Kerala board class 10 Physics 2023

Instruction:

- The first 15 minutes is cool-off time.
- You may use the time to read the questions and plan your answers.
- Answer only on the basis of instructions and questions given.
- Consider score and time while answering.

SECTION- A

Answer any 4 questions from 1 to 5. Each carries 1 score.

Q1. The prominent effect produced when a current passes through a solenoid is _____.
[chemical effect, mechanical effect, magnetic effect, light effect]

Solution: Magnetic effect

Q2. When there is a change in magnetic flux linked with a conductor, an EMF is induced in it. Name the phenomenon.

Solution: Electromagnetic induction

Electromagnetic induction is the phenomenon of producing an EMF in a circuit whenever there is a change in magnetic flux linked with the coil.

Q3. In mirrors which point is considered as origin while measuring distances according to the New Cartesian Sign Convention?

Solution:

According to the new cartesian sign convention, pole of the mirror is taken as the origin. All the measurements of object distance, image distance and the focal length are recorded from the pole of the mirror.

Q4. Which phenomenon of light is used in optical fibres that are used for communications?

Solution:

Optical fibres are used for telecommunication, and it is based on the phenomenon of total internal reflection.

Q5. What is the distance to the near point from an eye with healthy vision?

Solution: 25 cm

The human eye can see objects clearly without any strain on the eye when an object is placed at least 25 cm away. This distance of 25 cm is known as the near point of the eye.

Section B

Answer any four questions. Each question carries 2 scores.

Q6. (a) What is the main disadvantage of an incandescent lamp?

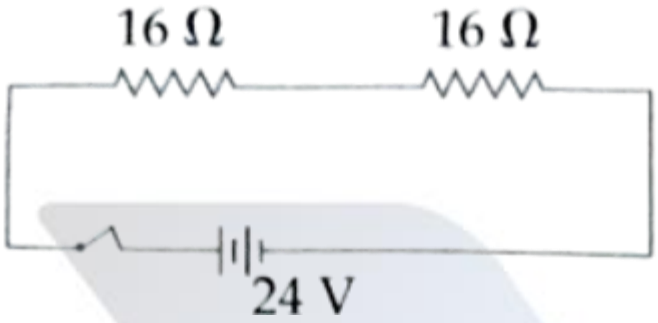
(b) Write any two properties of tungsten that make it suitable for being used as a filament.

Solution: (a)

- It is energy inefficient.
- It has a very short lamp lifetime, i.e. about 1000 hours typically.
- It is a warm light source and hence requires air conditioning to cool the room.
- It has a higher operating cost.
- It is very fragile and hence needs to be handled very carefully.
- It generates a low lumen per watt. Ordinary incandescent bulbs produce about 5 to 20 lumens per watt. This means it has lower efficacy.

(b) Tungsten is used exclusively for electric light filaments because it has the lowest coefficient of thermal expansion, a high melting point, and good tensile strength.

Q7. Observe the diagram. Two 16 Ω resistors are connected in series, and a potential difference of 24 V is applied.



(a) Calculate the effective resistance in the circuit.

(b) If the resistors were connected in parallel without changing the voltage source what will be the current in the circuit?

Solution:

(a) The effective resistance for two resistors in series is given as:

$$R = R_1 + R_2$$

Here, $R_1 = 16\Omega = R_2$

Hence, the effective resistance is given as:

$$R_{\text{eff}} = 16 + 16 = 32\Omega$$

(b) If the resistors are connected in parallel then effective resistance will be

$$\frac{1}{R_{\text{eff}}} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{16} + \frac{1}{16} = \frac{16+16}{16\times 16} = \frac{1}{8}$$

$$R_{\text{eff}} = 8\Omega$$

Given, Potential = 24 V and $R_{\text{eff}} = 8\Omega$,

From Ohm's law, V = IR

$$I = \frac{V}{R} = \frac{24}{8} = 3 \text{ A}$$

Q8. A conductor kept in a magnetic field experiences a force when current passes through it.

(a)Name the rule that helps us to find the direction of the force.

(b)Name any two devices that work based on this principle

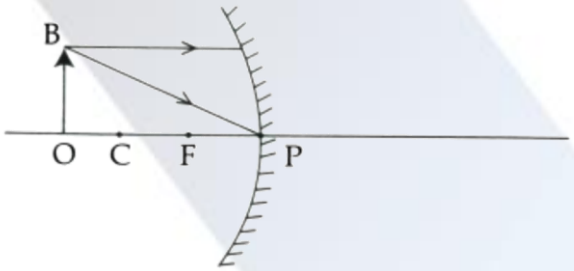
Solution:

(a) Fleming's left-hand rule gives the direction of force experienced by a current-

carrying conductor placed in an external magnetic field.

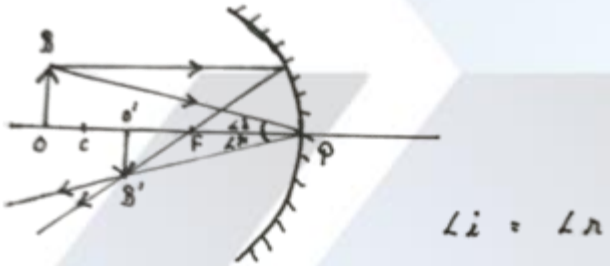
(b)Induction motors, generators, and electric motors are examples of appliances that function according to Fleming's left-hand rule.

Q9. Observe the diagram



Redraw the ray diagram and complete it to show the image.

Solution:



The image formed is real, inverted and diminished. The image is formed between C and F.

Q10. Match the following appropriately.

A	B
(a) Fuel Cell	(i) Carbon
(b) L.P.G.	(ii) Methane
(c) Coal	(iii) Hydrogen
(d) CNG	(iv) Butane

Solution:

(a) – (III), (b) – (iv), (c) – (i), (d) – (ii)

Fuel Cell – Hydrogen, A fuel cell is a device that generates electricity through an electrochemical reaction, not combustion. In a fuel cell, hydrogen and oxygen are combined to generate electricity, heat, and water.

L.P.G. - Butane, LPG is the abbreviation or short form of Liquefied Petroleum gas. Its major constituents are propane and butane.

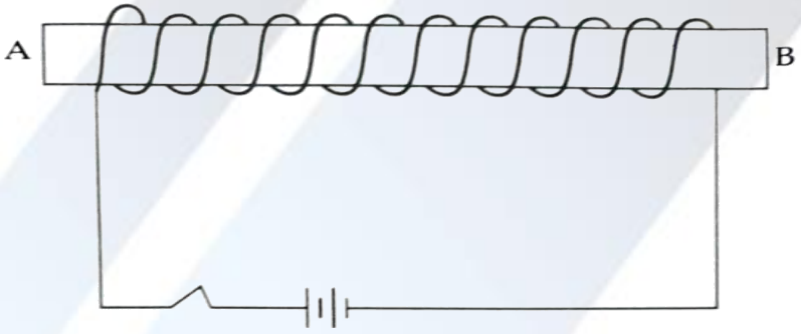
Coal – Carbon, Coal is a mineral in which the chemical element of carbon is present in highest percentage.

CNG - Methane, CNG is made by compressing natural gas, which is mainly composed of methane (CH_4).

Section C

Answer any four questions. Each question carries 3 scores.

Q11. A DC current passes through an insulated copper coil wound over a soft iron core as shown in the figure.



(a) By just observing the experimental setup, how will you identify the south pole of the electromagnet?

(b) Compare the properties of an electromagnet and a permanent bar magnet.

Solution:

(a) The polarity of a magnetic pole in a solenoid is the south pole if the current is flowing clockwise and the north pole if the current flows anti-clockwise. Polarity can

also be found using the right-hand thumb rule.

Thus, the polarity of the solenoid XY at X is the south pole, and at Y is the north pole.

(b)

Permanent (Bar) Magnet	Electromagnet
They are permanently magnetised.	These are temporarily magnetised.
These are usually made of hard materials.	They are usually made of soft materials.
The poles of a Permanent magnet cannot be changed.	The poles of an electromagnet can be altered.
An example of a permanent magnet is a Bar Magnet	An example of a temporary magnet is solenoid wounded across a nail and connected to a battery.

Q12. The current in the secondary coil of a transformer with no power loss is 5 A and that in the primary is 0.5 A.

(a) What type of transformer is this?

(b) If the input voltage of this transformer is 240 V calculate the output voltage.

Solution:

(a) Step Down transformer.

(b) $\frac{I_s}{I_p} = \frac{V_p}{V_s}$

$$V_s = \frac{I_p \times V_P}{I_s} = \frac{240 \times 0.5}{5} = 24 \text{ V}$$

Q13. A doctor's prescription for a person with defective vision have the figures -1D, -1.25D.

(a) What do these figures indicate?

(b) Identify the defect of the eye.

(c) Write the reason for this defect.

Solution:

(a) $-1D, -1.25D$ indicates the power of the lens they require. A lens's power is defined as its ability to converge or diverge a beam of light falling on it.

(b)The power of a convex lens is positive, while the power of a concave lens is negative. In this -1D,-1.25D power means a person suffers from myopia or near-sightedness.

(c)Nearsightedness or myopia happens when your eyeball grows too long from front to back, or when there are problems with the shape of your cornea (clear front layer of the eye) or lens (an inner part of the eye that helps the eye focus).

Q14. An object of height 6 cm is placed 10 cm away in front of a concave mirror. A real inverted image of height 3 cm is formed.

(a) Find the magnification of the image.

(b) Calculate the distance of the image from the mirror.

Solution:

Distance of the object from the mirror, $u = -10$ cm

Object height $= h_1 = 6$ cm

Image height $= h_2 = -3$ cm

Now, from the magnification formula, we know that:

$$m = \frac{h_2}{h_1} = \frac{-v}{u}$$

$$m = \frac{-3}{6} = \frac{-1}{2}$$

(b) Distance of the image from the mirror $= v$

Now, from the magnification formula, we know that:

$$m = \frac{h_2}{h_1} = \frac{-v}{u}$$

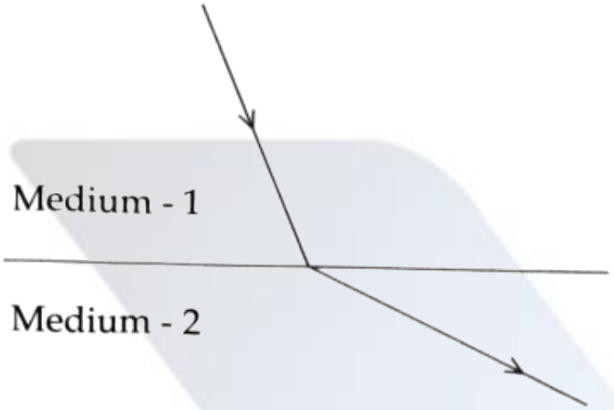
$$m = \frac{-v}{u}$$

$$m = \frac{-1}{2} = \frac{-v}{-10}$$

$$v = 10 \times \frac{-1}{2}$$

$$v = -5 \text{ cm}$$

Q15. Observe the figure. A ray of light enters from medium-1 to medium-2.



(a) Find out which medium has greater optical density.

Solution: Medium 1

When the light rays enter from medium 1 to 2, they move away from the normal. The speed of light is also greater in medium 2 than in medium 1.

(b) Explain the terms:

(i) relative refractive index.

Solution: The refractive index of any medium with respect to another medium which is not vacuum is called the relative refractive index.

$$\text{Relative refractive index} = \frac{\text{speed of light in one medium}}{\text{speed of light in another medium}}$$

(ii) absolute refractive index

Solution: The absolute refractive index of a medium is the ratio of the velocity of light in a vacuum to the velocity of light in the medium. The value of the absolute refractive index can never be less than 1.

$$\text{Absolute refractive index} = \frac{\text{speed of light in vacuum}}{\text{speed of light in other medium}}$$

Section D

Answer any four questions. Each question carries 4 scores.

Q16. A heating coil with 60 Ω resistance is connected to a 240 V supply.

(a) Calculate the power of the appliance.

(b) Calculate the amount of heat generated by this heating coil in 5 minutes.

(c) If this appliance continuously works for 10 hours, calculate the energy consumed in commercial units.

Solution:

Given, Resistance (R) $= 60\Omega$

$$\text{Voltage (v)} = 240 \text{ V}$$

Now, $$\text{Current (I)} = \frac{V}{R} = \frac{240}{60} = 4 \text{ A}$$

(a) $$\text{Power (P)} = I^2\text{R} = 4^2 \times 60$$

$$\text{P} = 960 \text{ W} = 0.96 \text{ kW}$$

(b) Amount of heat generated $= \text{P} \times \text{T}$

$$= 960 \times 5 \times 60 = 288000 \text{ J}$$

(C) Energy consumed (E) $= \text{P} \times \text{T} = 0.96 \text{ kW} \times 10 \text{ h} = 9.6 \text{ kWh}$

Q17. AC generators are used in power stations in our Country.

(a) What is the voltage produced by the generators in our power stations?

(b) What do you mean by transmission loss?

(c) Explain how it is minimised?

Solution:

(a) Electricity is generated at 11000 V or 11 kV at the generating stations. It is cheaper to generate electricity at a relative lower voltage and then step it up for transmission. Hence, most power generating plants are designed to operate at 11 kV across the world.

(b) Since a transmission line has enormous length, its resistance increases. Hence, electrical energy is lost in the form of heat. The transmission line may touch nearby branches of plants, and due to shorting, some energy is lost. The energy loss in

transmission lines due to the above-mentioned reasons is called transmission loss.

(c) During the transmission of electricity, one most important concern is power loss in transmission lines in the form of heat, which is dissipated due to the resistance of the conductor. The power loss can be decreased by reducing the current and resistance of the transmission cable.

Q18. An object is placed at a distance of 15 cm from a lens of focal length +10 cm.

(a) Which type of lens is used here?

(b) Calculate the image distance.

(c) What is the nature of the image formed?

Solution:

(a) The focal length of a convex lens is positive according to sign convention as the light rays converge on the opposite side from where the light ray is coming after passing through the lens. In the given problem, the focal length is +10 cm; hence, convex lens is used here.

(b) Object distance from a lens, $u = -15$ cm

Focal length of the convex lens, $f = +10$ cm

Using lens formula to find the image distance as

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

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

$$\frac{1}{v} = \frac{1}{10} + \frac{1}{-15}$$

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

$$v = 30 \text{ cm}$$

The image is located at a distance of 30 cm from the lens.

(c) The ratio of image distance to object distance is called magnification. So,

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

$$m = \frac{30}{-15} = -2$$

It shows the formed image is real and inverted.

Q19. The red colour during sunset and the beautiful rainbow make nature colourful.

(a) Name the phenomenon that creates a rainbow.

(b) What is the colour seen at the upper edge of the primary rainbow?

(c) During sunset sun seems to be in red colour. Explain why?

Solution:

(a) Dispersion of light caused by water droplets in the atmosphere causes a rainbow.

(b) The order of colours in a rainbow is R – O – Y – G – B – I – V. Red is at the top edge of the rainbow and violet is at the bottom edge, with the other colours in between.

(c) Among all these seven colours, red colour has the maximum wavelength whereas, violet has the shortest wavelength.

During sunrise and sunset, the rays have to travel a larger part of the atmosphere because they are very close to the horizon. Therefore, light other than red having shorter wavelengths is mostly scattered away.

Most of the red light, which is the least scattered, enters our eyes. Hence, the sun and the sky appear red

Q20. Kalpakkam, Moolamattam and Neyveli are some places where power stations are located.

(a) Which among the above is a nuclear power station?

Solution: Out of these three Kalpakkam is the nuclear power station.

(b) Explain the energy changes taking place in a nuclear power station.

Solution: A nuclear power plant uses heat produced during nuclear fission to heat water. During nuclear fission, atoms are split apart to form smaller atoms, releasing

energy. Water is allowed to heat using this energy, producing steam. This steam is used to spin large turbines to generate electricity.

(c) What type of pollution is caused by such power stations?

Solution: Radioactive Pollution

Nuclear energy produces radioactive waste. A major environmental concern related to nuclear power is the creation of radioactive wastes such as uranium mill tailings, spent (used) reactor fuel, and other radioactive wastes. These materials can remain radioactive and dangerous to human health for thousands of years.