CHEMISTRY STUDY MATERIALS FOR CLASS 12
(Questions – Answers of Chapter -08)
GANESH KUMAR DATE:- 19/01/2021

d – block and f -block elements

Each question carries THREE marks

60. (a) How does the neutral or faintly alkaline potassium permanganate solution react with Iodide

(b) thiosulphite? Write the ionic equations for the reactions

Ans. In neutral or faintly alkaline solutions:

(a) The oxidation of iodide to iodate:

$$2MnO_4^- + H_2O + I^- \longrightarrow 2MnO_2 + 2OH^- + IO_3^-$$

(b)Thiosulphate is oxidised almost quantitatively to sulphate:

$$8MnO_4^- + 3S_2O_3^{2-} + H2O \longrightarrow 8MnO_2 + 6SO_4^{2-} + 2OH^-$$

61. Name the metal of the 1st row transition series that

i) has highest value for magnetic moment

ii) has zero spin only magnetic moment in its +2 oxidation state.

iii) exhibit maximum number of oxidation states.

Ans. i) Chromium ii) Zinc iii) Manganese

62. Transition metals form a large number of complex compounds. Give reason. Ans. Transition metals for complex compounds due to,

i) small sizes of metal cations

ii) their ionic charges and

iii) availability of d orbitals for bond formation.

63. Explain the trend in atomic size of 3d series of transition elements with reason. Ans. With increase in atomic number in 3d series - atomic size decreases (Sc to Cr) , then remain almost constant (Cr to Cu) and increase slightly at the end (Cu to Zn).

Reason: In the beginning of the series the screening (or shielding effect) effect of a d electron is not that effective, hence the net electrostatic attraction between the nuclear charge and the outermost electron increases, hence atomic size radius decreases.

In the middle of the series, increase in nuclear charge and increase in screening effect balance each other. So atomic radii become almost constant Increase in atomic radii towards the end is due to the electron – electron repulsions cause the expansion of electron cloud.

64. Explain trend in Ionisation Enthalpies of 3d series of transition elements . Ans.Ionisation enthalpy increase along each series of the transition elements from left to right. However many small variations, IE of Chromium is lower because removal of an electron from Chromium does not change in the d ($3d^5\ 4s^1$ to $3d^5\ 4s^0$) configuration. I.E value for Zn ($3d^{10}\ 4s^2$) is higher because an electron is removed from 4s level which needs more energy.

(i) How is potassium dichromate prepared from iron chromite ore?

Ans. Potassium dichromate is manufactured from chromite ore Chromite ore is fused ($FeCr_2O_4$) with sodium or potassium carbonate in free access of air to get sodium chromate.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

(ii) The yellow solution of sodium chromate is filtered and acidified with sulphuric acid to give a solution from which orange sodium dichromate, $Na_2Cr_2O_7.\ 2H_2O$ can be crystallized.

$$2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$$

Potassium dichromate prepared by treating the solution of sodium dichromate with potassium chloride.

$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$

Orange crystals of potassium dichromate crystallize out.

65. Describe the preparation of potassium permanganate from manganous dioxide. Potassium permanganate is prepared by fusion of MnO_2 with an alkali metal hydroxide and an oxidising agent like KNO_3. This produces the dark green K_2MnO_4 which disproportionate in a neutral or acidic solution to give permanganate.

$$2MnO_2 + 4KOH + O_2 \rightarrow 2K_2MnO_4 + 2H_2O$$

$$3MnO_4^{2-} + 4H^+ \rightarrow 2MnO_4^- + MnO_2 + 2H_2O$$

66. How does the acidified permanganate solution react with

(a) iron(II) ions (b) oxalic acid and (c) hydrogen sulphide?

Write the ionic equations for the reactions In acid solutions:

Ans.

(a) Fe^{2+} ion (green) is converted to Fe^{3+} (yellow):

$$5Fe^{2+} + MnO_4^- + 8H^+ \longrightarrow Mn^{2+} + 4H_2O + 5Fe^{3+}$$

(b)Oxalate ion or oxalic acid is oxidised at 333 K:

$$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 10CO_2$$

(c)Hydrogen sulphide is oxidised, sulphur being precipitated:

$$H_2S \longrightarrow 2H^+ + S^{2-}$$

$$5S^{2-} + 2MnO_4^- + 16H^+ \longrightarrow 2Mn^{2+} + 8H_2O + 5S$$

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