of using a closed core in a transformer.



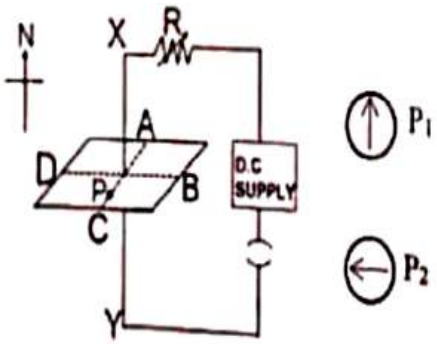
Question 8. **[3+3+4]**

(i) In the given circuit diagram, a cell of 9 V and internal resistance 0.5 Ω is connected across a resistor of 2 Ω in series and two resistors 2 Ω and 6 Ω which are in parallel. Calculate:
(a) the total resistance of the circuit.
(b) the current in the ammeter.
(c) the current in the 6 Ω resistor. [3]



(ii) Given aside is a circuit to study the magnetic effect of electric current. ABCD is a cardboard kept perpendicular to the conductor XY. A magnetic compass is placed at the point P of the

cardboard. P_1 and P_2 are the positions of the magnetic compass, before and after passing a current through XY respectively.



(a) Name the rule that is used to predict the direction of deflection of the magnetic compass.

(b) State the direction of current in the conductor (X to Y or Y to X) when the circuit is complete.

(c) If resistance R is increased, then what will be the effect on the magnetic lines of force around the conductor ?

(iii) A calorimeter of mass 60 g contains 180 g of water at 29℃. Find the final temperature of the mixture, when 37.2 g of ice at −10℃ is added to it (Given: specific heat capacity of water = 4200 J/kg K, latent heat of ice = 336×10^3 J/kg, specific heat capacity of ice = 2100 J/kg K, specific heat capacity of the calorimeter is 0.42 J g^{-1} $℃^{-1}$.

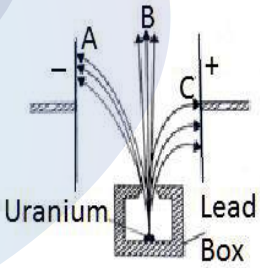
Question 9. **[3+3+4]**

(i) (a) Why is an alternating current (a.c.) considered to be advantageous over direct current (d.c.) for the long distance transmission of electric power?

(b) A fuse is rated 8 A. Can it be used with an electrical appliance rated 5 kW, 200 V? Give a reason.

(c) State any one advantage of the earth wire in domestic electric appliances.

(ii) Radiations given out from a radioactive source when subjected to an electric field in a direction perpendicular to their path are shown in the given diagram. The arrows show the path of the radiations A, B and C. Answer the following questions in terms of A, B and C.

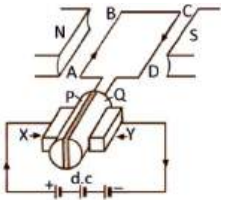


(a) Why does radiation C deflect more than A?

(b) Write the product obtained after $^{235}_{92}U$ undergoes one α-decay followed by one β-decay.

(c) Why Uranium is stored in lead box ?

(iii) In the figure given below, a simple d.c. motor is shown:



As shown in the figure, the current in the armature coil ABCD flows from A to B in the arm AB and C to D in the arm CD.

(a) State the directions in which the arms AB and CD will experience a force.

(b) State the factors on which the force experienced by the armature coil depends.

(c) State one change that could be done in the construction of the given d.c. motor to convert it into an a.c. generator.

(d) At what position the deflecting couple on the armature coil ABCD is zero ?

ICSE ACADEMY

ST. VINCENT'S HIGH AND TECHNICAL SCHOOL, ASANSOL

MOCK EXAMINATION, 2026

CLASS X

SUBJECT: PHYSICS

Maximum Marks: 80

Time Allowed: Two hours

SECTION A is compulsory. Attempt any four questions from **SECTION B**.

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

SECTION A

(*Attempt **all** questions from this Section*)

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(v) A cylindrical conductor of length 'l' and uniform area of cross-section 'A' has resistance 'R'. The area of cross-section of another conductor of same material and same resistance but of length '2l' is:

(a) A/2 (b) 3A/2 (c) 2A (d) 3A

(vi) Strength of magnetic field produced by a current carrying solenoid does not depend upon:

(a) number of turns in the solenoid. (b) direction of current flowing through it.

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C. $^{q-1}_{p-5}P \longrightarrow {}^{q-5}_{p-7}R + {}^{4}_{2}He$
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(a) only D (b) only C (c) both A & C (d) both C & D

(xiii) Specific latent heat of a substance:
(a) is directly proportional to mass
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(c) both (a) & (b) (d) neither (a) nor (b)

(xv) A car travels with a constant speed of 15 m/s. The car's engine produces a 4000 N pushing force in order to keep the speed constant. How much power is developed by the engine?
(a) 600 W (b) 6000 W (c) 60000 W (d) 600000W

(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)	(xiii)	(xiv)	(xv)
(b)	(a)	(c)	(b)	(c)	(b)	(a)	(c)	(b)	(d)	(a)	(d)	(d)	(c)	(c)

Question 2
(i) Complete the following by choosing the correct answers from the bracket: [6]
(a) If the fulcrum of a third class lever is moved away from the effort then its mechanical advantage will become ..... (more/less) than 1.
(b) Direction of Lorentz force can be found by Fleming's ..... (left/right) hand rule.
(c) An emf is induced in a coil when there is a change in the ..... (voltage/magnetic flux/magnetic force) linked with it.
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(e) For a body moving in a circular path, the work done by the centripetal force is ..... (positive/negative/zero)
(f) Greater the wavelength of incident light ..... (greater/less) is lateral displacement when passes through a glass block.

(a)	(b)	(c)	(d)	(e)	(f)
less	left	magnetic flux	isotope	zero	less

(ii) A ray of light travelling in air is made to incident on a glass slab at an angle of 45°. The light ray is deviated through 15° in glass.

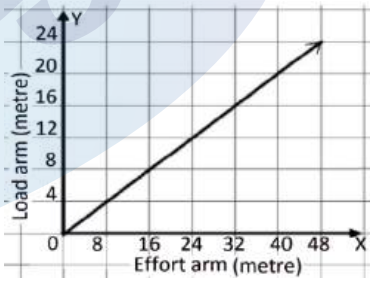
(a) Find the angle of refraction.
(b) Calculate the critical angle for glass air surface. [2]
Sol: (ii) (a) r = i – δ = 45° - 15° = 30°. ..... 1 M
Sol: (ii) (b) $_a\mu_g = \frac{\sin 45°}{\sin 30°} = \frac{1}{\sqrt{2}} \times 2 = \sqrt{2}$.
$\therefore \sin C = \frac{1}{a\mu g} = \frac{1}{\sqrt{2}} = \sin 45°$.
Or, C = 45°. ..... 1 M

(iii) State two ways to produce increase output voltage in an a.c generator. [2]
Ans: Two ways to increase output voltage in generator are: ..... (any 2) ..... 1+1 M
(i) Increase the magnetic field strength
(ii) Increase the speed of rotation of the coil
(iii) Increase the number of turns of the coil
(iv) Increase the area of the coil

Question 3

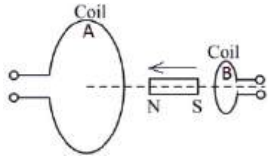
(i) State the nature of the vibration (free, damped or resonant) for the given examples:
(a) Drilling of the ground vibrates the windows.
(b) Drilling of the ground vibrates the windows with rattling sound. [2]
Ans: (i)(a) forced vibrations. ..... 1 M
Ans: (i)(b) resonant vibrations. ..... 1 M

(ii) The graph shows load against effort for a lever with load and effort on the same side of fulcrum.



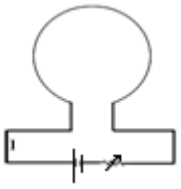
(a) Calculate the effort from the graph, if the load is 20 kgf.
(b) Which class does this lever belong to ? [2]
Sol: (ii)(a) M.A. = $\frac{\text{effort arm}}{\text{load arm}} = \frac{8}{4} = 2$
Again, M.A. = $\frac{L}{E}$.
$\Rightarrow 2 = \frac{20}{E}$ or E = 10 kgf. ..... 1 M
Sol: (ii)(b) IInd class of Lever. ..... 1 M

(iii) A cylindrical bar magnet is kept inbetween two co-axial circular coils as shown in the diagram. The magnet is moved along the axis towards coil A.



(a) State the polarity developed at the right side of coil B.
(b) State the direction of induced current in coil A when seen from left side. [2]
Ans: (iii)(a) South pole. ..... 1 M
Ans: (iii)(b) Clockwise direction. ..... 1 M

(iv) The given diagram shows a circular loop carrying current I. [2]

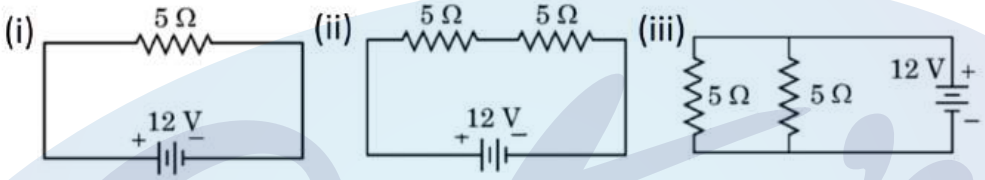


(a) State the polarity of the magnetic field produced by the current carrying loop that faces us.
(b) What change in the magnetic field strength of the magnetic field produced by the current carrying loop is observed if the circumference is increased ?
Ans: (iv)(a) South pole. ..... 1 M
Ans: (iv)(b) magnetic field strength decreases. ..... 1 M

(v) Two bulbs A and B of power 25 W and 40 W respectively, are connected in parallel to a d.c. supply.
(a) Which bulb will have more resistance ?
(b) Which bulb will consume more current ? [2]
Sol: (v)(a) 25 W bulb (A) has higher resistance. ..... 1 M
Sol: (v)(a) 40 W bulb (B) draws more current. ..... 1 M

(vi) Write two factors on which the internal resistance of a cell depends. Also state how the mentioned factors depend on the internal resistance. [2]
Ans: The two factors on which the internal resistance of a cell depend are:..... (any 2)....1+1M
(i) Surface area of the electrodes – inversely proportional (larger area less is int. resistance)
(ii) Distance bet. Electrodes – directly proportional (more distance more int. resistance)
(iii) Nature/concentration of electrolyte – directly proportional (high concentration more int. resistance)
(iv) Temperature of electrolyte – inversely proportional (more temp. less int. resistance)

(vii) Consider the following circuits: [3]



In which circuit will the power dissipated be (a) minimum and (b) maximum. Justify your answer.
Ans: (vii) Power dissipated in circuit (i) = $\frac{V^2}{R} = \frac{144}{5}$ = <u>28.8 W</u>
Equivalent resistance of circuit (ii) =10 Ω
∴ Power dissipated in circuit (ii) = $\frac{V^2}{R} = \frac{144}{10}$ = <u>14.4 W</u> ..... 1 M
Equivalent resistance of circuit (iii) = $\frac{5 \times 5}{5+5} = \frac{25}{10}$ = 2.5 Ω
∴ Power dissipated in circuit (iii) = $\frac{V^2}{R} = \frac{144}{2.5}$ = <u>57.6 W</u> ..... 1 M
(a) Minimum power id dissipated in circuit (ii)
Ans: (vii)(b) maximum power is dissipated in circuit (iii). (both)..... 1 M

SECTION B

(*Attempt **any four** questions*)

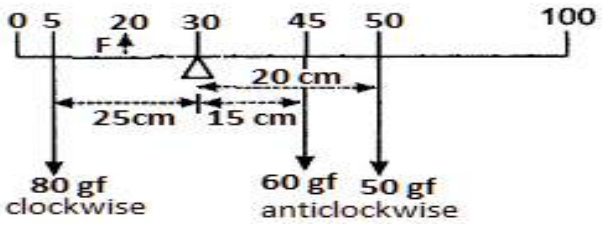
Question 4. **[3+3+4]**

(i) (a) State work energy theorem. Give its mathematical expression also.
(b) A given force displaces an object through a distance 's' in its own direction and then in a direction inclined at 60° to its own direction. What is the ratio of the work done in the two cases ?
Ans: (i)(a) Work energy theorem states that, the increase in kinetic energy of a moving body is equal to the work done by a force acting in the <u>direction of the moving body</u>. ..... 1 M
Mathematical expression of work energy theorem: $W = \frac{1}{2}m(v^2 - u^2)$ ..... 1 M
Ans: (i)(b) Ratio of work done = $\frac{F \times S}{F S \cos 60°} = \frac{2 \times F \times S}{F \times S}$ = 2:1 ..... 1 M

(ii) A uniform metre scale of weight 50 gf is balanced at 30 cm mark when weights of 80 gf and 60 gf act at 5 cm mark and 45 cm mark respectively. (a) What force must be applied at 20 cm mark to balance the metre scale. (b) Draw the diagram of the arrangement.
Sol: (ii)(a) Clockwise moment = Counterclockwise/anticlockwise moment
⇒ 2000 gf cm = 900 gf cm + 1000 gf cm + F × 10 cm. ..... 1 M

⇒ 2000 = 1900 + 10F.
⇒ 2000 – 1900 = 10F
⇒ 100 = 10F
⇒ F = 10 gf. ..... +1 M

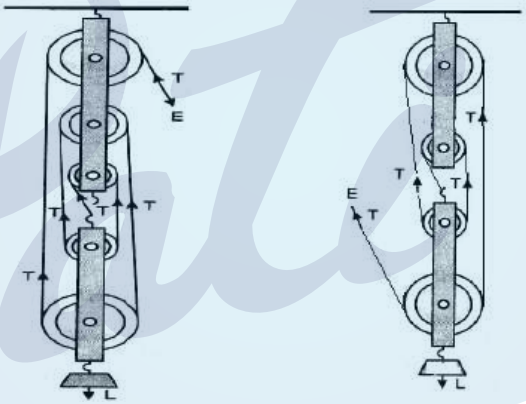
Sol: (ii)(a) Diagram: correct positions 80gf, 60gf, 50gf and F with arrows showing clockwise/anticlockwise directions ..... 1 M



(iii) A block and tackle system has V.R. = 5.
(a) Draw a neat labelled diagram of a system indicating the direction of its load, effort and tension.
(b) If the M.A. of the system is 5 and its efficiency is 80% then what effort is required to lift a load of 200 kgf to a height of 20 m?

Ans: (iii)(a) pulley & correct connection of tackle (straight) & correct direction of T, E and F (all) ..... 1+1+1M

(any one correct diagram)



Sol: (iii)(b) Given: M.A = 5; n = 80%; L = 200 kgf; d_L = 20 m.

M.A = $\frac{L}{E}$.

⇒ E = $\frac{L}{M.A}$ = $\frac{200}{5}$ = 40 kgf. ..... 1 M

Question 5. **[3+3+4]**

(i) A man standing infront of a wall produces a sound and hears an echo after 3 seconds. He walks 'x' m away from the wall and produces the same sound. Now he hears an echo after 5.25 s. The speed of sound in air is 340 ms^{-1}.
(a) Find the distance of the wall from the man before moving away.
(b) Find the distance 'x' he walked away from the wall.
(c) State one use of echo in medical field.

Ans: (i) (a) Distance of wall from man before moving away = $\frac{340 \times 3}{2}$ = 510 m. ..... 1 M

Ans: (i) (b) Total distance after moving away from wall = (510 + x) metre

∴ 510 + x = $\frac{340 \times 5.25}{2}$

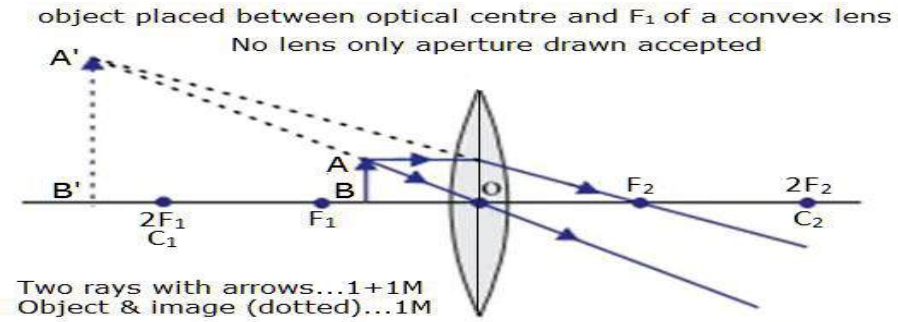
⇒ x = 892.5 – 510 = 382.5 metre

The distance 'x' he walked away from the wall is 382.5 m ..... 1 M

Ans: (i) (c) Use of echo in medical field: echocardiography to know the function and structure of heart, ultrasonography to visualize internal organs. ..... 1 M

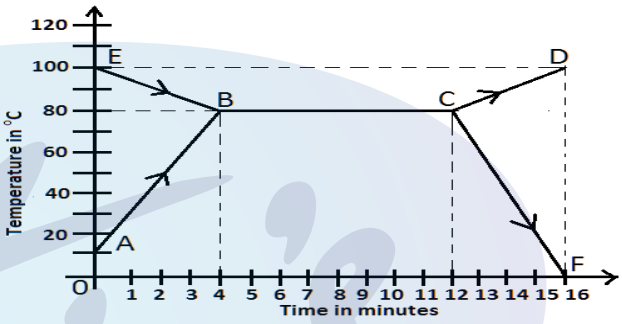
(ii) Draw a ray diagram to show the formation of image, when the object is placed between optical centre and principal focus of a convex lens.

Ans: (ii) Ray diagram of convex lens:



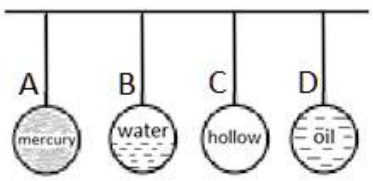
(iii) A graph between time and temperature during heating as well as cooling for a solid substance is shown in the given figure.

Complete the table, using the labels from the figure. The first label is done for you.



S.No	Description	Label
(a)	The part of the graph which represents the rise in temperature of the solid with gain of heat energy.	AB
(b)	The part of the graph which represents the rise in temperature of the liquid with the gain of heat energy.	1Mark CD
(c)	The part of the graph which represents the change in state of the solid to liquid without any rise in temperature.	1Mark BC
(d)	The part of the graph which represents the fall in temperature of the gas with the loss of heat energy.	1Mark EB
(e)	The part of the graph which represents the fall in temperature of the liquid with the loss of heat energy.	1Mark CF

Question 6. **[3+3+4]**



(i) The given diagram shows four pendulums A, B, C and D suspended freely from a rigid rod. A is filled with mercury, B with water, D with oil and C is hollow. Study the given diagram and answer the following:

(a) If pendulum A is initiated into oscillation, which pendulum/s will exhibit the highest amplitude of vibration ?

(b) State the cause for attaining the highest amplitude of vibration.

(c) How many force/s act on the pendulum during such vibration?

Ans: (i)(a) All will vibrate with same amplitude. ..... 1 M

Ans: (i)(b) Frequency of externally applied periodic force is equal to natural frequency of body..... 1 M

Ans: (i)(c) Three forces: restoring force, frictional/resistive/damping force and external periodic force/driving force. ..... 1 M

(ii) An object is placed at a distance of 75 cm from a screen. (a) Where a convex lens should be placed so as to obtain a 4 times magnified image of the object on the screen ? (b) Also find the focal length of the lens.

Sol: (ii)(a) Given, m = − 4, v − u = 75 (considering signs).

$\Rightarrow$ v − u = 75

or, v = 75 + u. ..... (i)

Again, $m = \frac{v}{u}$ or $-4 = \frac{v}{u}$.

or, v = − 4 u.....(ii) .....(any one equation)..... 1 M

From, (i) & (ii), we get,

$\Rightarrow$ 75 + u = − 4 u.

$\Rightarrow$ − 5 u = 75.

$\Rightarrow$ u = − 15 cm.

Thus, the object distance is 15 cm.

Hence, the lens is placed 15 cm from the object. ..... +1 M

Sol: (ii)(b) From eqn. (ii), we get,

$\therefore$ v = (− 4) x (− 15) = 60 cm.

From lens formula,

$\Rightarrow \frac{1}{v} - \frac{1}{u} = \frac{1}{f}$.

$\Rightarrow \frac{1}{60} + \frac{1}{15} = \frac{1}{f}$.

$\Rightarrow \frac{5}{60} = \frac{1}{f}$.

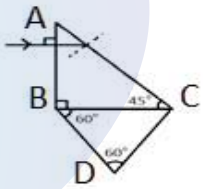
$\Rightarrow$ f = 12 cm

The focal length of the convex lens is 12 cm. ..... +1 M

(iii) Two prisms *ABC* and *DBC* are arranged as shown in figure. The critical angles for the two prisms with respect to air are 41° and 45° respectively.

(a) Trace the path of the ray through the combination till it emerges out of the combination.

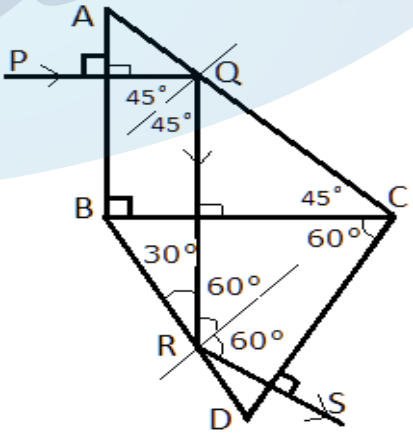
(b) Mark the necessary angles.



Ans: (iii)

(a) Ray QR with arrow ... 1 M
Ray RS with arrow ... 1 M

(b) Angles at Q marked 45°...1 M
Angles at R marked 60° ... 1 M



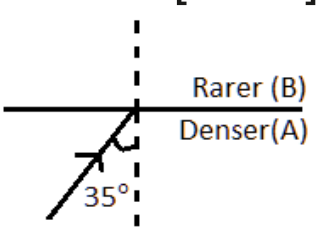
Question 7. **[3+3+4]**

(i) A ray of light travelling through denser medium A strikes the surface at angle of 35° as shown in the diagram. Speed of light in medium A = 1×10^8 ms^{-1} and speed of light in medium B = 2×10^8 ms^{-1}.

(a) Calculate the critical angle of A-B interface.

(b) Determine whether the ray will undergo total internal reflection.

(c) State one factor affecting the critical angle of a given pair of media.



Ans: (i)(a) R.I. of rarer medium B ($_a\mu_b$) = $\frac{\text{speed of light in medium A}}{\text{speed of light in medium B}} = \frac{1 \times 10^8}{2 \times 10^8} = \frac{1}{2}$ or 0.5

∴ R.I. of denser medium A ($_b\,\mu_a$) = $\frac{1}{a\,\mu\,b} = \frac{1}{1/2} = 2$.

Now, sin C = $\frac{1}{b\,\mu\,a} = \frac{1}{2}$

⇒ sin C = sin 30°

⇒ C = 30°. ..... 1 M

Ans: (i)(b) Yes, the ray will undergo TIR. ..... +1 M

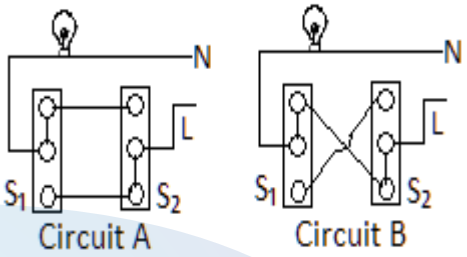
Ans: (i)(c) Factors affecting the critical angle of a given pair of media are: colour or wavelength of incident light and temperature of medium. ..... (any one)..... 1 M

(ii) The diagram below shows a bulb connected by a dual control switches. Observe the diagrams and answer the questions that follow:

(a) Which of the above circuits will be able to switch ON or switch OFF the bulb using both switches ?

(b) At present, in which circuit is the bulb glowing ?

(c) If we interchange the L and N wires in circuit B, will the circuit work ?



Ans: (ii)(a) Both circuits will be able to switch ON and switch OFF the bulb using both switches. ..... 1 M

Ans: (ii)(b) Circuit B. ..... 1 M

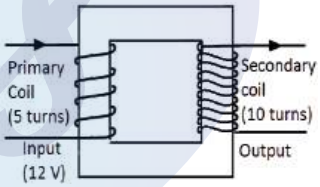
Ans: (ii)(c) Yes, the circuit will work. ..... 1 M

(iii) The given diagram shows a transformer having 5 turns in primary coil and 10 turns in secondary coil. The input voltage is 12 volt. Answer the questions that follow:

(a) Find the turns ratio (n) and name the type of transformer.

(b) Calculate the output voltage of the given transformer.

(c) What is the advantage of using a closed core in a transformer.



Ans: (iii)(a) Turns ratio (n) = $\frac{\text{no. of turns in the secondary coil } N_S}{\text{no. of turns in the primary coil } N_P} = \frac{10}{5} = 2$.

The transformer is Step-up transformer (n>1). .....(both correct)..... 1 M

Ans: (iii)(b) Turns ratio (n) = $\frac{\text{output voltage } (E_S)}{\text{input voltage } (E_P)}$.

⇒ 2 = $\frac{\text{output voltage } (E_S)}{12}$

⇒ Output voltage (E_S) = 24 V. ..... +1 M

Ans: (iii)(c) The advantage of using a closed core is that it gives a closed path for the magnetic field lines **or** to make the flux linkage nearly perfect **or** helps in linking the magnetic field lines of primary coil with the secondary coil. ..... 1 M

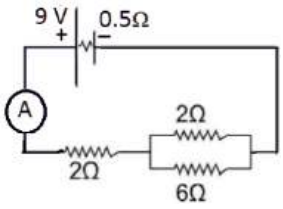
Question 8. **[3+3+4]**

(i) In the given circuit diagram, a cell of 9 V and internal resistance 0.5 Ω is connected across a resistor of 2 Ω in series and two resistors 2 Ω and 6 Ω which are in parallel. Calculate:

(a) the total resistance of the circuit.

(b) the current in the ammeter.

(c) the current in the 6 Ω resistor. [3]



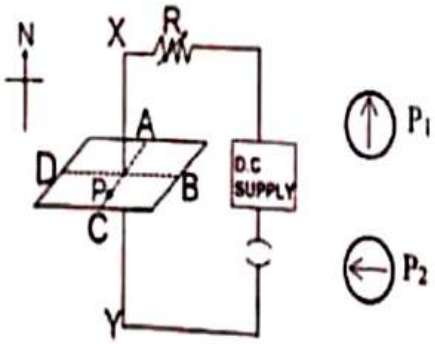
Sol: (i)(a) $R_p = \frac{2 \times 6}{2+6} = \frac{12}{8} = \frac{3}{2} = 1.5\ \Omega$

∴ R_{eq}(total resistance of circuit) = 2 + 1.5 + 0.5 = 4 Ω ..... 1 M

Sol: (i)(b) Current in the ammeter (I) = $\frac{\mathcal{E}}{R_{eq}} = \frac{9}{4} = 2.25$ A. ..... +1 M

Sol: (i)(c) Current in 6 Ω resistor = $\frac{2.25 \times 2}{2+6} = \frac{4.5}{8}$ = 0.5625 A or 0.6 A. ..... +1 M

(ii) Given aside is a circuit to study the magnetic effect of electric current. ABCD is a cardboard kept perpendicular to the conductor XY. A magnetic compass is placed at the point P of the cardboard. P_1 and P_2 are the positions of the magnetic compass, before and after passing a current through XY respectively.



(a) Name the rule that is used to predict the direction of deflection of the magnetic compass.
(b) State the direction of current in the conductor (X to Y or Y to X) when the circuit is complete.
(c) If resistance R is increased, then what will be the effect on the magnetic lines of force around the conductor ?

Ans: (ii)(a) Right Hand thumb rule (Maxwell) ..... 1 M
Ans: (ii)(b) Current will flow from X to Y. ..... 1 M
Ans: (ii)(c) The magnetic lines of force becomes less dense/spread out/magnetic field strength decreases. ..... 1 M

(iii) A calorimeter of mass 60 g contains 180 g of water at 29°C. Find the final temperature of the mixture, when 37.2 g of ice at −10°C is added to it (Given: specific heat capacity of water = 4200 J/kg K, latent heat of ice = 336×10^3 J/kg, specific heat capacity of ice = 2100 J/kg K, specific heat capacity of the calorimeter is 0.42 J g^{-1} $°C^{-1}$.
Sol: (iii) Let the final temperature be 't'
Heat gained by ice (Q_{ice}) = $m_I c_{ice} \Delta t + m_I L + m_W c_{water} \Delta t$
⇒ Q_{ice} = 37.2 x 2.1 x 10 + 37.2 x 336 + 37.2 x 4.2 x t = 781.2 + 12,499.2 + 156.24t
⇒ Q_{ice} = 13,280.4 + 156.24t. ..... 1 M
Heat lost by calorimeter & water (Q_{C+W}) = $m_C c_C \Delta t + m_W c_{water} \Delta t$
⇒ Q_{C+W} = 60 x 0.42 x (29 – t) + 180 x 4.2 x (29 – t).
⇒ Q_{C+W} = 25.2 (29 – t) + 756 (29 – t).
⇒ Q_{C+W} = (29 – t) (25.2 + 756).
⇒ Q_{C+W} = (29 – t) 781.2
⇒ Q_{C+W} = 22,654.8 – 781.2t. ..... 1 M
By the principle of calorimetry;
Heat lost by calorimeter & water (Q_{C+W}) = Heat gained by ice (Q_{ice})
⇒ 22,654.8 – 781.2t = 13,280.4 + 156.24t. .....(correct substitution either LHS or RHS)... +1 M
⇒ 156.24t + 781.2t = 22,654.8 – 13,280.4.
⇒ 937.44 t = 9374.4
⇒ t = $\frac{9374.4}{937.44} = \frac{937440}{93744}$ = 10°C ..... +1 M
The final temperature of the mixture is 10°C.

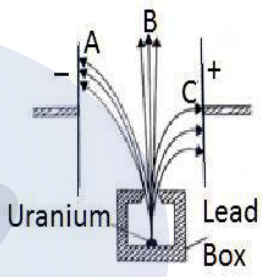
Question 9. **[3+3+4]**
(i) (a) Why is an alternating current (A.C.) considered to be advantageous over direct current (D.C.) for the long distance transmission of electric power?
(b) A fuse is rated 8 A. Can it be used with an electrical appliance rated 5 kW, 200 V? Give a reason.
(c) State any one advantage of the earth wire in domestic electric appliances.
Ans: (i)(a) Advantage of a.c over d.c in long distance transmission: .....(any one)..... 1 M

Alternating current	Direct current
(i) Voltage can be easily stepped up or down using transformers.	(i) Voltage cannot be easily changed.
(ii) Can be transmitted at very high	(ii) Transmitted at relatively low voltage

voltage and low current, so power loss (I^2R loss) is small.	so current is high and power losses are large.
(iii) Requires thinner conductors, hence cheaper.	(iii) Requires thicker conductors, hence costly.

Ans: (i)(b) Given: P = 5 kW = 5000 W; V = 200 V.
$\therefore$ Safe limit of current (I) = $\frac{P}{V} = \frac{5000}{200}$ = 25 A.
No, it cannot be used.
Reason: Since the current exceeds the fuse rating, the fuse will melt (blow) immediately and disconnect the circuit. Hence, an 8 A fuse is not suitable for this appliance. ……(both)…… 1 M
Ans: (i)(c) It prevents electric shock and protect both the user and the appliance; It provides a low-resistance path for leakage current to flow safely to the ground. …(any one)…… 1 M

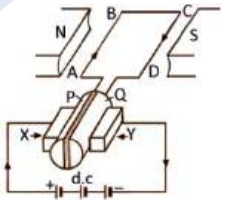
(ii) Radiations given out from a radioactive source when subjected to an electric field in a direction perpendicular to their path are shown in the given diagram. The arrows show the path of the radiations A, B and C. Answer the following questions in terms of A, B and C.
(a) Why does radiation C deflect more than A?
(b) Write the product obtained after $^{235}_{92}U$ undergoes one α-decay followed by one β-decay.
(c) Why Uranium is stored in lead box ?



Ans: (ii)(a) Radiation C (beta) deflect more than A (alpha) because β particles are lighter than α particles. …… 1 M
Ans: (ii)(b) $^{235}_{92}\text{U} \longrightarrow {}^{231}_{90}\text{Th} + {}^{4}_{2}\text{He} \longrightarrow {}^{231}_{91}\text{Pa} + {}^{0}_{-1}e$.
The product is: $^{231}_{91}\text{Pa}$ or $^{231}_{91}\text{X}$. …… 1 M
Ans: (ii)(c) Uranium is stored in lead box because:

- Lead is a very good absorber of radiation, particularly gamma rays.
- The lead box prevents these radiations from escaping, thus protecting people and the surroundings from radiation hazards. ……(any one)…… 1 M

(iii) In the figure given below, a simple d.c. motor is shown:
As shown in the figure, the current in the armature coil ABCD flows from A to B in the arm AB and C to D in the arm CD.



(a) State the directions in which the arms AB and CD will experience a force.
(b) State the factors on which the force experienced by the armature coil depends.
(c) State one change that could be done in the construction of the given d.c. motor to convert it into an a.c. generator.
(d) At what position the deflecting couple on the armature coil ABCD is zero ?

Ans: (iii)(a) Arm AB experiences a force downwards and Arm CD experiences a force upwards
……(both)…… 1 M
Ans: (iii)(b) The force experienced by each arm of the coil depends on:

- Strength of the magnetic field.
- Magnitude of current flowing in the coil.
- Length of the conductor kept in the magnetic field. ……(any one)…… 1 M

Ans: (iii)(c) Replace the split-ring/commutator by slip rings.
Ans: (iii)(d) The deflecting couple on the armature coil ABCD is zero when the plane of the coil is perpendicular to the magnetic field (i.e. when the coil is in the vertical position or split rings not touching the carbon brushes) …… 1 M

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