Karnataka Board Class 10 Science 2022

Physics

Part - A

I. Answer the following questions: $4 \times 1 = 4$

Q1. The device used to produce electricity is

(a) Galvanometer

(b) Electric generator

(c) Ammeter

(d) Electric motor.

Solution:

(b) Electric generator

Q2. The correct formula that shows the relationship between potential difference, electric current and resistance in an electric circuit is

(a) $I = \frac{R}{V}$

(b) $I = VR$

(c) $V = \frac{I}{R}$

(d) $R = \frac{V}{I}$

Solution:

(d) $R = \frac{V}{I}$

Q3. In Fleming's right hand rule, the middle finger indicates the direction of

(a) induced electric current

(b) magnetic field

(c) motion of the conductor

(d) mechanical force.

Solution:

(a) induced electric current

Q4. To get diminished and real image of an object from a convex lens, the object should be placed

(a) at principal focus F_1

(b) between principal focus F_1 and $2F_1$

(c) beyond $2F_1$

(d) between principal focus F_1 and optical centre O.

Solution:

(c) beyond $2F_1$

II. Answer the following questions: 2 x 1 = 2

Q5. Magnetic field lines do not intersect each other. Why?

Solution:

At the point of intersection the compass needle would point towards two directions which is not possible.

Q6. Mention the SI unit of power of lens.

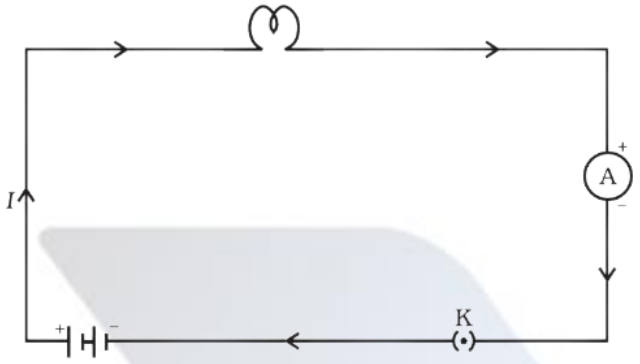
Solution:

Dioptre is the SI unit of power of lens.

III. Answer the following questions: 2 x 2=4

Q7. Draw the schematic diagram of an electric circuit comprising of electric cell, electric bulb, ammeter and plug key.

Solution:



Q8. An object is placed at 25 cm in front of a concave mirror of a focal length of 15 cm. At what distance from the mirror should a screen be placed in order to obtain a sharp image?

Solution:

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

$$\frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-15}-\frac{1}{-25}$$

$$\frac{1}{v}=\frac{-5+3}{75}=\frac{-2}{75}$$

$$v=\frac{75}{-2}=-37.5\text{ cm}$$

The screen should be placed at a distance of 37.5 cm, in front of the concave mirror.

OR

A concave lens has focal length of 15 cm. At what distance should the object from the lens be placed so that it forms an image at 10 cm from the lens?

Solution:

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

$$\frac{1}{u}=\frac{1}{v}-\frac{1}{f}=\frac{1}{-10}-\frac{1}{-15}$$

$$\frac{1}{u}=\frac{-3+2}{30}=\frac{-1}{30}$$

$$u=-30\text{ cm}$$

The object is placed at a distance of 30 cm from the concave lens.

IV. Answer the following questions: $3 \times 3 = 9$

Q9. Which is the major component of biogas? Write four characteristics of a good source of energy.

Solution:

Major component of biogas: Methane (CH_4)

Characteristics of a good source of energy:

- Produces a large amount of energy per unit mass or volume.
- Readily available and easily accessible.
- Convenient to store and transport.
- Economical and efficient.

OR

Which element is used in making solar cell? Write any four advantages of solar cells.

Solution:

Element used in solar cells: Silicon (Si)

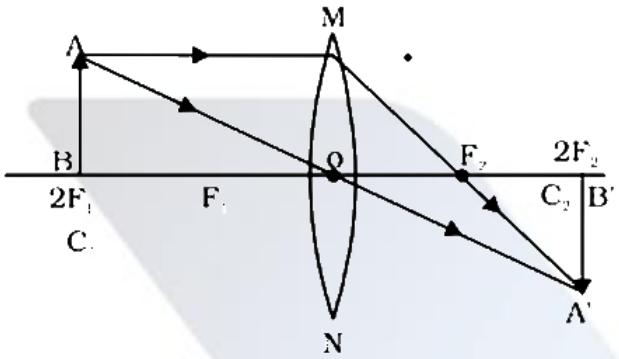
Advantages of solar cells:

- Converts sunlight directly into electricity without pollution.
- Requires minimal maintenance.
- Works efficiently even in remote locations.
- Renewable and long-lasting energy sources.

Q10. Draw the ray diagram to show the image formation by a convex lens, when the object is kept at $2F_1$ of the lens. With the help of the ray diagram mention the position and nature of the image formed.

[F_1: Principal focus of the lens]

Solution:



Position of the image - At $2F_2$

Nature of the image - Real and inverted

Q11. What are the functions of an earth wire? It is necessary to connect the electric appliances having metallic body to earth wire in domestic electric circuit. Why? Explain.

Solution:

Functions of an earth wire:

- Acts as a safety measure for appliances with a metallic body in a domestic circuit.
- Provides a low-resistance path for electric current.
- Prevents severe electric shocks by keeping the appliance's potential at the same level as the earth in case of current leakage.

Earthing is necessary for metallic appliances because:

- If a fault occurs and the metallic body becomes live, the earth wire ensures that the excess current flows safely into the ground.
- This prevents the risk of electric shocks to the user.

OR

Explain Faraday's experiment related to electromagnetic induction. Mention the difference between direct and alternate current.

Solution:

Faraday's experiment on electromagnetic induction:

- A coil of copper wire with multiple turns is connected to a galvanometer.
- A strong magnet is moved towards the coil, causing the galvanometer needle to deflect, indicating an induced current.
- When the magnet is pulled away, the galvanometer deflects in the opposite direction, showing that current is again induced.
- This experiment demonstrates that a changing magnetic field induces an electric current in a conductor.

Difference between Direct and Alternating current:

- Direct Current (DC): Flows in a single direction without changing polarity.
- Alternating Current (AC): Reverses its direction periodically.

V. Answer the following question: 1 x 4=4

Q12. a) What are the advantages of connecting electrical devices in parallel in an electric circuit instead of connecting them in series?

b) How are ammeter and voltmeter connected in an electric circuit? What are their functions?

Solution:

(a) Advantages of connecting electrical devices in parallel instead of series:

- Independent operation: Each device gets the same voltage and works independently. If one device stops working, others remain unaffected.
- Consistent voltage: All devices receive the same voltage as the power source, ensuring proper functioning.
- Lower resistance: The total resistance decreases in a parallel circuit, allowing efficient current distribution.
- Safe and convenient: Devices with different power ratings can operate efficiently without interference.

(b) Connection and function of ammeter and voltmeter in an electric circuit:

- Ammeter:

- Connected in series with the circuit.
- Measures the current flowing through the circuit.

- Voltmeter:
  - Connected in parallel across the component whose voltage is to be measured.
  - Measures the potential difference (voltage) between two points.

VI. Answer the following question: 1 x 5=5

Q13. a) What is refraction of light? State two laws of refraction of light.

b) What is refractive index of light? "The refractive index of diamond is 2.42. What is the meaning of this statement?

Solution:

(a) Refraction of light and its laws:

Refraction of Light: It is the bending of light when it passes from one transparent medium to another due to a change in its speed.

Laws of Refraction:

- The incident ray, the refracted ray, and the normal to the interface between two media all lie in the same plane.
- The ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant for a given pair of media. (Snell's Law)

  $\frac{\sin i}{\sin r}$ =constant(n)

(b) Refractive index and its meaning for diamond:

Refractive Index: It is the ratio of the speed of light in a vacuum to its speed in a given medium.

n=Speed of light in vacuum/Speed of light in the medium

Meaning of diamond's refractive index (2.42):

The refractive index of diamond is 2.42, which means that light travels 2.42 times slower in diamond than in vacuum.

Part - B

Chemistry

VII. Multiple Choice: 2 x 1=2

Q14. The gas liberated at the cathode during the electrolysis of water is:

(a) Oxygen

(b) Hydrogen

(c) Chlorine

(d) Nitrogen.

Solution:

(b) Hydrogen

Q15. Atomic number of chlorine is 17. The period number of this element in modern periodic table is

(a) 2

(b) 7

(c) 4

(d) 3

Solution:

(d) 3

VIII. Answer the following questions: 4 x 1 = 4

Q16. State modern periodic law.

Solution:

"Properties of elements are periodic functions of their atomic numbers."

Q17. Write any two uses of Plaster of Paris.

Solution:

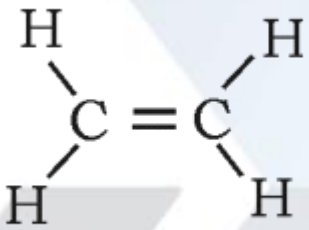
Plaster of Paris is used in:

- Supporting fractured bones
- Making toys
- Decorative materials
- Making smooth surfaces.

(Any two)

Q18. Write the structural formula of ethene molecule.

Solution:



Q19. $ZnO + C \rightarrow Zn + CO$

In this reaction, name the reactant

i) that is oxidised and

ii) that is reduced.

Solution:

i) Oxidised reactant is: C

ii) Reduced reactant is: ZnO

IX. Answer the following questions: $3 \times 2 = 6$

Q20. The pH values of A, B and C solutions are 5, 6 and 7 respectively. Which of these solutions is more acidic in nature? Why?

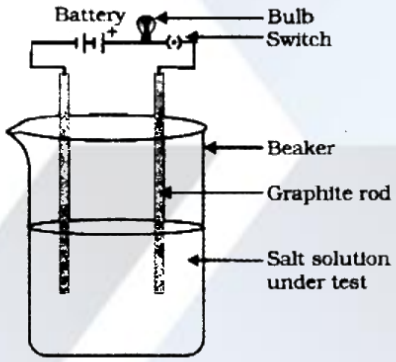
Solution:

- Solution A is more acidic.
- The pH scale ranges from 0 to 14, where a lower pH value indicates higher acidity. Since pH 5 < pH 6 < pH 7, Solution A is the most acidic among the three. A lower pH means a higher concentration of hydrogen ions (H^+), making the solution more acidic.

Q21. Draw the diagram to show the arrangement of the apparatus used for testing the conductivity of salt solution and label 'graphite rod'.

Solution:

Testing the conductivity of a salt solution:



Q22. Give reason:

a) Metals are used in making cooking vessels.

b) Sodium metal is stored in kerosene.

Solution:

a) Metals are used in making cooking vessels because they are good conductors of heat and can withstand high temperatures without melting.

b) Sodium metal is stored in kerosene because it is highly reactive with water and oxygen, and kerosene prevents it from coming into contact with moisture and air, avoiding accidental ignition.

OR

Give reason:

a) When a calcium metal reacts with water, the liberated hydrogen gas does not catch fire.

b) Ionic compounds have high melting and boiling points.

Solution:

a) When calcium metal reacts with water, the liberated hydrogen gas does not catch fire because the reaction is not highly exothermic, and the heat produced is insufficient to ignite the gas.

b) Ionic compounds have high melting and boiling points because of the strong electrostatic forces of attraction between oppositely charged ions, which require a large amount of energy to break.

X. Answer the following questions: 3 x 3 = 9

Q23. What is the atomic size? In the modern periodic table, the atomic size decreases along a 'period' and increases down the 'group'. Why? Explain.

Solution:

- Atomic size refers to the distance between the nucleus and the outermost shell of an isolated atom.
- In the modern periodic table, atomic size decreases across a period because:
    - Electrons are added to the same outermost shell, leading to a stronger nuclear attraction, pulling the electrons closer to the nucleus.
    - No new electron shells are introduced.
- Atomic size increases down a group because:
    - New electron shells are added, increasing the distance between the nucleus and the outermost electrons.
    - The shielding effect reduces the pull of the nucleus on outer electrons, leading to a larger atomic radius.

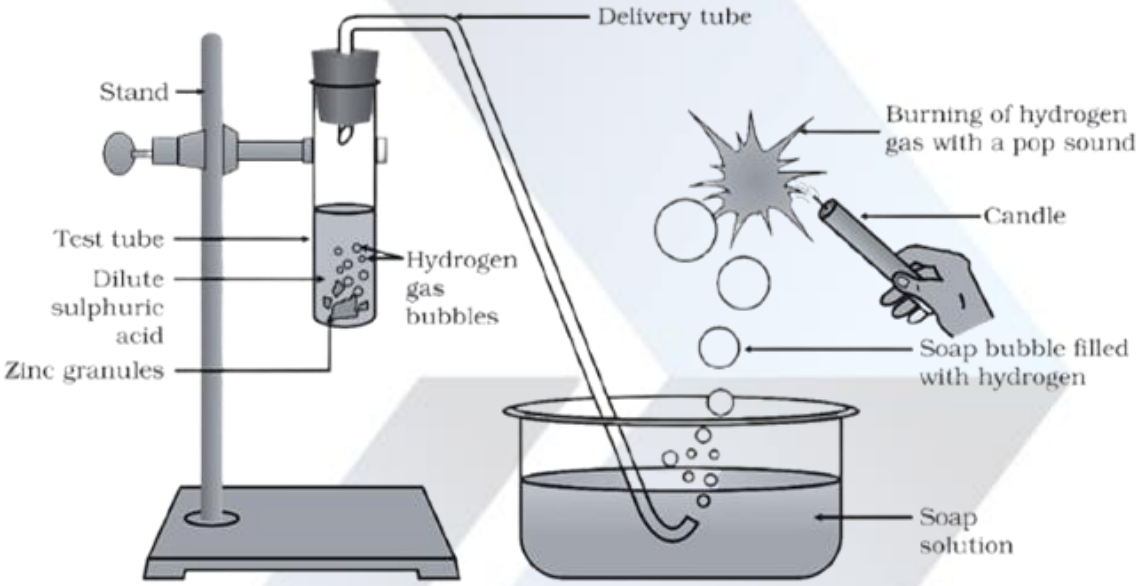
Q24. Draw the diagram of arrangement of the apparatus to show the reaction of zinc granules with dilute sulphuric acid and testing hydrogen gas by burning. Label the following parts:

i) Zinc granules

ii) Delivery tube.

Solution:

Reaction of zinc granules with dilute sulphuric acid:



Q25. Write the balanced chemical equation for the following chemical reactions:

i) Calcium carbonate $\xrightarrow{\text{Heat}}$ Calcium oxide + Carbon dioxide

ii) Hydrogen + Chlorine ⟶ Hydrogen chloride

iii) Magnesium + Hydrochloric acid → Magnesium chloride + Hydrogen.

Solution:

i) $CaCO_3 \rightarrow CaO + CO_2$

ii) $H_2 + Cl_2 \longrightarrow 2HCl$

iii) $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

OR

Which type of chemical reaction takes place when an iron nail is dipped in copper sulphate solution? Why? Write a balanced chemical equation for this chemical reaction.

Solution:

When an iron nail is dipped in copper sulfate ($CuSO_4$) solution, a displacement reaction occurs.

Reason:

Iron is more reactive than copper. It displaces copper from the copper sulfate solution, forming iron sulfate ($FeSO_4$) and depositing copper metal on the nail.

Balanced chemical equation:

$Fe + CuSO_4 \longrightarrow FeSO_4 + Cu.$

XI. Answer the following question: 1 x 4=4

Q26. a) What are structural isomers? Write the molecular and structural formula of butane.

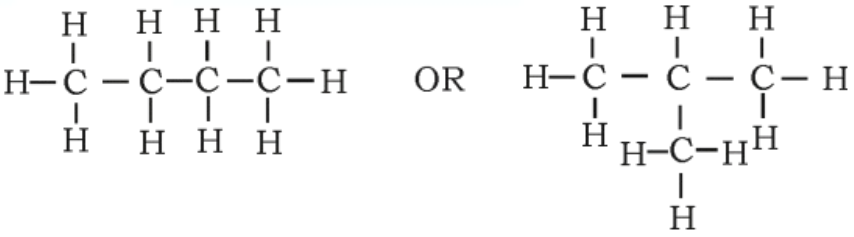
b) What is catenation? Write general formula for alkenes.

Solution:

a) Carbon compounds having the same molecular formula but different structural formulae are known as structural isomers.

Molecular formula of butane is C_4H_{10}

Structural formula of butane is:



b) Catenation is the property of an element (especially carbon) to form long chains or rings by bonding with atoms of the same element. This property allows carbon to form a variety of organic compounds.

General formula for alkene is C_nH_{2n}.

Part - C

Biology

XII. Multiple choice: 2×1=2

Q27. Atmospheric layer that absorbs ultraviolet radiations coming from the sunlight is made up of this molecule.

(a) N_2

(b) H_2

(c) O_3

(d) O_2

Solution:

(b) O_3

Q28. In humans, sexually transmitted viral infection is

(a) AIDS

(b) Syphilis

(c) Tuberculosis

(d) Gonorrhoea

Solution:

(a) AIDS

XIII. Answer the following questions: 2 x 1=2

Q29. What is the role of decomposers in an ecosystem?

Solution:

Decomposers break down dead organisms and recycle nutrients back into the ecosystem.

Q30. In males, testes are located outside the abdominal cavity in scrotum. Why?

Solution:

Because it helps maintain a lower temperature required for the formation of sperms than the normal body temperature.

XIV. Answer the following questions: 3 x 2=6

Q31. Mention the function of the following plant hormones:

i) Auxin

ii) Cytokinin.

Solution:

i) Auxin: Helps the cells in the stems and the cells in the many parts of the plant body to grow longer.

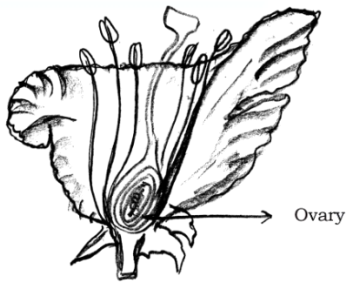
ii) Cytokinin:

* Promotes cell division in fruits and seeds

* Helps in promoting overall growth of plants.

Q32. Draw the diagram showing the longitudinal section of a flower and label 'ovary'.

Solution:



Q33. Give reason:

a) 'Ventricles of the human heart have thick wall.'

b) 'It is necessary to separate oxygenated and deoxygenated blood in mammals and birds.'

Solution:

a) Ventricles have thick walls because they need to generate high pressure to pump blood to different parts of the body.

b) Separating oxygenated and deoxygenated blood ensures efficient oxygen supply, which is essential for maintaining a constant body temperature in mammals and birds.

XV. Answer the following questions: $3 \times 3 = 9$

Q34. When a tall (TT) pea plant is crossed with a dwarf (tt) pea plant, represent the result obtained in F_2 generation of monohybrid cross with the help of checker board and mention the ratio of varieties of plants.

Solution:

	T	**t**
T	TT (Tall)	Tt (Tall)
t	Tt (Tall)	tt (Dwarf)

Phenotypic Ratio:

Tall : Dwarf = 3:1

Genotypic Ratio:

TT : Tt : tt = 1:2:1

Q35. What is trophic level? Flow of energy in an ecosystem is always unidirectional. Why? Explain.

Solution:

A trophic level is the position an organism occupies in the food chain based on its source of energy, such as producers, primary consumers, or secondary consumers.

The flow of energy in an ecosystem is always unidirectional because:

- Energy flows from the Sun to producers and then to consumers at different trophic levels.
- At each step, some energy is lost as heat due to metabolic activities.
- The lost energy cannot be reused by previous trophic levels, ensuring energy moves in one direction only.

Q36. a) Mention any four main factors that lead to the rise of new species.

b) The experiences of an individual acquired during its lifetime cannot be passed on to its progeny. Give reason.

Solution:

a) Factors responsible for the rise of new species:

* Geographical isolation

* Natural selection

* Inheritance of traits

* Genetic drift/gene flow

* Variation/mutuation/changes in DNA.

b) The experiences and acquired traits of an individual during its lifetime cannot be inherited by its progeny because they do not bring changes in the organism's DNA. Inheritance occurs through genetic material (DNA) passed from parents to offspring, while acquired traits affect only body cells and not reproductive cells (germ cells). Thus, they are not transmitted to the next generation.

OR

What are fossils? Mention the methods of estimation of dating fossils and explain briefly.

Solution:

Fossils are preserved remains or traces of ancient living organisms found in the deeper layers of the Earth.

Methods of fossil dating:

- Relative dating: Fossils found in upper layers of rock are considered more recent, while those in deeper layers are older.
- Radioactive dating: The age of fossils is determined by measuring the ratio of isotopes of the same element present in the fossil material.

XVI. Answer the following questions: $2 \times 4 = 8$

Q37. Which molecule is formed during the first step of cellular respiration by the breakdown of glucose molecule in cytoplasm? Mention the types of respiration and write any two differences between them.

Solution:

Pyruvate.

Two types:

Aerobic Respiration	Anaerobic Respiration
• Atmospheric oxygen is utilized.	• Atmospheric oxygen is not utilized.
• Liberates more energy with carbon dioxide and water.	• Liberates less energy with ethanol and carbon dioxide.
• Takes place in mitochondria.	• Takes place in cytoplasm.
• Takes place in higher levels of organisms	• Takes place in lower organisms like yeast.

OR

Which are the factors essential for photosynthesis? Mention the events that occur during this process and represent this process by balanced chemical equation.

Solution:

Factors essential for photosynthesis:

Carbon dioxide, water, minerals, sunlight and chlorophyll.

Events that occur during photosynthesis:

i) Absorption of light energy by chlorophyll.

ii) Conversion of light energy into chemical energy.

iii) Splitting of water molecules into hydrogen and oxygen molecules.

iv) Reduction of carbon dioxide into carbohydrates.

Equation:

$$6CO_2 + 12H_2O \xrightarrow{Sunlight} C_6H_{12}O_6 + 6O_2 + 6H_2O$$

Q38. Draw the diagram showing the structure of the human brain and label the following parts:

i) Cerebrum

ii) Cerebellum.

Solution:

Human Brain: