GIRLS' HIGH SCHOOL AND COLLEGE

2020-2021

Class XII A & B

CHEMISTRY

WORKSHEET NO. – 3

Note: - Parents please ensure that your ward refers to the given reference books and website at least for two days.

Reference Books – Nootan ISC Chemistry- Vol II Class XII- H.C. Srivastava

Website – www.wikipedia.org

www.studiestoday.com

www.khanacademy.org

Chapter- p-block Elements

Topic- Group 16 elements

Group 16 of the periodic table consists of oxygen, sulphur, selenium, tellurium and polonium. They are also referred to as chalcogens (ore-forming elements). The atomic radii, density, melting and boiling points and metallic character increases on moving down the group.

Ionisation energy, electro-negativity, tendency to exist in -2 oxidation state decreases on moving down the group. The electron affinity of oxygen is less than that of sulphur. Electron gain enthalpy decreases on moving down the group. All the elements of group 16 exhibit allotropy. The hydrides of the elements of group 16 are of the type H_2M and are formed by sp^3 hybridisation. Except water all other hydrides act as reducing agents. The reducing power increases from H_2S to H_2Te. The compound of oxygen with fluorine is OF_2 and is called oxygen fluoride. Ozone is an allotropic form of oxygen. It can be obtained by passing a silent electric discharge in pure and dry oxygen. On large scale, it is usually prepared by Siemen-Halske Ozoniser. Ozone is a pale blue gas with characteristic odour. It is a powerful oxidizing agent. It is a stronger oxidizing agent than oxygen because it easily decomposes to give an atom of nascent oxygen which is more reactive than oxygen

$$O_3 \longrightarrow O_2 + [O]$$

Ozone molecule has an angular or bent structure with bond angle of 116.8^o.

It is used as a disinfectant and germicide in the purification of water. It is also used for improving the atmosphere of crowded places.

Sulphur exhibits the phenomenon of allotropy. The important allotropes of sulphur are rhombic sulphur, monoclinic sulphur and plastic sulphur. Rhombic sulphur and monoclinic sulphur are insoluble in water but soluble in CS_2. Both exist as S_8 molecules having puckered rings. Plastic sulphur is soluble neither in water nor in CS_2. It consists of an open chain structure.

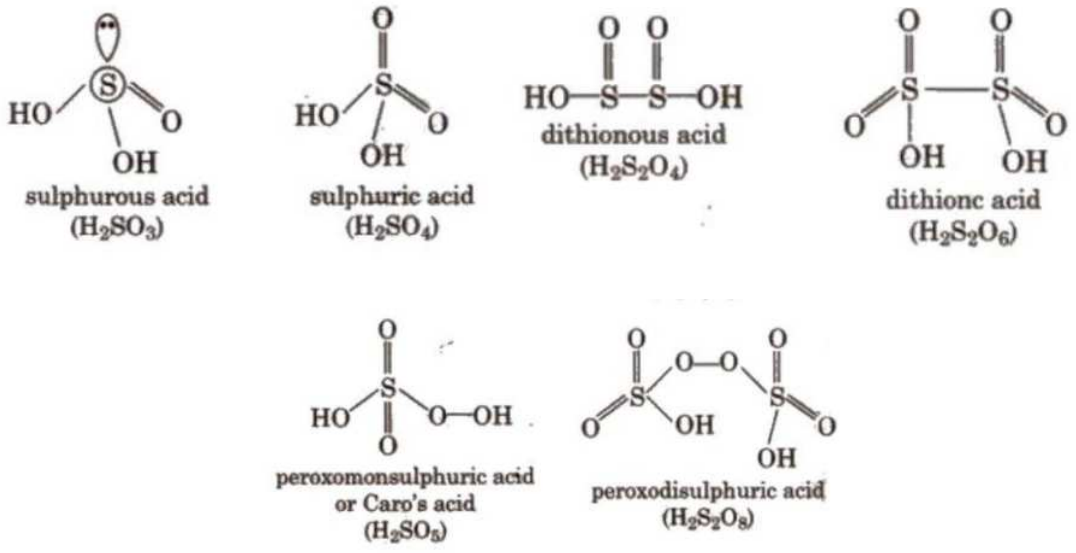

Figure 1: Structures of some important oxoacids of sulphur

Sulphur dioxide is a colorless gas having pungent and suffocating smell. It is prepared in the laboratory by the action of hot and concentrated sulphuric acid on copper turnings.

$$Cu + 2H_2SO_4 \longrightarrow CuSO_4 + SO_2 + 2H_2O$$

In presence of moisture, sulphur dioxide liberates nascent hydrogen and acts as a reducing agent. H_2SO_4 has a strong affinity for water and acts as a very good dehydrating agent. It acts as a moderately strong oxidising agent and can oxidise C into CO_2, H_2S into S, S_8 into SO_2 etc.

Answer the following questions:

Q1). i). Why does H-M-H bond angle in the hydrides of group 16 elements decrease on moving down the group?

ii). What is tailing of mercury.

iii). Why is ozone a stronger oxidizing agent than oxygen?

Q2). Sulphur dioxide acts an oxidising agent as well as a reducing agent. Give one reaction each to show its oxidising and reducing nature.

Q3). Discuss the theory involved in the manufacture of sulphuric acid by contact process.

Q4). Draw the structure of

i). Sulphurous acid (H_2SO_3)

ii). Sulphuric acid (H_2SO_4)

Q5). Compare elements of group 15 with those of group 16 with respect to following properties

i). Electronegativity

ii). Oxidation State

iii). Electron Affinity

Q6). Account for the following:

i). Tendency to show -2 oxidation state diminishes from Sulphur to polonium in group 16.

ii). SCl_6 is not known but SF_6 is known.

iii). Atomic radii of group 16 elements are smaller than those of the corresponding elements of group 15.

iv). First ionsation energy of oxygen is lower than that of nitrogen.

v). Sulphur in vapour state exhibits paramagnetism.

vi). Ozone is used as a disinfectant.

vii). Water does not act as a reducing agent.

viii). Sulphur exhibits tendency for catenation but oxygen does not.

ix). H_2O is a liquid while H_2S is a gas.

Q7). i). Explain why high pressure is required in the manufacture of Sulphur trioxide by contact process. State the law or principle used.

ii). Explain how does Sulphur exist in +2, +4 and +6 oxidation state.

Q8). What happens when

i). Lead sulphide is treated with ozone.

ii). Concentrated sulphuric acid is added to sucrose.

iii). Sulphur dioxide is passed in acidified $KMnO_4$ solution.

iv). Concentrated Sulphuric acid is added to hydrated copper sulphate.

Q9). How is ozone manufactured by Siemen Halske Ozoniser.

Q10). Give balanced equations for the following reactions:

i). Ozone and mercury

ii) Ozone with potassium iodide

iii). Copper with concentrated sulphuric acid

iv). Hydrogen sulphide and concentrated sulphuric acid

v). Phosphorus with concentrated sulphuric acid.