# Jharkhand Polytechnic Chemistry

## Sample Paper – 5

**Duration: 50 Minutes** **Maximum Marks: 50**

### Instructions

- This paper contains **50** Multiple Choice Questions (Single Correct Answer), modelled on the Chemistry section of the **Jharkhand Polytechnic (PECE)** entrance examination conducted by JCECEB.
- Each correct answer carries **+1 mark**. There is **a negative marking of 0.25 mark** for every wrong answer. Unattempted questions carry **no penalty**.
- Only **one** option is correct. Choose carefully.
- This is an offline OMR based test. Darken the correct bubble fully with a blue or black ball pen.
- Use of mobile phones, calculators, or electronic gadgets is strictly prohibited.

**Q1.** Evaporation of a liquid is a process that:

(A) takes place only at the surface and produces a cooling effect

(B) takes place throughout the bulk of the liquid

(C) occurs only at the boiling point of the liquid

(D) raises the temperature of the surroundings

**Q2.** The chemical symbol of the element gold is:

(A) Gd

(B) Go

(C) Au

(D) Ag

**Q3.** The formula mass of sodium chloride (NaCl) is (atomic masses: Na $= 23$ u, Cl $= 35.5$ u):

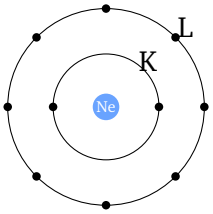
(A) $48.5$ u

(B) $58.5$ u

(C) $35.5$ u

(D) $23$ u

**Q4.** The Bohr diagram shown below represents a neon atom ($Z = 10$). Its electronic configuration is:




(A) $2, 6$

(B) $2, 8, 1$

(C) $8, 2$

(D) $2, 8$

**Q5.** Atoms of different elements that have the same mass number but different atomic numbers are called:

(A) isotopes

(B) isobars

(C) isomers

(D) isotones

**Q6.** In an atom, the L shell is the:

(A) second shell from the nucleus

(B) first shell from the nucleus

(C) third shell from the nucleus

(D) outermost shell of every atom

**Q7.** A neutral atom contains 19 electrons. Its atomic number is:

(A) 38

(B) 9

(C) 10

(D) 19

**Q8.** The idea that electrons revolve around the nucleus only in certain fixed orbits (shells) was proposed by:

(A) John Dalton

(B) J. J. Thomson

(C) Niels Bohr

(D) James Chadwick

**Q9.** Which one of the following is a pure substance having a fixed composition?

(A) air

(B) carbon dioxide

(C) brass

(D) soil

**Q10.** The modern periodic law states that the properties of elements are a periodic function of their:

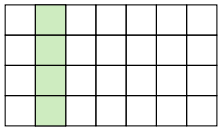
(A) atomic number

(B) atomic mass

(C) number of neutrons

(D) density

**Q11.** The alkaline earth metals (such as magnesium and calcium) are placed in the highlighted column of the table shown. This column is:



(A) group 1

(B) group 17

(C) group 2

(D) group 18

**Q12.** On moving from left to right across a period, the metallic character of the elements generally:

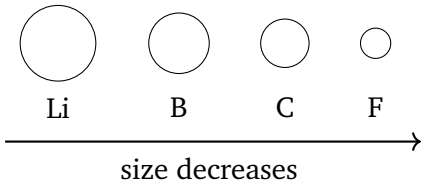
(A) increases

(B) first decreases then increases

(C) remains the same

(D) decreases

**Q13.** The diagram shows how atomic size changes across period 2. Among lithium, boron, carbon and fluorine, the atom with the smallest size is:




(A) lithium

(B) fluorine

(C) boron

(D) carbon

**Q14.** For the main-group (representative) elements, the number of valence electrons is closely related to the element's:

(A) group number

(B) period number

(C) atomic mass

(D) number of neutrons

**Q15.** The slaking of lime, in which calcium oxide reacts with water, is a reaction that:

(A) absorbs heat (endothermic)

(B) shows no energy change at all

(C) releases heat (exothermic)

(D) takes place only on strong heating

**Q16.** Silver bromide slowly turns grey when left in sunlight. This change is an example of:

(A) a combination reaction

(B) a displacement reaction

(C) neutralisation

(D) decomposition brought about by light

**Q17.** Decomposition reactions generally require a supply of:

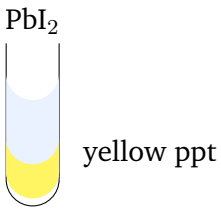
(A) energy as heat, light or electricity

(B) a catalyst only

(C) water only

(D) no energy of any kind

**Q18.** When lead nitrate solution is added to potassium iodide solution, a yellow precipitate of lead iodide forms (shown). This reaction is a:




(A) combination reaction

(B) double displacement reaction

(C) decomposition reaction

(D) displacement of a metal by hydrogen

**Q19.** In a redox reaction, the substance that acts as the oxidising agent is itself:

(A) oxidised

(B) left unchanged

(C) reduced

(D) evaporated

**Q20.** A reaction in which two or more substances combine to form a single product is called a:

(A) decomposition reaction

(B) displacement reaction

(C) double displacement reaction

(D) combination reaction

**Q21.** The acid naturally present in tamarind is:

(A) acetic acid

(B) tartaric acid

(C) lactic acid

(D) citric acid

**Q22.** Which one of the following can act as an olfactory indicator (one detected by its smell)?

(A) onion extract

(B) blue litmus paper

(C) methyl orange

(D) universal indicator paper

**Q23.** When a dilute acid reacts with an active metal, the products formed are:

(A) salt and water

(B) salt and oxygen

(C) salt and carbon dioxide

(D) salt and hydrogen

**Q24.** The chemical formula of plaster of Paris is:

(A) $CaSO_4$

(B) $CaSO_4 \cdot 2H_2O$

(C) $CaSO_4 \cdot \frac{1}{2}H_2O$

(D) $CaCl_2$

**Q25.** A base that is soluble in water is known as:

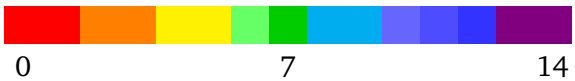
(A) an alkali

(B) an acid

(C) a salt

(D) an indicator

**Q26.** The indicator that shows a different colour across the whole range of pH values, as in the colour chart below, is:



(A) plain blue litmus

(B) universal indicator

(C) phenolphthalein

(D) methyl orange

**Q27.** Metals produce a ringing sound when struck. This property of metals is described as their being:

(A) malleable

(B) ductile

(C) lustrous

(D) sonorous

**Q28.** Which one of the following non-metals is a good conductor of electricity?

(A) graphite

(B) sulphur

(C) phosphorus

(D) diamond

**Q29.** The process of heating an ore strongly in the absence (or limited supply) of air is called:

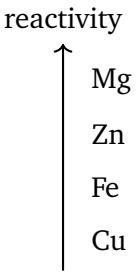
(A) roasting

(B) smelting

(C) calcination

(D) galvanisation

**Q30.** Using the activity series shown, a metal can displace another metal from its salt solution only if the first metal is:




(A) less reactive than the second metal

(B) more reactive than the second metal

(C) exactly as reactive as the second metal

(D) a non-metal

**Q31.** Silver articles slowly turn black on exposure to air because they become coated with:

(A) silver oxide

(B) silver chloride

(C) silver carbonate

(D) silver sulphide

**Q32.** Steel is an alloy made mainly of iron and:

(A) carbon

(B) zinc

(C) tin

(D) lead

**Q33.** Ionic compounds are generally:

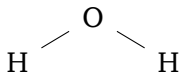
(A) insoluble in water

(B) gases at room temperature

(C) soluble in water

(D) soluble only in petrol or kerosene

**Q34.** From the structure of a water molecule shown below, the number of covalent bonds present is:




(A) 1

(B) 2

(C) 3

(D) 4

**Q35.** Covalent compounds, in general:

(A) are good conductors of electricity

(B) conduct electricity only when molten

(C) conduct electricity only in the solid state

(D) do not conduct electricity

**Q36.** During the formation of sodium chloride (NaCl), the sodium atom:

(A) loses one electron to chlorine

(B) gains one electron from chlorine

(C) shares one electron with chlorine

(D) loses two electrons to chlorine

**Q37.** Graphite is used as a lubricant in machine parts because it is:

(A) very hard and rigid

(B) soft and slippery

(C) strongly magnetic

(D) a poor conductor of heat

**Q38.** The functional group present in every member of the homologous series of alcohols is:

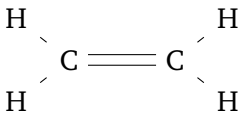
(A) $-COOH$

(B) $-CHO$

(C) $-OH$

(D) $-Cl$

**Q39.** The structure shown below is that of ethene. Its molecular formula is:




(A) $C_2H_4$

(B) $C_2H_6$

(C) $C_2H_2$

(D) $CH_4$

**Q40.** The addition of hydrogen across the carbon–carbon double bond of an unsaturated compound is called:

(A) substitution

(B) oxidation

(C) dehydration

(D) hydrogenation

**Q41.** The IUPAC name of the compound $CH_3OH$ is:

(A) methanal

(B) methanol

(C) methanoic acid

(D) ethanol

**Q42.** The two carbon skeletons shown below contain multiple bonds. Unsaturated hydrocarbons are those that contain at least one:

double $C=C$ triple $C\equiv C$

(A) single bond only

(B) ionic bond

(C) carbon–carbon double or triple bond

(D) hydrogen bond

**Q43.** Carbon forms an extremely large number of compounds mainly because of its:

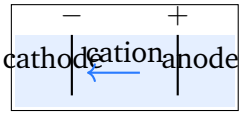
(A) catenation and tetravalency

(B) metallic nature

(C) ability to form ionic bonds

(D) very large atomic size

**Q44.** In the electrolytic cell shown, the positively charged ions (cations) move towards the:




(A) anode

(B) positive terminal

(C) surface of the electrolyte

(D) cathode

**Q45.** At standard temperature and pressure (STP), one mole of any gas occupies a volume of about:

(A) $11.2$ litres

(B) $1$ litre

(C) $22.4$ litres

(D) $44.8$ litres

**Q46.** The electrical conduction in a solid metal is due to the movement of:

(A) positive ions

(B) free electrons

(C) neutrons

(D) protons

**Q47.** The number of particles present in one mole of a substance (Avogadro's number) is:

(A) $6.022 \times 10^{23}$

(B) $6.022 \times 10^{-23}$

(C) $3.011 \times 10^{23}$

(D) $1.6 \times 10^{19}$

**Q48.** A dry cell (the battery used in a torch) converts:

(A) electrical energy into chemical energy

(B) heat energy into light energy

(C) chemical energy into electrical energy

(D) light energy into electrical energy

**Q49.** Which greenhouse gas is released in large amounts from paddy (rice) fields and from cattle?

(A) carbon dioxide

(B) sulphur dioxide

(C) oxygen

(D) methane

**Q50.** The smoke and harmful gases released from motor vehicles mainly cause:

(A) water pollution

(B) air pollution

(C) soil pollution

(D) noise pollution

## Detailed Solutions

**Q1.**

**Solution**

**Concept — Evaporation:** Evaporation is the slow change of a liquid into vapour that occurs at the surface of the liquid at all temperatures below its boiling point.

**Step 1 — Where it happens:** Only the fast-moving molecules at the surface escape, so evaporation is a surface phenomenon.

**Step 2 — Effect on temperature:** As these high-energy molecules leave, the average energy of the remaining liquid falls, so evaporation causes cooling.

**Why other options are wrong:**

- Boiling, not evaporation, happens throughout the bulk of the liquid.
- Evaporation occurs below the boiling point, not only at it.
- Evaporation lowers temperature; it does not raise it.

**Final Answer:** Evaporation is a surface process that causes cooling $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q1

**Q2.**

**Solution**

**Concept — Chemical symbols:** Some elements take their symbols from their Latin names. Gold comes from the Latin word *aurum*, giving the symbol Au.

**Step 1 — Recall the Latin name:** Gold = aurum.

**Step 2 — Write the symbol:** The first two letters give Au.

**Why other options are wrong:**

- Gd is the symbol of gadolinium.
- Go is not a valid element symbol.
- Ag is the symbol of silver (from *argentum*).

**Final Answer:** The symbol of gold is Au $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q2

## Q3.

**Solution**

**Concept — Formula mass:** The formula mass of a compound is the sum of the atomic masses of all the atoms in its formula unit.

**Step 1 — List the atoms:** NaCl has one sodium atom and one chlorine atom.

**Step 2 — Add the atomic masses:** $23 + 35.5$.

**Step 3 — Compute:** $23 + 35.5 = 58.5$ u.

**Why other options are wrong:**

- $48.5$ u uses a wrong chlorine value.
- $35.5$ u is only the mass of chlorine.
- $23$ u is only the mass of sodium.

**Final Answer:** Formula mass of NaCl $= 58.5$ u $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q3

## Q4.

**Solution**

**Concept — Electronic configuration:** Electrons fill shells in order: K holds up to $2$, L holds up to $8$. Neon has $10$ electrons.

**Step 1 — Fill the K shell:** $2$ electrons. Remaining $= 10 - 2 = 8$.

**Step 2 — Fill the L shell:** the remaining $8$ electrons.

**Step 3 — Write the configuration:** $2, 8$ (both shells completely filled).

**Why other options are wrong:**

- $2, 6$ accounts for only $8$ electrons.
- $2, 8, 1$ has $11$ electrons (sodium).
- $8, 2$ wrongly fills the K shell first with $8$.

**Final Answer:** Neon is $2, 8 \Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q4

## Q5.

**Solution**

**Concept — Isobars:** Isobars are atoms of different elements (different atomic numbers) that happen to have the same mass number.

**Step 1 — Identify what is the same:** The mass number is the same.

**Step 2 — Identify what differs:** The atomic number (number of protons) is different, so they are different elements.

**Why other options are wrong:**

- Isotopes have the same atomic number but different mass numbers.
- Isomers are compounds with the same formula but different structures.
- Isotones have the same number of neutrons.

**Final Answer:** Same mass number, different atomic number = isobars $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q5

## Q6.

**Solution**

**Concept — Naming of shells:** The shells around a nucleus are named K, L, M, N ... outwards, corresponding to $n = 1, 2, 3, 4 \ldots$

**Step 1 — Match the letter:** K is the first shell ($n = 1$), so L is the second shell ($n = 2$).

**Step 2 — Confirm:** The L shell lies just outside the K shell.

**Why other options are wrong:**

- The first shell is K, not L.
- The third shell is M.
- L is not the outermost shell in every atom; that depends on the element.

**Final Answer:** The L shell is the second shell $\Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q6

## Q7.

**Solution**

**Concept — Atomic number:** In a neutral atom, the number of electrons equals the number of protons, which is the atomic number ($Z$).

**Step 1 — Use the data:** The atom is neutral and has $19$ electrons.

**Step 2 — Equate:** Number of protons $=$ number of electrons $= 19$, so $Z = 19$.

**Why other options are wrong:**

- $38$ would be double the electron count.
- $9$ and $10$ do not match the given $19$ electrons.

**Final Answer:** Atomic number $= 19 \Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q7

## Q8.

**Solution**

**Concept — Bohr model:** Niels Bohr proposed that electrons revolve around the nucleus only in certain fixed, stable orbits (energy levels or shells) without losing energy.

**Step 1 — Match the scientist:** The fixed-shell model $\rightarrow$ Bohr.

**Step 2 — Confirm:** These shells are the K, L, M ... energy levels.

**Why other options are wrong:**

- Dalton gave the atomic theory, not the shell model.
- Thomson discovered the electron and gave the plum-pudding model.
- Chadwick discovered the neutron.

**Final Answer:** Bohr proposed fixed electron shells $\Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q8

## Q9.

**Solution**

**Concept — Pure substances:** A pure substance (an element or a compound) has a fixed composition throughout. A compound contains elements combined in a fixed ratio.

**Step 1 — Test the options:** Air, brass and soil are all mixtures with no fixed composition.

**Step 2 — Identify the pure substance:** Carbon dioxide ($CO_2$) is a compound with a fixed ratio of carbon to oxygen, so it is a pure substance.

**Why other options are wrong:**

- Air is a mixture of gases.
- Brass is an alloy (a mixture) of copper and zinc.
- Soil is a mixture of many substances.

**Final Answer:** Carbon dioxide is the pure substance $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q9

## Q10.

**Solution**

**Concept — Modern periodic law:** The modern periodic law states that the physical and chemical properties of elements are a periodic function of their atomic number.

**Step 1 — Identify the key quantity:** Atomic number is the property on which periodicity depends.

**Step 2 — Confirm:** This replaced Mendeleev's law, which was based on atomic mass.

**Why other options are wrong:**

- Atomic mass was the basis of the older (Mendeleev) law.
- Number of neutrons and density are not the basis of the law.

**Final Answer:** Properties are a periodic function of atomic number $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q10

## Q11.

**Solution**

**Concept — Groups in the periodic table:** Elements with similar properties are placed in the same vertical column (group). The alkaline earth metals form group 2.

**Step 1 — Recall the family:** Magnesium and calcium are alkaline earth metals.

**Step 2 — Place them:** They have 2 valence electrons and sit in group 2.

**Why other options are wrong:**

- Group 1 holds the alkali metals.
- Group 17 holds the halogens.
- Group 18 holds the noble gases.

**Final Answer:** Alkaline earth metals are in group $2 \Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q11

## Q12.

**Solution**

**Concept — Trend across a period:** Across a period from left to right, the nuclear charge increases and atoms hold electrons more tightly, so the tendency to lose electrons (metallic character) decreases.

**Step 1 — Note the change in nature:** The left side has metals; the right side has non-metals.

**Step 2 — State the trend:** Metallic character decreases from left to right.

**Why other options are wrong:**

- It does not increase across a period.
- There is no decrease-then-increase pattern across a period.
- It does not stay constant.

**Final Answer:** Metallic character decreases across a period $\Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q12

## Q13.

**Solution**

**Concept — Atomic size across a period:** As we move left to right across a period, the increasing nuclear charge pulls the electrons closer, so atomic size decreases.

**Step 1 — Order the elements:** In period 2, the order is lithium, then boron, then carbon, then fluorine.

**Step 2 — Pick the smallest:** Fluorine, being farthest to the right of these, has the smallest size.

**Why other options are wrong:**

- Lithium is on the left and is the largest of these.
- Boron and carbon lie in between and are larger than fluorine.

**Final Answer:** Fluorine has the smallest atomic size $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q13

## Q14.

**Solution**

**Concept — Valence electrons and groups:** For the main-group elements, the group number is directly linked to the number of valence (outermost) electrons.

**Step 1 — Recall the link:** Group 1 has 1 valence electron, group 2 has 2, and so on.

**Step 2 — Conclude:** So valence electrons are related to the group number.

**Why other options are wrong:**

- The period number gives the number of shells, not valence electrons.
- Atomic mass and neutron number do not fix the valence electrons.

**Final Answer:** Valence electrons relate to the group number $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q14

## Q15.

### Solution

**Concept — Exothermic reaction:** A reaction that releases heat to the surroundings is exothermic. The slaking of lime is a well-known exothermic reaction.

**Step 1 — Write the change:** $CaO + H_2O \rightarrow Ca(OH)_2 + \text{heat}$.

**Step 2 — Note the heat:** A large amount of heat is given out, so the mixture becomes hot.

**Why other options are wrong:**

- It does not absorb heat, so it is not endothermic.
- There is a clear energy change (heat is released).
- It occurs on adding water, not on heating.

**Final Answer:** Slaking of lime is exothermic $\Rightarrow \boxed{C}$

**Answer: (C)** Go Back to Q15

## Q16.

### Solution

**Concept — Photochemical decomposition:** A decomposition reaction caused by light is a photochemical decomposition. Silver bromide breaks down in sunlight.

**Step 1 — Write the change:** $2AgBr \xrightarrow{\text{light}} 2Ag + Br_2$.

**Step 2 — Identify the cause:** Light supplies the energy to break AgBr, turning it grey (silver).

**Why other options are wrong:**

- A combination reaction joins substances; here one breaks apart.
- No metal is being displaced.
- Neutralisation is an acid–base reaction.

**Final Answer:** It is decomposition caused by light $\Rightarrow \boxed{D}$

**Answer: (D)** Go Back to Q16

## Q17.

**Solution**

**Concept — Decomposition reactions:** In a decomposition reaction, a single compound breaks into two or more simpler substances. Breaking bonds needs energy.

**Step 1 — Recall the energy need:** Energy is supplied as heat (thermal), light (photochemical) or electricity (electrolytic).

**Step 2 — Conclude:** Decomposition reactions are generally energy-absorbing.

**Why other options are wrong:**

- A catalyst alone does not provide the needed energy.
- Water alone is not the general requirement.
- Energy is definitely required, so "no energy" is wrong.

**Final Answer:** Decomposition needs heat, light or electricity $\Rightarrow$ A

**Answer: (A)** Go Back to Q17

## Q18.

**Solution**

**Concept — Double displacement reaction:** In a double displacement reaction, two compounds exchange their ions. If an insoluble solid forms, it is also called a precipitation reaction.

**Step 1 — Write the change:** $Pb(NO_3)_2 + 2KI \rightarrow PbI_2\downarrow + 2KNO_3$.

**Step 2 — Identify the exchange:** Lead pairs with iodide and potassium pairs with nitrate; a yellow precipitate of $PbI_2$ forms.

**Why other options are wrong:**

- Combination forms a single product.
- Decomposition breaks one substance into many.
- No metal is displaced by hydrogen here.

**Final Answer:** It is a double displacement (precipitation) reaction $\Rightarrow$ B

**Answer: (B)** Go Back to Q18

## Q19.

**Solution**

**Concept — Oxidising agent:** An oxidising agent oxidises another substance by accepting electrons (or giving oxygen). In doing so, it is itself reduced.

**Step 1 — Recall the role:** The oxidising agent gains electrons.

**Step 2 — State the result:** Gaining electrons means it is reduced.

**Why other options are wrong:**

- The substance oxidised is the reducing agent, not the oxidising agent.
- It does take part, so it does not stay unchanged.
- Evaporation is unrelated to redox roles.

**Final Answer:** The oxidising agent is itself reduced $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q19

## Q20.

**Solution**

**Concept — Combination reaction:** In a combination (synthesis) reaction, two or more reactants join together to form a single product.

**Step 1 — Match the definition:** Many reactants $\rightarrow$ one product is combination.

**Step 2 — Example:** $CaO + H_2O \rightarrow Ca(OH)_2$.

**Why other options are wrong:**

- Decomposition is the reverse: one substance gives many.
- Displacement and double displacement involve exchange or replacement, not simple joining.

**Final Answer:** Forming one product from many is a combination reaction $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q20

## Q21.

**Solution**

**Concept — Natural acids in foods:** Many fruits contain characteristic organic acids. Tamarind owes its sour taste to tartaric acid.

**Step 1 — Match the source:** Tamarind → tartaric acid.

**Step 2 — Confirm:** Tartaric acid is also present in grapes.

**Why other options are wrong:**

- Acetic acid is found in vinegar.
- Lactic acid is found in sour milk.
- Citric acid is found in lemons and oranges.

**Final Answer:** Tamarind contains tartaric acid ⇒ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q21

## Q22.

**Solution**

**Concept — Olfactory indicators:** An olfactory indicator is a substance whose smell changes in acidic and basic media, so it is detected by the nose. Onion and vanilla are common examples.

**Step 1 — Test the options:** Litmus, methyl orange and universal indicator are detected by colour, not smell.

**Step 2 — Identify the olfactory one:** Onion extract loses its smell in a base, so it is an olfactory indicator.

**Why other options are wrong:**

- Blue litmus is a colour indicator.
- Methyl orange and universal indicator work by colour change.

**Final Answer:** Onion extract is an olfactory indicator ⇒ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q22

## Q23.

**Solution**

**Concept — Acid + metal:** An active metal reacts with a dilute acid to form a salt and release hydrogen gas: metal + acid → salt + hydrogen.

**Step 1 — Recall the products:** A salt and hydrogen gas.

**Step 2 — Example:** $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$.

**Why other options are wrong:**

- Salt and water form in neutralisation (acid + base).
- Oxygen is not released here.
- Carbon dioxide forms with carbonates, not metals.

**Final Answer:** Products are salt and hydrogen $\Rightarrow$ D

**Answer: (D)** Go Back to Q23

## Q24.

**Solution**

**Concept — Plaster of Paris:** Plaster of Paris is calcium sulphate hemihydrate. Its formula is $CaSO_4 \cdot \frac{1}{2}H_2O$, meaning one water molecule for every two formula units.

**Step 1 — Recall the source:** It is made by gently heating gypsum ($CaSO_4 \cdot 2H_2O$).

**Step 2 — Write the formula:** $CaSO_4 \cdot \frac{1}{2}H_2O$.

**Why other options are wrong:**

- $CaSO_4$ is anhydrous calcium sulphate.
- $CaSO_4 \cdot 2H_2O$ is gypsum.
- $CaCl_2$ is calcium chloride.

**Final Answer:** Plaster of Paris is $CaSO_4 \cdot \frac{1}{2}H_2O \Rightarrow$ C

**Answer: (C)** Go Back to Q24

## Q25.

**Solution**

**Concept — Alkali:** A base that dissolves in water is called an alkali. It gives hydroxide ions ($OH^-$) in solution.

**Step 1 — Recall the definition:** Water-soluble base = alkali.

**Step 2 — Example:** Sodium hydroxide and potassium hydroxide are alkalis.

**Why other options are wrong:**

- An acid is the opposite of a base.
- A salt is the product of neutralisation.
- An indicator only shows acidity or basicity.

**Final Answer:** A water-soluble base is an alkali $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q25

## Q26.

**Solution**

**Concept — Universal indicator:** A universal indicator is a mixture of several dyes that shows a different colour at each pH value, giving the whole rainbow from red (strong acid) to violet (strong base).

**Step 1 — Read the chart:** The colour changes continuously from pH $0$ to pH $14$.

**Step 2 — Identify the indicator:** Only the universal indicator gives this full colour range.

**Why other options are wrong:**

- Blue litmus only tells acid from base by turning red or staying blue.
- Phenolphthalein is only colourless or pink.
- Methyl orange shows only red, orange or yellow.

**Final Answer:** The full colour range is given by the universal indicator $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q26

## Q27.

**Solution**

**Concept — Sonorous metals:** A material that produces a ringing sound when struck is said to be sonorous. Metals are sonorous, which is why bells are made of metal.

**Step 1 — Match the property:** Ringing sound on striking = sonorous.

**Step 2 — Confirm:** This is different from being shiny, bendable or drawable.

**Why other options are wrong:**

- Malleable means it can be beaten into sheets.
- Ductile means it can be drawn into wires.
- Lustrous means it has a shiny surface.

**Final Answer:** Producing a ringing sound is being sonorous $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q27

## Q28.

**Solution**

**Concept — Conducting non-metal:** Non-metals are usually poor conductors, but graphite is an exception. It has free electrons that let it conduct electricity.

**Step 1 — Test the options:** Sulphur, phosphorus and diamond are poor conductors.

**Step 2 — Identify the conductor:** Graphite (a form of carbon) conducts electricity.

**Why other options are wrong:**

- Sulphur and phosphorus are non-conducting non-metals.
- Diamond, though made of carbon, has no free electrons and does not conduct.

**Final Answer:** Graphite is the conducting non-metal $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q28

## Q29.

**Solution**

**Concept — Calcination:** Calcination is the process of heating a carbonate ore strongly in the absence (or limited supply) of air to convert it into its oxide.

**Step 1 — Match the definition:** Heating without air = calcination.

**Step 2 — Example:** $ZnCO_3 \xrightarrow{\text{heat}} ZnO + CO_2$.

**Why other options are wrong:**

- Roasting is heating a sulphide ore in the presence of air.
- Smelting reduces the oxide to the metal.
- Galvanisation is coating iron with zinc.

**Final Answer:** Heating an ore without air is calcination $\Rightarrow$ C

**Answer: (C)** Go Back to Q29

## Q30.

**Solution**

**Concept — Displacement and reactivity:** In the activity series, a metal placed higher (more reactive) can displace a metal placed lower (less reactive) from its salt solution.

**Step 1 — Read the ladder:** Mg is above Zn, which is above Fe, which is above Cu.

**Step 2 — Apply the rule:** The displacing metal must be more reactive than the one in the salt.

**Why other options are wrong:**

- A less reactive metal cannot displace a more reactive one.
- Equally reactive metals do not displace each other.
- Non-metals do not displace metals in this way.

**Final Answer:** The displacing metal must be more reactive $\Rightarrow$ B

**Answer: (B)** Go Back to Q30

## Q31.

**Solution**

**Concept — Tarnishing of silver:** Silver reacts slowly with hydrogen sulphide gas present in air to form a black coating of silver sulphide ($Ag_2S$).

**Step 1 — Identify the reactant gas:** Traces of $H_2S$ in air.

**Step 2 — Name the product:** The black layer is silver sulphide.

**Why other options are wrong:**

- Silver oxide and silver carbonate are not the cause of the black colour here.
- Silver chloride is white, not black.

**Final Answer:** The black coating is silver sulphide $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q31

## Q32.

**Solution**

**Concept — Alloys:** An alloy is a mixture of a metal with one or more other elements. Steel is an alloy of iron with a small amount of carbon.

**Step 1 — Recall the main metal:** Iron forms the base of steel.

**Step 2 — Recall the added element:** A small percentage of carbon is added, giving steel its strength.

**Why other options are wrong:**

- Zinc with copper gives brass.
- Tin with copper gives bronze.
- Lead is used in solder, not in ordinary steel.

**Final Answer:** Steel is iron plus carbon $\Rightarrow$ $\boxed{\text{A}}$

**Answer: (A)** Go Back to Q32

## Q33.

**Solution**

**Concept — Properties of ionic compounds:** Ionic compounds are usually crystalline solids that dissolve readily in water (a polar solvent) but not in organic solvents.

**Step 1 — Recall solubility:** Water pulls the ions apart, so ionic compounds are generally water-soluble.

**Step 2 — Confirm:** For example, NaCl dissolves easily in water.

**Why other options are wrong:**

- They are not generally insoluble in water.
- They are solids, not gases, at room temperature.
- They are usually insoluble in petrol or kerosene.

**Final Answer:** Ionic compounds are generally soluble in water $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q33

## Q34.

**Solution**

**Concept — Covalent bonds in water:** In a water molecule, the central oxygen atom shares one electron pair with each of the two hydrogen atoms, forming two O–H covalent bonds.

**Step 1 — Read the structure:** H–O–H has two O–H links.

**Step 2 — Count the bonds:** Two single covalent bonds.

**Why other options are wrong:**

- 1 would account for only one O–H bond.
- 3 and 4 are more bonds than water actually has.

**Final Answer:** Water has 2 covalent bonds $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q34

## Q35.

**Solution**

**Concept — Conduction in covalent compounds:** Covalent compounds are made of neutral molecules with no free ions or electrons, so they generally do not conduct electricity.

**Step 1 — Look for charge carriers:** There are no free ions or mobile electrons.

**Step 2 — Conclude:** Hence covalent compounds do not conduct electricity.

**Why other options are wrong:**

- They are not good conductors.
- Unlike ionic compounds, they do not conduct when molten.
- They do not conduct in the solid state either.

**Final Answer:** Covalent compounds do not conduct electricity $\Rightarrow \boxed{\text{D}}$

**Answer: (D)** Go Back to Q35

## Q36.

**Solution**

**Concept — Formation of NaCl:** Sodium $(2, 8, 1)$ has one electron in its outer shell. To reach a stable octet, it loses that one electron to chlorine.

**Step 1 — Sodium's action:** Na loses $1$ electron and becomes $Na^+$.

**Step 2 — Chlorine's action:** Cl gains that electron and becomes $Cl^-$, completing its octet.

**Why other options are wrong:**

- Sodium loses, not gains, an electron.
- It transfers, not shares, the electron (the bond is ionic).
- Sodium loses one electron, not two.

**Final Answer:** Sodium loses one electron to chlorine $\Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q36

## Q37.

**Solution**

**Concept — Structure of graphite:** In graphite, carbon atoms form layers that can slide over one another easily, making graphite soft and slippery. This is why it works as a lubricant.

**Step 1 — Recall the structure:** Weak forces between the layers let them slip.

**Step 2 — Link to use:** The slippery layers reduce friction in machine parts.

**Why other options are wrong:**

- Diamond, not graphite, is hard and rigid.
- Graphite is not magnetic.
- Graphite is actually a fair conductor of heat; that is not why it lubricates.

**Final Answer:** Graphite lubricates because it is soft and slippery $\Rightarrow \boxed{\text{B}}$

**Answer: (B)** Go Back to Q37

## Q38.

**Solution**

**Concept — Functional group of alcohols:** A homologous series is a family of compounds with the same functional group. All alcohols contain the hydroxyl group, $-\text{OH}$.

**Step 1 — Recall the family:** Methanol, ethanol and so on are alcohols.

**Step 2 — Identify the group:** Each carries the $-\text{OH}$ group.

**Why other options are wrong:**

- $-\text{COOH}$ is the carboxylic acid group.
- $-\text{CHO}$ is the aldehyde group.
- $-\text{Cl}$ is a halogen group (haloalkanes).

**Final Answer:** Alcohols contain the $-\text{OH}$ group $\Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q38

## Q39.

**Solution**

**Concept — Ethene:** Ethene is the simplest alkene. It has two carbon atoms joined by a double bond, each carrying two hydrogen atoms.

**Step 1 — Count the carbons:** Two carbon atoms.

**Step 2 — Count the hydrogens:** Four hydrogen atoms (two on each carbon).

**Step 3 — Write the formula:** $C_2H_4$.

**Why other options are wrong:**

- $C_2H_6$ is ethane (an alkane).
- $C_2H_2$ is ethyne (an alkyne).
- $CH_4$ is methane.

**Final Answer:** Ethene is $C_2H_4 \Rightarrow \boxed{A}$

**Answer: (A)** Go Back to Q39

## Q40.

**Solution**

**Concept — Hydrogenation:** Hydrogenation is an addition reaction in which hydrogen adds across a carbon–carbon double (or triple) bond, in the presence of a catalyst such as nickel.

**Step 1 — Identify the change:** An unsaturated compound takes up hydrogen.

**Step 2 — Name the process:** Adding hydrogen = hydrogenation (for example, oil $\rightarrow$ ghee).

**Why other options are wrong:**

- Substitution replaces an atom, it does not add across a double bond.
- Oxidation involves oxygen, not hydrogen.
- Dehydration removes water.

**Final Answer:** Adding hydrogen across a double bond is hydrogenation $\Rightarrow \boxed{D}$

**Answer: (D)** Go Back to Q40

## Q41.

**Solution**

**Concept — IUPAC naming:** An alcohol with one carbon atom and an $-OH$ group is named methanol (meth- for one carbon, -ol for alcohol).

**Step 1 — Count the carbons:** $CH_3OH$ has one carbon, so the root is "meth".

**Step 2 — Add the suffix:** The $-OH$ group gives the suffix "-ol", so the name is methanol.

**Why other options are wrong:**

- Methanal is the aldehyde HCHO.
- Methanoic acid is HCOOH.
- Ethanol has two carbon atoms.

**Final Answer:** $CH_3OH$ is methanol $\Rightarrow$ $\boxed{B}$

**Answer: (B)** Go Back to Q41

## Q42.

**Solution**

**Concept — Unsaturated hydrocarbons:** Hydrocarbons that contain at least one carbon–carbon double bond (alkenes) or triple bond (alkynes) are called unsaturated.

**Step 1 — Read the figures:** One skeleton has a double bond, the other a triple bond.

**Step 2 — Conclude:** The presence of a multiple (double or triple) bond makes a hydrocarbon unsaturated.

**Why other options are wrong:**

- Only single bonds means the compound is saturated (an alkane).
- Hydrocarbons do not contain ionic or hydrogen bonds in their skeleton.

**Final Answer:** Unsaturated hydrocarbons have a C–C double or triple bond $\Rightarrow$ $\boxed{C}$

**Answer: (C)** Go Back to Q42

## Q43.

**Solution**

**Concept — Why carbon forms many compounds:** Carbon shows catenation (the ability to bond to other carbon atoms forming long chains, branches and rings) and has a valency of four (tetravalency), letting it bond with many atoms.

**Step 1 — First reason:** Catenation gives an endless variety of carbon skeletons.

**Step 2 — Second reason:** Tetravalency lets each carbon form four strong bonds.

**Why other options are wrong:**

- Carbon is a non-metal, so metallic nature is not the reason.
- Carbon mostly forms covalent, not ionic, bonds.
- Carbon has a small, not a large, atomic size.

**Final Answer:** Carbon's catenation and tetravalency explain its many compounds $\Rightarrow$ A

**Answer: (A)** Go Back to Q43

## Q44.

**Solution**

**Concept — Movement of ions in electrolysis:** During electrolysis, positive ions (cations) are attracted to the negative electrode (cathode), while negative ions (anions) move to the anode.

**Step 1 — Recall the cathode's charge:** The cathode is the negative electrode.

**Step 2 — Apply attraction:** Opposite charges attract, so positive cations move towards the cathode.

**Why other options are wrong:**

- The anode and the positive terminal attract negative ions, not cations.
- Cations move to an electrode, not to the surface of the electrolyte.

**Final Answer:** Cations move towards the cathode $\Rightarrow$ D

**Answer: (D)** Go Back to Q44

## Q45.

**Solution**

**Concept — Molar volume:** At standard temperature and pressure (STP), one mole of any gas occupies the same volume, called the molar volume, which is $22.4$ litres.

**Step 1 — Recall the value:** Molar volume at STP $= 22.4$ L.

**Step 2 — Confirm:** This holds for any gas, regardless of its identity.

**Why other options are wrong:**

- $11.2$ L is the volume of half a mole.
- $1$ litre is far too small.
- $44.8$ L is the volume of two moles.

**Final Answer:** One mole of gas at STP occupies $22.4$ L $\Rightarrow$ $\boxed{\text{C}}$

**Answer: (C)** Go Back to Q45

## Q46.

**Solution**

**Concept — Conduction in metals:** A solid metal has a sea of free (delocalised) electrons. When a voltage is applied, these electrons drift and carry the current.

**Step 1 — Identify the charge carriers:** Free electrons in the metal.

**Step 2 — Conclude:** Their movement is responsible for metallic conduction.

**Why other options are wrong:**

- In a solid metal the positive ions stay fixed in the lattice.
- Neutrons and protons are locked inside the nuclei and do not carry current.

**Final Answer:** Free electrons carry the current in a metal $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q46

## Q47.

**Solution**

**Concept — Avogadro's number:** One mole of any substance contains a fixed number of particles, called Avogadro's number, equal to $6.022 \times 10^{23}$.

**Step 1 — Recall the value:** $6.022 \times 10^{23}$ particles per mole.

**Step 2 — Confirm:** This applies to atoms, molecules or ions.

**Why other options are wrong:**

- $6.022 \times 10^{-23}$ has the wrong (negative) power.
- $3.011 \times 10^{23}$ is only half of Avogadro's number.
- $1.6 \times 10^{19}$ is unrelated (close to the charge on an electron in coulombs).

**Final Answer:** Avogadro's number is $6.022 \times 10^{23} \Rightarrow \boxed{\text{A}}$

**Answer: (A)** Go Back to Q47

## Q48.

**Solution**

**Concept — Dry cell:** A dry cell is a device in which a chemical reaction takes place to produce electricity. So it converts chemical energy into electrical energy.

**Step 1 — Identify the input:** Stored chemical energy in the cell.

**Step 2 — Identify the output:** Electrical energy that runs the torch.

**Why other options are wrong:**

- It produces, not stores from, electrical energy in normal use.
- It does not convert heat into light or light into electricity.

**Final Answer:** A dry cell converts chemical energy into electrical energy $\Rightarrow \boxed{\text{C}}$

**Answer: (C)** Go Back to Q48

## Q49.

**Solution**

**Concept — Greenhouse gases:** Besides carbon dioxide, methane ($CH_4$) is an important greenhouse gas. It is released from waterlogged paddy fields and from the digestion of cattle.

**Step 1 — Recall the sources:** Paddy fields and cattle release methane.

**Step 2 — Identify the gas:** The greenhouse gas from these sources is methane.

**Why other options are wrong:**

- Carbon dioxide is a greenhouse gas but is mainly from burning fuels.
- Sulphur dioxide causes acid rain, not the greenhouse effect.
- Oxygen is not a greenhouse gas.

**Final Answer:** Paddy fields and cattle release methane $\Rightarrow$ $\boxed{\text{D}}$

**Answer: (D)** Go Back to Q49

## Q50.

**Solution**

**Concept — Air pollution:** Motor vehicles burn fuel and release smoke and harmful gases (such as carbon monoxide and oxides of nitrogen) into the air, causing air pollution.

**Step 1 — Identify the medium affected:** The gases go into the air.

**Step 2 — Name the pollution:** This contamination of the air is air pollution.

**Why other options are wrong:**

- Water and soil pollution involve contamination of water and land.
- Noise pollution is caused by loud sound, not by gases.

**Final Answer:** Vehicle smoke and gases cause air pollution $\Rightarrow$ $\boxed{\text{B}}$

**Answer: (B)** Go Back to Q50

# Answer Key

| Q | Ans | Q | Ans | Q | Ans | Q | Ans | Q | Ans |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A | 2 | C | 3 | B | 4 | D | 5 | B |
| 6 | A | 7 | D | 8 | C | 9 | B | 10 | A |
| 11 | C | 12 | D | 13 | B | 14 | A | 15 | C |
| 16 | D | 17 | A | 18 | B | 19 | C | 20 | D |
| 21 | B | 22 | A | 23 | D | 24 | C | 25 | A |
| 26 | B | 27 | D | 28 | A | 29 | C | 30 | B |
| 31 | D | 32 | A | 33 | C | 34 | B | 35 | D |
| 36 | A | 37 | B | 38 | C | 39 | A | 40 | D |
| 41 | B | 42 | C | 43 | A | 44 | D | 45 | C |
| 46 | B | 47 | A | 48 | C | 49 | D | 50 | B |