

ICSE-Science 2 (Chemistry) 1997

Answers to this Paper must be written on the paper provided separately.

You will not be allowed to write during the first 15 minutes.

This time is to be spent in reading the Question Paper.

The time given at the head of this paper is the time allowed for writing the answers.

Section I is compulsory. Attempt any four questions from Section II.

The intended marks for questions or parts of questions are given in brackets [].

SECTION I (40 Marks)

*Attempt **all** questions from this Section*

Question 1

(a) Name one element, in each case, to which the following descriptions could apply: [4]

(i) The molten metal which gives white fumes when reacting with chlorine;

(ii) The burning metal which combines directly with nitrogen;

(iii) The metal which combines directly with sulphur on heating;

(iv) The non-metal which forms two compounds when reacting with chlorine.

Question 1

(b) Name the gas that you can obtain in the laboratory from each of the following and write the equation for the reaction taking place in each case; [6]

(i) Ammonium nitrite;

(ii) Ammonium chloride;

(iii) Ammonium nitrate.

Question 1

(c) [5]

(i) Name the two crystalline allotropes of sulphur. For each allotrope give a sketch of the shape of its crystals.

(ii) Which sulphur allotrope is stable at room temperature?

Question 1

(d) [5]

(i) What is the mass of nitrogen in 1000 kg of urea [$\text{CO}(\text{NH}_2)_2$]? (Answer correct to the nearest kg.) (H = 1; C = 12; N = 14; O = 16)

(ii) Is it possible to change the temperature and pressure of a fixed mass of gas without changing its volume? Explain your answer.

Question 1

(e) [6]

(i) What should be the physical state of lead bromide, if it is to conduct electricity?

(ii) What particles are present in pure lead bromide?

(iii) Write the equations for the reactions which take place at the electrodes during the electrolysis of lead bromide.

Question 1

(f) Three test tubes contain calcium nitrate solution, zinc nitrate solution and lead nitrate solution respectively. Each solution is divided into two portions (f) (i) and (f) (ii). Describe the effect of: [6]

(i) Adding sodium hydroxide solution to each portion in turn, till it is in excess.

(ii) Adding ammonium hydroxide to each portion in turn, till it is in excess.

Question 1

[3]

(g) State three tests by which you could identify a gas as being chlorine.

Question 1

(h) Define or explain the meaning of the following terms: [5]

(i) Molar volume;

(ii) Fixation of nitrogen;

(iii) Acid salt;

(iv) Vulcanisation;

(v) Ore.

SECTION II (40 marks)

Answer any four questions

Question 2

(a) [4]

(i) What is the purpose of the pH scale?

(ii) What is the pH of pure water?

(iii) A is a soluble acidic oxide; B is a soluble base. Compared to the pH of pure water, what will be the pH of:

1. Solution of A; 2. Solution of B.

Question 2

(b) Taking sodium carbonate as an example, give the meaning of the following terms: [3]

(i) Water of crystallisation;

(ii) Anhydrous;

(iii) Efflorescence.

Question 2

(c) [3]

(i) Barium chloride solution can be used to distinguish between a sodium sulphate solution and a sodium nitrate solution. How is this done?

(ii) Write the equation for the action of heat on sodium nitrate.

Question 3

(a) Write equations for the following reactions: [2]

(i) Burning of ammonia in oxygen.

(ii) Catalytic oxidation of ammonia.

Question 3

(b) [4]

(i) What would you see in (a) (i) above?

(ii) Name the catalyst used in (a) (ii).

(iii) In the reaction referred to in (a) (ii) the catalyst glows red hot. Why?

(iv) What is the name of the industrial process which starts with the reaction referred to in (a) (ii)?

Question 3

(c) [4]

(i) How soluble is ammonia in water?

(ii) Give two reasons to show that the solution of ammonia in water contains hydroxide ions.

(iii) Name a simple method you would employ to prepare ammonium salts in your laboratory.

Question 4

(a) Calculate the empirical formula of the compound having 37.6% sodium, 23.1% silicon and 39.3% oxygen. (Work to two decimal places) [O = 16; Na = 23; Si = 28] [3]

(b) The empirical formula of a compound is C_2H_5 . It has a vapour density of 29. Determine the relative molecular mass of the compound and hence its molecular formula. [2]

Question 4

(c) Solid ammonium dichromate (relative molecular mass = 252) decomposes according to the following equation:



(i) What volume of nitrogen, at STP, will be evolved when 63g of ammonium dichromate is decomposed?

(ii) If 63 g of ammonium dichromate is heated above 100°C, what will be the loss of mass? (H = 1; N = 14; O = 16; Cr = 52)

Question 5

(a) The following substances are put into the blast furnace when manufacturing Iron: Iron ore, coke, limestone and hot air. [7]

(i) What is the name of the most common ore of iron and what is its chemical formula?

(ii) What is the purpose of using (1) the coke; (2) the limestone?

(iii) Write the equation for the reduction reaction which produces iron.

(iv) Name the two substances which separate at the bottom of the blast furnace.

Question 5

(b) [3]

(i) What is the main impurity present in the iron produced in the blast furnace?

(ii) By what chemical process is this impurity removed in steel-making?

(iii) What is added to steel to make stainless steel?

Question 6

(a) [4]

(i) Write the equation for the laboratory preparation of the sulphur dioxide from sodium sulphite.

(ii) How is the sulphur dioxide collected?

(iii) What does the method of collection tell you about the density of sulphur dioxide?

(iv) What do you see when sulphur dioxide is bubbled through an acidified potassium dichromate solution?

Question 6

(b) Write one equation in each case to show the action of sulphur dioxide as: [3]

(i) a reducing agent;

(ii) an oxidising agent;

(iii) an acid anhydride.

Question 6

(c)

[3]

- (i) What is the similarity in the use of sulphur dioxide and chlorine as bleaching agents?
- (ii) When chlorine is involved in bleaching, what is the type of chemical reaction that changes the coloured compound to a colourless one?
- (iii) What is the reason for not using chlorine to bleach wool?

Question 7

[5]

- (a) Outline the steps required to convert hydrogen chloride to anhydrous iron (III) chloride. Write the equations for the reactions which take place.

Question 7

(b)

[5]

- (i) What are the two steps necessary to change lead carbonate into lead chloride?
- (ii) Give the name of a soluble lead salt and write the equation for the action of heat on this salt.
- (iii) Write the equation for the preparation of nitric acid from potassium nitrate.