WORKSHEET 1

CHAPTER 11 – STUDY OF COMPOUNDS – SULPHURIC ACID

A. Tick (√) the correct option.

1. Which chemical is also known as the "king of chemicals"?

   a. Nitric acid b. Ammonia c. Sulphuric acid d. Hydrochloric acid

2. Who prepared sulphuric acid by burning sulphur with saltpetre in the presence of steam?

   a. John Roebuck b. Johann Glauber c. Lavosier d. Peregrine Phillips

3. Who prepared sulphuric acid by the Lead chamber method?

   a. John Roebuck b. Johann Glauber c. Robert Boyle d. Peregrine Phillips

4. Who prepared sulphuric acid by the Contact Process?

   a. John Roebuck b. Johann Glauber c. Lavosier d. Peregrine Phillips

5. What is the common name of sulphuric acid?

   a. Blue vitriol b. Oil of vitriol c. Green vitriol d. Alkaline air

B. Fill in the blanks from the choices given within the brackets.

1. The reduced product obtained when hydrogen sulphide reacts with conc. sulphuric acid is _____ (SO_2/S/H_2O)
2. The dehydrated product obtained when sugar reacts with conc. sulphuric acid is _____ (CO_2/CO/C)
3. The salt which reacts with dil. sulphuric acid to form insoluble ppt. is _____ [$Pb(NO_3)_2$/$NaNO_3$/$Cu(NO_3)_2$]
4. The oxidised product obtained when sulphur reacts with conc. sulphuric acid is _____ (H_2SO_3/H_2S/SO_2)
5. The type of salt formed when excess of caustic soda reacts with sulphuric acid is _____ (normal salt/acid salt).

C. Write balanced equations for the following reactions.

1. Formation of an acid salt from sulphuric acid by a sodium salt.
2. Formation of black spot on a piece of wood due to conc. sulphuric acid.
3. Formation of sulphur dioxide gas using a metal below hydrogen in activity series.
4. Oxidation of a fowl smelling gas by conc. sulphuric acid.
5. Formation of CO and CO_2 by using conc. sulphuric acid.

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D. Some properties of sulphuric acid are listed below. Choose the property from a. to d. which is responsible for the reactions 1. to 5. Some properties may be repeated.

a. Acid

b. Dehydrating agent

c. Non-volatile acid

d. Oxidizing agent

1. $C_{12}H_{22}O_{11} + nH_2SO_4 \rightarrow 12C + 11H_2O + nH_2SO_4$
2. $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$
3. $NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl$
4. $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$
5. $Na_2CO_3 + H_2SO_4 \rightarrow Na_2SO_4 + H_2O + CO_2$

E. Answer the following.

1. How is sulphuric acid prepared industrially by Contact process?
2. Why is sulphur trioxide formed in this process not absorbed directly in water?
3. Why is vanadium pentoxide considered a better catalyst than platinised asbestos?
4. Why is heating of catalyst discontinued the moment when the oxidation of sulphur dioxide takes place?
5. Why are the wooden shelves on which concentrated sulphuric acid bottles kept, stained black?

ANSWERS

WORKSHEET 1

A. Tick (√) the correct option.

1. c 2. b 3. a 4. d 5. b

B. Fill in the blanks from the choices given within the brackets.

1. S
2. C
3. $Pb(NO_3)_2$
4. SO_2
5. normal salt

C. Write balanced equations for the following reactions.

1. $NaCl + H_2SO_4 \xrightarrow{200\ ^\circ C} NaHSO_4 + HCl$
2. $(C_6H_{10}O_5)_n + 5(H_2SO_4)_n \rightarrow 6C_n + 5(H_2SO_4 \cdot H_2O)$
3. $Cu + 2H_2SO_4\ (conc.) \xrightarrow{heat} CuSO_4 + 2H_2O + SO_2$
4. $H_2SO_4 + H_2S \rightarrow 2H_2O + SO_2 + S$
5. $\begin{matrix}COOH\\|\\COOH\end{matrix} + H_2SO_4 \rightarrow CO + CO_2 + H_2O$

D. Some properties of sulphuric acid are listed below. Choose the property from a. to d. which is responsible for the reactions 1. to 5. Some properties may be repeated.

1. b 2. d 3. c 4. a 5. a

E. Answer the following.

1. Contact process for the manufacture of sulphuric acid:

   i. Pure sulphur is burnt in excess of oxygen in sulphur burners to form a mixture of sulphur dioxide and oxygen. The mixture is cooled and then washed with water to remove any dust particles as impurity.

   $S + O_2 \rightarrow SO_2$

   The moist mixture is dried in conc. sulphuric acid and then passed through arsenic purifier, so as to remove any arsenious oxide present in it. The purified mixture is then passed through testing box.

   ii. The purified mixture is finally introduced into catalytic oxidation chamber which contains a series of vertical tubes filled with vanadium pentoxide or platinised asbestos.

   Sulphur dioxide on coming in contact with catalyst is oxidised to sulphur trioxide.

   $2SO_2 + O_2 \xrightarrow{V_2O_5 \text{ at } 450\ ^\circ C} 2SO_3$

iii. The sulphur trioxide gas is then absorbed in conc. sulphuric acid to form pyrosulphuric acid or oleum.

$SO_3 + H_2SO_4$ (conc.) $\rightarrow H_2S_2O_7$

iv. The pyrosulphuric acid is treated with calculated amount of water to form conc. sulphuric acid.

$H_2S_2O_7 + H_2O \rightarrow 2H_2SO_4$

2. It is because sulphur trioxide dissolves in water, producing a large amount of heat which changes sulphuric acid to sulphuric acid mist. The latter is very difficult to liquefy.

3. Vanadium pentoxide does not get poisoned easily as compared to platinised asbestos, if the mixture of sulphur dioxide and oxygen is slightly impure.

4. The reaction between sulphur dioxide and oxygen is exothermic in nature. Thus, once the reaction starts, it proceeds with its own heat.

5. Sulphuric acid (concentrated) is a very powerful dehydrating agent. It removes atoms of hydrogen and oxygen in the form of water from the cellulose $[(C_6H_{10}O_5)_n]$, leaving behind carbon. It is black carbon which appears in the form of black stains.