Question 25. Write chemical reactions to justify that hydrogen peroxide can function as an oxidising as well as reducing agent.
Answer: As an oxidising agent

$2Fe^{2+}$ (aq) + $2H^{+}$(aq) +H_2O_2(aq) → $2Fe^{3+}$ (aq) + 2 H_2O(l)

As a reducing agent

I_2(s) + H_2O_2 (aq) + $2OH^{-}$ (aq) → $2I^{-}$ (aq) + 2 H_2O(l) + O_2(g)

Question 26. What is meant by 'demineralised water' and how can it be obtained?
Answer: Demineralised water is free from all soluble mineral salts which is obtained by passing water successively through a cation exchange (in the form of H^{+}) and an anion exchange in the form of OH^{-} resins.

$$2RH(s) + M^{2+}(aq) \rightleftharpoons MR_2(s) + 2H^{+}(aq)$$

H^{+} exchanges for Na^{+}, Ca^{2+}, Mg^{2+} and other cations present in water. This process results in release of proton which makes the water acidic.

OH^{-} exchanges, for anions like Cl^{-}, HCO_3^{-},SO_4^{2-}etc.

OH^{-} ions thus liberated neutralize the H^{+} ions set free in the cation exchange process. H^{+}(aq) + OH^{-}(aq) → H_2O(l)

Question 27. Is demineralised or distilled water useful for drinking purposes? If not, how can it be made useful ?
Answer: No, demineralised water is not fit for drinking purposes. It can be made useful by adding required amount of ions which are useful for our body.

Question 28. Describe the usefulness of water in biosphere and biological systems.
Answer:
(i) Major part of all living system is made of water.
(ii) It constitutes about 65 - 70% of body weights of animals and plants.
(iii) Some properties of water like high specific heat, thermal conductivity, surface tension, high polarity allow water to play a major role in biosphere.
(iv) Because of high heat of vaporisation it is responsible ro regulate temperature of living beings.
(v) It is an excellent fluid for the transportation of minerals and nutrients in plants.
(vi) It is also required for photosynthesis in plants.

Question 29. What properties of water make it useful as a solvent? What types of compound can it (i) dissolve (ii) hydrolyse?
Answer: Water is highly polar in nature thats why it has high dielectric constant and high dipole moment. Because of these properties, water is a universal solvent.
It can hydrolyse many oxides metallic or non-metallic, hydrides, carbides, nitrides etc.

Question 30. Knowing the properties of H_2O and D_2O, do you think D_2O can be used for drinking purpose.
Answer: No, D_2O is injurious to human beings, plants and animals.

Question 31. What is the difference between the terms 'hydrolysis' and 'hydration'?
Answer: Hydrolysis is a chemical reaction in which a substance reacts with water under neutral, acidic or alkaline conditions.

$$\underset{\text{Salt 1}}{Na_2CO_3} + 2H_2O \longrightarrow \underset{\text{Base 2}}{2NaOH} + \underset{\text{Acid 1}}{H_2CO_3}$$

Hydration on the other hand is the property of a chemical compound to take up molecules of water of crystallisation and get hydrated.

$$\underset{\text{colorless}}{CuSO_4(s)} + 5H_2O(l) \longrightarrow \underset{\text{(Blue)}}{CuSO_4\,5H_2O(s)}$$

Question 32. How can saline hydrides remove traces of water from organic compounds?
Answer: Saline hydrides (i.e, CaH_2 NaH etc.) react with water and form the corresponding metal hydroxide with the liberation of H_2 gas. Thus, these hydrides can be used to remove traces of water from the organic compounds.
$NaH(s) + H_2O(l) \rightarrow NaOH(aq) + H_2(g)$
$CaH_2(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

Question 33. What do you expect the nature of hydrides is, if formed by elements of atomic numbers 15,19, 23 and 44 with dihydrogen? Compare their behaviour towards water.
Answer: Atomic No. 15 is of phosphorus. The hydride is PH_3 and its nature is covalent. Atomic No. (Z = 19) is of potassium. The hydride is KH and it is ionic in nature. Atomic No. (Z = 23) is of vanadium. The hydride is VH. It is interstitial or metallic. Atomic No. 44 is of ruthenium, its hydride is interstitial or metallic.

Question 34. Do you expect different products in solution when aluminium (III) chloride and potassium chloride treated separately with (i) normal water (ii) acidified water (iii) alkaline water? Write equation wherever necessary.
Answer:

(*i*) In normal water

$$AlCl_3 + 3H_2O \longrightarrow Al(OH)_3 + 3HCl$$

KCl will dissolve in water and ions will get hydrated.

(*ii*) KCl will be unaffected in acidified water. While in acidic water H^+ ion react with Al $(OH)_3$ to form Al^{3+} (aq) ions and H_2O. Thus in acidic water $AlCl_3$ exists as
Al^{3+} (aq) and Cl^- (aq) ions

$$AlCl_3(s) \xrightarrow{\text{Acidified}} Al^{3+}(aq) + 3Cl^-(aq)$$

(*iii*) In alkaline water since the aqueous solution of KCl is neutral therefore, it is unaffected.
$Al(OH)_3$ reacts to form soluble tetrahydroxoaluminate complex or meta-aluminate.

$$AlCl_3(s) \xrightarrow[\text{water}]{\text{Alkaline}} Al^+[(OH)_4]^- + 3Cl^- OH^- \downarrow AlO_2^-(aq)\ 2H_2O(l) + 3Cl^-(aq)$$

Question 35. How does H_2O_2 behave as a bleaching agent?
Answer: Bleaching action of H_2O_2 is due to the oxidation of colouring matter by nascent oxygen.
$H_2O_2(Z) \rightarrow H_2O(Z) + O(g)$

Question 36. What do you understand by the terms:
(i) Hydrogen economy
(ii) hydrogenation
(iii) syngas
(iv) water-gas shift reaction
(v) fuel-cell?
Answer:
(i) Hydrogen economy: The basic principle of hydrogen economy is the storage and transportation of energy in the form of liquid or gaseous dihydrogen.
(ii) Hydrogenation: Hydrogenation means addition of hydrogen across double and triple bonds in presence of catalyst to form saturated compounds.

$$\text{Vegetable oil} + H_2 \xrightarrow{\text{Ni, 437K}} \text{Vegetable Ghee}$$

(iii) Syngas: The mixture of CO and H_2 are called synthesis or syngas. It can be produced by the reaction of steam on hydrocarbon or coke at high temperature in the presence of nickel catalyst

$$CH_4(g) + H_2O(g) \xrightarrow[Ni]{1270K} CO(g) + 3H_2(g)$$

The process of producing syngas from coal is called 'Coal gasification'.

$$C(s) + H_2O(g) \xrightarrow[Ni]{1270K} CO(g) + H_2(g)$$

(iv) Water-gas shift reaction: The amount of hydrogen in the syngas can be increased by the action of CO of syngas mixture with steam in the presence of iron chromate as catalyst.This is called water-gas shift reaction.

$$C(s) + H_2O(g) \xrightarrow[FeCrO_4]{673K} CO(g) + H_2(g)$$

(v) Fuel-Cell: It is a cell which converts chemical energy of fuel directly into electrical energy.

********** END **********