Kerala Board Class 10 Physics 2024

SECTION - A

Answer any four questions. Each question carries 1 score.

Q1. Identify the relation in the first word pair and complete the second.

(i) Brown Energy: Coal

(ii) Green Energy: _____

Solution:

(i) Brown Energy: Coal

(ii) Green Energy: **Solar (or Wind, Hydro, etc.)**

Q2. If the near point of a person is 25 cm, and the far point is not infinity then his eye has _____.

(No defect, Myopia, Hypermetropia, Presbyopia)

Solution:

If a person's near point is 25 cm and the far point is not infinity, then his eye has **Myopia**.

Q3. Name the process in which the nuclei of greater mass are split into lighter nuclei?

Solution:

The process in which the nuclei of greater mass are split into lighter nuclei is called nuclear fission. (Nuclear fission occurs when a heavy nucleus splits into two or more lighter nuclei, releasing a large amount of energy).

Q4. The power of a lens is +2D. Find its focal length.

Solution:

The power of a lens is +2D. The focal length (f) is given by:

$$f = \frac{1}{2}$$

$$= 0.5\ m$$

$$= 50\ cm$$

The focal length is **+50 cm**, indicating a **convex lens**.

Q5. The work done to move a charge of 3 coulomb between the points X and Y is 12 J. Then the potential difference between these points is _____.

Solution:

The work done to move a charge of 3 coulombs between points X and Y is 12 J. The potential difference (V) is given by:

$$V = \frac{W}{Q}$$

$$V = \frac{12}{3}$$

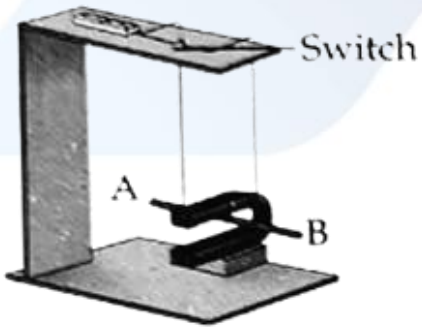
$$= 4\ \text{V}$$

The potential difference between X and Y is 4 V.

Section – B

Answer any four questions. Each question carries 2 scores.

Q6. A conductor AB suspended freely between the poles of a U magnet is depicted. DC source is connected to the circuit.



(a) State the rule to find the direction of motion of the conductor AB when a

current is switched on.

(b) Write two methods to reverse the direction of motion of the conductor.

Solution:

(a) The direction of motion of the conductor can be determined using Fleming's Left-Hand Rule which states that:

Hold your left hand in such a way that the thumb, the index finger, and the middle finger are mutually perpendicular to each other (like the three axes of a coordinate system).

- Thumb: Represents the direction of the force (motion) on the conductor.
- Index Finger: Represents the direction of the magnetic field (from north to south).
- Middle Finger: Represents the direction of the current (from positive to negative).

(b) Methods to Reverse Motion:

- Reverse the direction of the current.
- Reverse the direction of the magnetic field.

Q7. A magnetic field is formed around a current-carrying conductor.

(a) Write the law to find the direction of this magnetic field.

(b) Write two methods to increase the strength of magnetic field by current carrying conductors.

Solution:

(a) The law to find the direction of the magnetic field is Right-Hand Thumb Rule. According to the Right-Hand Thumb Rule, if you hold a current-carrying conductor with your right hand such that the thumb points in the direction of the current, then the fingers curl in the direction of the magnetic field around the conductor.

(b) Two methods to increase the strength of the magnetic field by current-carrying conductors:

- Increase the current flowing through the conductor.

- Use a coil instead of a straight conductor and insert a soft iron core inside it (making it a solenoid or an electromagnet).

Q8. Various stages in the working of a moving coil microphone are given.

1. Electric signals
2. The Diaphragm vibrates
3. Sound energy
4. The coil vibrates in the magnetic field

(a) Write them in the correct order.

(b) What is the working principle of this microphone?

Solution:

(a) Correct order of working stages:

1. Sound energy causes vibrations in the diaphragm.
2. The diaphragm vibrates and moves the attached coil.
3. The coil vibrates in the magnetic field, inducing an electric signal.
4. Electric signals are produced as output.

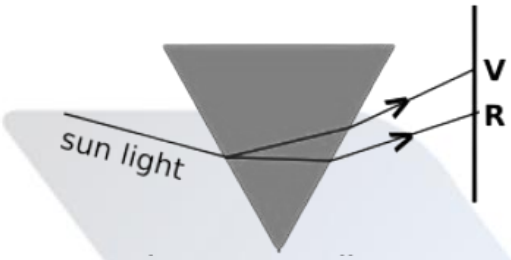
(b) Working principle of the microphone:

A moving coil microphone works on the principle of **electromagnetic induction.** When the diaphragm moves due to sound waves, the coil vibrates in the magnetic field, inducing a current in the coil. This converts sound energy into electrical signals.

Q9. The figure shows sunlight falling obliquely on a glass prism.

Copy the diagram and complete it. Mark the colours seen on the screen.

Solution:



When white light passes through a prism, it undergoes dispersion, splitting into its seven constituent colors (VIBGYOR) due to different wavelengths refracting at different angles.

Q10. Which material is used to make the filament of an incandescent lamp? What properties make this material suitable for this purpose?

Solution:

(a) The material used for making the filament is Tungsten (W).

(b) Properties that make Tungsten suitable:

- High melting point (~3422°C) – Prevents filament from melting at high temperatures.
- High resistivity – Increases heat production, making it glow brightly.
- Low evaporation rate – Ensures long filament life.
- Good mechanical strength – Can withstand repeated heating and cooling.

Section – C

Answer any four questions. Each question carries 3 scores.

Q11. A student has a large number of identical 2 Ω resistors. He requires a circuit having an effective resistance of 9 Ω.

(a) What will be the minimum number of 2 Ω resistors used for this?

(b) Draw the circuit diagram of this arrangement.

Solution:

(a) Step 1: Connecting 4 Resistors in Series

When 4 resistors of 2Ω are connected in series, the total resistance is:

$$R_{\text{series}} = 2\ \Omega + 2\ \Omega + 2\ \Omega + 2\ \Omega = 8\ \Omega$$

Step 2: Connecting 2 Resistors in Parallel

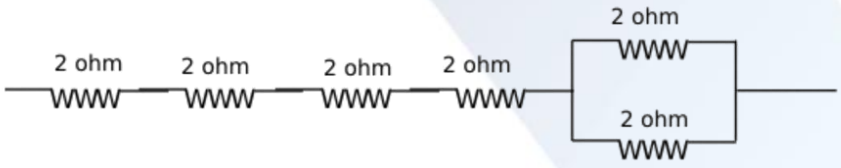
When 2 resistors of 2Ω are connected in parallel, the total resistance is:

$R_{\text{parallel}} = \frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1\ \Omega$

Step 3: Combining the Two Resistances

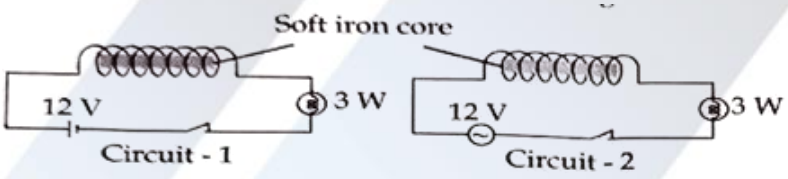
The total resistance of the circuit is:

$R_{\text{total}} = R_{\text{series}} + R_{\text{parallel}} = 8\ \Omega + 1\ \Omega = 9\ \Omega$



(b)

Q12. Analyse the circuits and answer the following questions.



(a) "A magnetic field is developed around the solenoid only in the second circuit." Do you agree with this statement? Explain.

(b) In which circuit, a continuous emf is induced? Name and explain this phenomenon.

Solution:

(a) The statement "A magnetic field is developed around the solenoid only in the second circuit." is incorrect.

A magnetic field is formed around any current-carrying solenoid, irrespective of the circuit.

If the first circuit also has a current flow, it will produce a magnetic field around the solenoid.

The strength of the field depends on current, number of turns, and core material.

(b) Induced EMF in Circuits

Continuous EMF is induced in the circuit where magnetic flux changes continuously (Faraday's Law of Electromagnetic Induction).

In a moving coil within a magnetic field, a continuous EMF is induced.

This phenomenon is called **electromagnetic induction.**

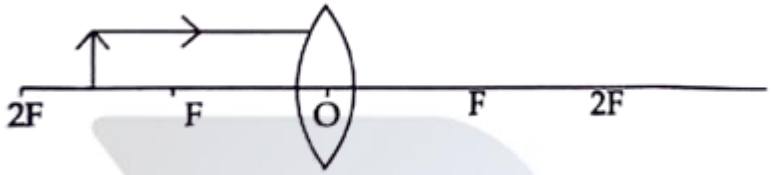
Q13. Match the following statements associated with mirrors in column A, B and C in correct order.

A Mirror	B Characteristics of the virtual image	C Use
Concave mirror	Always forms a diminished image	To see the face
Convex mirror	The size of the image and the size of of the object will be equal	Used by dentists
Plane mirror	Always forms enlarged images	Used as rear view mirror in vehicles

Solution:

A Mirror	B Characteristics of the virtual image	C Use
Concave mirror	Always forms enlarged images	Used by dentists
Convex mirror	Always forms a diminished image	Used as a rear-view mirror in vehicles
Plane mirror	The size of the image and the size of the object will be equal	To see the face

Q14. Observe the diagram of an object placed on the principal axis of a convex lens.

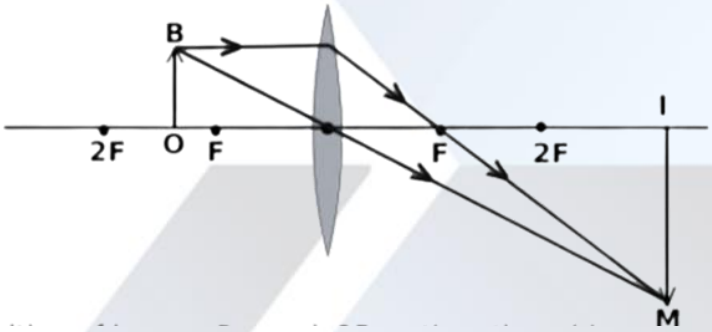


(a) Copy down the ray diagram and complete it to show the position of the image

(b) Write the characteristics of the image obtained.

Solution:

(a)



(b) The image obtained is enlarged, inverted and real.

Q15. The calorific value should be considered when choosing a good fuel.

(a) What is calorific value of a fuel?

(b) What are the essential factors for the complete combustion of a fuel?

(c) What are the characteristics of a good fuel?

Solution:

(a) Calorific value of a fuel

It is the amount of heat energy produced when 1 kg of fuel is completely burned.

Measured in kilojoules per kilogram (kJ/kg).

(b) Essential factors for complete combustion:

- Sufficient oxygen supply.
- Proper temperature for ignition.

- Good mixing of fuel and air to ensure complete burning.

(c) Characteristics of a Good Fuel:

- High calorific value (releases more energy per unit mass).
- Burns completely without producing harmful gases.
- Easily available and economical.
- Safe to store and handle.
- Produces minimal pollution.

Section – D

Answer any four questions. Each question carries 4 scores.

Q16. The resistance of an electrical device designed to work at 230 V is 460Ω.

(a) Calculate the current drawn by this device when operated at 230 V .

(b) Find the rated power of the device. $p = J$ V/P − T

(c) Calculate the heat produced if this device works for 10 minutes. $11 - J^j$

Solution:

Resistance of an electrical device

Given:

Voltage, V = 230 V

Resistance, R = 460 Ω

Time, t = 10 minutes = 600 s

(a) Current drawn by the device:

Using Ohm's law:

$$I = \frac{V}{R} = \frac{230}{460} = 0.5 \text{ A}$$

(b) Rated power of the device:

$$P = VI = 230 \times 0.5 = 115 \text{ W}$$

(c) Heat produced:

Using the formula:

$$H = P \times t = 115 \times 600 = 69000J = 69 \text{ kJ}$$

Q17. A transformer has 100 turns in the primary and 1000 turns in the secondary.

(a) Which coil of this transformer is made using thick wire? Give reason.

(b) Explain how electrical energy is transferred from the primary to the secondary of the transformer.

Solution:

(a) The primary coil is made using a thick wire.

Reason: The primary coil carries more current, and a thicker wire reduces resistance. There are two benefits for this.

i. Overheating of the coil can be prevented.

ii. Efficiency of the transformer can be increased/ Energy loss can be minimised.

(b) When AC voltage is applied to the primary coil, a changing magnetic field is created.

This magnetic field induces an alternating voltage in the secondary coil through mutual induction.

The voltage ratio follows

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$ (transformer equation).

Q18. An object is located on the principal axis of a spherical mirror at a distance of 40 cm from the pole. The magnification of the image is -4.

(a) What does the negative sign indicate?

(b) How far from the pole of the mirror is the image formed?

(c) Calculate the focal length of the mirror by considering the New Cartesian sign.

Solution:

Given:

Object distance, $u = -40\ cm$

Magnification, $m = -4$

(a) What does the negative sign indicate?

The negative sign indicates that the image is real and inverted.

(b) Image distance v:

Using the magnification formula:

$$m = -\frac{v}{u}$$

$$-4 = -\frac{v}{-40}$$

$$v = -160 \text{ cm}$$

(The image is formed 160 cm in front of the mirror.)

(c) Focal length of the mirror:

Using the mirror formula:

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

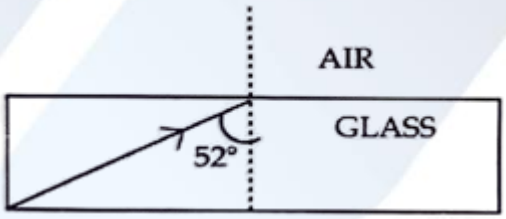
$$\frac{1}{f} = \left(\frac{1}{-40}\right) + \left(\frac{1}{-160}\right)$$

$$\frac{1}{f} = -\left(\frac{4}{160} + \frac{1}{160}\right) = -\frac{5}{160} = -\frac{1}{32}$$

$$f = -32 \text{ cm}$$

(Since f is negative, the mirror is concave.)

Q19. The critical angle of glass with respect to air is 42°. Observe the figure and answer the questions.



(a) What do you mean by critical angle?

(b) What happens to the given incident ray as it continues its path?

(c) Explain phenomenon of light that occurs here.

Solution:

(a) The critical angle is the angle of incidence beyond which light does not refract but is completely reflected inside the denser medium.

(b) If the incident angle exceeds 42°, the light reflects back and does not exit the glass. Therefore, here the ray will be reflected back to the glass since $52^{o} > 42^{o}$.

(c) Total internal reflection: When light travels from a medium of higher optical density to a medium of lower optical density, if the angle of incidence is greater than the critical angle, the light will be reflected back into the same medium instead of undergoing refraction.

Q20. Give reason for each of the following.

(a) A rapidly rotating Newton's colour disc appears white.

(b) Sun appears red during sunrise and sunset.

(c) A clear sky appears blue.

(d) On frosty mornings the path of sunlight passing through the woods is clearly visible.

Solution:

A rapidly rotating Newton's colour disc appears white:

The disc contains seven colours of light. When it rotates fast, the human eye cannot distinguish individual colours, and they blend to appear white due to persistence of vision.

(b) The Sun appears red during sunrise and sunset:

The sunlight has to pass through a thicker atmosphere during sunrise and sunset. Short-wavelength light (blue, violet) gets scattered away, while the longer-wavelength red light reaches our eyes.

(c) A clear sky appears blue:

Rayleigh scattering causes shorter-wavelength blue light to scatter more than other colours, making the sky appear blue.

(d) Sunlight passing through the woods is visible on frosty mornings:

The tiny water droplets in fog scatter sunlight, making the path of sunlight clearly visible.