LEVEL-9

CHEMISTRY

REVISION WORKSHEET-2

2019-20

PAPER - 3

2. (5) Iron is a transition element. **(2016/SP/03)**

(a) In the blast furnace, iron(III) oxide reacts with carbon monoxide.

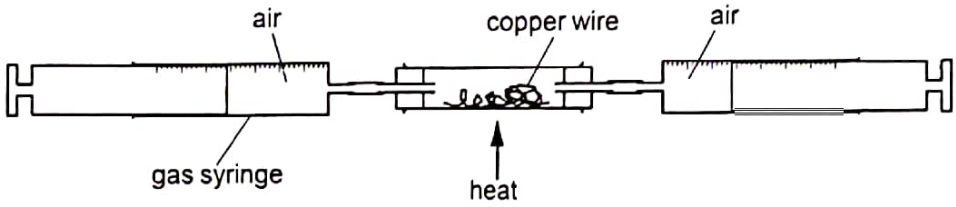
$$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$$

Which substance gets reduced in this reaction? Explain your answer.

substance ..... Fe_2O_3 Iron oxide .....

explanation ..... It loses oxygen. .....

3. 7(b) The percentage of oxygen in air can be found using the apparatus shown below. **(2016-SP-03)**



Air is passed backwards and forwards over the heated copper using the syringes. The copper reacts with oxygen in the air.

$$\text{copper} + \text{oxygen} \longrightarrow \text{copper(II) oxide}$$

As the experiment proceeds, suggest what happens to

i. the total volume of air in the gas syringes,

..... Decreases ..... [1]

ii. the mass of the wire in the tube.

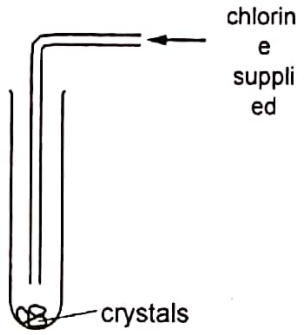
..... Increases ..... [1]

b. State one use of copper.

..... Electrical wiring. ..... [1]

4. (5 b) The halogens are a group of non-metals in Group VII of the Periodic Table. **(2015-J-31)**

(c) Iodine reacts with chlorine to form a dark brown liquid, iodine monochloride. .



$I_2(s) + Cl_2(g) \square\square\square 2ICl(l)$

dark brown

When more chlorine is added and the tube is sealed, a reversible reaction occurs and the reaction comes to equilibrium.

$$ICl(l) + Cl_2(g) \rightleftharpoons ICl_3(s)$$

dark brown — yellow

(i) Give another example of a reversible reaction.

$CuSO_4 + 5H_2O \rightleftharpoons CuSO_4 \cdot 5H_2O$ [1]

(ii) Explain the term *equilibrium*.

In a closed system, forward and backward reactions take place at the same rate. So there is no overall change. [2]

(b) Chlorine is removed from the tube and a new equilibrium is formed.

Explain why there is less of the yellow solid and more dark brown liquid in the new equilibrium mixture.

Equilibrium goes to LHS, that is reactant side, because concentration of Chlorine decreased.

[2]

(c) A sealed tube containing the equilibrium mixture is placed in ice-cold water. There is an increase in the amount of yellow solid in the equilibrium mixture.

What can you deduce about the forward reaction in this equilibrium?

$$ICl(l) + Cl_2(g) \rightleftharpoons ICl_3(s)$$

Explain your deduction. [Total: 13]

Equilibrium goes to RHS, that is product side. Exothermic reactions are favoured by low temperature. Forward reaction is exothermic.

[3]

7. (3) Quicklime, which is calcium oxide, is made by heating limestone in a furnace. **(2015-J-33)**

$$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$$

The reaction does not come to equilibrium.

a. Suggest why the conversion to calcium oxide is complete.

CO_2 is a gas. CO_2 escapes or releases in the reaction.

8. (5) The law of constant composition states that all pure samples of a compound contain the same elements in the same proportion by weight. **(2015-J-33)**

A typical experiment to test this law is to prepare the same compound by different methods and then show that the samples have the same composition.

Methods of making copper(II) oxide include:

- heating copper carbonate,
- heating copper hydroxide,
- heating copper nitrate,
- heating copper foil in air.

a. (b) Copper oxide can be reduced to copper by heating in hydrogen.

i. What colour change would you observe during the reduction?(1)

Black to brown

ii. Explain why the copper must be allowed to cool in hydrogen before it is exposed to air.(2)

Hot Copper reacts with oxygen to form Copper oxide. To avoid this, Copper must be cooled.

iii. Name another gas which can reduce copper(II) oxide to copper.(1)

carbon monoxide

iv. Name a solid which can reduce copper(II) oxide to copper.(1)

carbon or any metal more reactive than Copper.

9. (3) Ammonia is manufactured by the Haber process. Nitrogen and hydrogen are passed over a catalyst at a temperature of 450 °C and a pressure of 200 atmospheres.

The equation for the reaction is as follows. **(2015-M-32)**

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

The forward reaction is exothermic.

(a) State **one** use of ammonia.

Making fertilizers [1]

(b) What is the meaning of the symbol $\rightleftharpoons$?

Reversible reaction [1]

(c)What are the sources of nitrogen and hydrogen used in the Haber process?

nitrogen From Air

hydrogen Cracking of hydrocarbons [2]

(d) Name the catalyst in the Haber process.

Iron [1]

(e) **(i)** If a temperature higher than 450 °C was used in the Haber process, what would happen to the **rate** of the reaction? Give a reason for your answer.

Rate increases (reverse reaction favours)
More collision occurs. [2]

(ii) If a temperature higher than 450 °C was used in the Haber process, what would happen to the **yield** of ammonia? Give a reason for your answer.

Yield decreases.
Because forward reaction is exothermic reaction [2]

(f) **(i)** If a pressure higher than 200 atmospheres was used in the Haber process, what would happen to the **yield** of ammonia? Give a reason for your answer.

Yield increases.
Higher pressure favours the reaction in the direction of less number of molecules. [2]

(ii)Explain why the rate of reaction would be faster if the pressure was greater than 200 atmospheres.

At high pressure molecules come closer and more collisions occur. [1]

(iii) Suggest **one** reason why a pressure higher than 200 atmospheres is not used in the Haber process.

safety issues. [1]

10. (7)The rate of a photochemical reaction is affected by light. **(2015-N-31)**

a. The decomposition of silver bromide is the basis of film photography. This is a redox reaction.

$$2AgBr \rightarrow 2Ag + Br_2$$
cream black

step 1 $2Br^- \rightarrow Br_2 + 2e^-$

step 2 $Ag^+ + e^- \rightarrow Ag$

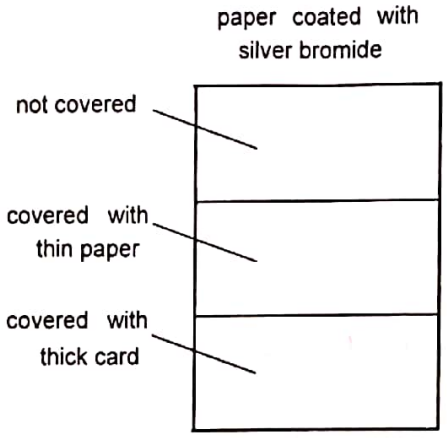
(i) Which step is reduction? Explain your answer.

Step 2: Gain of electron is reduction reaction. [1]

(ii) Which ion is the oxidising agent? Explain your answer.

Ag^+ Silver ion : Ag^+ accepts electrons [1]

(b) A piece of white paper was coated with silver bromide and exposed to the light. Sections of the paper were covered as shown in the diagram.



Predict the appearance of the different sections of the paper after exposure to the light and the removal of the card. Explain your predictions.

The not covered Section will be black.
The covered with thick card Section will be white.
The covered with thin paper Section will be grey: Because more light intensity more Silver ions are reduced. [4]

(c) Photosynthesis is another example of a photochemical reaction. Green plants can make simple carbohydrates, such as glucose. These can polymerise to make more complex carbohydrates, such as starch.

(i) Write a word equation for photosynthesis.

carbon dioxide + water $\xrightarrow[\text{chlorophyll}]{\text{light}}$ glucose + oxygen [2]

11. (4,d) A piece of magnesium was added to 100 cm^3 of an aqueous acid. The time taken for the metal to react completely was measured. This experiment was repeated using different aqueous acids. The same volume of acid was used in each experiment and the pieces of magnesium used were identical. In one experiment the reaction was carried out at a different temperature.

(2014-J-32)

experiment	Acid	concentration in mol / dm^3	temperature / °C	time / minutes
A	propanoic	1.0	20	5
B	propanoic	1.0	30	3
C	propanoic	0.5	20	8
D	hydrochloric	1.0	20	1

Explain the following in terms of collision rate between reacting particles.

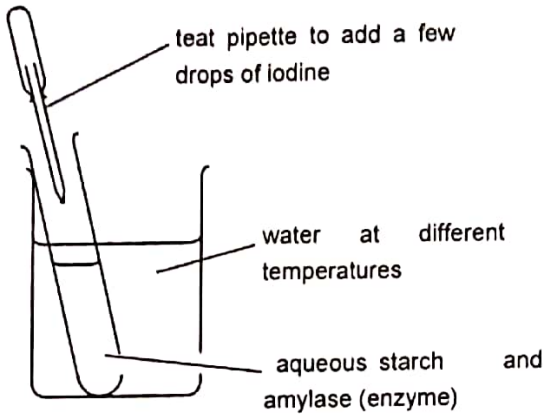
i. Why is the rate in experiment **C** slower than the rate in experiment **A**?

Concentration of acid in expt C is less or concentration of acid in expt A is more or double. [2]

(ii) Why is the rate in experiment **B** faster than the rate in experiment **A**?

Higher temperature in expt B, so particles move faster with more energy. So more successful collision. So rate of expt B is faster compared to A. [2]

(b) The effect of temperature on this reaction can be studied by the experiment shown below. Starch and iodine form a blue-black colour.Glucose and Iodine do not form a blue-black colour.



The experiment is set up as in the diagram and the time measured for the mixture to change from blue-black to colourless. The experiment is repeated at different temperatures.
Typical results of this experiment are given in the table below.

experiment	Temperature / °C	time for blue-black colour to disappear / min
A	20	30
B	40	15
C	70	remained blue-black

(i) Put the experiments in order of reaction rate – slowest first and fastest last.

C, A, B [2]

(ii)Explain why the reaction rates in experiments A and B are different.

① At higher temperature particles have more energy and move faster ② At higher temperature there will be higher rate of collision ③ more successful collisions result in high rate of reaction. Hence reaction rate in expt B is more compared to expt A. [3]

(iii) Suggest why the colour remains blue-black in experiment C.

Enzymes denatured. Hence rate of reaction is zero. [1]

16. (4)At present the most important method of manufacturing hydrogen is steam reforming of methane. **(2013-J-32)**

In the first stage of the process, methane reacts with steam at 800 °C.

$$CH_4(g) + H_2O(g) \rightleftharpoons 3H_2(g) + CO(g)$$

In the second stage of the process, carbon monoxide reacts with steam at 200 °C.

$$CO(g) + H_2O(g) \rightleftharpoons CO_2(g) + H_2(g)$$

(g) Explain why the position of equilibrium in the first reaction is affected by pressure but the position of equilibrium in the second reaction is not.

Number of molecules of reactants and products are diffrent in first reaction. So pressure affected the position of eqm. In second reaction, number of molecules of [2] reactants and products are same. no effect of pressure on eqm.

(i) Suggest why a high temperature is needed in the first reaction to get a high yield of products but in the second reaction a high yield is obtained at a low temperature.

First reaction, forward reaction is endothermic. So high temp increases yield. Second reaction, forward [2] reaction is exothermic. So low temp increases yeild.

17. (2)One of the factors which determine the reaction rate of solids is particle size.

(i) A mixture of finely powdered aluminium and air may explode when ignited.
An explosion is a very fast exothermic reaction.
This causes a large and sudden increase in temperature. **(2013-J-33)**

Explain each of the following in terms of collisions between reacting particles.

Why is the reaction between finely powdered aluminium and air very fast?

Finely powdered Al has large surface area. So many collisions between O_2 molecules and Al atoms. So reaction [2] is very fast.

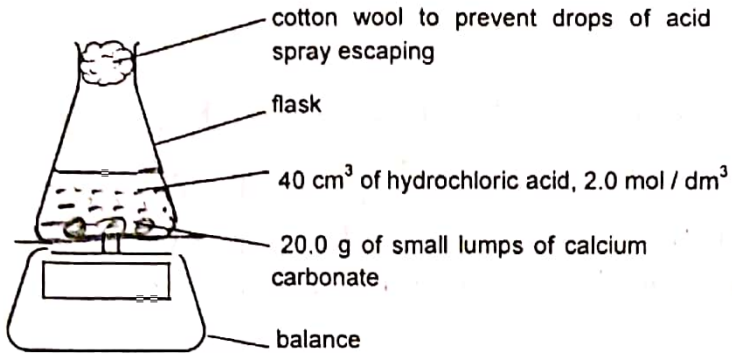
(ii) Explain why for most reactions the rate of reaction decreases with time.

concentration of reactants decreases or reactants used up. [2]

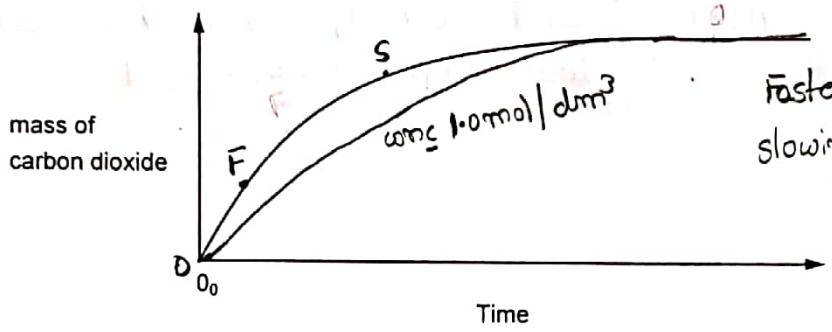
(iii) Suggest an explanation why the rate of reaction in an explosion could increase rather than decrease with time.

Increase in temperature during explosion causes molecules to move faster. So higher collision rate. More particles or molecules get enough energy to react. [3]

19. (4)20.0 g of small lumps of calcium carbonate and 40 cm^3 of hydrochloric acid, concentration 2.0 mol / dm^3, were placed in a flask on a top pan balance. The mass of the flask and contents was recorded every minute. **(2013-N-31)**



The mass of carbon dioxide given off was plotted against time.



Fastest at beginning slowing down between origin and flat section.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

In all the experiments mentioned in this question, the calcium carbonate was in excess.

(i) Explain how you could determine the mass of carbon dioxide given off in the first five minutes.

(mass at t=5) − (mass at t=0) [1]

(ii) Label the graph F where the reaction rate is the fastest, S where it is slowing down and 0 where the rate is zero. [2]

(iii) Explain how the shape of the graph shows where the rate is fastest, where it is slowing down and where the rate is zero.

Curve steepest means reaction fastest.

Curve less steep means reaction slower.

Curve flat means reaction over.

..... [2]

(b) Sketch on the same graph, the line which would have been obtained if 20.0 g of small lumps of calcium carbonate and 80 cm^3 of hydrochloric acid, concentration 1.0 mol / dm^3, had been used. [2]

(c) Explain in terms of collisions between reacting particles each of the following.

(i) The reaction rate would be slower if 20.0 g of larger lumps of calcium carbonate and 40 cm^3 of hydrochloric acid, concentration 2.0 mol / dm^3, were used.

Large lumps of calcium carbonate has smaller surface area. So lower collision rate, rate of reaction is slow. [2]

(ii) The reaction rate would be faster if the experiment was carried out at a higher temperature.

At Higher temperature, molecules get more energy, collide more frequently, more successful collision, so rate of reaction is faster. [2]

20. (3,a) Nitric acid is now made by the oxidation of ammonia. It used to be made from air and water. This process used very large amounts of electricity. **(2013-N-32)**

Air was blown through an electric arc and heated to 3000 °C.

$$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$$ **equilibrium 1**

nitric oxide

The equilibrium mixture leaving the arc contained 5 % of nitric oxide. This mixture was cooled rapidly. At lower temperatures, nitric oxide will react with oxygen to form nitrogen dioxide.

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2$$ **equilibrium 2**

Nitrogen dioxide reacts with oxygen and water to form nitric acid.

(iii) Suggest a reason why the yield of nitric oxide in **equilibrium 1** increases with temperature.[1]

The forward reaction is endothermic

(iv) What effect, if any, would increasing the pressure have on the percentage of nitric oxide in **equilibrium 1**? Explain your answer.[2]

None. Because volume of reactants and Products are the same.

Deduce why **equilibrium 2** is only carried out at lower temperatures.[2]

Because the reaction between O_2 and nitric oxide is exothermic. Lower temperature favours forward reaction (exothermic reaction).