

**K.C.S.E YEAR 2010
PAPER 1**

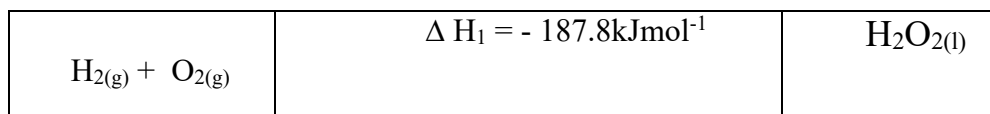
1.
 - a) Distinguish between a deliquescent and a hygroscopic substance.
(2 marks)
 - b) Give **one** use of hygroscopic substance in the laboratory.
(1 mark)
2. a) What is meant by the terms:
(2 marks)
 - a. element
 - b. atomic number

b) The formula for a chloride of titanium is $TiCl_3$. What is the formula of its sulphate?
(1 mark)
3. What is the name given to each of the following:
 - a) Ability of a metal to be made into a wire:
(1 mark)
 - b) Minimum energy required for a chemical reaction to start;
(1 mark)
 - c) Type of force that hold atoms of neon together?
(1 mark)
4. Draw the structure and give the name of the three alkaline having molecular formula C_5H_{10}
(3 marks)
5. Hydrated cobalt(II) chloride exists as pink crystals and anhydrous cobalt(II) chloride is a blue powder. Describe a laboratory experiment that can be used to show that the action of heat on hydrated cobalt(II) chloride is a reversible reaction.
(3 marks)
6. Aluminium oxide reacts with both acids and bases.
 - a) Write an equation for the reaction between aluminium oxide and hydrochloric acid.
(1 mark)
 - b) Using the equation in (a) above, calculate the number of moles of hydrochloric acid that would react completely with 153.0g of aluminium oxide. (AL = 27.0, O = 16.0)
(2 marks)
7. Complete the table below by writing the product formed at the electrodes during the electrolysis of the electrolytes given in the table.
(3 marks)

Electrolyte	Product at anode	Product at cathode
Aqueous sodium sulphate using inert electrodes	oxygen (1/2 mark)	Hydrogen (1/2 mark)

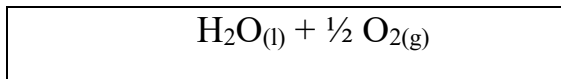
Aqueous copper(II) sulphate using copper electrodes	Copper ions (1 mark)	Copper metal (1 mark)
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8. The pressure of nitrogen gas contained in a 1dm^3 cylinder at -196°C was 10^7 Pascals. Calculate the:
- Volume of the gas at 25°C and 10^5 Pascals.
(1 ½ marks)
 - Mass of nitrogen gas (Molar volume of gas is 24dm^3 , $N = 14.0$)
(1 ½ marks)
9. Carbon -14, $^{14}_6\text{C}$, is used in carbon dating. It decays to form nitrogen, $^{14}_7\text{N}$. The graph below shows the amount of carbon -14 left in a sample against its age in years.
- Write a nuclear equation for the decay process of carbon -14.
(1 mark)
 - From the graph, determine the;
 - Half-life of carbon -14;
(1 mark)
 - Percentage of carbon -14 in a sample whose age is 1950 years.
(1 mark)
10. The figure below shows an energy cycle.



$$\Delta H_2 = -285.8\text{kJmol}^{-1}$$

$$\Delta H_3$$



- Give the name of the enthalpy change ΔH_1 .
(1 mark)
 - Determine the value of ΔH_3 .
(2 marks)
11. Hydrogen sulphide is a highly toxic and flammable gas. It is normally prepared in a fume chamber.
- Name **two** reagents that can be used to prepare hydrogen sulphide in the laboratory.
(1 mark)

- b) One of the uses of hydrogen sulphide is to produce sulphur as shown in the following equation;



Identify the reducing agent in this reaction and give a reason for your answer.

(1 mark)

- c) Other than production of sulphuric(IV) acid, state **one** commercial use of sulphur.

(1 mark)

12. A beaker contained 75.0cm^3 of aqueous copper (II) sulphate at 23.7°C . when scrap iron metal was added to the solution, the temperature rose to 29.3°C .

- a) Write an ionic equation for the reaction that took place.

(1 mark)

- b) Given that the mass of copper deposited was 5.83g , calculate the molar enthalpy change in kJmol^{-1} . (specific heat capacity of solution = $4.2\text{Jg}^{-1}\text{K}^{-1}$, density of solution 1.0gcm^{-3} , $\text{Cu} = 63.5$)

(2 marks)

13. Some animal and vegetable oils are used to make margarine and soap. Give the reagents and conditions necessary for converting the oils into:

- a) Margarine

(2 marks)

- b) Soap

(1 mark)

14. Using electrons in the outermost energy level, draw the dot (.) and cross (x) diagrams for the molecules H_2O and C_2H_4 . ($\text{H} = 1$, $\text{C} = 6$, $\text{O} = 8$)

(2 marks)

- i) H_2O

- ii) C_2H_4

- b) The formula of a complex ion is $\text{Zn}(\text{NH}_3)_4^{2+}$. Name the type of bond that is likely to exist between zinc and ammonia in the complex ion.

(1 mark)

15. Carbon (II) oxide is described as a “silent killer”

- a) State **one** physical property of carbon (II) oxide that makes it a “silent killer”

(1 mark)

- b) State and explain **one** chemical property that makes carbon (II) oxide poisonous to human beings (2 marks)

16. A sample of fertilizer is suspected to be calcium ammonium nitrate. Describe chemical tests for each of the following ions in the sample:

- a) Calcium ions;

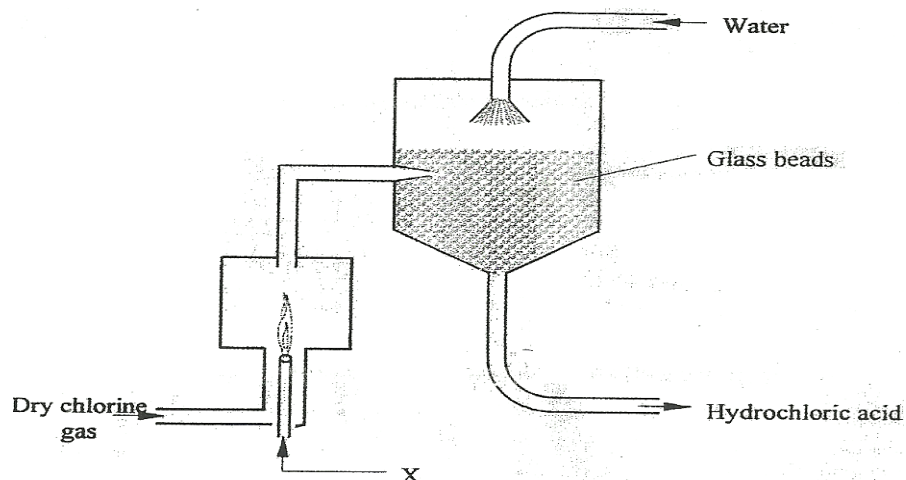
(2 marks)

- b) Ammonium ions.

(1 mark)

17. Analysis of a compound showed that it had the following composition: 69.42% carbon, 4.13% hydrogen and the rest oxygen.

- a) Determine the empirical formula of the compound. (C = 12.0, H = 1.0, O = 16.0)
(2 marks)
- b) If the mass of one mole of the compound is 242, determine its molecular formula
(1 mark)
18. The diagram below represents set up for large scale manufacture of hydrochloric acid. Study it and answer the questions that follow.

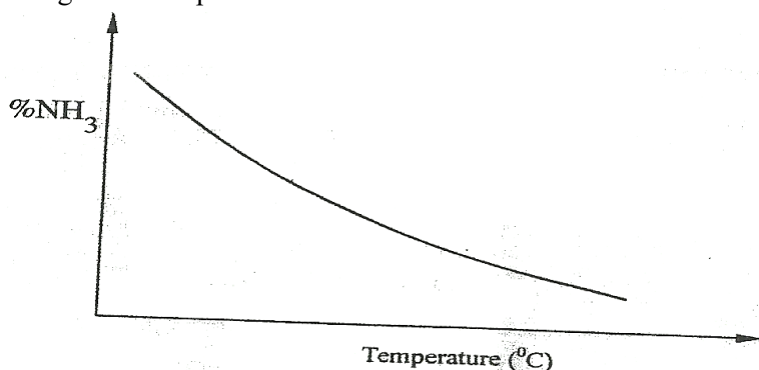


- a) Name substance X
(1 mark)
- b) What is the purpose of the glass beads?
(1 mark)
- c) Give two uses of hydrochloric acid.
(1 mark)
19. The half equations involved in a cell are:
- $$2H_2O(l) + 2e = H_{2(g)} + 2OH_{(aq)}; E^{\theta} = - 0.83V$$
- $$O_{2(g)} + 2H_2O(l) + 4e = 4OH_{(aq)}; E^{\theta} = + 0.40V$$
- a) Write the overall equation for the electrochemical cell.
(1 mark)
- b) Calculate the e.m.f. generated by a battery consisting of ten cells.
(1 mark)
- c) State **one** environment advantage of using these cells in spacecrafts.
(1 mark)
20. In an experiment to prepare nitrogen (I) oxide, ammonium nitrate was gently heated in a flask.
- a) Write the equation for the reaction that took place in the flask.
(1 mark)
- b) State and explain how the gas was collected.
(1 mark)

- c) A sample of the gas was tested with damp blue and red litmus papers. What observations were made?
21. The use of CFCs has been linked to depletion of the ozone layer.
- What does CFC stand for?
(1 mark)
 - Explain the problem associated with the depletion of the ozone layer
(1 mark)
 - State another environment problem caused by CFCs
(1 mark)
22. Nitrogen and hydrogen react to form ammonia gas as shown in the following equation:

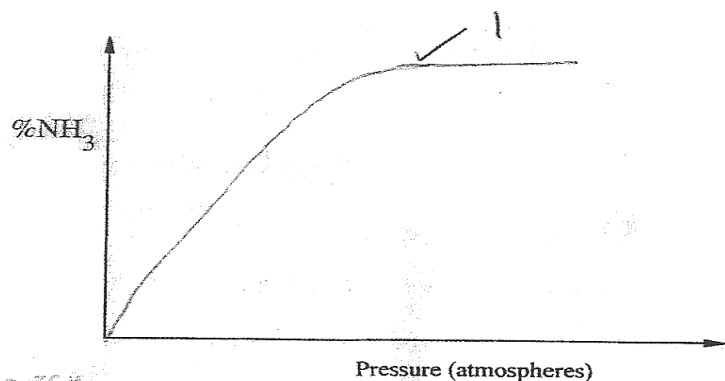


- a) The figure below shows how the percentage of ammonia in the equilibrium mixture change with temperature.

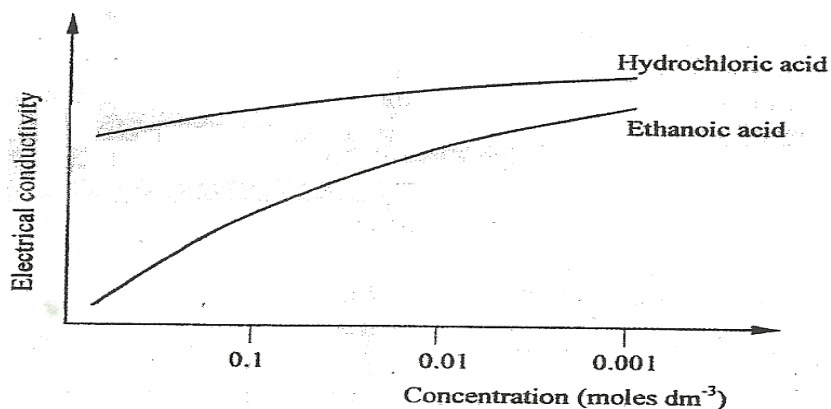


Explain why the percentage of ammonia gas change as shown in the figure.
(2 marks)

- b) On the axes below, sketch a graph showing how the percentage of ammonia gas in equilibrium mixture changes with pressure.



23. The curves below shows how the electronic conductivity of hydrochloric and ethanoic acids vary with concentration.



Explain why the electrical conductivity of 0.01M hydrochloric acids is higher than that of 0.01M ethanoic acid.

(2 marks)

24. Describe how a solid sample of the double salt, ammonium iron(II) sulphate, can be prepared using the following reagents; Aqueous ammonia, sulphuric(VI) acid and iron metal.

(3 marks)

25. A sample of river water was divided into three portions. The table below shows the test carried out on the portions and the observations made.

Test	Observation	Inference
To the first portion, 1cm ³ of soap solution was added	No lather formed	
The second portion was boiled, cooled and 1cm ³ of soap solution was added	No lather formed	
To the third portion, 3cm ³ of aqueous sodium carbonate was added, the mixture filtered and 1cm ³ of soap solution added to the filtrate.	Lather formed immediately	

Complete the table by filling in the inferences.

(3 marks)

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26. A water trough, aqueous sodium hydroxide, burning candle, watch glass and a graduated gas jar were used in an experimental set up to determine the percentage of active part of air. Draw a labeled diagram of the set up at the end of the experiment.

(3 marks)

27. The atomic numbers of phosphorus, sulphur and potassium are 15, 16 and 19 respectively. The formulae of their ions are P^{3-} , S^{2-} and K^{+} . These ions have the same number of electrons.

a) Write the electron arrangement for the ions.

(1 mark)

b) Arrange the ions in the order of increasing ionic radius starting with the smallest. Give a reason for the order.

(2 marks)