

ICSE EXAMINATION PAPER - 2024

PHYSICS

Class-10th

(Solved)

Maximum Marks: 80

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.

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

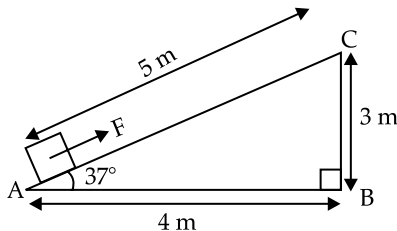
(Attempt all questions from this Section.)

Question 1 [15]

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

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

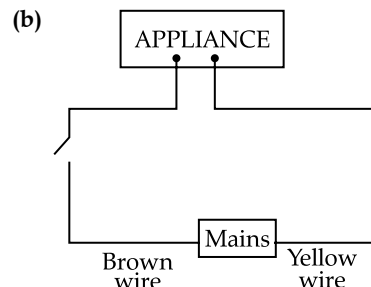
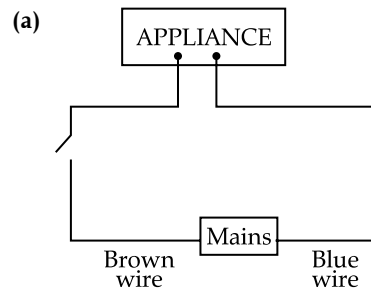
- (i) When a bell fixed on a cycle rings, then the energy conversion that takes place is
- gravitational potential energy to sound energy
 - kinetic energy to sound energy
 - sound energy to electrical energy
 - sound energy to mechanical energy
- (ii) A door lock is opened by turning the lever (handle) of length 0.2 m. If the moment of force produced is 1 Nm, then the minimum force required is
- 5 N
 - 10 N
 - 20 N
 - 0.2 N
- (iii) A force 'F' moves a load from A to C as shown in the figure below. For the calculation of the work done, which of these lengths would you use as the displacement?

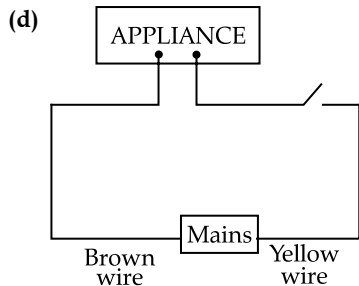
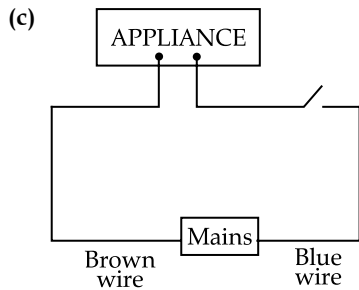


- 3 m
 - 4 m
 - 5 m
 - 7 m
- (iv) A radioactive nucleus containing 128 nucleons emits a β -particle. After β -emission the number of nucleons present in the nucleus will be
- 128
 - 129
 - 124
 - 127
- (v) **Assertion (A):** Ultraviolet radiations are scattered more as compared to the microwave radiations.

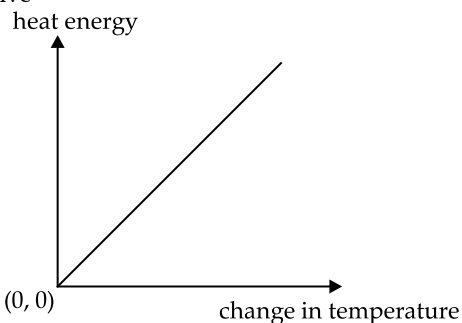
Reason (R): Wavelength of ultraviolet radiation is more than the wavelength of microwave radiation.

- Both A and R are true.
 - A is true but R is false.
 - A is false but R is true.
 - Both A and R are false.
- (vi) When the stem of vibrating tuning fork is pressed on a table, the tabletop starts vibrating. These vibrations are definitely an example of
- resonance
 - natural vibrations
 - forced vibrations
 - damped vibrations
- (vii) Which of the following is a class III lever?
- Pair of scissors
 - Wheelbarrow
 - Crowbar
 - Human forearm
- (viii) The specific resistance of a conductor depends on its
- length
 - material
 - area of cross section
 - radius
- (ix) Identify the option that displays the correct wiring with correct colour code





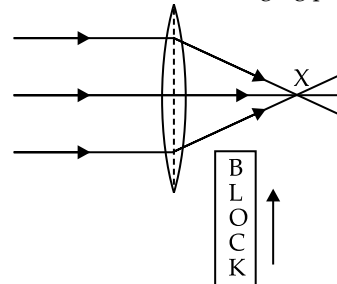
- (x) The potential difference between terminals of a cell in a closed electric circuit is
- terminal voltage
 - electro motive force
 - voltage drop
 - none of these
- (xi) During melting of ice at 0°C the
- energy is released and temperature remains constant.
 - energy is absorbed and temperature remains constant.
 - energy is released and temperature decreases.
 - energy is absorbed and temperature increases.
- (xii) Linear magnification (m) produced by a concave lens is
- $m < 1$
 - $m > 1$
 - $m = 1$
 - $m = 2$
- (xiii) A radioactive element is placed in an evacuated chamber. Then the rate of radioactive decay will
- Decrease
 - Increase
 - Remain unchanged
 - Depend on the surrounding temperature
- (xiv) The graph given below shows heat energy supplied against change in temperature when no energy is lost to the surrounding. The slope of this graph will give



- Specific heat capacity
- Latent heat of fusion

- Latent heat of vaporization
- Heat capacity

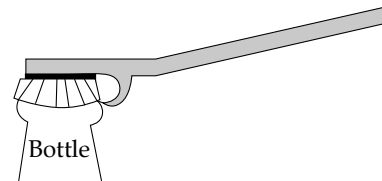
- (xv) A block of glass is pushed into the path of the light as shown below. Then the converging point X will



- Move away from the slab
- Move towards the slab
- Not shift
- Move towards the left side of the lens

Question 2

- (i) (a) In the following atoms, which one is a radioisotope? Give one use of this isotope.
 O^{16} , C^{14} , N^{14} , He^4
- (b) Name the class of the lever shown in the picture below: [3]

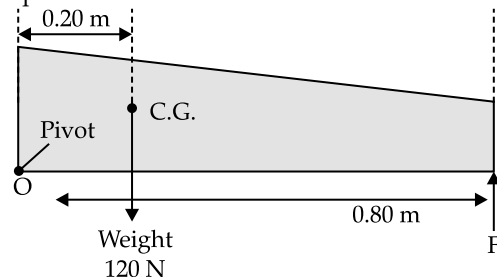


- (ii) Fill in the blanks: [2]

- (a) When a stone tied to a string is rotated in a horizontal plane, the tension in the string provides _____ force necessary for circular motion.
- (b) Work done by this force at any instant is _____.

- (iii) A non uniform beam of weight 120 N pivoted at one end is shown in the diagram below.

Calculate the value of F to keep the beam in equilibrium. [2]



- (iv) Meera chose to use a block and tackle system of '9' pulleys instead of a single movable pulley to lift a heavy load. [2]

- What is the advantage of using a block and tackle system over a single movable pulley?
- Why should she connect more number of pulleys in the upper fixed block?

- (v) Sumit does 600 J of work in 10 min and Amit does 300 J of work in 20 min. Calculate the ratio of the powers delivered by them. [2]

- (vi) 5 bulbs are connected in series in a room. One bulb is fused. It is removed and remaining 4 bulbs are again connected in series to the same circuit. What will be the effect on the following physical quantities? (Increases, Decreases, Remain Same)
- Resistance
 - Intensity of light
- [2]
- (vii) Rohan conducted experiments on echo in different media. He observed that a minimum distance of 'x' metres is required for the echo to be heard in oxygen and 'y' metres in benzene. Compare 'x' and 'y'. Justify your answer.
- Speed of sound in oxygen: 340 ms^{-1}
Speed of sound in benzene: 200 ms^{-1}
- [2]

Question 3

- (a) In a reading glass what is the position of the object with respect to the convex lens used?
(b) Why can we not use concave lens for the same purpose?
 - A fuse is rated 5 A. Can it be used with a geyser rated 1540 W, 220 V. Write Yes or No. Give supporting calculations to justify your answer.
 - State *two* factors affecting the speed of rotation of the coil in a D.C. motor.
 - How much heat is required to convert 500 g of ice at 0°C to water at 0°C ? The latent heat of fusion of ice is 330 Jg^{-1} .
 - Copy and complete the nuclear reaction by filling in the blanks.
- $${}_{92}\text{U}^{235} + {}_0\text{n}^1 \longrightarrow {}_{56}\text{Ba}^{...} + \dots \text{Kr}^{92} + 3 {}_0\text{n}^1$$

SECTION B - 40 MARKS

(Attempt any four questions from this Section.)

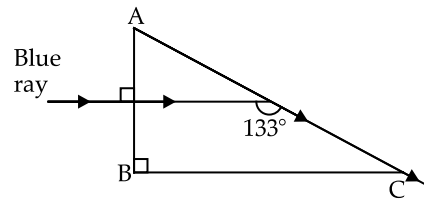
Question 4

- The image of a candle flame placed at a distance of 36 cm from a spherical lens, is formed on a screen placed at a distance of 72 cm from the lens. Calculate the focal length of the lens and its power.
- Below is an incomplete table showing the arrangement of electromagnetic spectrum in the increasing order of their wavelength. Complete the table.

Gam-ma ray	X-ray	U V rays	Visible rays	Infra-red	A	Radio waves
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- Identify the radiation A.
 - Name the radiation used to detect fracture in bones.
 - Name *one* property common to both A and Radio waves.
- (iii) (a) Why do we use red colour as a danger signal on the top of a skyscraper?
(b) The diagram below shows the path of a blue ray through the prism:
- Calculate the critical angle of the material of the prism for blue colour.

- What is the measure of the angle of this prism (A)?
- Which colour should replace the blue ray, for the ray to undergo Total Internal Reflection?



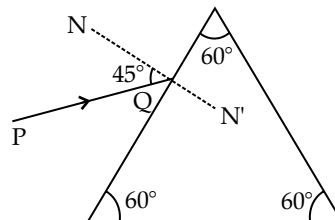
[4]

Question 5

- (i) (a) Refractive index of glass with respect to water is $\frac{9}{8}$.

Find the refractive index of water with respect to glass.

- Name the principle used to find the value in part (a).
 - If we change the temperature of water, then will the ratio $\frac{9}{8}$ remain the same? Write Yes or No. [3]
- (ii) Light travels a distance of '10x' units in time ' t_1 ' in vacuum and it travels a distance of 'x' units in time ' t_2 ' in a denser medium. Using this information answer the question that follows:
- 'Light covers a distance of '20x' units in time ' t_1 ' in diamond. 'State true or false.
 - Calculate the refractive index of the medium in terms of ' t_1 ' and ' t_2 '. [3]
- (iii) A monochromatic ray of light is incident on an equilateral prism placed at minimum deviation position with an angle of incidence 45° as shown in the diagram.

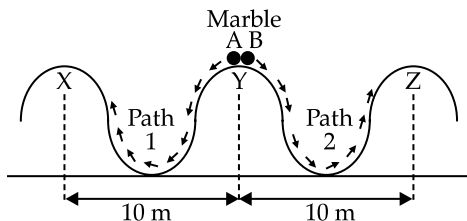


- Copy the diagram and complete the path of the ray PQ.
- State two factors on which the angle of deviation depends. [4]

Question 6

- (a) Define Centre of Gravity. [3]
(b) A hollow ice cream cone has height 6 cm.
 - Where is the position of its centre of gravity from the broad base?
 - Will its position change when it is filled completely with honey? Write Yes or No.

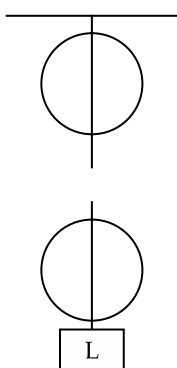
(ii)



Two identical marbles A and B are rolled down along Path 1 and Path 2 respectively. Path 1 is frictionless and Path 2 is rough.

- (a) Which marble will surely reach the next peak?
- (b) Along which path/s the mechanical energy will be conserved?
- (c) Along which path/s is the law of conservation of energy obeyed?

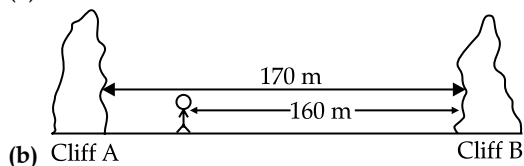
(iii) Given are two pulleys.



- (a) Copy and complete the labelled diagram connecting the two pulleys with a tackle to obtain Velocity Ratio = 2.
- (b) If Load = 48 kgf and efficiency is 80% then calculate:
 1. Mechanical Advantage.
 2. Effort needed to lift the load.

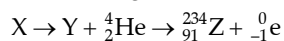
Question 7

(i) (a) Name the waves used in SONAR. [3]



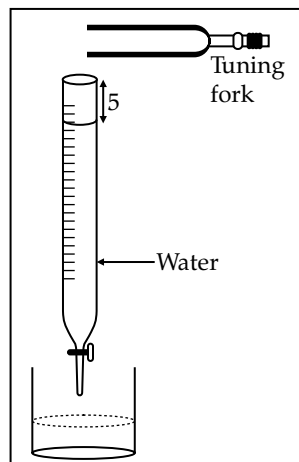
(b) In the above diagram Lata stands between two cliffs and claps her hands. Determine the time taken by her to hear the first echo. Speed of sound in air 320 ms^{-1} .

(ii) (a) Complete the following radioactive reaction:



(b) Uranium is available in two forms U-235 and U-238. Which of the two isotopes of Uranium is more fissionable? [3]

(iii) In the given diagram, a vibrating tuning fork is kept near the mouth of a burette filled with water. The length of the air column is adjusted by opening the tap of the burette. At a length of 5 cm of the air column, a loud sound is heard. [4]



- (a) Name the phenomenon illustrated by the above experiment.
- (b) Why is a loud sound heard at this particular length?
- (c) If the present tuning fork is replaced with a tuning fork of higher frequency, should the length of the air column increase or decrease to produce a loud sound? Give a reason.

Question 8

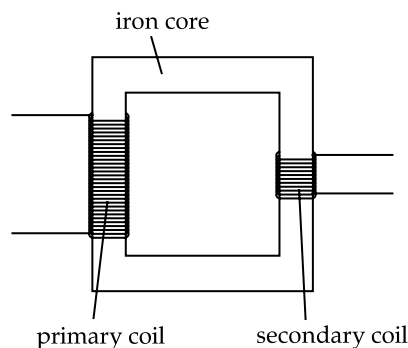
(i) The voltage - current readings of a certain material are shown in the table given below: [3]

Voltage (V)	10 V	20 V	30 V
Current (I)	2 A	3 A	4 A

Study the table.

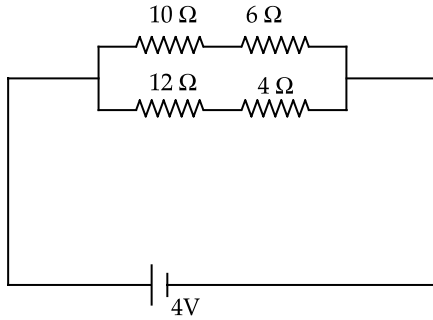
- (a) State whether the conductor used is ohmic or non-ohmic.
- (b) Justify your answer.
- (c) State Ohm's law.

(ii) Below is the diagram of a transformer: [3]



- (a) Identify the type of transformer.
- (b) In this type of transformer which of the wire is thicker, the primary or the secondary? Give a reason.

(iii) Study the diagram:



[4]

- Calculate the total resistance of the circuit.
- Calculate the current drawn from the cell.
- State whether the current through $10\ \Omega$ resistor is greater than, less than or equal to the current through the $12\ \Omega$ resistor.

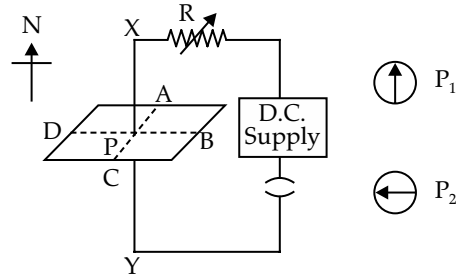
Question 9

- 85 g of water at 30°C is cooled to 5°C by adding certain mass of ice. Find the mass of ice required. [3]
[Specific heat capacity of water = $4.2\ \text{Jg}^{-1}\text{C}^{-1}$, Specific latent heat of fusion = $336\ \text{Jg}^{-1}$] [3]
- Why does it become pleasantly warm when the lakes start freezing?
 - Water freezes to form ice. What change would you expect in the average kinetic energy of the molecules?

- Which will contain more heat energy 1 g of ice at 0°C or 1 g water at 0°C ? [3]

(iii) (a) State one factor that affects the magnitude of induced current in an AC generator. [3]

- Given below 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.



- Name the rule that is used to predict the direction of deflection of the magnetic compass.
- State the direction of current in the conductor (X to Y or Y to X) when the circuit is complete.
- If resistance R is increased, then what will be the effect on the magnetic lines of force around the conductor? [4]



ANSWERS

SECTION A

1. (i) **Option (b) is correct.**

Explanation: Bell fixed on a cycle rings when pressure by finger is applied. So, mechanical energy is converted into sound energy.

(ii) **Option (a) is correct**

Explanation: Moment of a force = Force \times perpendicular distance from the line of action of the force

$$\text{Or,} \quad 1 = F \times 0.2$$

$$\therefore \quad F = 5 \text{ N}$$

(iii) **Option (c) is correct.**

Explanation: Displacement should be in the direction of force.

(iv) **Option (a) is correct.**

Explanation: Number of nucleons i.e., mass no. does not change due to β emission Only atomic number will increase by 1.

(v) **Option (b) is correct.**

Explanation: As wavelength decreases, scattering increases.

Wavelength of ultraviolet is less than the wavelength of microwave.

Hence, scattering of ultraviolet is more than that of microwave.

Hence, the assertion is true but reason is false.

(vi) **Option (c) is correct.**

Explanation: When stem of a vibrating tuning fork is pressed on a table, the table top starts vibrating due to the periodic force applied by the tuning fork. This is an example of forced vibration.

(vii) **Option (d) is correct.**

Explanation: For class III lever force is applied in between the fulcrum and the load.

In human forearm, elbow is the pivot, bicep muscle applies the force and load is placed on the palm. Hence, it is a class III lever.

(viii) **Option (b) is correct.**

Explanation: Specific resistance is independent of the dimension of the conductor. It depends on the material of the conductor.

(ix) **Option (a) is correct.**

Explanation: From mains, blue wire (NEUTRAL) should directly reach the appliance and the brown wire (LIVE) should reach the appliance through a switch.

(x) **Option (a) is correct.**

Explanation: Potential difference between terminals of a cell, in open circuited condition, is termed as electromotive force. Potential difference between terminals of a cell, in closed circuited condition, is termed as terminal voltage.

(xi) **Option (b) is correct.**

Explanation: During melting, ice requires latent heat (a form of energy) and temperature remains constant at its melting point.

(xii) **Option (a) is correct.**

Explanation: Concave lens always produces virtual, erect image, smaller than the object. Hence, the magnification is less than 1.

(xiii) **Option (c) is correct.**

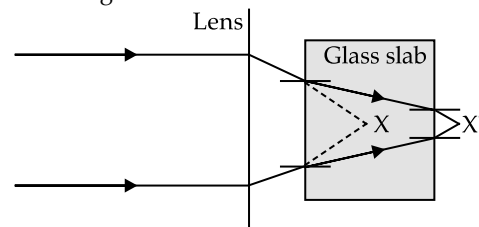
Explanation: Rate of radioactive elements is determined by the properties of the nucleus of an atom. so, it does not change by environment (external factors).

(xiv) **Option (d) is correct.**

Explanation: Slope the graph gives the amount of heat required for unit rise of temperature. This is termed as the heat capacity.

(xv) **Option (a) is correct.**

Explanation: The light passing through glass slab will bend towards the normal and after coming out in the air, the light will converge out at a point away from the glass slab.



2. (i) **(a)** C^{14} is a radioisotope because of the instability of the nucleus. Used for carbon dating.

(b) Class II lever.

(ii) **(a)** Centripetal

(b) zero

(iii) The weight of the beam will produce a clockwise moment and the applied force F will produce a clockwise moment.

Equating the moments of the force,

$$120 \times 0.2 = F \times 0.8$$

$$\therefore \quad F = 30 \text{ N}$$

(iv) **(a)** Mechanical advantage using a block and tackle system of 9 pulleys is 9 whereas the mechanical advantage of a single moveable pulley is 2.

(b) Increase of number of pulley increases mechanical advantage.

$$(v) \quad \frac{P_{\text{Sumit}}}{P_{\text{Amit}}} = \frac{\frac{W_{\text{Sumit}}}{t_{\text{Sumit}}}}{\frac{W_{\text{Amit}}}{t_{\text{Amit}}}} = \frac{\frac{600}{10}}{\frac{300}{20}} = 4:1$$

(vi) **(a)** Resistance decreases

(b) Current (Intensity of light) increases as resistance decreases

(vii) Applying the formula

$$d = v \times \frac{0.1}{2}$$

$$\text{For Oxygen,} \quad x = 340 \times \frac{0.1}{2} = 17 \text{ m}$$

For Benzene, $y = 200 \times \frac{0.1}{2} = 10 \text{ m}$

So, $x : y = 17 : 10$

3. (i) (a) In between optical centre and focus
(b) Because concave lens produces reduced size image.

(ii) No.

The geyser draws $I = \frac{P}{V} = \frac{1540}{220} = 7 \text{ A}$.

Hence, 5A rated fuse will blow off for the geyser.

- (iii) Speed of rotation may be increased by
Increasing the number of turns of the armature.
Increasing the applied battery e.m.f.

(iv) Required heat $Q = mL = 500 \times 330 = 165000 \text{ J}$

(v) ${}_{92}\text{U}^{235} + {}_0\text{n}^1 \rightarrow {}_{46}\text{Ba}^{141} + {}_{36}\text{Kr}^{92} + 3{}_0\text{n}^1$

SECTION B

4. (i) Using lens formula,

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

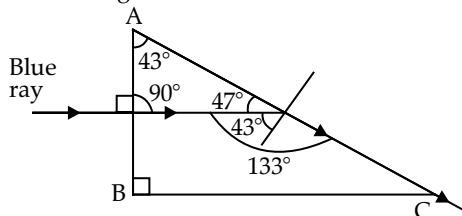
Or, $\frac{1}{72} + \frac{1}{36} = \frac{1}{f}$

Or, $\frac{3}{72} = \frac{1}{f}$

$\therefore f = 24 \text{ cm}$

Power of the lens = $\frac{1}{f} = \frac{100}{24} = 4.17 \text{ D}$

- (ii) (a) Microwave
(b) X-rays
(c) Both have same speed in vacuum
- (iii) (a) Red colour is used as danger signal because it is scattered least due to its longest wavelength in visible range. Hence, it is visible from a very long distance.
- (b) 1. Critical angle is 43°



2. From the above figure, Angle of prism = 43°
3. If the blue ray is replaced by indigo or violet, there will be total internal reflection.
Critical angles for indigo and violets are less than that of blue. Hence, the angle of incidence 43° will be greater than the critical angle and total internal reflection will occur.

5. (i) (a) Refractive index of glass with respect to water = $\frac{9}{8}$

Hence, the Refractive index of water with respect to glass = $\frac{8}{9}$

(b) The principle of reversibility

(c) No.

- (ii) (a) The statement is false.

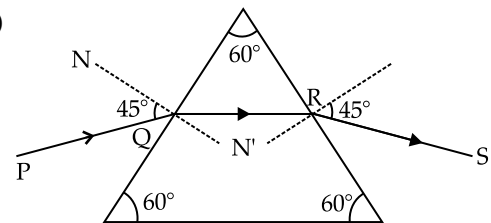
Diamond is a denser medium compared to vacuum. Hence, in it light cannot cover longer distance than that in vacuum.

(b) Speed of light in vacuum = $\frac{10x}{t_1}$

Speed of light in the medium = $\frac{x}{t_2}$

$$\begin{aligned} \text{So, refractive index of the medium} &= \frac{\frac{10x}{t_1}}{\frac{x}{t_2}} \\ &= \frac{10t_2}{t_1} \end{aligned}$$

- (iii) (a)



- (b) Angle of deviation depends on

- Angle of incidence
- Refractive index

6. (i) (a) **Centre of gravity:** Centre of gravity is the point where the mass of the whole body appears to be concentrated.

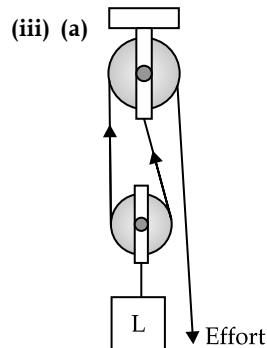
- (b) 1. The centre of gravity from the broad base is at a height $\frac{h}{3} = \frac{6}{3} = 2 \text{ cm}$.

2. Yes.

- (ii) (a) Marble A

(b) Along both the paths.

(c) Along both the paths.



- (b) 1. Efficiency = $\frac{\text{M.A.}}{\text{V.R.}}$

Or, $0.8 = \frac{\text{M.A.}}{2}$

$\therefore \text{M.A.} = 1.6$

$$2. \quad \text{Effort} = \frac{\text{Load}}{\text{M.A.}}$$

$$\text{Or,} \quad \text{Effort} = \frac{48}{1.6}$$

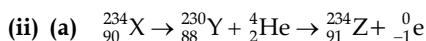
$$\therefore \quad \text{Effort} = 30 \text{ kgf}$$

7. (i) (a) Ultrasonic wave

(b) Lata cannot clearly distinguish the sound reflected from cliff A. Since the distance is less than the minimum distance required to hear a distinct echo.

So, she will hear the sound reflected from cliff B as 1st echo.

$$\begin{aligned} \text{So, she will hear the 1}^{\text{st}} \text{ echo after time } t &= \frac{2d}{v} \\ &= \frac{2 \times 160}{320} = 1 \text{ s.} \end{aligned}$$



(b) U-235

(iii) (a) Resonance

(b) Natural frequency of the air column matched with the frequency of the tuning fork.

(c) Length of air column should be decrease. Since frequency is inversely proportional to the air column.

8. (i) (a) Non-ohmic

(b) The resistance is not constant. It increases as voltage and current increases.

(c) Ohm's law:

The flow of current through the conductor is directly proportional to the potential difference established across the conductor provide its physical conditions (like, temperature, pressure, density, volume etc.) are constant.

(ii) (a) Step down transformer

(b) Wire of secondary coil is thicker because secondary current is higher than primary current.

(iii) (a) 10 Ω and 6 Ω are in series. Hence, equivalent resistance $R_1 = 16 \Omega$.

12 Ω and 4 Ω are in series. Hence, equivalent resistance $R_2 = 16 \Omega$.

R_1 and R_2 are in parallel. Hence, the equivalent resistance = $R_{eq} = 8 \Omega$.

(b) Current $I = \frac{V}{R_{eq}} = \frac{4V}{8 \Omega} = 0.5A$

(c) Current in both the resistors are equal because both the arms have same resistance value.

9. (i) Let the amount of ice = m gram

$$\text{Heat lost by water} = 85 \times 4.2 \times (30 - 5)$$

$$\text{Heat lost by ice} = m \times 336 + m \times 4.2 \times (5 - 0)$$

Applying principle of calorimetry,

$$85 \times 4.2 \times (30 - 5) = m \times 336 + m \times 4.2 \times (5 - 0)$$

$$\text{Or,} \quad 8925 = 357 m$$

$$\therefore \quad m = 25 \text{ g}$$

(ii) (a) When lake freezes, it released latent heat to the atmosphere which warms the atmosphere. So, the atmosphere becomes pleasantly warm.

(b) Since there is no change of temperature there is no change in kinetic energy.

(c) 1 g of ice (solid) at 1°C has extra heat in the form of its Latent Heat while 1 g of water (liquid) at 1°C has no Latent heat.

Hence, heat energy in 1 g of ice at 0°C has more heat energy than the 1 g water at 0°C.

(iii) (a) Number of turns in armature may be increased.

(b) 1. Maxwell right hand thumb rule.

2. Deflection being clockwise, the direction of current is from X to Y.

3. As R increases, current decreases. So, strength of magnetic field decreases and hence, the density of magnetic lines of force decreases.

