ICSE Board
Class IX Chemistry
Paper – 5 Solution

SECTION I

Answer 1

(a)

i. Dalton used the symbol $\underline{[O]}$ for oxygen and the symbol $\underline{[\mathbf{O}]}$ for hydrogen.
ii. Symbol represents gram atom(s) of an element.
iii. Symbolic expression for a molecule is called molecular formula.
iv. Sodium chloride has two radicals. Sodium is a basic radical, while chloride is an acid radical.
v. Valency of carbon in CH_4 is 4, in C_2H_6 is 4, in C_2H_4 is 4 and in C_2H_2 is 4.

(b)

i. Double decomposition – neutralisation
ii. Double decomposition – precipitation
iii. Synthesis
iv. Thermal decomposition
v. Thermal dissociation

(c)

i. $MnO_2 + 4HCl \xrightarrow{\text{Conc.}} MnCl_2 + 2H_2O + Cl_2$
ii. $K_2Cr_2O_7 + 14HCl \xrightarrow{\text{Conc.}} 2KCl + 2CrCl_3 + 7H_2O + 3Cl_2$
iii. $2SO_2 + O_2 \rightarrow 2SO_3$
iv. $Zn + H_2O \rightarrow ZnO + H_2$
v. $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

(d)

Basics radical	Acidic radical	Chemical formula
(i) Ni^{2+}	SO_4^{2-}	$NiSO_4$
(ii) Na^+	SiO_3^{2-}	Na_2SiO_3
(iii) Fe^{2+}	SO_4^{2-}	$FeSO_4$
(iv) Ca^{2+}	F^-	CaF_2
(v) Na^+	NO_2^-	$NaNO_2$

(e)

		Valency	Formula
i.	Ammonium ion	+1	NH_4^+
ii.	Cupric ion	+2	Cu^{2+}
iii.	Ferric ion	+3	Fe^{3+}
iv.	Plumbous	+2	Pb^{2+}
v.	Nitrate	−1	NO_3^-

(f)

i. Nitrous oxide
ii. Sodium and potassium hydroxide
iii. Silver and gold
iv. Zinc and iron
v. Magnesium and calcium

(g)

i.

Sodium atom	**Sodium ion**
(i) Sodium atom is electrically neutral.	(i) Sodium ion is positively charged.
(ii) In sodium atom, there are 11 protons and 11 electrons, i.e. equal number of protons and electrons.	(ii) In sodium ion, there are 11 protons but 10 electrons, i.e. sodium ion contains lesser number of electrons.
(iii) Sodium atom has only one electron in its valence shell.	(iii) Sodium ion has 8 electrons in its valence shell.
(iv) Size of a sodium atom is larger than a sodium ion.	(iv) Size of a sodium ion is smaller than a sodium atom.

ii.

a) In chlorine atom, the number of protons (17) is equal to the number of electrons (17). In chloride ion, there are 17 protons but 18 electrons.
b) Chlorine atom is electrically neutral. Chloride ion is negatively charged.
c) Chlorine atom is reactive. It reacts with sodium vigorously forming sodium chloride. Chloride ion is unreactive. It does not react with sodium.
d) Chlorine (Cl_2) is a poisonous, toxic, corrosive gas which is used in the manufacture of bleaching agents and disinfectants. It is non-toxic and readily adsorbed by plants.

(h)

i. H and P are noble gases.
ii. G and O are halogens.
iii. A and I are alkali metals.
iv. D and L have valency 4.

SECTION II

Answer 2

(a)

i. Liquid hydrogen is used as a fuel for rocket propulsion.
ii. All metals above hydrogen in the activity series react with acids to give hydrogen.
iii. Metals such as palladium, platinum or nickel adsorb hydrogen at room temperature.
iv. The reaction between hydrogen and oxygen to form water is highly exothermic.
v. Dil. H_2SO_4 reacts with zinc to liberate hydrogen.

(b)

i. Catalyst is written above the arrow.
ii. The temperature and pressure conditions are written above or below the arrow.
iii. Evolution of a gas is depicted by an upward arrow (↑).
iv. Formation of precipitate is depicted by a downward arrow (↓).
v. Evolution of heat is represented by writing 'Δ' sign or '+ Heat' on the product side.
vi. Physical state of the reactants and products are represented by writing (s), (l) and (g) adjacent to the reactants and products which represents solid, liquid and gas, respectively.

(c)

i. An atom is electrically neutral because the number of positively charged particles, i.e. protons, is equal to the number of negatively charged particles, i.e. electrons.
ii. The mass of an atom is contributed by the mass of the protons and neutrons present in the nucleus of an atom. The electrons present outside the nucleus are of negligible mass; therefore, the mass of atom is concentrated in the nucleus of an atom.
iii. According to Rutherford, the protons are present in the nucleus and the electrons revolve around the nucleus. Electrons continuously lose energy and ultimately fall into the nucleus following a spiral path. Thus, the nucleus of an atom gets destroyed.

Answer 3

(a)

i. A – Nitrogen
   B – Hydrogen
   C – Ammonia

ii. Gas 'C' is manufactured by the Haber process.
   $N_2 + 3H_2 \rightarrow 2NH_3 + Heat$
   Favourable conditions:
   Temperature should be between 450°C and 500°C. Pressure should be high (200–1000 atm.). Promoter used should be molybdenum.

iii.
   1. It turns moist red litmus blue.
   2. $NH_3 + HCl \rightarrow NH_4Cl$
      (Conc.) (Dense white fumes)

(b) An atom of each element has a definite combining capacity called its valency.

The combining capacity of the atoms, i.e. their tendency to react and form molecules with atoms of the same or different elements, was explained as an attempt to attain a fully filled outermost shell of electrons. This is done by sharing, gaining or losing electrons.

For example, lithium and sodium atoms contain one electron each in their outermost shell; therefore, each of them can lose one electron to have 8 electrons in their outermost shell. So, they are said to have valency = 1.

(c)

i. Electronic configuration is the arrangement of electrons in the atomic or molecular orbitals of atoms or molecules.
ii. Atomic number of elements is the number of protons in an atom of the element.
   Atomic mass of an element is the total mass of electrons, protons and neutrons in one atom of the element.

Answer 4

(a)

Water has an unusual physical property. When cooled, it first contracts in volume, as do other liquids, but at 4°C (maximum density), it starts expanding and continues to do so till the temperature reaches 0°C, the point at which it freezes into ice.

The property of anomalous expansion of water enables marine life to exist in the colder regions of the world, because even when the water freezes on the surface, it is still liquid below the ice layer.

(b) Solutions can be classified on the basis of their solubility, i.e. depending on the amount of solute which dissolves in a given solvent.

i. Unsaturated solution: If more solute can be dissolved in a solvent at a particular temperature, then the solution is called an unsaturated solution.
ii. Saturated solution: If no more solute can be dissolved in a solvent at a particular temperature, then the solution is called a saturated solution.
iii. Supersaturated solution: If the solution contains more of the solute, then the saturated solution at a particular temperature is called a supersaturated solution.

(c) Two elements whose properties were correctly predicted by Mendeleev are

Eka-aluminium – Gallium

Eka-silicon – Germanium

(d) Reactions in which heat is given out along with the products are called exothermic reactions.

Example: Burning of methane gas releases a large amount of energy. Hence, it is an exothermic reaction.

CH_4 (g) + $2O_2$ (g) → CO_2 (g) + $2H_2O$ (g)

Reactions which absorb energy or require energy in order to proceed are called endothermic reactions.

Example: When ammonium chloride is dissolved in water in a test tube, the test tube becomes cold. Thus, the reaction is an example of an endothermic reaction.

Answer 5

(a)

i. In the periodic table, the vertical lines are called groups and the horizontal lines are called periods.

ii.

(1) The first period is the shortest period with only 2 elements.

(2) The second period is a short period consisting of 8 elements.

(3) The third period is also a short period consisting of 8 elements.

Group 1	Group 17
H	F
Li	Cl
Na	Br
K	I
Rb	At
Cs	Uus
Fr	

(b) The word 'latent' means 'hidden'. It is called latent heat because it is hidden in the substance undergoing the change of state and does not show its presence by raising the temperature.

Latent heat is of two types – latent heat of fusion and latent heat of vaporisation.

Latent heat of fusion: It is the heat energy required to change 1 kg of a solid substance into its liquid state at atmospheric pressure at its melting point. For example, the amount of heat required to melt ice at 0°C into water at 0°C will be known as the latent heat of fusion of ice.

Latent heat of vaporisation: It is the heat required to change 1 kg of a liquid substance into the gaseous state at atmospheric pressure at the boiling point of the substance. For example, the amount of heat required to vaporise water at 100°C into the vapour state at 100°C and at atmospheric pressure will be known as the latent heat of vaporisation of water.

Answer 6

(a)

i. Bosch process

ii. $CO + H_2 + H_2O \xrightarrow[450°C]{Fe_2O_3/Cr_2O_3} 2H_2 + CO_2$

Water gas

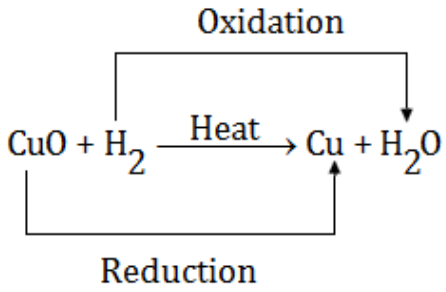
iii. Hydrogen obtained by this process contains impurities of carbon monoxide in traces and carbon dioxide. Carbon monoxide can be removed by passing it through ammoniacal cuprous chloride solution. Carbon dioxide can be removed by passing it through cold water under pressure.

(b)

i. Redox reaction is a type of reaction in which oxidation and reduction take place simultaneously. During this reaction, one of the reactants gets oxidised and the other gets reduced.

Example:

When copper (II) oxide reacts with hydrogen, it gives copper and water.



Here, copper oxide loses oxygen and is reduced, and hydrogen gains oxygen and is oxidised.

ii.

1. Sulphur is oxidised.
2. Carbon is oxidised.
3. Chlorine is reduced.
4. Lead is reduced.
5. Iron is reduced.

Answer 7

(a) $V_1 = 20\ dm^3$ $V_2 = 20 + 20 = 40\ dm^3$

$P_1 = 200\ atm$ $P_2 = ?$

$$P_1V_1 = P_2V_2$$

$$200 \times 20 = P_2 \times 40$$

$$P_2 = \frac{200 \times 20}{40} = 100\ atm$$

(b) $V_1 = 200\ cm^3$ $V_2 = ?$

$T_1 = 27 + 273 = 300\ K$ $T_2 = 3 + 273 = 276\ K$

$P_1 = 200\ atm$ $P_2 = 740\ mm\ Hg$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$$

$$\frac{720 \times 200}{300} = \frac{740 \times V_2}{276}$$

$$V_2 = \frac{720 \times 200 \times 276}{300 \times 740}$$

$$= \frac{72 \times 2 \times 276}{3 \times 74} = \frac{39744}{222}$$

$$= 179.02\ cm^3$$

(C) The forces of attraction in liquids are less than solids but are enough to keep the molecules in contact with other. Therefore, the liquids flow from a higher level to a lower level.

(c)

i. **Solution:** A solution is a homogeneous mixture of two or more substances, the components of which cannot be seen separately.

ii. **Solute:** A solute is the substance which dissolves in a solvent to form a solution.

iii. **Solvent:** A solvent is the medium in which a solute dissolves.

Solution = Solute + Solvent