Kerala Board Class 10 Physics 2020

Instructions :

- 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 radius of curvature of a convex mirror is 24 cm. What is its focal length?

(24 cm, 6 cm, 12 cm, 3 cm)

Solution:

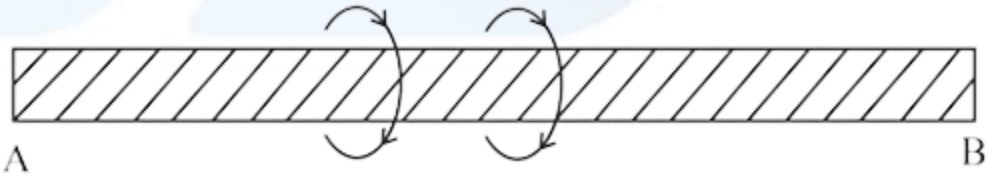
$$\text{Given, } R = 24 \text{ cm}$$

$$\text{We know, } f = \frac{R}{2}$$

$$\text{Hence, } f = \frac{24}{2} = 12 \text{ cm}$$

The focal length of the convex mirror is 12 cm.

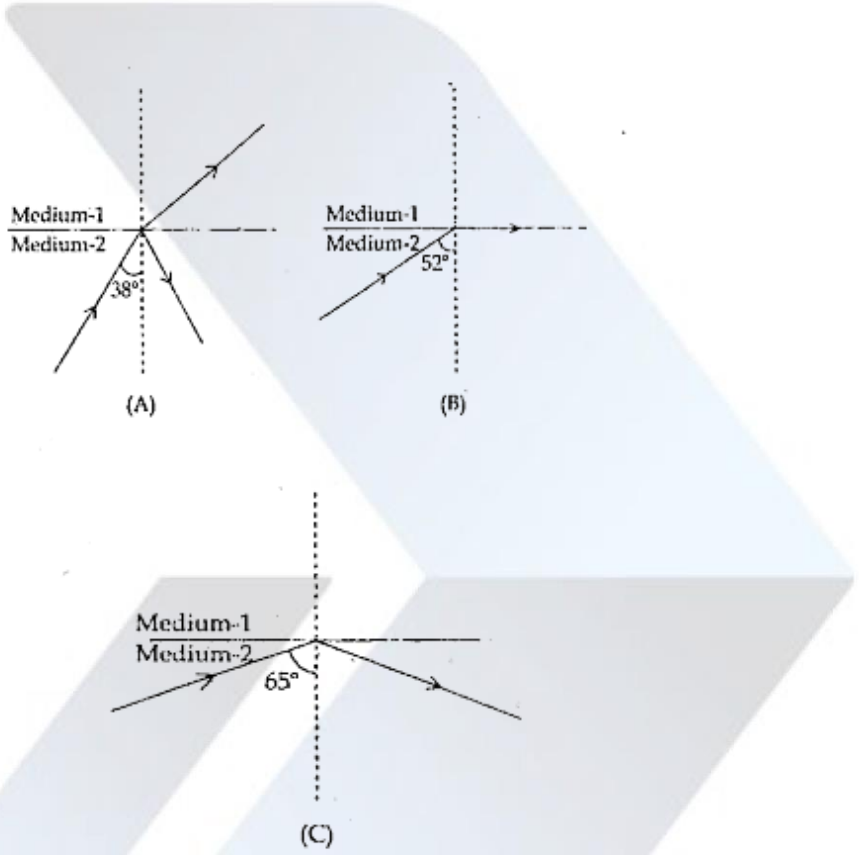
Q2. The magnetic field around a current carrying conductor AB is given in the figure. Based on Maxwell's right-hand screw rule, find the direction of the current through the conductor.



Solution:

Based on Maxwell's right-hand screw rule, the direction of the current through the conductor, will be from A to B.

Q3. Which of the following figures represents the critical angle?



Solution:

Critical angle is correctly represented by figure (B).

Q4. The order of various colours observed in the spectrum of sunlight is given below. Choose the correct order.

a. Blue, Violet, Green, Red

b. Violet, Blue, Yellow, Red

c. Violet, Yellow, Blue, Green

d. Green, Yellow, Orange, Blue

Solution:

b. Violet, Blue, Yellow, Red

(according to the increasing order of wavelength)

Q5. Write any two products that are obtained when coal is distilled in the absence of air.

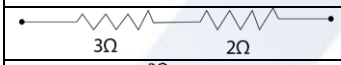
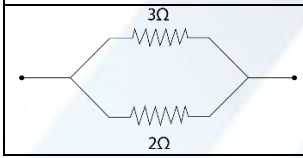
Solution:

Distilling coal in the absence of air produces coal gas, coal tar, coke, ammonia, and other by-products.

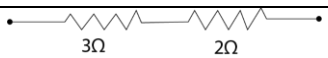
Section-B

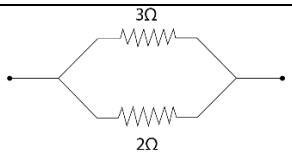
Answer any four questions. Each question carries 2 scores.

Q6. The following table is prepared for comparing the properties of resistances in different combinations. Re-arrange the contents in each column to match them correctly.

Connection diagram of resistance	Effective resistance of the circuit	Voltage across each resistance	Current through each resistor
	Decreases	Same	Same
	Increases	Different	Different

Solution :

Connection diagram of resistance	Effective resistance of the circuit	Voltage across each resistance	Current through each resistor
	Increases	Different	Same

	Decreases	Same	Different

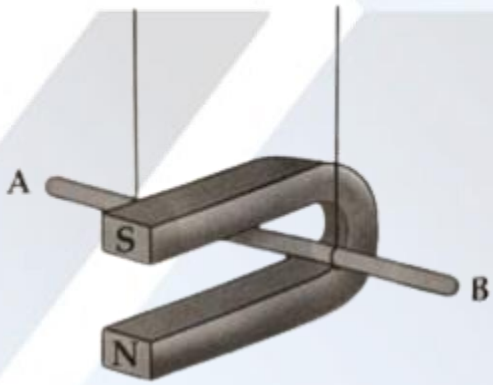
Q7. Write any two methods to provide first aid in the case of electric shock.

Solution:

Here are some first aid methods in case of electric shock:

- Apply pressure on the chest to stimulate the heart if necessary.
- Provide artificial respiration if the person is not breathing.
- Massage the body gently to raise temperature and improve circulation.

Q8. A conductor AB is placed in a magnetic field as shown in the figure.



a. If you are moving the conductor outwards, then what will be the direction of the current in the conductor?

b. If an electric current passes from *A* to *B*, then in which direction will the conductor move?

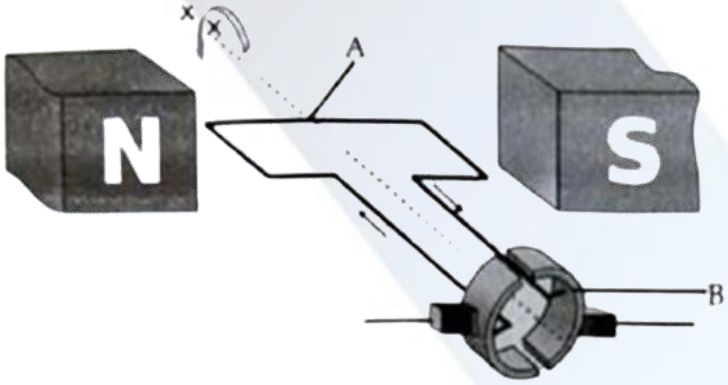
[Inwards the magnet/ Outwards the magnet]

Solution:

a. If the conductor is moved outward, the current in the conductor will flow from B to A.

b. If the electric current flows from A to B, the conductor will move outward from the magnet.

Q9. Observe the figure of a DC motor.



a. Write the names of the parts labelled A and B.

b. What are the changes to be made to convert this device into an AC generator?

Solution:

a. A is the Armature, which is the rotating coil in the motor. B is the Split ring, which functions as a commutator to reverse the direction of current in the armature.

b. To convert this DC motor into an AC generator, you need to replace the split rings with slip rings, which allow continuous flow of current without reversing its direction, which is essential for generating alternating current (AC). Additionally, field magnets will also need to be used to create a magnetic field necessary for induction.

Q10. Write the reason for the twinkling of stars in the Sky.

Solution:

Refraction occurs when light passes from one medium to another and bends due to a change in speed. If light travels from a rarer to a denser medium, it bends towards the normal and if it moves from a denser to a rarer medium, it bends away from the normal.

The twinkling of stars is caused by the Earth's atmosphere, which has layers with varying temperatures, densities, and winds. As light from a star enters this turbulent atmosphere, it refracts multiple times due to the constant changes in density. Some light rays travel directly towards us, while others bend away or towards us. These rapid and continuous changes in direction create the shimmering or twinkling effect, causing the stars to appear as if they are twinkling when seen from Earth.

Section-C

Answer any four questions. Each question carries 3 scores.

Q11. Specification of two electrical heaters are given below:

Heater-A	Heater-B
Resistance- 690Ω Working Voltage- 230 V	Resistance- 460Ω Working Voltage- 230 V

a. Which heater requires a fuse of higher amperage?

b. Which of the heaters generate more heat when they work for 5 minutes under the same voltage rating? Explain the reason.

Solution:

a. **Heater B** requires a fuse of higher amperage.

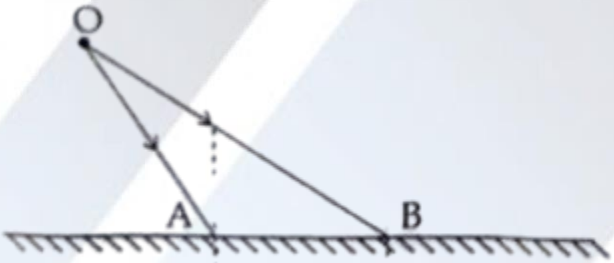
The amount of current passing through a heater depends on its resistance and the applied voltage, as described by Ohm's Law. Since heater B has a lower resistance than heater A, it will draw more current. Therefore, heater B requires a fuse with a higher amperage rating to safely handle the larger current.

b. **Heater B** generates more heat when operated for 5 minutes under the same voltage.

Heat generated by an electrical device is proportional to the power $P = \frac{V^2}{R}$.

Since heater B has a lower resistance than heater A, it will generate more power and, thus, more heat. With a lower resistance, the power dissipation increases, leading to more heat production.

Q12. Two rays of light OA and OB coming from an object " *O* ", are falling obliquely on the surface of a plane mirror as shown.

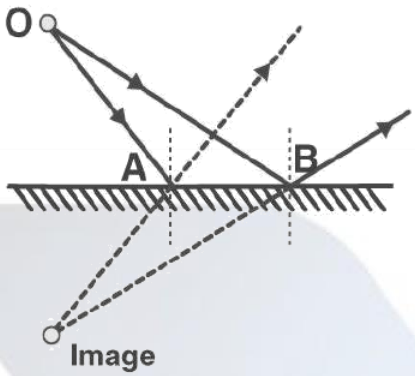


a. Draw a ray diagram indicating the image formation

b. Write any two properties of the image formed in this case.

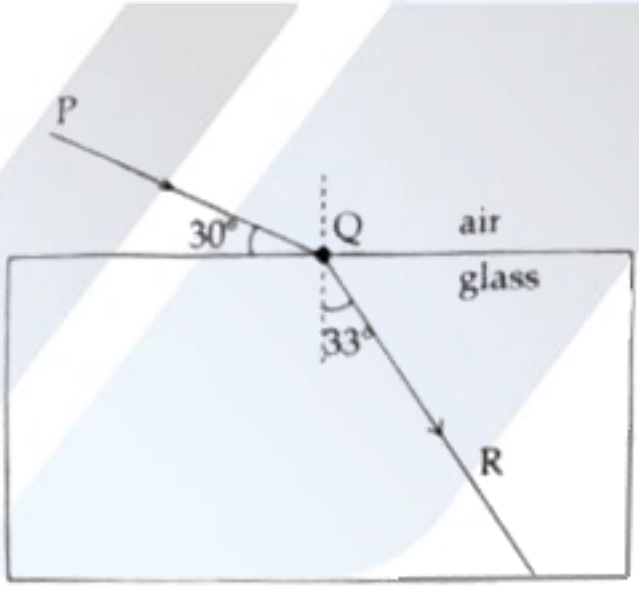
Solution:

a.



b. The image formed by the plane mirror is virtual, erect and same size as the object.

Q13. A ray of light falling obliquely from air to a glass slab is shown in the figure.



a. Find out the angle of incidence.

b. Why is the angle of refraction less than that of the angle of incidence in this case?

c. How can you calculate the refractive index of the material of this slab? (calculation not required)

Solution:

a. The angle of incidence, i $(90° - 30°)=60°$

b. The angle of refraction is less than the angle of incidence because the refractive index and optical density of glass are greater than those of air. When light travels from a rarer medium (air) to a denser medium (glass), it slows down and bends towards the normal, according to the laws of refraction. As a result, the angle of refraction is smaller than the angle of incidence.

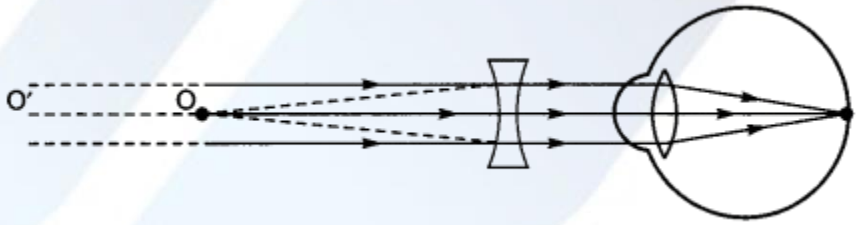
c. The refractive index of the material of the slab can be calculated using the formula, $n = \frac{\sin i}{\sin r}$,

Where, i = angle of incidence.

r = angle of refraction.

Hence, $n = \frac{\sin 60°}{\sin 33°}$

Q14. The picture represents a method of rectification of the defect of an eye using a lens of suitable focal length.



a. Name the disorder of this eye.

b. Give two reasons for this defect.

c. Explain the role of the concave lens in the rectification of this defect.

Solution:

a. **Myopia** or short-sightedness is the disorder of this eye.

b. The two main reasons for this defect are:

- Increase in power of the eye's lens.
- Increase in size of the eyeball.

c. A **concave lens** is used to diverge the incoming light rays before they enter the eye. This ensures that the image is formed on the retina, rather than in front of it, thus helping to rectify myopia.

Q15. a. What will be the marking on a cooking gas cylinder that has a maturity period up to March-2020?

b. Write any two precautions to be taken to avoid accidents due to 'LPG' leakage.

Solution:

a. The marking found on a cooking gas cylinder that has a maturity period of March-2020 is A-20.

b. Two precautionary measures to take to avoid accidents due to 'LPG' leakage is given below:

- Regularly check the rubber tube and regulator for signs of wear or leakage.
- Always turn on the regulator before lighting the stove, and ensure the stove knob is turned off when not in use to prevent any gas leakage.

Section-D

Answer any four questions. Each question carries 4 scores.

Q16. Two stages of an experiment conducted with a solenoid and a magnet is given below:

(Magnets shown in fig-A and fig-B are stationary magnet and a moving magnet respectively)

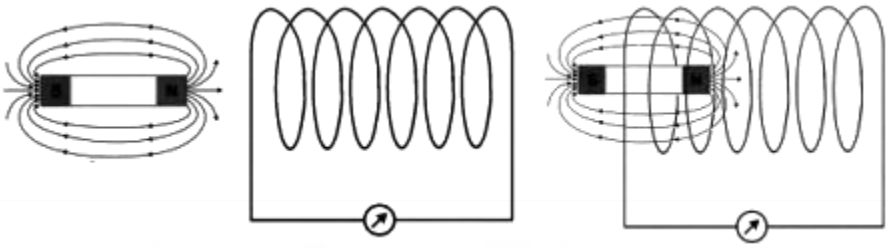


fig-A fig-B

a. In which stage does the galvanometer deflect?

b. Explain the reason for this deflection in the galvanometer with the help of the scientific principle that you have learned.

c. Write any two devices that work on this principle.

Solution:

a. The galvanometer deflects in Figure B, where the magnet is moving.

b. The deflection in the galvanometer occurs due to **electromagnetic induction.** According to Faraday's Law of Induction, a changing magnetic field induces an electric current in the solenoid. This induced current causes the galvanometer to deflect.

c. Two devices that work on this principle are:

- Moving coil microphone
- Electric generator

Q17. Explain the scientific reason behind the phenomena given below.

a. The path of sunlight is visible on a misty morning.

b. Newton's colour disc appears white when rotated fast.

c. The rising and setting sun appears red.

d. A person can see the distant object and near object clearly.

Solution:

a. The path of sunlight is visible on a misty morning due to the Tyndall effect, where light is scattered by the tiny particles in the mist, making the path visible.

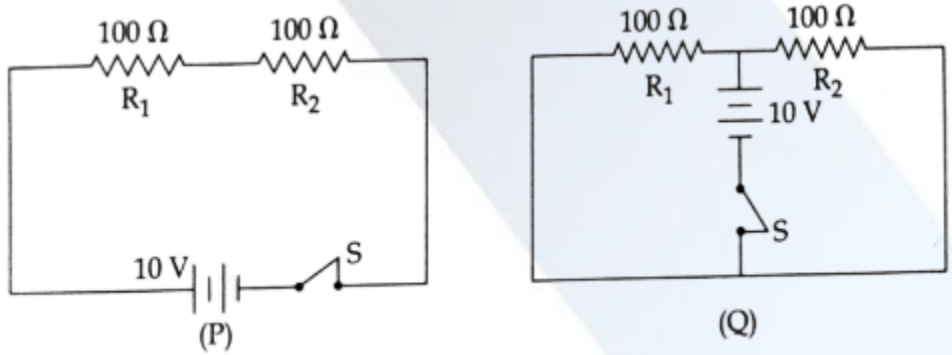
b. Newton's colour disc appears white when rotated fast due to persistence of vision, where the human eye retains an image for a fraction of a second after the

image disappears, causing the colors to blend together and appear white.

c. The rising and setting sun appears red due to the scattering of light.

d. A person can see both distant and near objects clearly due to the power of accommodation, where the eye's lens changes shape to focus on objects at different distances.

Q18. Analyse the circuits A and B



a. In which circuit, the resistors get the same voltage?

b. Calculate the voltage across the resistor R_2 in the circuit (P).

c. If current due to the applied emf is flowing through these two circuits for a time of 5 minutes, which circuit will produce more heat energy? Explain.

Solution:

a. In Circuit P, resistors R_1 and R_2 are connected in series, so the voltage divides proportionally between them based on their resistances. In Circuit Q, R_1 and R_2 are connected in parallel, meaning the voltage across each resistor is the same and equal to the source voltage. Therefore, the resistors in Circuit Q receive the same voltage.

b. In Circuit P, where R_1 and R_2 are connected in series, the total voltage is divided across the resistors in proportion to their resistances. Since $R_1 = R_2$, the voltage is equally divided between them. With a total voltage of 10V, the voltage across R_2 (and also R_1) will be 5V.

c. Q will produce more heat

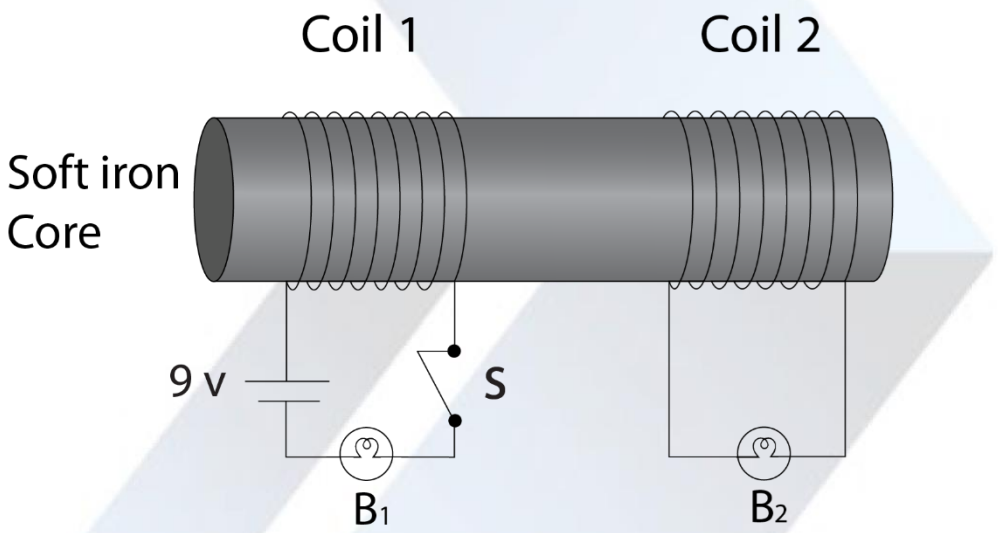
Effective resistance of P $= 100 + 100 = 200\Omega$

Effective resistance of Q $= 100/2 = 50\Omega$

Now, $H = \frac{v^2 t}{R}$

Since heat is inversely proportional to resistance, the lower the resistance, the more heat is produced.

Q19. Observe the figure and answer the following questions. B_1 and B_2 are identical bulbs.



a. Which bulb will glow in the circuits?

b. If the battery in the circuit is replaced by an AC source of the same voltage, what change can be observed in the working of the bulbs? Explain the reasons for the change.

Solution:

a. Bulb B_1 will glow in the circuits.

B_1 will glow when the circuit is closed because it is directly connected to the power source. B_2 will not glow as there is no changing current in the coil to induce a

current in the secondary coil.

b. With an AC source, B_2 will also glow along with B_1. This is because the alternating current in the first coil creates a changing magnetic field, which produces current in the second coil. This process, called mutual induction, makes B_2 light up. However, the brightness of B_1 may vary due to energy shared with the secondary circuit.

Q20. Define the following terms of a lens.

a. Optic centre.

b. Centre of curvature.

c. Principal focus of the convex lens.

d. Focal length of a concave lens.

Solution:

a. The optical centre of a lens is the central point within the lens through which light passes without deviation.

b. The centre of curvature of a lens is the centre of the sphere of which the lens surface forms a part.

c. The principal focus of a lens is the point on its principal axis where light rays parallel to the axis converge (for a convex lens) or appear to diverge (for a concave lens) after refraction.

d. The focal length of a lens is the distance between its optical centre and its principal focus.