

## SENIOR FOUR CHEMISTRY REVISION QUESTION 2020

1. (a). (i) Draw a labeled diagram of the setup of apparatus that can be used to prepare carbon dioxide using calcium carbonate, and write equation for the reaction that leads to formation of carbon dioxide (4<sup>1</sup>/<sub>2</sub> marks)
- (ii) Name one common drying agent that cannot be used for drying carbon dioxide; and give reasons for your answer. (1<sup>1</sup>/<sub>2</sub> marks)
- (b). Explain the reaction of carbon dioxide with aqueous calcium hydroxide. (your answer should include equations of reactions) (6<sup>1</sup>/<sub>2</sub> marks)
- (c). State what would be observed, and write an equation for the reaction that would take place if carbon dioxide was bubbled through water and the resultant solution was tested with litmus. (2 marks)
- (d) One industrial use of carbon dioxide
2. (a) (i) Name the raw material from which sulphuric acid can be manufactured by the contact process. (1 mark)
- (ii) With the help of equations, outline the reactions which take place during the contact process. (5marks)
- (b) Explain why fuming sulphuric acid has no effect on litmus paper whereas dilute sulphuric acid readily turns blue litmus paper red. (3 marks)
- (c) State what would be observed and write equation for the reaction that would take place when concentrated sulphuric acid was added to;
- (i) Sugar. (3 <sup>1</sup>/<sub>2</sub> marks)
- (ii) heated sodium chloride crystals (2<sup>1</sup>/<sub>2</sub> marks)
3. (a) State one difference between fats and oils. (1 mark)
- (b) Fats and oils can be used to make soap and detergents.
- (i) State what is meant by the term soap. (1 mark)
- (ii) Briefly describe how soap can be prepared. (No equation is required) (3 marks)
- (c)(i) Name one substance which when in water can cause permanent hardness of water. (1 mark)

(ii) State one chemical method of removing permanent hardness of water.

(1 mark)

(i) Write an ionic equation for the reaction involved in (c) (ii) above. ( $1\frac{1}{2}$  marks)

(a) Soap solution was added to hard water.

(i) State what was observed. (1 mark)

(ii) Write an ionic equation for the reaction. ( $1\frac{1}{2}$  marks)

(b) (i) Why are detergents preferred for use rather than soap? (1 mark)

(iii) State one disadvantage of using detergents. (1 mark)

4. Spathic iron is one of the major ores of iron

(a) Write the chemical name and formula of spathic iron (1 mark)

(b) During the extraction of iron, spathic iron is first roasted in air before being transferred into the Blast furnace. State the purpose of roasting the ore in air (1 mark)

(c) Name;

(i) the major impurity in iron ore (1 mark)

(ii) two substances, which are fed into the Blast furnace together with roasted iron ore (1 mark)

(iii) any other substance that is also fed into the furnace, and describe where from the substance is let into the furnace (1 mark)

(d) Using equations only, outline reactions which take place inside the Blast furnace up to

(i) Formation of iron ( $3\frac{1}{2}$  marks)

(ii) Removal of the major impurity in the ore (2 marks)

(e) State the importance of slag during extraction of iron in the furnace. (1 mark)

(f) Describe how iron reacts with

(i) Water (2 marks)

(ii) Chlorine (2 marks)

5. (a) Explain how nitric acid can be prepared in the laboratory. (No diagram is required; but your answer should include equation for reaction leading to formation of nitric acid.) (6 1/2 marks)

(b) (i) Write equation for the reaction of concentrated nitric acid with carbon. (1 1/2 marks)

(ii) State one use of nitric acid, other than preparation of nitrates. (1/2 mark)

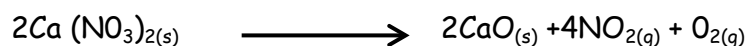
(c). Nitric acid reacts with metals to form metal nitrates.

Write equation to show the effect of heat on;

(i) Silver nitrate. (1 1/2 marks)

(ii).Sodium nitrate. (1 1/2 marks)

(d) Calcium nitrate decomposes when heated to produce nitrogen dioxide as shown by the following equation.



Calculate the mass of calcium nitrate that when heated; would produce 896.0cm<sup>3</sup> of nitrogen dioxide measured at s.t.p. (3 1/2 marks)

(N = 14, O = 16, Ca = 40; 1 mole of a gas occupies 22.4 dm<sup>3</sup> at s.t.p).

6. a) Copy and complete the table below which shows the laboratory preparation of the two gasses.

(4 marks)

Gas	Name of reagents from which the gas is prepared	Method of collection	Effect on blue litmus
Sulphur dioxide			
Ammonia			

- b) i) State the condition for the reaction in each case. (1½ marks)  
 ii) Write an equation leading to the formation of sulphur dioxide. (1½ marks)

- c) Write crystals of solid Q when heated decompose forming a yellow residue on cooling and a reddish-brown mixture of gases.

- i) Identify Q (½ marks)  
 ii) Write an equation for the decomposition of Q. (1½ marks)

- a) The yellow residue in (c) above was dissolved in hot dilute hydrochloric acid and the mixture left to cool.

- i) State what was observed. (1 mark)  
 ii) Write an equation for the dissolution of the yellow solid in dilute hydrochloric acid.

(1½ marks)

- b) An aqueous solution of solid Q was made and divided into two parts. To the first part was added ammonia solution drop wise until excess and to the second part sodium chloride solution and the mixture warmed,

- i) State what was observed in each case. (1½ marks)  
 ii) Write an ionic equation for the reaction of an aqueous solution of Q with sodium chloride solution. (1 mark)

7. a) Define the terms:

(4 marks)

- i) Standard solution

- ii) Molar solution. Give an example in each case.  
b)  $48\text{cm}^3$  of a solution containing  $7.0\text{g}$  of potassium hydroxide per litre required  $25.0\text{cm}^3$  of  $0.12\text{M}$  phosphoric acid,  $\text{H}_3\text{PO}_4$  for complete neutralization. Calculate the mole ratio in which the acid reacts with the alkali.

**(4 marks)**

- a) Complete combustion of  $10.0\text{g}$  of a hydrocarbon produced  $33.85\text{g}$  of carbon dioxide gas.

i) Calculate the percentage by mass of carbon in the hydrocarbon.

**(2 marks)**

ii) Calculate the empirical formula of the hydrocarbon and hence the molecular formula (molar mass of the hydrocarbon is 26).

**(5 marks)**

8. a) i) Distinguish between natural polymers and synthetic polymers. **(2 marks)**

ii) Give two examples of each of the polymers in a(i) **(2 marks)**

- b) The structure of a polymer is given below  $(\text{CH}_2\text{CH}_2)_n$

i) Name the type of polymerization by which the polymer is formed

**(1 mark)**

ii) Write the structure formula of the monomer from which the polymer is obtained.

**(1 mark)**

iii) Name the polymer

**(1 mark)**

iv) State two disadvantages of materials made from the polymer.

**(1½ marks)**

v) Name one natural polymer that is formed by the type of polymerization as the polymer above.

**(1 mark)**

vi) Write equation for the reaction of the monomer of  $(\text{CH}_2\text{CH}_2)_n$  with bromine.

**(1 mark)**

c) i) What is sewage?

**(1½ marks)**

ii) Explain the role of bacteria in sewage treatment.

**(1 mark)**

iii) State one use of sewage sludge.

**(1 mark)**

9. a) i) Describe how a pure sample of Iron (II) sulphate-7-water can be prepared in the laboratory.

**(5½ marks)**

ii) Write an equation for the reaction.

**(1½ marks)**

b) i) State what would be observed when iron (II) sulphate-7-water was heated strongly.

(3 marks)

ii) Write an equation for the reaction in b(i).

(1½ marks)

c) Sodium hydroxide solution was added drop wise to a solution iron (II) sulphate until there was no change.

i) State what was observed.

(1½ marks)

ii) Give a reason for your observation in c(i).

(½ mark)

iii) Write an equation for the reaction.

(1½ marks)

10. (a). Name two substances from which ammonia can be manufactured; and write equation for the reaction leading to the formation of ammonia. (2½marks)

(b). State two conditions under which ammonia can react with oxygen; and write equation in each case, to show the reaction that takes place. (4marks)

(c). The product in one of the reactions in (b) is used in the production of nitric acid on a large scale.

Identify the product, and write equation(s) only to show it is converted into nitric acid.

(3½ marks)

(d). Explain the reaction of nitric acid with copper.

(5 marks)

11. (a). Haematite is an ore of iron from which the metal is extracted.

Write the chemical name and formula of haematite.

(02 marks)

(b). During the extraction of iron in the blast furnace, carbon monoxide is formed, which converts the ore into iron and slag is also produced.

(i) Outline the reactions leading to the formation of carbon monoxide and subsequently to the conversion of the ore to iron.

(06 marks)

(ii). Write the chemical name of the slag and explain how it is formed. (05 marks)

(c). Most of the iron that is extracted is used for making steel, which is more commonly used instead of pure iron. State what steel is and give two reasons why it is more commonly used instead of pure iron.

(2marks)

12. (a) (i) Outline an experiment which can be carried out to show that the rate of the reaction between calcium carbonate and dilute hydrochloric acid depends on the surface area of the calcium carbonate. (No equations or diagrams required)  
(7 marks)

(ii) State two conditions that would affect the rate of reaction in (i) other than the surface area of the calcium carbonate  
(1mark)

(b) In an experiment to investigate the rate of the reaction of magnesium with dilute sulphuric acid, a flask containing magnesium and sulphuric acid was weighted after every 10 minutes for a total time interval of 50 minutes. The results obtained are shown in the table below..

Time (minutes )	0	10	20	30	40	50
Mass of flask +contents (g)	95.9	64.5	39.0	24.4	15.0	11.9

- (i) Plot the graph of mass of flask + contents against time. (4 marks)  
(ii) Determine the rates of the reaction after 15.0 and 27.5 minutes respectively and comment on your results.

13. (a) Draw a labeled diagram of the set up of apparatus that can be used in the laboratory preparation of nitric acid. (3 marks)

- (b) Write equation for the reaction that occurs;  
(i) during the laboratory preparation of nitric acid (1  $\frac{1}{2}$  marks)  
(ii) when nitric acid decomposes (1  $\frac{1}{2}$  marks)

(c) Describe the effect of heat on the following nitrates and write equation for the reaction that takes place in each case.

- (i) Mercury (II) nitrate  
(ii) Lead (II) nitrate

(a) A When 40.0cm<sup>3</sup> of a 2M nitric acid was mixed with 40.0cm<sup>3</sup> of a 2M sodium hydroxide solution at an initial temperature of 25.8°C, the temperature of the solution rose to T°C.

Determine T. (S.H.C of water =  $4.2\text{Jg}^{-1}\text{K}^{-1}$  density of water =  $1\text{gcm}^{-3}$ ; and enthalpy of neutralization of nitric acid by sodium hydroxide =  $56.5\text{KJmol}^{-1}$ )

(4 marks)

14. (a) (i) Name two substances that are used together to prepare nitric acid in the laboratory and write equation for the reaction leading to the formation of nitric acid. (3 marks)

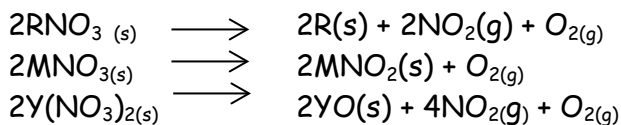
(ii) Explain the laboratory preparation of nitric acid (No diagram or equation required) (6 marks)

(b) Write the equation to show the reaction between nitric acid and;

(i) sodium hydrogen carbonate (1½ marks)

(ii) sulphur (1½ marks)

(b) The following equations show the effect of heat on the nitrates of metals R, M and Y



Suggest the possible identity of

(i) R (1 mark)

(ii) M (1 mark)

(iii) M (1 mark)

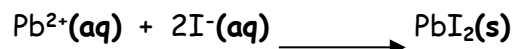
15. a) Describe how you would prepare pure crystals of lead (II) nitrate in the laboratory starting from lead (II) oxide. Write an equation for the reaction that takes place.

b) State what happens when lead (II) nitrate is strongly heated.

c) State what is observed if ammonia solution is gradually added to a solution of lead (II) nitrate until the alkali is in excess. Write an equation for the reaction that takes place.

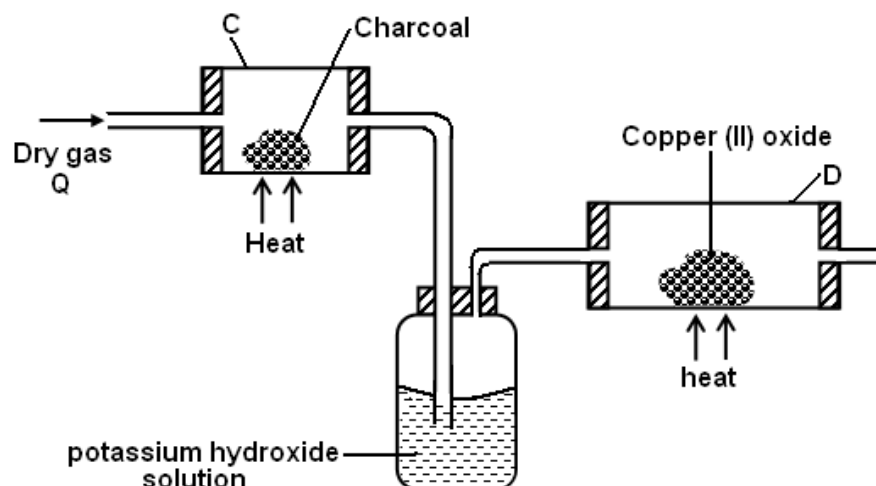


- d) Lead (II) ions react with iodide ions according to the following equation.



400cm<sup>3</sup> of a 1M solution of iodide ions was added to a solution containing excess lead (II) ions. Calculate the mass in grams of lead (II) iodide formed. (Pb = 207, I = 127)

16. a) i) State two properties which show that air is a mixture.  
ii) Name two other gases other than oxygen that are constituents of air and give their approximate percentages in air.
- b) Describe an experiment to determine the percentage of oxygen in air, show how the percentage can be calculated from the results.
- c) i) State what is observed when burning sulphur is lowered into a jar of oxygen.  
ii) Write the name and formula of the product of the reaction between sulphur and oxygen.
17. An experiment to prepare carbon monoxide and investigate its effect on copper (II) oxide was carried out using apparatus in the diagram below. Use it to answer questions that follow.



- a)
  - i) Name gas Q
  - ii) Write equation for the reaction that took place in tube C.
- b)
  - i) Explain using an equation the purpose of potassium hydroxide solution.
  - ii) State what was observed in the tube D.
  - iii) Write an equation and name for the reaction that took place.
- c)
  - i) Why is this experiment carried out in a fume board?
  - ii) Give one industrial application of carbon monoxide gas.
- d) Using equations, briefly describe what happens when:
  - i) Burning magnesium is lowered in to gas jar of carbon dioxide.
  - ii) Excess carbon dioxide is passed into a solution of calcium hydroxide and then heated.

18. a) Define the following terms:

- i) Molarity
- ii) Standard solution

b) 16g of impure anhydrous potassium carbonate was dissolved in water and diluted to make one liter.  $25\text{cm}^3$  of this solution required  $24\text{cm}^3$  of 0.2M dilute hydrochloric acid for complete reaction.

- i) Write the equation for the reaction
  - ii) Determine the moles of acid that reacted
  - iii) Determine the moles of potassium carbonate that reacted.
- c) Calculate:
- i) Concentration of potassium carbonate in moles/liter
  - ii) Concentration of potassium carbonate in g/l
  - iii) Percentage of a pure carbonate in the impure carbonate.
- (K = 39, C = 12, O = 16)

19. (a) State what is observed when hydrochloric acid reacts with each of the following.

(i) a piece of zinc metal

(ii) Copper (II) oxide

(i) Calcium carbonate.

(4  $\frac{1}{2}$  marks)

(b) Write equation for each of the reactions above.

(4  $\frac{1}{2}$  marks)

(c) In an experiment to determine the basicity of an acid HnX the following results were obtained

20.00 cm<sup>3</sup> of 0.05 M HnX was found to react with 10.00 cm<sup>3</sup> of 0.2M NaOH solution.

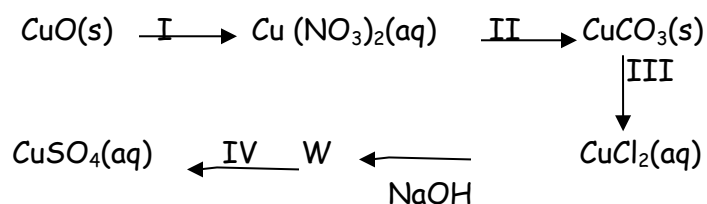
(i) Write equation for the reaction.

(1  $\frac{1}{2}$  marks)

(ii) Calculate the number of moles of acid and sodium hydroxide that reacted and hence determine the basicity of the acid.

20 . A series of reactions was carried out with different chemical reagents in order to obtain

copper II crystals.



- (a) (i) What chemical reagents would be used for stages I, III, III, IV? (4 marks)
- (ii) Write equations for the reactions at stage I and II. (3 marks)
- (b) (i) Identify the solid W. (1 mark)
- (ii) What is observed when sodium hydroxide is added to a solution of copper II chloride. (1 mark)
- (c) Describe how you would obtain dry copper II sulphate crystals from copper II sulphate solution. (2 marks)
- (d) Copper II sulphate crystals were heated gently and then strongly.
- (i) State what was observed. (2 marks)
- (ii) Write equation(s) for the reactions that took place. (2 marks)