Bihar Board Class 10th Science - 2023 Question Paper with Solutions

Time Allowed :3 Hour 15 mins	Maximum Marks :50	Total Questions :100

General Instructions

Read the following instructions very carefully and strictly follow them:

1. Candidates must enter his / her Question Booklet Serial No. (10 Digits) in the OMR Answer Sheet.
2. Candidates are required to give their answers in their own words as far as practicable.
3. Figures in the right hand margin indicate full marks.

Section-A

1. Which of the following is a non-renewable source of energy?

(1) Sun
(2) Wind
(3) Petroleum
(4) Flowing water

Correct Answer: (3) Petroleum

Solution:
Step 1: Definition.
Non-renewable sources of energy are those which cannot be replenished in a short period of time. They take millions of years to form.
Step 2: Analysis of options.
- Sun, Wind, and Flowing water are renewable sources.
- Petroleum is formed from fossils over millions of years and once used cannot be replenished quickly.
Step 3: Conclusion.
Hence, petroleum is a non-renewable source.

Quick Tip

Petroleum, coal, and natural gas are non-renewable sources because they take millions of years to form.

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2. The actual source of energy of fossil fuel is:

(1) Nuclear fusion
(2) Sun
(3) Moon
(4) None of these

Correct Answer: (2) Sun

Solution:
Step 1: Origin of fossil fuels.
Fossil fuels are formed from plants and animals buried under the earth millions of years ago.
Step 2: Energy source.
Plants get their energy through photosynthesis from the sun. That energy is trapped and stored in fossil fuels.
Step 3: Conclusion.
Thus, the Sun is the ultimate source of fossil fuel energy.

Quick Tip

All fossil fuels store ancient solar energy captured by plants.

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3. Those which 'produce heat on combustion' are called:

(1) Engine
(2) Fuel
(3) Heater
(4) None of these

Correct Answer: (2) Fuel

Solution:
Step 1: Definition.
A fuel is any substance that produces heat and energy on combustion.
Step 2: Explanation of options.
- Engine uses fuel but is not itself fuel.
- Heater is a device, not a substance.
- Fuel like coal, petrol, LPG gives heat on burning.
Step 3: Conclusion.
Therefore, substances producing heat on combustion are called fuels.

Quick Tip

Petrol, diesel, coal, LPG are common fuels that release energy when burned.

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4. Euro-II is related to:

(1) Air pollution
(2) Soil pollution
(3) Water pollution
(4) None of these

Correct Answer: (1) Air pollution

Solution:
Step 1: Background.
Euro norms are standards for controlling emissions from vehicles.
Step 2: Explanation.
Euro-II was introduced to reduce harmful gases like CO, NOx, SO2 from vehicles. It directly deals with air pollution.
Step 3: Conclusion.
Hence, Euro-II relates to air pollution control.

Quick Tip

Euro norms are emission standards for vehicles to reduce air pollution.

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5. Dispersion of white light is produced by:

(1) Glass slab
(2) Plane mirror
(3) Spherical mirror
(4) Prism

Correct Answer: (4) Prism

Solution:
Step 1: Dispersion meaning.
Dispersion is the splitting of white light into seven colours (VIBGYOR).
Step 2: Device responsible.
A prism bends different colours at different angles due to refraction. This causes dispersion.
Step 3: Conclusion.
Hence, prism produces dispersion of light.

Quick Tip

Dispersion is best shown in Newton's prism experiment.

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6. The device which directly converts solar energy into electricity is known as:

(1) Daniel cell
(2) Leclanche cell
(3) Solar cell
(4) None of these

Correct Answer: (3) Solar cell

Solution:
Step 1: Definition.
A solar cell is a device that directly converts solar energy into electrical energy using photovoltaic effect.
Step 2: Options.
Daniel cell and Leclanche cell are chemical cells, not solar energy devices.
Step 3: Conclusion.
Hence, the correct device is solar cell.

Quick Tip

Solar cells work on the principle of photovoltaic effect.

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7. Which one of the following is a strong base?

(1) NaOH
(2) $Cu(OH)_2$
(3) NH_4OH
(4) $Mg(OH)_2$

Correct Answer: (1) NaOH

Solution:
Step 1: Definition.
Strong bases are those which completely dissociate in water.
Step 2: Explanation.
- NaOH dissociates completely, hence strong base.
- $Cu(OH)_2$, NH_4OH, $Mg(OH)_2$ are weak bases because they dissociate partially.
Step 3: Conclusion.
Thus, NaOH is the correct answer.

Quick Tip

Strong bases are generally hydroxides of alkali metals like NaOH and KOH.

8. What is the chemical formula of dry ice?

(1) CO
(2) CO_2
(3) H_2O
(4) H_2O_2

Correct Answer: (2) CO_2

Solution:
Step 1: Definition.
Dry ice is the solid form of carbon dioxide.
Step 2: Explanation.
It is called "dry" because it sublimates directly into gas without becoming liquid.
Step 3: Conclusion.
Thus, formula of dry ice is CO_2.

Quick Tip

Dry ice is widely used for cooling and fog effects in stage shows.

9. Which one of the following proteins is responsible for the red colour of blood?

(1) Heparin
(2) Haemoglobin
(3) Thrombin
(4) Fibrinogen

Correct Answer: (2) Haemoglobin

Solution:
Step 1: Background.
Haemoglobin is a protein present in red blood cells. It binds oxygen and contains iron.
Step 2: Explanation.
The iron in haemoglobin gives blood its characteristic red colour.
Step 3: Conclusion.
Hence, haemoglobin is responsible for red colour.

Quick Tip

Haemoglobin carries oxygen from lungs to tissues.

10. The colour of chlorophyll pigment is:

(1) Black
(2) Yellow
(3) Blue
(4) Green

Correct Answer: (4) Green

Solution:
Step 1: Definition.
Chlorophyll is the green pigment present in plant leaves.
Step 2: Explanation.
It absorbs red and blue light for photosynthesis and reflects green light, making plants look green.
Step 3: Conclusion.
Thus, chlorophyll pigment is green.

Quick Tip

Chlorophyll is essential for photosynthesis as it traps solar energy.

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11. The hardest part of the teeth is:

(1) dentine
(2) enamel
(3) pulp cavity
(4) canine

Correct Answer: (2) enamel

Solution:
Step 1: Fact.
Enamel is a highly mineralised layer (mainly hydroxyapatite) covering the crown of the tooth.
Step 2: Comparison.
Dentine lies below enamel and is softer; pulp cavity contains nerves and blood vessels; canine is a type of tooth, not a tissue.
Step 3: Conclusion.
Therefore, enamel is the hardest part of the tooth.

Quick Tip

Enamel is the hardest substance in the human body—harder than bone.

12. Which of the following is necessary in the synthesis of thyroxine hormone?

(1) Chlorine
(2) Iodine
(3) Manganese
(4) Iron

Correct Answer: (2) Iodine

Solution:
Step 1: Key idea.
Thyroxine (T_4) and triiodothyronine (T_3) are iodinated hormones of the thyroid gland.
Step 2: Application.
Iodine deficiency leads to reduced thyroxine, causing goitre and cretinism.
Step 3: Conclusion.
Hence iodine is essential for thyroxine synthesis.

Quick Tip

Use iodised salt to prevent iodine-deficiency disorders.

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13. Which is an example of a decomposer?

(1) Cow
(2) Fungus
(3) Tiger
(4) Grass

Correct Answer: (2) Fungus

Solution:
Step 1: Definition.
Decomposers break down dead organic matter into simpler substances, recycling nutrients.
Step 2: Analysis.
Fungi (and many bacteria) are classic decomposers; cow and tiger are consumers; grass is a producer.
Step 3: Conclusion.
Therefore, fungus is a decomposer.

Quick Tip

Decomposers close the nutrient cycle by converting complex organics back to soil nutrients.

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14. Which is the main source of energy on earth?

(1) Coal
(2) Wood
(3) Water
(4) Sun

Correct Answer: (4) Sun

Solution:
Step 1: Core concept.
Almost all natural energy on Earth originates from the Sun—directly (solar energy) or indirectly (wind, water cycle, biomass, fossil fuels).
Step 2: Conclusion.
Hence, the Sun is the ultimate/main source of energy on Earth.

Quick Tip

Even fossil fuels store ancient solar energy captured by plants.

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15. Which of the following is/are a part of environment?

(1) Atmosphere
(2) Hydrosphere
(3) Lithosphere
(4) All of these

Correct Answer: (4) All of these

Solution:
Step 1: Understanding environment.
The environment includes air (atmosphere), water bodies (hydrosphere), and land/rocks (lithosphere), along with the biosphere.
Step 2: Conclusion.
Therefore, all listed spheres are components of the environment.

Quick Tip

Remember: Atmosphere + Hydrosphere + Lithosphere + Biosphere = Environment.

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16. How many trophic levels are there in a forest ecosystem?

(1) 1
(2) 2
(3) 3
(4) 4

Correct Answer: (4) 4

Solution:
Step 1: Concept.
Typical forest food chains include: producers (plants), primary consumers (herbivores), secondary consumers (small carnivores), and tertiary consumers (top carnivores).
Step 2: Conclusion.
Thus, commonly we consider four trophic levels in a forest ecosystem.

Quick Tip

Energy decreases by about 90% at each successive trophic level (10% law).

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17. The reaction in which ions are exchanged is called:

(1) displacement
(2) double displacement
(3) combination
(4) precipitation

Correct Answer: (2) double displacement

Solution:
Step 1: Definitions.
Double displacement reactions involve mutual exchange of ions between two compounds (AB + CD $\rightarrow$ AD + CB).
Step 2: Note.
Precipitation is a *type* of double displacement where an insoluble solid forms.
Step 3: Conclusion.
Hence the general name is double displacement.

Quick Tip

If two ionic solutions react to form a precipitate, think "double displacement."

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18. Which of the following equations is *not* balanced?

(1) $2H_2 + O_2 \rightarrow 2H_2O$
(2) $2KClO_3 \rightarrow 2KCl + 3O_2$
(3) $H_2 + Cl_2 \rightarrow 2HCl$
(4) $Pb(NO_3)_2 \rightarrow PbO + NO_2 + O_2$

Correct Answer: (4) $Pb(NO_3)_2 \rightarrow PbO + NO_2 + O_2$

Solution:
Step 1: Count atoms on each side.
LHS: Pb=1, N=2, O=6.
RHS: Pb=1, N=1 (in NO_2), O=5 (1 in PbO, 2 in NO_2, 2 in O_2).
Step 2: Observation.
N and O counts differ, so the equation is not balanced. Others are balanced.
Step 3: Conclusion.
Thus option (4) is not balanced.

Quick Tip

Always tally each element's atoms on LHS and RHS to check balance.

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19. The pH value of any neutral solution is:

(1) 0
(2) 4
(3) 7
(4) 14

Correct Answer: (3) 7

Solution:
Step 1: Concept.
Neutral solutions have equal concentrations of H^+ and OH^- ions.
Step 2: Definition.
On the pH scale (0–14), neutrality corresponds to pH = 7 at 25°C.
Step 3: Conclusion.
Hence, neutral solutions have pH 7.

Quick Tip

pH ¡ 7 acidic; pH ¿ 7 basic; pH = 7 neutral.

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20. Which of the following is a natural indicator?

(1) Phenolphthalein
(2) Turmeric
(3) Methyl orange
(4) None of these

Correct Answer: (2) Turmeric

Solution:
Step 1: Idea.
Natural indicators are obtained from plants (e.g., litmus, red cabbage, turmeric).
Step 2: Analysis.
Phenolphthalein and methyl orange are synthetic indicators; turmeric is natural and turns reddish-brown in bases.
Step 3: Conclusion.
Therefore, turmeric is a natural indicator.

Quick Tip

Turmeric stains become reddish-brown with soap (basic), a quick home-test for bases.

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21. What is the chemical formula of washing soda?

(1) $Na_2CO_3.7H_2O$
(2) $Na_2CO_3.5H_2O$
(3) $Na_2CO_3.10H_2O$
(4) $Na_2CO_3.H_2O$

Correct Answer: (3) $Na_2CO_3.10H_2O$

Solution:
Step 1: Identification.
Washing soda is the decahydrate form of sodium carbonate.
Step 2: Formula.
Its correct chemical formula is $Na_2CO_3.10H_2O$.
Step 3: Conclusion.
Thus, option (3) is correct.

Quick Tip

Washing soda is used for cleaning and water softening because it removes hardness.

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22. Which of the following is a heterogeneous compound?

(1) Chalk
(2) Limestone
(3) Marble
(4) Plaster of Paris

Correct Answer: (3) Marble

Solution:
Step 1: Concept.
Heterogeneous compounds are those in which the composition is not uniform throughout.
Step 2: Explanation.
Marble ($CaCO_3$ with impurities) has non-uniform distribution of minerals, making it heterogeneous.
Step 3: Conclusion.
Thus, marble is the heterogeneous compound among the given options.

Quick Tip

Impurities in marble cause its different colours and make it heterogeneous.

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23. The hardest natural substance is:

(1) Iron
(2) Gold
(3) Silver
(4) Diamond

Correct Answer: (4) Diamond

Solution:
Step 1: Fact.
Diamond is made of pure carbon atoms arranged in a rigid tetrahedral structure.
Step 2: Hardness.
This structure makes diamond the hardest natural substance on Mohs hardness scale.
Step 3: Conclusion.
Hence, diamond is the hardest natural substance.

Quick Tip

Diamond is used in cutting tools due to its extreme hardness.

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24. Which of the following ions can turn red litmus paper blue?

(1) H^+
(2) OH^-
(3) O^{2-}
(4) None of these

Correct Answer: (2) OH^-

Solution:
Step 1: Recall.
Red litmus turns blue in alkaline/basic medium.
Step 2: Explanation.
OH^- ions are responsible for basic nature. Thus, they turn red litmus paper blue.
Step 3: Conclusion.
So, the correct answer is OH^-.

Quick Tip

Acids release H^+ (turn blue litmus red), bases release OH^- (turn red litmus blue).

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25. Fruit-ripening hormone is:

(1) Ethylene
(2) Auxin
(3) Gibberellin
(4) Cytokinin

Correct Answer: (1) Ethylene

Solution:
Step 1: Recall.
Ethylene is a gaseous plant hormone responsible for ripening of fruits like bananas and mangoes.
Step 2: Other hormones.
Auxins promote growth, gibberellins stimulate elongation, cytokinins promote cell division.
Step 3: Conclusion.
Thus, the fruit ripening hormone is ethylene.

Quick Tip

Ethylene gas is often used commercially to ripen fruits quickly.

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26. Mushroom is:

(1) A saprophyte
(2) A parasite
(3) An autotroph
(4) An algae

Correct Answer: (1) A saprophyte

Solution:
Step 1: Recall.
Mushrooms feed on dead and decaying organic matter.
Step 2: Explanation.
This mode of nutrition is called saprophytic. Mushrooms cannot make their own food.
Step 3: Conclusion.
Hence, mushrooms are saprophytes.

Quick Tip

Fungi like mushrooms decompose organic matter and recycle nutrients.

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27. The molecular formula of ozone is:

(1) O_2
(2) O_3
(3) O_4
(4) O_5

Correct Answer: (2) O_3

Solution:
Step 1: Recall.
Ozone is an allotrope of oxygen formed by three oxygen atoms.
Step 2: Properties.
It forms the ozone layer which protects Earth from harmful UV radiation.
Step 3: Conclusion.
Thus, formula of ozone is O_3.

Quick Tip

Ozone is less stable than O_2 and has a sharp smell.

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28. Which mode of nutrition is found in fungi?

(1) Autotrophic
(2) Holozoic
(3) Saprophytic
(4) None of these

Correct Answer: (3) Saprophytic

Solution:
Step 1: Definition.
Saprophytic nutrition means obtaining food from dead organic matter.
Step 2: Explanation.
Fungi cannot photosynthesise; they release enzymes and absorb nutrients.
Step 3: Conclusion.
Thus, fungi show saprophytic nutrition.

Quick Tip

Fungi recycle nutrients back to the ecosystem via saprophytic nutrition.

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29. The flow of energy in an ecosystem is:

(1) Unidirectional
(2) Bidirectional
(3) Multidirectional
(4) Cyclic

Correct Answer: (1) Unidirectional

Solution:
Step 1: Recall.
Energy enters the ecosystem through sunlight (producers) and flows to herbivores, carnivores, and decomposers.
Step 2: Concept.
Unlike matter, energy cannot be recycled. It flows in one direction only.
Step 3: Conclusion.
Thus, energy flow in an ecosystem is unidirectional.

Quick Tip

Matter cycles in ecosystem, but energy flows in a single direction and eventually dissipates as heat.

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30. How many chambers are found in human heart?

(1) 1
(2) 2
(3) 3
(4) 4

Correct Answer: (4) 4

Solution:
Step 1: Recall.
The human heart has four chambers: two atria (upper) and two ventricles (lower).
Step 2: Importance.
This separation allows efficient double circulation: oxygenated and deoxygenated blood remain separate.
Step 3: Conclusion.
Hence, human heart has 4 chambers.

Quick Tip

Four-chambered hearts are found in birds and mammals for efficient oxygen supply.

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31. According to evolutionary view, we are more similar to:

(1) Chimpanzee
(2) Spider
(3) Orangutan
(4) Bacteria

Correct Answer: (1) Chimpanzee

Solution:
Step 1: Concept.
Humans share about 98–99% of DNA with chimpanzees, making them our closest relatives.
Step 2: Analysis of options.
Spiders are arthropods, bacteria are prokaryotes, orangutans are close but less similar than chimpanzees.
Step 3: Conclusion.

Thus, humans are most similar to chimpanzees.

Quick Tip

Chimpanzees are considered our evolutionary cousins.

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32. Which one of the following reactions occurs in the formation of curd from milk?

(1) Dissociation
(2) Fermentation
(3) Excretion
(4) Photosynthesis

Correct Answer: (2) Fermentation

Solution:
Step 1: Process.
Curd forms when lactic acid bacteria ferment lactose sugar in milk.
Step 2: Explanation.
This is a fermentation process, not dissociation, excretion, or photosynthesis.
Step 3: Conclusion.
Hence, curd formation is due to fermentation.

Quick Tip

Lactobacillus bacteria ferment milk to form curd.

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33. Which of the following lenses is called diverging lens?

(1) Concave lens
(2) Convex lens
(3) Convex lens and concave lens
(4) Bifocal lens

Correct Answer: (1) Concave lens

Solution:
Step 1: Recall.
Concave lenses spread out light rays (diverge them).
Step 2: Explanation.
Convex lens is converging, bifocal has both convex + concave parts.
Step 3: Conclusion.
Thus, concave lens is called a diverging lens.

Quick Tip

Concave lens is used in spectacles for myopia (short-sightedness).

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34. Which colour has maximum wavelength in visible light?

(1) Yellow
(2) Violet
(3) Red
(4) Green

Correct Answer: (3) Red

Solution:
Step 1: Spectrum.
Visible spectrum: Violet (shortest wavelength, 400 nm) to Red (longest wavelength, 700 nm).
Step 2: Conclusion.
Hence, red light has maximum wavelength.

Quick Tip

That's why red is used in danger signals—it scatters the least.

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35. To increase the value of the resistance, resistors should be connected in:

(1) Series
(2) Parallel
(3) Both (A) and (B)
(4) None of these

Correct Answer: (1) Series

Solution:
Step 1: Concept.
In series: $R_{eq} = R_1 + R_2 + R_3...$ (greater than individual).
In parallel: $R_{eq} < R_{smallest}$.
Step 2: Conclusion.
So, to increase resistance, use series.

Quick Tip

Series = more resistance, Parallel = less resistance.

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36. Which instrument does not have a positive (+) and a negative (-) sign?

(1) In voltmeter
(2) In ammeter
(3) In electric cell
(4) In coil

Correct Answer: (4) In coil

Solution:
Step 1: Explanation.
Voltmeter and ammeter have polarity signs; electric cell has positive and negative terminals.
Step 2: Note.
A coil is just a wire wound in loops, without polarity signs.
Step 3: Conclusion.
Thus, coil has no + or – sign.

Quick Tip

Only devices that measure or supply current/voltage need polarity marking.

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37. A converging beam is incident on a plane mirror. The reflected beam will be:

(1) Diverging
(2) Converging
(3) Parallel
(4) None of these

Correct Answer: (2) Converging

Solution:
Step 1: Law of reflection.
Plane mirror simply reflects rays without changing their convergence/divergence.
Step 2: Application.
If a converging beam strikes a plane mirror, the reflected rays will remain converging.
Step 3: Conclusion.
Thus, the answer is converging.

Quick Tip

Plane mirrors change direction but not convergence/divergence of rays.

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38. The SI unit of magnetic flux is:

(1) Watt
(2) Joule
(3) Weber
(4) Newton

Correct Answer: (3) Weber

Solution:
Step 1: Recall.
Magnetic flux $\Phi = B \cdot A$ (Tesla $\times$ m^2).
Step 2: SI unit.
Unit is weber (Wb).
Step 3: Conclusion.
Hence, the SI unit of magnetic flux is weber.

Quick Tip

1 weber = magnetic flux producing 1 volt when reduced to zero in 1 second.

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39. There are 20 divisions between the zero (0) and 2A number of an ammeter. What is the least count of the ammeter?

(1) 0.01 A
(2) 0.1 A
(3) 0.001 A
(4) 2 A

Correct Answer: (1) 0.01 A

Solution:
Step 1: Formula.
Least count = Range / Number of divisions.
Step 2: Substitution.
Range = 2A, divisions = 200 (20 major $\times$ 10 small).
So least count = 2 / 200 = 0.01 A.
Step 3: Conclusion.
Thus, least count is 0.01 A.

Quick Tip

Least count is the smallest value an instrument can measure.

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40. If several resistances are parallel, their equivalent resistance will be:

(1) More than each resistance
(2) Less than each resistance
(3) Equal to each resistance
(4) None of these

Correct Answer: (2) Less than each resistance

Solution:
Step 1: Formula.
For parallel: $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + ...$
Step 2: Property.
R_{eq} is always less than the smallest individual resistance.
Step 3: Conclusion.
Hence, equivalent resistance in parallel is less.

Quick Tip

Parallel connections reduce resistance, series increases it.

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41. The pores of the stomata are surrounded by which of the following?

(1) Cuticle
(2) Guard cells
(3) Lenticels
(4) None of these

Correct Answer: (2) Guard cells

Solution:
Step 1: Structure.
Each stoma (pore) in a leaf epidermis is bordered by two kidney-shaped guard cells.
Step 2: Function.
Guard cells control opening and closing of stomata by changing turgor pressure, thus regulating gas exchange and transpiration.
Step 3: Conclusion.
Hence, stomatal pores are surrounded by guard cells.

Quick Tip

Lenticels are pores on woody stems, not on leaf epidermis.

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42. Which gas is liberated during respiration?

(1) O_2
(2) SO_2
(3) NO_2
(4) CO_2

Correct Answer: (4) CO_2

Solution:
Step 1: Concept.
In aerobic respiration, glucose is oxidised using oxygen to form carbon dioxide and water with release of energy.
Step 2: Equation.
$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy.
Step 3: Conclusion.
Therefore, CO_2 is liberated.

Quick Tip

Exhaled air has higher CO_2 and lower O_2 than inhaled air.

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44. What is liberated by complete oxidation of glucose?

(1) Only CO_2
(2) Only energy
(3) Only H_2O
(4) All of these

Correct Answer: (4) All of these

Solution:
Step 1: Reaction.
Complete oxidation: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + Energy (ATP).
Step 2: Output.
Products are CO_2, H_2O and energy.
Step 3: Conclusion.
Therefore, "All of these" is correct.

Quick Tip

Energy from glucose is captured mainly as ATP during respiration.

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45. What type of membrane is the cell membrane?

(1) Permeable
(2) Impermeable
(3) Semi-permeable
(4) None of these

Correct Answer: (3) Semi-permeable

Solution:
Step 1: Idea.
The plasma membrane allows selective passage of substances—some pass easily, others are restricted.
Step 2: Term.
This property is called selective or semi-permeability.
Step 3: Conclusion.
Hence, the cell membrane is semi-permeable.

Quick Tip

"Selectively permeable" and "semi-permeable" are used interchangeably in Class 10 context.

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46. Full form of ATP is:

(1) Adenine thymine phosphate
(2) Adenine triphosphate
(3) Adenosine triphosphate
(4) Adenine thymine diphosphate

Correct Answer: (3) Adenosine triphosphate

Solution:
Step 1: Definition.
ATP is the energy currency of the cell, consisting of adenine, ribose (together adenosine) and three phosphate groups.
Step 2: Clarify options.
It is not "adenine triphosphate"; the correct nucleoside is *adenosine*.

Step 3: Conclusion.
Thus, ATP stands for adenosine triphosphate.

Quick Tip

Breaking the terminal phosphate bond of ATP releases usable energy.

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47. Which solution is used to test the presence of starch?

(1) Iodine
(2) Safranin
(3) Eosin
(4) Methylene blue

Correct Answer: (1) Iodine

Solution:
Step 1: Test.
Iodine solution turns blue-black in presence of starch due to formation of a starch–iodine complex.
Step 2: Others.
Safranin, eosin, and methylene blue are general stains, not specific starch indicators.
Step 3: Conclusion.
Therefore, iodine is used to test starch.

Quick Tip

A blue-black colour confirms starch; no colour change means no starch.

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48. Rate of photosynthesis is dependent on which factors?

(1) Properties of light
(2) The amount of light
(3) Both (A) and (B)
(4) None of these

Correct Answer: (3) Both (A) and (B)

Solution:
Step 1: Factors.
Photosynthesis rate depends on light intensity (amount) and quality (wavelength/colour), among other factors (CO_2, temperature).
Step 2: Application.

Red and blue light are more effective; higher intensity increases rate up to a limit.
Step 3: Conclusion.
So both properties and amount of light affect the rate.

Quick Tip

Red and blue wavelengths are most efficient for photosynthesis.

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49. What is the common name of $CaOCl_2$?

(1) Calcium chloro oxide
(2) Calcium oxy oxide
(3) Bleaching powder
(4) Calcium chloride

Correct Answer: (3) Bleaching powder

Solution:
Step 1: Identification.
Calcium oxychloride ($CaOCl_2$) is commonly known as bleaching powder.
Step 2: Use.
It is used for bleaching, disinfection, and water treatment.
Step 3: Conclusion.
Thus, $CaOCl_2$ is bleaching powder.

Quick Tip

Bleaching powder releases chlorine, which kills germs and bleaches fabrics.

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50. Iodized salt is:

(1) NaCl + KIO_3
(2) NaCl + KI
(3) both (A) and (B)
(4) none of these

Correct Answer: (3) both (A) and (B)

Solution:
Step 1: Composition.
Iodized salt contains table salt (NaCl) fortified with iodine—commonly as potassium iodate (KIO_3) or potassium iodide (KI).
Step 2: Purpose.

It prevents iodine-deficiency disorders like goitre.
Step 3: Conclusion.
Therefore, both (A) and (B) correctly represent iodized salt.

Quick Tip

Check "iodized" on salt packets—fortified with KI or KIO_3.

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51. The alloy consisting of 90% Cu and 10% Sn is named as

(1) Solder
(2) Brass
(3) German silver
(4) Bronze

Correct Answer: (4) Bronze

Solution:
Step 1: Understanding alloys.
Bronze is an alloy mainly of copper (Cu) and tin (Sn).
Step 2: Percentage composition.
The given mixture has 90% Cu and 10% Sn, which is the typical composition of bronze.
Step 3: Eliminate others.
- Solder is an alloy of lead and tin.
- Brass is copper + zinc.
- German silver is copper + zinc + nickel.
Step 4: Conclusion.
Hence, the alloy is bronze.

Quick Tip

Bronze is historically important and used in making statues, medals, and tools.

---

52. How many bonds are there between two atoms of one molecule of oxygen gas?

(1) 1
(2) 2
(3) 3
(4) No bond

Correct Answer: (2) 2

Solution:

Step 1: Oxygen molecule structure.
Oxygen exists as O_2. Each oxygen atom has 6 valence electrons.
Step 2: Bonding.
They share two pairs of electrons, forming a double bond (O=O).
Step 3: Conclusion.
Therefore, there are two covalent bonds between O atoms.

Quick Tip

O_2 has a double bond, while N_2 has a triple bond.

---

53. What is Philosopher's wool?

(1) ZnO
(2) ZnS
(3) $ZnCl_2$
(4) $ZnSO_4$

Correct Answer: (1) ZnO

Solution:
Step 1: Concept.
Philosopher's wool is the common name for zinc oxide (ZnO).
Step 2: Reason.
It forms as white fluffy wool-like substance when zinc metal is oxidized.
Step 3: Conclusion.
Hence, Philosopher's wool = ZnO.

Quick Tip

ZnO is amphoteric – reacts with both acids and bases.

---

54. The sodium salts of higher fatty acids are called

(1) Rubber
(2) Plastic
(3) Soap
(4) Detergent

Correct Answer: (3) Soap

Solution:
Step 1: Reaction.

Saponification of fats and oils with NaOH gives sodium salts of fatty acids.
Step 2: Identification.
These sodium salts are soaps.
Step 3: Conclusion.
Therefore, the answer is soap.

Quick Tip

Soaps work well in soft water, but not in hard water due to scum formation.

---

55. Which of the following is a symbol of carbonyl group?

(1) –CHO
(2) –COOH
(3) ¿CO
(4) –O–

Correct Answer: (3) ¿CO

Solution:
Step 1: Carbonyl definition.
A carbonyl group is C=O, where carbon is double-bonded to oxygen.
Step 2: Elimination.
- –CHO is an aldehyde group.
- –COOH is a carboxyl group.
- –O– is ether linkage.
Step 3: Conclusion.
Thus, the correct symbol is ¿CO.

Quick Tip

Carbonyl group is common in aldehydes and ketones.

---

56. Which of the following organic compounds is an alkyne?

(1) Ethene
(2) Methane
(3) Acetylene
(4) Chloroform

Correct Answer: (3) Acetylene

Solution:

Step 1: Definition.
Alkynes are hydrocarbons with a triple bond.
Step 2: Options.
- Ethene: alkene (double bond).
- Methane: alkane (single bond).
- Acetylene (ethyne): C_2H_2, with a triple bond.
- Chloroform: not a hydrocarbon.
Step 3: Conclusion.
So acetylene is an alkyne.

Quick Tip

General formula of alkyne: C_nH_{2n-2}.

---

57. The focal length of which mirror is taken as negative according to the convention of signs?

(1) Plane mirror
(2) Concave mirror
(3) Convex mirror
(4) None of these

Correct Answer: (2) Concave mirror

Solution:
Step 1: Sign convention.
In mirror formula, distances measured against incident light are taken negative.
Step 2: Mirrors.
For concave mirror, focal length is on the left side (against light), hence negative.
For convex mirror, focal length is positive.
Step 3: Conclusion.
So, concave mirror has negative focal length.

Quick Tip

Remember: Concave = negative focal length, Convex = positive focal length.

---

58. Where is the object placed to form a magnified virtual image in a concave mirror?

(1) Between focus and pole
(2) Beyond centre of curvature
(3) At focus

(4) Between centre of curvature and focus

Correct Answer: (1) Between focus and pole

Solution:
Step 1: Image formation.
Concave mirrors form different images depending on object position.
Step 2: For magnified virtual image.
When object is between focus (F) and pole (P), the mirror forms a virtual, erect, and magnified image.
Step 3: Conclusion.
Thus, the correct answer is "between focus and pole".

Quick Tip

Concave mirrors are used in makeup mirrors for magnified virtual images.

---

59. How many laws of refraction of light are there?

(1) 1
(2) 2
(3) 3
(4) 4

Correct Answer: (2) 2

Solution:
Step 1: Definition.
Refraction is bending of light when it passes from one medium to another.
Step 2: Laws.
1. Incident ray, refracted ray and normal lie in the same plane.
2. Snell's law: $\frac{\sin i}{\sin r} = \mu$, a constant for given media.
Step 3: Conclusion.
Thus, there are 2 laws.

Quick Tip

Snell's law is key to calculating refractive index.

---

60. What is the value of refractive index of a medium?

(1) $\frac{\sin i}{\sin r}$

(2) $\frac{\sin r}{\sin i}$
(3) $\sin i + \sin r$
(4) $\sin i \times \sin r$

Correct Answer: (1) $\frac{\sin i}{\sin r}$

Solution:
Step 1: Recall Snell's law.
$n = \frac{\sin i}{\sin r}$, where i = angle of incidence, r = angle of refraction.
Step 2: Concept.
This ratio remains constant for a given pair of media.
Step 3: Conclusion.
Therefore, refractive index is $\frac{\sin i}{\sin r}$.

Quick Tip

Higher refractive index = light bends more towards normal.

---

61. What is the S.I. unit of power of lens?

(1) cm^{-1}
(2) m
(3) cm
(4) Dioptre

Correct Answer: (4) Dioptre

Solution:
Step 1: Understanding power of a lens.
The power of a lens is defined as the reciprocal of its focal length (in meters).

$$P = \frac{100}{f\,(\text{in cm})} = \frac{1}{f\,(\text{in m})}$$

Step 2: Unit of power.
Since focal length is measured in meters, the unit of power is m^{-1}. This unit is given a special name "Dioptre (D)".
Step 3: Conclusion.
Therefore, the SI unit of power of a lens is Dioptre.

Quick Tip

Power of lens increases when focal length decreases.

62. The magnification (m) in a concave lens is equal to:

(1) uv
(2) $\frac{u}{v}$
(3) $\frac{v}{u}$
(4) $u + v$

Correct Answer: (3) $\frac{v}{u}$

Solution:
Step 1: Definition of magnification.
Magnification produced by a lens is defined as the ratio of the image distance (v) to the object distance (u):

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

Step 2: Application in concave lens.
In concave lens, the image is always virtual, erect and diminished, hence $m = \frac{v}{u}$ (always less than 1).
Step 3: Conclusion.
Thus, magnification in a concave lens is $\frac{v}{u}$.

Quick Tip

For concave lens, the image formed is always virtual, erect and diminished.

---

63. What is the refractive index of diamond?

(1) 1.42
(2) 1.32
(3) 2.24
(4) 2.42

Correct Answer: (4) 2.42

Solution:
Step 1: Refractive index meaning.
Refractive index is the ratio of speed of light in vacuum to the speed of light in medium. Diamond has one of the highest refractive indices among natural substances.
Step 2: Known value.
The refractive index of diamond is 2.42.
Step 3: Conclusion.
Hence, correct answer is 2.42.

Quick Tip

Diamond's high refractive index makes it sparkle brilliantly by causing total internal reflection.

---

64. A prism is bounded by how many surfaces?

(1) 2
(2) 3
(3) 4
(4) 5

Correct Answer: (2) 3

Solution:
Step 1: Understanding prism.
A prism is a transparent medium bounded by three rectangular surfaces and two triangular bases.
Step 2: Effective surfaces.
The prism is bounded by three surfaces (two triangular bases + one rectangular refracting surface).
Step 3: Conclusion.
So, a prism is bounded by 3 surfaces.

Quick Tip

Prism is used to study dispersion of light into seven colors (VIBGYOR).

---

65. The atomic number of potassium is 19. What is the valency?

(1) 1
(2) 2
(3) 3
(4) 4

Correct Answer: (1) 1

Solution:
Step 1: Electronic configuration.
Potassium (K) has atomic number 19. Its configuration is:

$$2, 8, 8, 1$$

Step 2: Valency concept.

Valency is determined by the number of electrons in the outermost shell. Here, it has 1 electron in outer shell.
Step 3: Conclusion.
So, valency of potassium is 1.

Quick Tip

Alkali metals (like Na, K, Li) all have valency 1.

---

66. What is the general formula of an alkane?

(1) C_nH_{2n}
(2) C_nH_{2n+2}
(3) C_nH_{2n-2}
(4) None of these

Correct Answer: (2) C_nH_{2n+2}

Solution:
Step 1: Understanding hydrocarbons.
Alkanes are saturated hydrocarbons with single bonds only.
Step 2: General formula.
For alkanes, the formula is:

$$C_nH_{2n+2}$$

Step 3: Examples.
Methane: CH_4 (n=1), Ethane: C_2H_6 (n=2).
Step 4: Conclusion.
Thus, correct general formula is C_nH_{2n+2}.

Quick Tip

Remember: Alkanes – single bonds (C_nH_{2n+2}), Alkenes – double bonds (C_nH_{2n}), Alkynes – triple bonds (C_nH_{2n-2}).

---

67. What is the atomic number of fluorine?

(1) 9
(2) 19
(3) 29
(4) 39

Correct Answer: (1) 9

Solution:
Step 1: Recall periodic table.
Fluorine belongs to Group 17 (Halogens).
Step 2: Atomic number.
The atomic number of fluorine is 9. Its electronic configuration is $2, 7$.
Step 3: Conclusion.
Thus, fluorine has atomic number 9.

Quick Tip

Halogens belong to group 17 and have 7 valence electrons.

---

68. A solution turns red litmus into blue. The pH value of this solution would be:

(1) 7
(2) More than 7
(3) Less than 7
(4) None of these

Correct Answer: (2) More than 7

Solution:
Step 1: Litmus test.
Red litmus turning blue indicates that the solution is basic.
Step 2: pH range.
Acidic solutions: $pH < 7$
Neutral solutions: $pH = 7$
Basic solutions: $pH > 7$.
Step 3: Conclusion.
Since the solution is basic, its pH is more than 7.

Quick Tip

Always remember: Acids (< 7), Neutral (=7), Bases (¿7).

---

69. What is the atomic weight of oxygen?

(1) 8
(2) 12
(3) 16

(4) 18

Correct Answer: (3) 16

Solution:
Step 1: Recall oxygen details.
Oxygen has atomic number 8 and its most common isotope is O^{16}.
Step 2: Atomic weight.
The relative atomic mass (atomic weight) of oxygen is 16 u.
Step 3: Conclusion.
Thus, the correct answer is 16.

Quick Tip

Atomic weight of oxygen = 16, hydrogen = 1 $\rightarrow$ so water H_2O has molar mass = 18 g/mol.

---

70. Bauxite is an ore of which of the following metals?

(1) Hg
(2) Fe
(3) Al
(4) Zn

Correct Answer: (3) Al

Solution:
Step 1: Understanding ores.
Bauxite is the principal ore of aluminium. It mainly contains hydrated aluminium oxides like $Al_2O_3 \cdot 2H_2O$.
Step 2: Extraction.
Aluminium is extracted from bauxite using electrolytic reduction after refining by the Bayer's process.
Step 3: Conclusion.
Hence, bauxite is an ore of Aluminium (Al).

Quick Tip

Important ores: Bauxite – Aluminium, Haematite – Iron, Galena – Lead, Cinnabar – Mercury.

---

71. The correct order of reactivity of metals is

(1) Na > Zn > Mg > Cu
(2) Na > Mg > Cu > Zn
(3) Mg < Na < Zn < Cu
(4) Na > Mg > Zn > Cu

Correct Answer: (4) Na > Mg > Zn > Cu

Solution:
Step 1: Activity series.
Standard reactivity series: K > Na > Ca > Mg > Al > Zn > Fe > Pb > H > Cu > Ag > Au.
Step 2: Pick the relative order.
Among Na, Mg, Zn, Cu the decreasing reactivity is Na > Mg > Zn > Cu.

Quick Tip

More reactive metals displace less reactive ones from their compounds.

---

72. $Fe_2O_3 + 2Al \rightarrow Al_2O_3 + 2Fe$ **is which of the following types reaction?**

(1) Combination
(2) Decomposition
(3) Displacement
(4) Double displacement

Correct Answer: (3) Displacement

Solution:
Step 1: Identify the change.
Aluminium replaces iron from iron(III) oxide to form aluminium oxide and iron.
Step 2: Type.
Replacement of one element by another is a *single displacement* reaction (Thermite reaction).

Quick Tip

In single displacement: $A + BC \rightarrow AC + B$.

---

73. Carbon combines with hydrogen to form

(1) aqua regia
(2) halogen
(3) hydrocarbon
(4) ionic compound

Correct Answer: (3) hydrocarbon

Solution:
Step 1: Definition.
Compounds containing only carbon and hydrogen are called *hydrocarbons* (e.g., methane, ethane).

Quick Tip

Hydrocarbons are of three main types: alkanes, alkenes, alkynes.

---

74. Boron and aluminium belong to which group of elements in periodic table?

(1) 10
(2) 17
(3) 13
(4) 3

Correct Answer: (3) 13

Solution:
Step 1: Periodic position.
B and Al are in Group 13 (IIIA), called the boron family.

Quick Tip

Group 13: B, Al, Ga, In, Tl.

---

75. Which pigment makes the colour of urine yellow?

(1) Chromoplast
(2) Urochrome
(3) Chloroplast
(4) Leucoplast

Correct Answer: (2) Urochrome

Solution:
Step 1: Fact.
Urochrome (a breakdown product of haemoglobin) imparts the yellow colour to urine.

Quick Tip

Colour can vary with hydration; darker yellow indicates dehydration.

---

76. The tiger is a consumer of

(1) first trophic level
(2) second trophic level
(3) third trophic level
(4) none of these

Correct Answer: (3) third trophic level

Solution:
Step 1: Trophic levels.
Producers (1st), herbivores/primary consumers (2nd), carnivores/secondary consumers (3rd).
Step 2: Tiger's role.
Tiger preys on herbivores (e.g., deer), so it is a secondary consumer at the 3rd trophic level.

Quick Tip

Some chains may add apex predators as 4th level, but in Class 10 context tiger is 3rd.

---

77. Bile juice is secreted by

(1) small intestine
(2) liver
(3) pancreas
(4) duodenum

Correct Answer: (2) liver

Solution:
Step 1: Production vs storage.
Bile is produced by the liver, stored in the gallbladder, and released into the duodenum.

Quick Tip

Bile emulsifies fats—mechanical aid to digestion; it has no enzymes.

---

78. The forelimbs of man, cat and bat are

(1) homologous organ
(2) analogous organs
(3) vestigial organ
(4) none of these

Correct Answer: (1) homologous organ

Solution:
Step 1: Concept.
Homologous organs have the same basic structure and origin but different functions.
Step 2: Application.
Human arm, cat's foreleg and bat's wing share the same bone arrangement—humerus, radius/ulna, carpals, etc.

Quick Tip

Homology evidences divergent evolution.

---

79. Which of the following is an example of regeneration?

(1) Hydra
(2) Frog
(3) Cow
(4) None of these

Correct Answer: (1) Hydra

Solution:
Step 1: Definition.
Regeneration is the ability to regrow lost body parts or a new organism from fragments.
Step 2: Example.
Hydra shows remarkable regeneration; frog and cow do not.

Quick Tip

Planaria and Hydra are classic regeneration examples.

---

80. The genic constitution of an individual organism is called

(1) genotype
(2) phenotype
(3) variation

(4) heredity

Correct Answer: (1) genotype

Solution:
Step 1: Terms.
Genotype = genetic makeup; phenotype = observable traits; variation = differences among individuals; heredity = transmission of traits.
Step 2: Conclusion.
Thus, the genic constitution is the genotype.

Quick Tip

Phenotype = Genotype + Environment (simplified view).

Section-B

1. What is the source of energy of the Sun?

Correct Answer: The Sun's energy is produced by *nuclear fusion* in its core. At temperatures of about 1.5×10^7 K and enormous pressures, hydrogen nuclei fuse through the proton–proton chain to form helium. In each step, a small part of mass is lost and converted into energy by $E = mc^2$. This energy leaves the Sun as photons (sunlight/heat) and neutrinos, powering almost all natural energy flows on Earth.
Solution: Step 1: Conditions in the core. The ∼200,000 km-wide solar core has $T \approx 1.5 \times 10^7$ K and density $\approx 150\,\mathrm{g\,cm^{-3}}$, enabling quantum tunnelling so protons overcome Coulomb repulsion.
Step 2: Fusion pathway. In the p–p chain: $p + p \rightarrow {}^2H + e^+ + \nu_e$; ${}^2H + p \rightarrow {}^3He + \gamma$; ${}^3He + {}^3He \rightarrow {}^4He + 2p$. Net: $4p \rightarrow {}^4He + 2e^+ + 2\nu_e +$ energy (≈ 26.7 MeV). The mass defect Δm transforms to energy via $E = \Delta mc^2$.
Step 3: Energy transport. Gamma photons random-walk outward, being repeatedly absorbed and re-emitted, and emerge at the photosphere as the solar spectrum (effective $T \approx 5778$ K). Neutrinos escape almost instantly, verifying fusion.

Quick Tip

Fusion releases $\sim 10^7$ times more energy per nucleon than chemical reactions—hence stars shine for billions of years.

---

2. What is nuclear fission?

Correct Answer: Nuclear fission is the splitting of a heavy nucleus (e.g., ^{235}U or ^{239}Pu) into two medium-mass nuclei when it absorbs a neutron, releasing $2-3$ neutrons and a large

amount of energy. Because the emitted neutrons can trigger further fissions, a chain reaction results. Controlled chain reactions in reactors generate electricity; uncontrolled ones cause nuclear explosions.

Solution: Step 1: Mechanism. A thermal neutron captured by ^{235}U produces an excited compound nucleus ^{236}U* which deforms and splits, e.g.

$$^{235}\mathrm{U} + n \rightarrow {}^{141}\mathrm{Ba} + {}^{92}\mathrm{Kr} + 3n + Q,$$

with $Q \approx 200$ MeV.

Step 2: Energy origin. Products have higher total binding energy per nucleon than the parent; the mass defect converts to energy ($E = mc^2$), mostly as kinetic energy of fragments plus prompt γ-rays and delayed β-decays.

Step 3: Chain reaction control. The average neutrons per fission sustain a chain reaction. Reactors keep the multiplication factor $k_{\text{eff}} = 1$ using moderators (to slow neutrons) and control rods (B, Cd) that absorb excess neutrons; coolant removes heat to run turbines. If $k_{\text{eff}} > 1$ and uncontrolled, the neutron population grows explosively.

Quick Tip

Remember: fusion joins light nuclei; fission splits heavy nuclei—both release energy due to increased binding energy of the products.

---

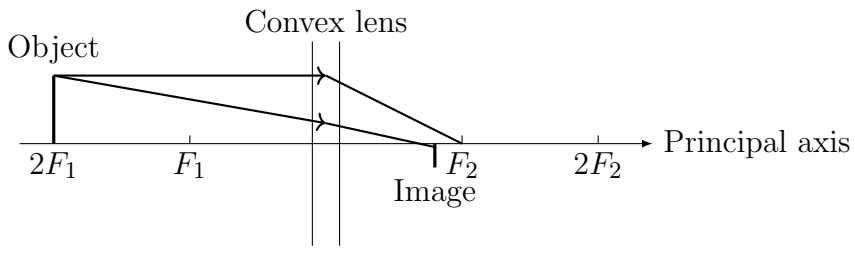
3. How does a light ray proceed in a lens? Show by a diagram.

Correct Answer: Light refracts at both surfaces of a thin lens. Key rules: (i) A ray parallel to the principal axis passes through the focal point of a convex lens (or appears to diverge from the focus of a concave lens). (ii) A ray through the optical center travels undeviated. (iii) A ray directed toward the focus emerges parallel to the axis. Image position and size follow from the lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ and magnification $m = \frac{v}{u}$.

Solution: Step 1: Refraction at a thin lens. Using the small-angle (paraxial) approximation, a lens redirects rays according to Snell's law at each surface; for a convex lens, rays converge, for a concave lens, rays diverge.

Step 2: Principal rays (construction). To locate images quickly: 1) *Parallel ray* $\rightarrow$ through F (convex) / appears from F (concave). 2) *Central ray* through optical center $O \rightarrow$ undeviated. 3) *Focal ray* aimed at $F \rightarrow$ emerges parallel to axis.

Step 3: Nature of images. Convex lens: — Object beyond $2F$: real, inverted, diminished (between F and $2F$). — At $2F$: real, inverted, same size (at $2F$). — Between F and $2F$: real, inverted, magnified (beyond $2F$). — Inside F: virtual, erect, magnified (same side). Concave lens: always virtual, erect, diminished.



Quick Tip

Sign convention (real is positive to the right of lens): $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, $m = \frac{v}{u} = \frac{h_i}{h_o}$.