

Merryland high school
Chemistry department
s.4 holiday work

- Describe an experiment that can be carried out to determine the heat of combustion of ethanol. (Illustrate with a diagram)
 - Why is the value of heat of combustion lower than expected?
 - When 0.382g of ethanol was burnt, the heat evolved raised the temperature of 100g of water from 16.5^oC to 43.5^oC. Calculate the heat of combustion of ethanol. (Specific heat capacity of water is 4.2 Jg⁻¹ °C⁻¹)
 - Name two products other than water of incomplete combustion of ethanol.

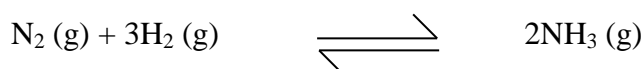
- What is rate of reaction?
 - How does particle size affect rate of reaction? Explain your answer
 - The table of results below shows the time taken for sulphur to form when various concentrations of sodiumthio-sulphate solution were reacted with a dilute acid.

Concentration of S ₂ O ₃ ²⁻ (M)	0.2	0.6	0.8	1.2	1.6
Time for sulphur to form(s)	60	20	15	10	75
¹ / _t (S – 1)	0.017	0.05	0.07	0.10	0.13

- Plot a graph of ¹/_t (s – 1) vertical axis against concentration
 - Explain the relationship between a rate of reaction and ¹/_t
 - Deduce from the graph how the rate of the reaction varies with the concentration of thiosulphate.
- Name one reagent that you would use to test for sulphurdioxide and state what would be observed if the reagent was used.
- Name the raw materials used for the manufacture of ammonia
 - Write equation leading to the formation of ammonia in a(i)
 - Explain how formation ammonia is affected by: -
 - Pressure
 - Temperature
 - State another factor that affects the formation of ammonia.
 - Dry ammonia was passed over heated copper (II) oxide until was no further change. State what was observed and explain your answer.

- Describe how sodium carbonate powder can be obtained in the laboratory starting from sodium hydroxide. Write equations for the reactions that take place
 - Crystals of sodium carbonate decahydrate (Na₂CO₃.10H₂O) were exposed to air for about two days.
 - State what was observed
 - Name the process that took place
 - Write an equation for the reaction that took place.
 - Calculate the number of moles of sodium ions, in one litre of 2M sodium carbonate solution

- The enthalpy of formation of ammonia from hydrogen and nitrogen as shown by the following equation is negative.



Explain why maximum yield of ammonia is favoured by

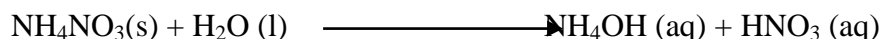
- i) high pressure (2 marks)
 ii) low temperature (2 marks)

b) State one other factor that would favour high yield of ammonia other than temperature and pressure. (½ mark)

c) Ammonia can be oxidized in the presence of a catalyst to nitric acid.

- i) Name the catalyst and state its role during oxidation of ammonia to nitric acid. (1 ½ marks)
 ii) Outline using equations only the reactions leading to the formation of nitric acid from ammonia. (4 ½ marks)

d) Ammonium nitrate is widely used as a nitrogen fertilizer. The salt dissolves in water according to the following equation.



- i) State what is meant by the term fertilizer. (1 mark)
 ii) Explain why the soil on which ammonium nitrate is often used as a fertilizer becomes acidic. (3 ½ marks)

6. a) Explain briefly what is meant by the term enthalpy of neutralization.

(3 marks)

b) The table below shows the maximum temperature of the resultant solution formed when various volumes of 2M potassium hydroxide solution was added to 20cm³ portions of 2M nitric acid.

Volume of KOH(cm ³)	0	5	10	15	20	25	30	35
Volume of HNO ₃ + KOH cm ³	20	25	30	35	40	45	50	55
Temperature °C	22	25.6	29.2	32.8	35.6	31.8	27.8	23.8

Plot a graph of temperature against volume of sodium hydroxide.

(4 marks)

c) Using the graph, determine:-

- i) the volume of potassium hydroxide required to completely neutralize 20.0cm³ of 2M nitric acid. (1 mark)
 ii) temperature of the resultant solution at the neutralization point.

d) Calculate the:

- i) number of moles of nitric acid used. (1 mark)
 ii) molar enthalpy of neutralization of nitric acid. (Specific heat capacity of resultant solution is 4.2Jg⁻¹°C⁻¹, density of the resultant solution is 1gcm⁻³) (3 marks)

e) State how the enthalpy of neutralization of ethanoic acid by potassium hydroxide would compare with that of nitric acid. Explain your answer.

(2 marks)

7. a) Copper (II) Sulphate -5-water is a blue crystalline solid. Write the chemical formula of copper (ii) sulphate-5-water. (1 mark)

b) When exposed in dry air, copper (ii) sulphate-5-water turns into a white powder.

- i) Explain (2 marks)

ii) Write equation to illustrate your explanation in (b) (i). (1 ½ marks)

c) Anhydrous copper (ii) sulphate decomposes on heating, giving off sulphur dioxide.

Name

i) the other substance that is produced together with sulphur dioxide.

(1 mark)

ii) One laboratory reagent that can be used to identify sulphur dioxide, and state what would be observed if sulphur dioxide was treated with the reagent that you have named.

(2 marks)

d) Explain your observation in (c) (ii)

(1 ½ marks)

e) A moist blue coloured flower lost its colour when it was placed in a gas jar containing sulphur dioxide.

i) Give a reason for the above observation.

(1 mark)

ii) State one industrial application of the property of sulphur dioxide shown in the above observation.

(1 mark)

f) To aqueous copper (ii) sulphate solution was added dilute sodium hydroxide dropwise until in excess.

i) State what was observed and write ionic equation for the reaction that took place.

(2 ½ marks)

ii) Aqueous ammonia was added to the product in (f). State and explain what was observed.

(1 ½ marks)

8. a) Carbon dioxide can be prepared in the laboratory using calcium carbonate and a substance T.

i) Identify T and write equation for the reaction leading to the formation of carbon dioxide.

(2 ½ marks)

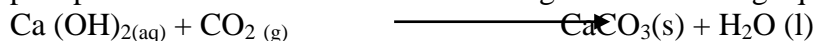
ii) Draw a labeled diagram for the set up of apparatus that can be used to prepare a dry sample of carbon dioxide starting from calcium carbonate.

(3 marks)

iii) With the aid of the diagram that you have drawn in (a)(ii) explain the preparation of carbon dioxide.

(3 marks)

b) When bubbled through calcium hydroxide solution, carbon dioxide reacted to form a white precipitate of calcium carbonate according to the following equations.



Calculate the mass of dry calcium carbonate that would be obtained if 600.0cm³ of carbon dioxide, measured at room temperature was bubbled through calcium hydroxide solution. (Ca=40, C=12, O=16; 1 mole of a gas occupies 24.0dm³ at room temperature)

(2 marks)

c) More carbon dioxide was bubbled through a mixture containing calcium carbonate as in (b).

i) State what was observed and explain the reaction that took place.

(No equation is required)

(2 ½ marks)

d) Burning magnesium was lowered into a jar of carbon dioxide. Write equation for the reaction that took place.

(1 ½ marks)

9. The formulae of three organic compounds are



- (a) State the name of each compound.
- (b) To which class of the compounds does each compound belong.
- (c) Which one of the compounds under goes
- polymerisation
 - dehydration
- (b) Write the structure of
- the product of polymerization in (c) (i)
 - the organic product in (c) (i).
- (c) Calculate the mass of carbon dioxide formed when one mole of CH_3CH_3 burns completely in oxygen.
- (d) What is the danger of burning CH_3CH_3 in limited supply of oxygen?
10. (a) (i) Describe how you would prepare dry sample of ammonia gas from ammonium chloride in a chemistry laboratory.
- Write the equation for the reaction.
- (b) Explain using equations where necessary,
- What happens when ammonia is passed over heated copper (II) oxide?
 - How would you test a given solution for the presence of ammonium ions?
- (b) What is the importance of ammonium salts in the soil and how do these salts affect the pH of soil?
11. (a) What is meant by the term fermentation?
- (b) (i) Name any **two** crop materials which are used to obtain ethanol in Uganda.
- Briefly describe how ethanol will be obtained from one of the materials you have named in (b) (i) above. (Diagram not required).
 - Write a balanced equation for the fermentation of glucose.
- (c) How do the local brewers purify their ethanol? (Diagram not required)
- (d) Give **two** bad social effects of consuming ethanol.
12. The rate of production of hydrogen by the reaction of an excess of 0.5M hydrochloric acid was investigated using 0.24g of magnesium ribbon. The following results were obtained.

Time(s)	0	30	60	90	120	150	180	210
Total volume of H ₂ (cm ³) at room temp.	0	80	140	190	220	240	250	250

(a) Draw a labeled diagram of the set up of apparatus which could be used to perform this experiment. (3 marks)

(b) Plot a graph of volume of hydrogen (vertical axis) against time (horizontal axis) (4 marks)

(c) State why an excess acid was used. (1 mark)

(d) On the same graph in (b) sketch the curves that you would expect if the experiment was repeated under same conditions but using:

(i) 0.4M HCl instead of 0.5M HCl and label this curve P (1 mark)

(ii) Same quantity of magnesium powder instead of magnesium ribbon. Label this curve Q (1 mark)

(iii) Explain the shapes of curves P and Q that you have sketched in (d) (i) and (ii) (3 marks)

(e) Explain how the final volume of the gas would change if

(i) 0.18g of magnesium was used with the same volume of the acid. (1 mark)

(ii) A larger volume of the acid was used with the same mass (0.24g) of magnesium ribbon. (1 mark)

13. (a) Describe how a pure dry sample of potassium nitrate crystals can be prepared in the laboratory. (6 ½ marks)

(b) A sample of potassium nitrate crystals was heated strongly until no further change

(i) Write equation for the reaction that took place. (1 ½ marks)

(ii) Calculate the loss in mass if 20.2g of potassium nitrate crystals was completely decomposed. (K = 39 N = 14 O = 16) (3 ½ marks)

(c) A mixture of concentrated sulphuric acid and potassium nitrate was heat gently

(i) State what was observed and write equation for the reaction that took place. (2 ½ marks)

(ii) State the practical application of the reaction in (c) (i) (1 mark)

14. (a) Explain the extraction of sulphur from its ore by the Frasch process. (No diagram is required) (5 marks)

(b) Describe how a sample of monoclinic sulphur can be prepared in the laboratory (4 marks)

(c) Outline how sulphur reacts with each of the following substances. In each case write an equation for the reaction that takes place

(i) Concentrated sulphuric acid (3 marks)

(ii) Oxygen (2 marks)

(a) State two uses of sulphur (1 mark)

15. a) What is meant by reaction rate?

- b) Describe an experiment to show the effect of concentration of reactants on the rate of the reaction.
- c) 2.4 g of magnesium powder was added to 25 cm³ of dilute sulphuric acid at 23°C.
- Sketch a graph to show how the rate of the reaction would vary with temperature.
 - On the same graph, Sketch another graph to show what would happen to the rate when the temperature was increased to 30°C but keeping the mass of magnesium powder.
 - Explain the shape of your graphs in c(ii) above.
 - Calculate the molarity of the acid (Mg= 24, H=1, S=32, O=16)