Kerala Board Class 10 Physics 2022

General Instructions to Candidates:

- There is a 'cool-off time' of **15** minutes in addition to the writing time. Use this time to get familiar with questions and to plan your answers.
- Questions with different scores are given as distinct parts.
- Read the instructions carefully before answering the questions.
- Keep in mind, the score and time while answering the questions.
- The maximum score for questions from 1 to 24 will be **40**.

Part – I

A. **Answer any four questions from 1 to 6. Each carries 1 score.** $4 \times 1 = 4$

Q1. Find the relation between the terms in the first pair and complete the second pais.

Incandescent lamp: Tungsten

Heating coil of heating appliances: _____.

Solution:

Incandescent lamp: Tungsten

Heating coil of heating appliances: **Nichrome**

Q2. The secondary coil of a transformer has double turns than that of its primary coil. If the voltage applied in the primary coil is 25 V, what will the voltage be in the secondary?

(25 V, 50 V, 2 V, 12.5 V)

Solution:

50 V

Q3. The midpoint of a lens is known as _____.

(Optic centre, Principal focus, Centre of curvature, Principal axis)

Solution:

Optic centre

Q4. If one joule of work is done to move one coulomb of charge from one point to another. What will be the potential difference between these points?
(2 V, 3 V, 1 V, 4 V)

Solution:

1 V

Q5. Which arrangement converts the AC induced in the armature of DC generator into DC ?

Solution:

The split ring commutator converts the AC induced in the armature of a DC generator into DC output.

Q6. When light passes through a medium it suffers partial and irregular reflection by hitting the particles of the medium. Name this phenomenon

Solution:

Scattering of light

B. Answer all questions from 7 to 9. Each carries I score. $3 \times 1 = 3$

Q7. Which is the commercial unit of electrical energy?
(ampere, kilowatt, kilowatt hour, volt)

Solution:

Kilowatt-hour (kWh)

Q8. Which rule helps us to find the direction of motion of a current-carrying conductor placed in a magnetic field?
(Joule's law, Maxwell's right-hand thumb rule, Fleming's left-hand rule, Fleming's right-hand rule)

Solution:

Fleming's left-hand rule

Q9. The figure shows a beam of light falling on two different surfaces.

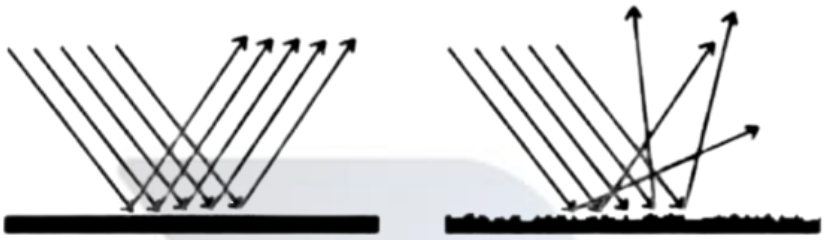


Figure 1 Figure 2

Which type of reflection is represented by Figure - 1?

Solution:

Regular reflection is shown in Figure 1. Regular reflection occurs when light falls on a smooth, shiny surface and reflects in a uniform manner, maintaining the same angle of incidence and reflection.

Part – II

A. Answer the following question. It carries 2 score. $1 \times 2 = 2$

Q10. When an object is placed in front of a concave mirror at a distance 60 cm. An image is obtained on a screen at a distance of 30 cm from the mirror. Find focal length of the mirror.

Solution:

To find the focal length of the concave mirror, we use the mirror formula:

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

where:

f= focal length

u = object distance = -60 cm (negative for concave mirror)

v = image distance = -30 cm (negative for real image formed on screen)

Substituting the values:

$$\frac{1}{f} = \left(\frac{1}{-60}\right) + \left(\frac{1}{-30}\right)$$

$$= -\left[\left(\frac{1}{60}\right) + \left(\frac{1}{30}\right)\right]$$

$$= -\left[\frac{(1+2)}{60}\right]$$

$$= -\left(\frac{3}{60}\right)$$

$$= -\left(\frac{1}{20}\right)$$

$$f = -20\ cm$$

The focal length of the concave mirror is 20 cm (negative sign indicates a concave mirror).

B. Answer any one question from 11 to 12. Each carries 2 score. $\mathbf{1 \times 2 = 2}$

Q11. Write any two precautions to be taken to avoid electric shock.

Solution:

Two precautions to avoid electric shock:

i. Avoid handling electrical appliances with wet hands – Water is a good conductor of electricity, and touching electrical devices with wet hands can lead to electric shock.

ii. Use proper insulation and earthing – Ensure that electrical wires are properly insulated and that appliances have proper earthing to prevent leakage of current.

Q12. Why does Newton's colour disc appears to be white, when it is rotated at high speed? Explain.

Solution:

Newton's color disc appears white when rotated at high speed due to the **persistence of vision.**

When the disc spins rapidly, the colors blend together because our eyes cannot distinguish them separately in such a short time. This happens because the human

eye retains an image for a fraction of a second even after it disappears. Since the disc contains all the seven colors of white light (VIBGYOR), their rapid mixing creates the perception of white light. This phenomenon demonstrates color addition in physics.

Part III

A. Answer any three questions from 13 to 16. Each carries 3 marks.

$$3 \times 3 = 9$$

Q13. The figure given below shows dispersion of white light when it passes through a prism.

(a) Which colour deviates more?

(b) Which colour of the visible light has the longest wavelength?

(c) During dispersion each colour has got different deviations Why?

Solution:

(a) Violet deviates the most as it has the shortest wavelength and refracts more.

(b) Red has the longest wavelength in the visible spectrum.

(c) Different deviations occur because the refractive index of the prism varies for different wavelengths, causing shorter wavelengths (like violet) to bend more than longer ones (like red).

Q14. (a) What is the energy transformation taking place in a moving coil loud speaker?

(b) Explain the working of a moving coil loud speaker.

Solution:

(a) Energy Transformation in a Moving Coil Loudspeaker:

Electrical energy → Magnetic energy → Mechanical energy (vibrations) → Sound energy

(b) Working of a Moving Coil Loudspeaker:

When an audio signal passes through the coil of a moving coil loudspeaker, it creates a varying magnetic field. This coil is placed in the field of a permanent magnet, causing it to move due to electromagnetic forces. As the coil moves, it makes the attached diaphragm (cone) vibrate. These vibrations generate sound waves in the air, converting electrical signals into audible sound.

Q15. Some characteristics of step up transformers and step down transformers are given below. Select the statements suitable for step up transformers.

(a) Primary voltage is greater than secondary voltage.

(b) Secondary voltage is greater than primary voltage.

(c) Current in the primary coil is greater than that in the secondary coil.

(d) Current in the secondary coil is greater than that in the primary coil.

(e) Thick wires are used in the primary.

(f) Thick wires are used in the secondary.

Solution:

(b) Secondary voltage is greater than primary voltage.

(c) Current in the primary coil is greater than that in the secondary coil.

(e) Thick wires are used in primary.

Q16. When an object of height 5 cm is placed at a distance of 12 cm in front of a concave mirror, a real image was formed at a distance of 24 cm.

(a) Calculate magnification (use New Cartesian Sign Convention)

(b) Find the height of the image.

(c) Based on magnification how can we predict whether the image formed is erect or inverted.

Solution:

Object height, h_1 = 5 cm

Object distance, u = -12 cm (since the object is in front of a concave mirror)

Image distance, v = -24 cm (since the image is real and formed on the same side as the object)

(a) Calculation of magnification (m):

Magnification formula:

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

Substituting the values:

$$m = \frac{-24}{-12} = 2$$

So, the magnification is +2.

(b) Finding the height of the image (h_2):

Magnification is also given by:

$$m = \frac{h_2}{h_1}$$

Substituting values:

$$2 = \frac{h_2}{5}$$

$$h_2 = 2 \times 5 = 10\ cm$$

Thus, the height of the image is 10 cm.

(c) Predicting the nature of the image using magnification:

Since the magnification m = +2, it is positive, which means the image is erect.

If m were negative, the image would be inverted.

In this case, the real image is magnified and upright.

B. Answer the following question. carries 3 score. $1 \times 3 = 3$

Q17. (a) Which among the following is not a discharge lamp? (Sodium vapour lamp, Arc lamp, fluorescent lamp, LED lamp)

(b) Explain the working of a discharge lamp.

Solution:

(a) The LED lamp is not a discharge lamp.

(b) Working of a Discharge Lamp:

A discharge lamp produces light by passing an electric current through a gas or vapor, which ionizes the gas and emits light.

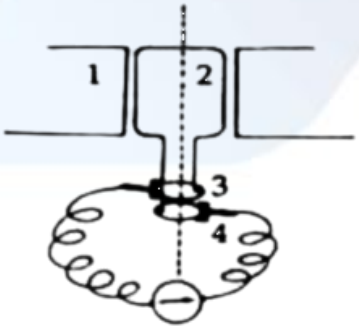
When a high voltage is applied between the electrodes, the gas inside the lamp becomes ionized, allowing current to flow and excite gas atoms.

These excited atoms release energy in the form of visible light or ultraviolet radiation, which may be converted into visible light using a phosphor coating (as in fluorescent lamps).

Part- IV

A. Answer any two questions from 18 to 20. Each carries 4 score

Q18. Schematic diagram of a generator is given:



(a) Which type of generator is this? (AC/DC)

(b) Name the parts of this generator marked as 1,2,3,4.

1: _____

2: _____

3: _____

4: _____

(c) State the working principle of this device.

Solution:

(a) AC

(b) 1: Magnet

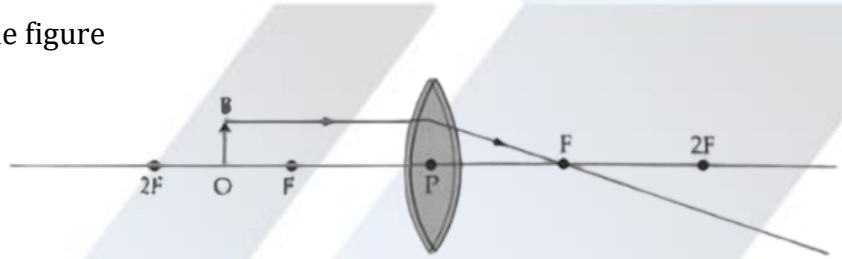
2: Armature

3: Slip rings

4: Brushes

(c) AC generators produce electricity by rotating a coil in a magnetic field, inducing current through electromagnetic induction.

Q19. Analyse the figure



An object is placed between F and 2F of a convex lens.

(a) Copy the diagram and complete it to show the image formation.

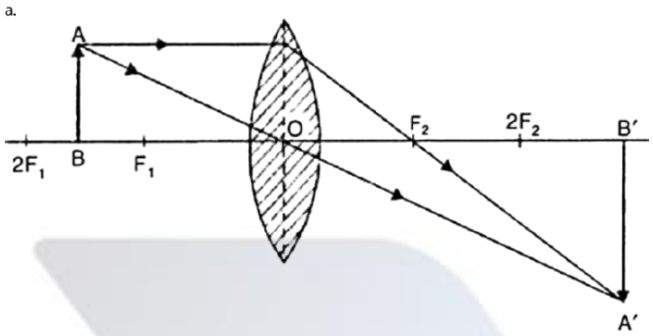
(b) Write any two features of the image formed here.

(c) Where must the object be placed to get a real image of same size as that of the object.

Solution:

(a)

a.



(b) Real, magnified, and inverted

(c) It should be placed at 2F distance in front of the lens

Q20. (a) What is meant by the term "energy crisis"?

(b) Write any two reasons for energy crisis. Suggest two methods to minimize it.

Solution:

(a) The term energy crisis refers to a situation where the demand for energy exceeds its supply, leading to shortages, high costs, and environmental concerns. It occurs due to overconsumption, depletion of natural resources, or inefficient energy use.

(b) **Reasons for Energy Crisis:**

- Overuse of Fossil Fuels – Excessive dependence on non-renewable resources like coal, oil, and natural gas depletes them quickly.
- Rapid Industrialization and Population Growth – Increased energy consumption in industries and households leads to higher demand and shortages.

Methods to Minimize Energy Crisis:

- Use of Renewable Energy Sources – Promoting solar, wind, and hydropower to reduce dependency on fossil fuels.
- Energy Conservation – Using energy-efficient appliances, reducing wastage, and promoting public transport to lower energy consumption.

B. Answer any one question from 21 to 22. Each carry 4 score. $1 \times 4 = 4$

Q21. An incandescent lamp bears the marking 200 V, 100 W.

(a) What does 100 W indicate?

(b) What is the resistance of its filament?

(c) Write an advantage of LED lamp over incandescent lamp?

Solution:

(a) 100 W represents the power rating of the incandescent lamp. It means the lamp consumes 100 watts of electrical power when operated at 200 V.

(b) Resistance of the filament:

Using Ohm's law and the power formula:

$$P = V^2 / R$$

Rearranging for R:

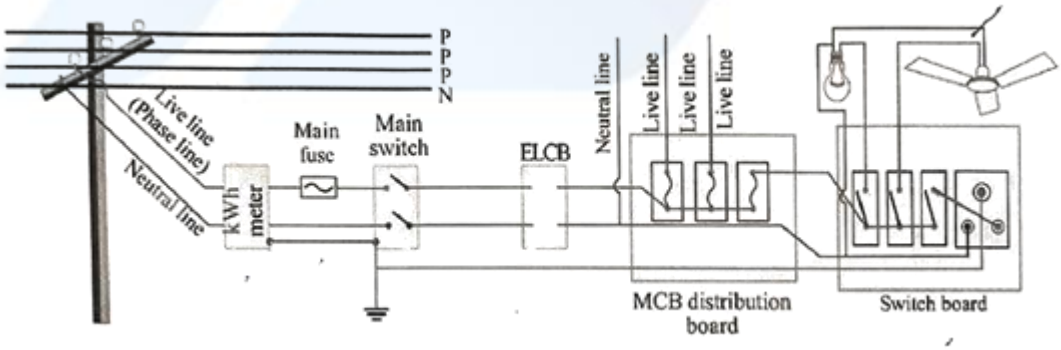
$$R = \frac{V^2}{P} = \frac{2002}{100} = \frac{40000}{100} = 400\,\Omega$$

So, the resistance of the filament is 400 Ω.

(c) Advantage of LED lamp over an incandescent lamp:

LED lamps are more energy-efficient than incandescent lamps because they consume less electricity and produce less heat while providing the same brightness.

Q22. Observe the circuit of household electrification.



(a) Which device is used to measure the electrical energy consumed in household circuit?

(b) Write any two advantages of connecting the devices in parallel in household circuit.

(c) Write the function of ELCB.

Solution:

(a) The device used to measure the electrical energy consumed in a household circuit is called a kilowatt-hour meter (or simply an energy meter).

(b) Two advantages of connecting devices in parallel in a household circuit:

Independent operation: Each device operates independently. If one device stops working, others continue to work without being affected.

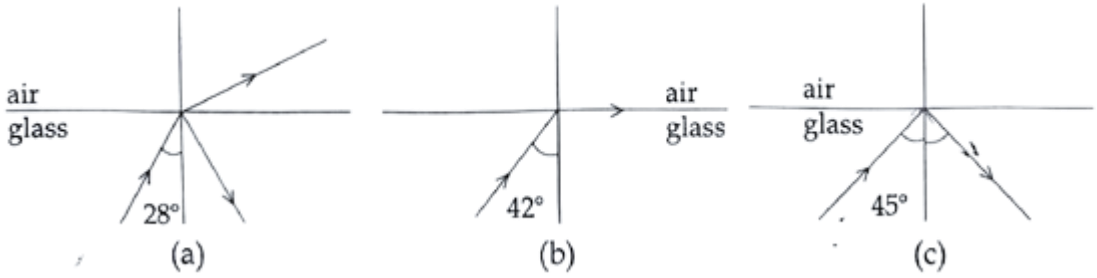
Constant voltage: All devices connected in parallel receive the same voltage, which is necessary for their proper functioning.

(c) The function of an ELCB (Earth Leakage Circuit Breaker) is to prevent electric shock and protect the circuit from leakage currents. It detects any leakage of current to the ground (earth) and disconnects the power supply to prevent potential hazards.

Part- V

A. Answer any one question from 23 to 24. Each carries 5 score.

Q23. Light rays entering into air from glass is depicted below. Observe the figures and answer the given questions.



(a) What is the critical angle of glass here?

(b) Which figure represents total internal reflection?

(c) Explain total internal reflection.

(d) Write any two instances that make use of total internal reflection.

Solution:

(a) The critical angle of glass is 42^o. The refractive index of glass is around 1.5,

The refractive index of air is around 1.

Now, applying these values to the formula:

$$sin(\theta_c) = \frac{1}{1.5} = 0.6667$$

Taking the inverse sine of 0.6667:

$$\theta_c = \sin^{-1}(0.6667) \approx 42^\circ$$

(b) The figure representing total internal reflection is Figure c.

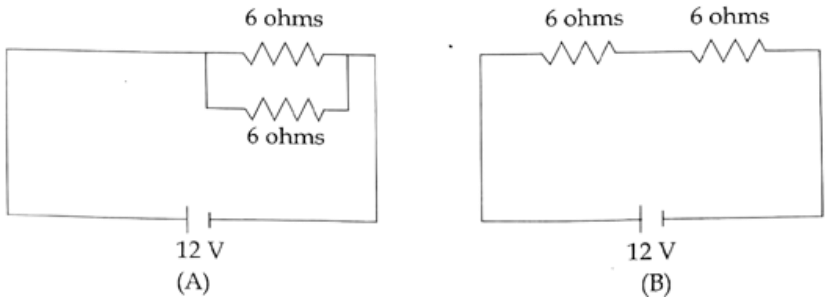
(c) Total internal reflection occurs when a ray of light passes from a medium with a higher optical density (like glass) to a medium with a lower optical density (like air) at an angle of incidence greater than the critical angle.

In this case, the light ray is reflected back into the same medium without refracting into the second medium.

(d) Examples of total internal reflection in daily life include:

- The formation of a mirage.
- The shining of an empty test tube in water.
- The sparkling of a diamond.
- The transmission of light rays in optical fibers.

Q24. Observe the given circuits



(a) Calculate the resultant resistance in Circuit (A) and Circuit (B).

(b) What is the intensity of electric current in Circuit (A) ?

(c) Calculate the heat energy produced in Circuit (B) if current flows for 30 minutes.

Solution:

(a) **For Circuit (A)** - Parallel Circuit:

The formula for the total resistance in a parallel circuit is:

$$R = \frac{R_1 \times R_2}{R_1 + R_2}$$

Substituting the given values (R_1=6 Ω and R_2=6 Ω):

$$R = \frac{6 \times 6}{6 + 6} = \frac{36}{12} = 3\ \Omega$$

So, the resultant resistance in Circuit A is 3 Ω.

For Circuit (B) - Series Circuit:

The total resistance in a series circuit is the sum of individual resistances:

$$R = R_1 + R_2$$

Substituting the given values:

$$R = 6 + 6 = 12\ \Omega$$

So, the resultant resistance in Circuit B is 12 Ω.

(b) Intensity of Electric Current in Circuit (A):

Using Ohm's Law:

$$I = \frac{V}{R}$$

Given V=12 V and R=3 Ω

$$I = \frac{12}{3} = 4\ \text{A}$$

So, the current in Circuit A is 4A.

(c) Heat Energy Produced in Circuit (B) for 30 Minutes:

The heat energy (H) is calculated using the formula:

$$H = \frac{V^2 \times t}{R}$$

Given:

$$V = 12\ \text{V}$$

t = 30 minutes = 30 × 60 = 1800

$$R = 12\ \Omega$$

Substituting the values:

$$H = \frac{12^2 \times 1800}{12}$$

$$H = \frac{144 \times 1800}{12}$$

$$H = 12 \times 1800$$

$$H = 21600\ \text{J} \quad = 21.6\ \text{kJ}$$

So, the heat energy produced in Circuit B is 21.6 kJ.