Solution

Class 10 - Science

2020-21 : part - 1

Section A

1. The sulphuric acid is one of the strongest acids. So, when we dilute the sulphuric acid, it evolves a huge amount of heat. Hence, the dilution of sulphuric acid is an **exothermic** reaction.
2. If water is added to an acid or base a large amount of heat energy is evolved which may cause the reaction mixture to splash out and cause injury to the person.

   OR

   i. Valency =+3
   ii. P, Q are metals R is metalloid and S is non-metal.
   iii. P is the most basic element
3. Electrolytic refining of metal is a process in which impure metal is made the anode and a thin strip of pure metal is made the cathode and is used for metals like Cu, Zn, Ag, Au etc. The method used for the refining of impure metal depends on the nature of the metals as well as on the nature of impurities present in it. So, metals gold and Copper are refined by electrolytic refining.
4. The given elements belong to the 17^{th} group, called Halogen family. Atomic radii increase in a group from top to bottom due to the corresponding increase in the number of filled electronic shells. Thus, the increasing atomic radii order of Cl, At, Br and I is as follows:
   Cl < Br < I < At

   OR

   When lead (Pb) reacts with hydrochloric acid (HCl), lead **displaces** hydrogen from hydrochloric acid slowly to form lead chloride ($PbCl_{2)}$ with the **liberation of hydrogen gas** (H_2). The bubbles of gas seen are of hydrogen gas.
5. CMC : Carboxymethylcellulose is added to synthetic detergent to keep the dust particles suspended in water, and helps in cleansing process.
6. $P = \mathrm{AgNO_3}, \mathrm{Q} = \mathrm{AgBr}$
   $2\mathrm{AgBr(s)} \rightarrow 2\mathrm{Ag(s)} + \mathrm{Br_2(g)}$
   Photochemical decomposition reaction
7. When a given amount of an acid is added to water, there are a fixed number of hydronium ions per unit volume of the solution. On dilution the number of hydronium ions per unit volume decreases and concentration of hydronium ion decreases.

   OR

   $CaOCl_2 + CO_2 \rightarrow CaCO_3 + Cl_2$
8. Metal atoms have 1, 2 or 3 electrons in their valence shells whereas non-metal atoms have 4 to 7 electrons in their valence shells.
9. Cryolite (Na_3AlF_6) has two roles in the metallurgy of aluminium:
   1. To decrease the melting point of the mixture from 2323 K to 1140 K.
   2. To increase the electrical conductivity of Al_2O_3 .

   OR

   Calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions may be present as chlorides, carbonates etc in water. Presence of these ions makes water hard.
10. The decomposition of ferrous sulphate is an endothermic reaction because heat is required to decompose the compound into its components.
11. Period - 4, as number of shells are 4 and group - 2 as valence shell has 2 electrons.
12. Curd and sour substances contain acids. Therefore, if we keep such food substances in brass and copper vessels, they will react with the metal to form poisonous metal compounds and liberate hydrogen gas thereby causing food poisoning and corrosion of the vessels.

    OR

A protective coating of aluminium oxide (Al_2O_3) is formed on the surface of the foil which prevents it from getting corroded in the presence of air and water. Hence, food items are saved from getting spoilt when packed in aluminium foils.

13. Calcium oxide is a fairly strong base, and hydrochloric acid is a strong acid. The two substances readily reacts with and neutralise each other, forming the soluble salt calcium chloride ($CaCl_2$) and water.

    $CaO + 2HCl\ (dil) \rightarrow CaCl_2 + H_2O$

14. **(a)** Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.
    Explanation: Both assertion and reason are CORRECT and reason is the CORRECT explanation of the assertion.

15. **(a)** Both A and R are true and R is the correct explanation of the assertion.
    Explanation: Both A and R are true and R is the correct explanation of the assertion. The aqueous solution of glucose and alcohol does not show acidic character. This is because, aqueous solutions of glucose and alcohol do not give H^+ ions.

    OR

    (a) Assertion is CORRECT but, reason is INCORRECT.
    Explanation: Assertion is CORRECT but, reason is INCORRECT.

16. **(a)** Assertion is INCORRECT but, reason is CORRECT.
    Explanation: Assertion is INCORRECT but, reason is CORRECT.

17. i. (a) $CuSO_4$
    ii. (b) gains the electron
    iii. (a) Copper, Zinc
    iv. (b) Displacement reaction
    v. (a) lemon water

18. i. (c) 7 to 7.4
    ii. (c) Both (a) and (b)
    iii. (d) 10
    iv. (b) 5.5
    v. (a) Lower

19. i. (b) Hydrogen
    ii. (a) $2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$
    iii. (a) Base + Acid $\rightarrow$ salt + water
    iv. (b) Na_3ZnO_3
    v. (d) $Ca(HCO_3)$

20. i. (d) double displacement reaction
    ii. (a) It is a decomposition reaction and endothermic in nature
    iii. (a) Barium Sulphate, Sodium Chloride
    iv. (d) Ca
    v. (c) $AgNO_3 + NaBr \longrightarrow AgBr + NaNO_3$

Section B

21. i. $2Na + 2H_2O \rightarrow 2NaOH + H_2$ **[Exothermic Reaction]**
    ii. $2FeSO_4 \rightarrow Fe_2O_3 + SO_2 + SO_3$ **[Endothermic Reaction]**

22. i. The pH scale was developed to check how much acidic or basic a given substance is.
    ii. The pH range for acids is 0-7 and for bases, it is 7-14.

    OR

    The interaction of an acid with a base to form salt and water is called neutralization reaction.
    Examples:
    Acid + Base $\rightarrow$ Salt + Water
    $HCl(aq) + KOH(aq) \rightarrow KCl(aq) + H_2O(l)$
    $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O\ (l)$

Basically, this reaction involves the combination of H^+ (aq) from acid with OH^- (aq) ions from base to form unionized water molecules.

H^+ (aq) + OH^- (aq) $\rightarrow$ $H_2O(l)$

23. i. The metal which is manufactured by the electrolysis of its molten oxide is Aluminium.
    ii. Zinc is used to galvanise iron, because it is more reactive.
    iii. Copper is alloyed with zinc to make brass.
    iv. Iron reacts with aqueous copper (II) sulphate to give a pink solid.
    v. Iron has no reaction with cold water but it reacts with steam.
24. Some of the detergents are non-biodegradable, i.e. they cannot be decomposed by microorganisms like bacteria, hence, causes water pollution in lakes and rivers.
25. The required information may be given in a tabular form as follows:

Element	Atomic No.	Electronic arrangement	Group
Carbon (C)	6	2, 4	14
Silicon (Si)	14	2, 8, 4	14

26. Magnesium reacts readily with dil. H_2SO_4:

    $Mg + H_2SO_4 \rightarrow MgSO_4 + H_2\uparrow$

    This reaction is called a dissolving metal reaction.

Section C

27. i. a. Double displacement reaction and precipitation reaction
        b. Combination reaction and exothermic reaction .
        c. Thermal decomposition reaction
    ii. Reaction (a) is a precipitation reaction, as a white precipitate of AgCl is formed. Due to the formation of precipitate this reaction is also called precipitation reaction.
28. Strong acid : HCl, H_2SO_4

    Weak acid : CH_3COOH, HCN, H_2CO_3

    Strong base : KOH, NaOH

    Weak base : $Ca(OH)_2$, NH_4OH

OR

The given oxide, MO suggests that the valency of metal is 2. It means that there are two valence electrons in the valence shell of metal. So it prefers to lose 2 electrons to oxygen atom and form X^{2+}. As it belongs to 2nd period, therefore, it contains two shells (K, L). In this period the only element which has 2 valence electrons is Beryllium. Hence, the atomic number of the metal is 4 and electronic configuration is 2,2. Therefore, atomic number =4 and valency =2.

29. i. Fluorine (F), chlorine (Cl) and bromine (Br) are collectively called halogens.
    ii. (a) These elements has 7 electrons in their outermost shell and has valency 1.
        (b) These elements have tendency to accept one electron to from uni-negative anions.
30. The metal X is aluminium.
    Reaction: 2 Al + $Fe_2O_3 \rightarrow$ Al_2O_3 + 2 Fe + Heat.
31. a. Carbon forms large number of compounds since carbon is small in size and can form stable covalent bonds (catenation) and it shows tetravalency.
    b. Air holes of gas burner are made open (adjusted) so that air can pass through, which is needed for complete combustion, so that heated vessels do not blackened.
    c. Some synthetic detergents are non-biodegradable, therefore, cause pollution of water.
32. (i) The temperature of the reaction mixture rises when aluminium is added because it is an exothermic reaction.
    (ii) Reaction of sodium metal is found to be highly explosive because it is an exothermic reaction.
    (iii) When lead is treated with hydrochloric acid, bubbles of hydrogen gas are evolved.
    $Pb + 2HCl \rightarrow PbCl_2 + H_2$
33. On arranging the given elements into different groups and periods in order of their increasing atomic numbers, we have

Group number	1	2	13	14
Third period:	-	Mg	-	-
Forth period:	K	Ca	Ga	Ge

In Modern Periodic table, as we go from left to right, metallic character decrease along the period, while non-metallic character increases. Therefore, K is on extreme left has highest metallic character, while Ge being on extreme right has least metallic character among these. Hence, metallic character increases in the order: Ge < Ga < Ca < K (as all these belong to same period). Now we compare the metallic character of Ca and Mg. Since, metallic character increases down the group from top to bottom, therefore, Ca (below Mg in periodic table) is more metallic than Mg. Combining the above two results, the overall metallic character increases in the order : Ge < Ga < Mg < Ca < K.

Section D

34. i. When potassium chloride is heated in the presence of manganese dioxide catalyst, it decomposes to give potassium chloride and oxygen:

$$2KClO_3(s) \xrightarrow[Decemporition]{Heat} 2KCl(s) + 3O_2(g)$$

This decomposition takes place in the presence of heat and catalyst. In this decomposition reaction, a single compound, potassium chlorate, split up into two simpler substances, potassium chloride and oxygen. This decomposition reaction is used for preparing oxygen gas in the laboratory.

ii. a. Aqueous solution is indicated by the symbol 'aq'.
b. An exothermic reaction is indicated by writing "+Heat" or "+Heat energy" or "+Energy" on the products side of an equation.
c. An endothermic reaction is indicated by writing "+Heat" or "+Heat energy" or "+Energy" on the reactants side of an equation.

OR

a. i. There is no fixed position of Hydrogen in the Mendeleev's periodic table.
ii. There is no space for isotopes of elements.
iii. Atomic mass does not increase in a regular manner.

b. i. From left to right metallic character decreases. The reason is effective nuclear charge increases when we go left to right in period.
ii. From top to bottom metallic character increases. The reason is size of atom increase therefore tendency to loose electron increases.

35. i. An aqueous solution of an acid conducts electricity because in water an acid (HCl) dissociates to give ions. Since the current is carried out by the movement of ions, an aqueous solution of acid conducts electricity.

ii. During dilution, more of acid dissociates into ions. Thus concentration of $[H_3O]^+$ ions will increase on dilution.

iii. Even on increasing $[H_3O]^+$ ions, the number of ions per unit volume decreases. Therefore ph will increases on dilution.

iv. (a) CO_2 gas will evolves accompanied by brick effervescence.

$$NaHCO_3(s) + HCl(aq) \rightarrow NaCl(aq) + CO_2(g) + H_2O(aq)$$

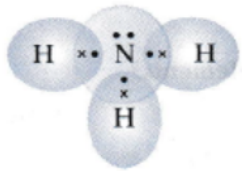
(b) H_2 gas will evolves accompanied by brick effervescence.

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl(aq) + H_2O(g)$$

36. i. The element is Nitrogen and it has 5 electrons in its outermost shell.

ii. Triple covalent bonds

iii. 3 single covalent bonds



OR

i. Universal indicator is a solution of many indicators which shows different color changes for solutions with different pH values. It is used to test whether a solution is an acid or a base. It changes color according to the pH of the acidic or basic medium.

ii. As solution A turns pink when phenolphthalein indicator is added, so solution A is a basic solution. Solution B is acidic as it gives a red color after adding a drop of methyl orange. The basic solution has higher pH value so, the pH value of A is higher as compared to B

iii. The salt solution which has a pH less than 7 is ammonium chloride (NH_4Cl) and the salt solution which has a pH more than 7 is sodium carbonate (Na_2CO_3)