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CHEMISTRY

PAPER 2

545/2 TIME: 2

HOURS

Instructions to candidates

- This paper consists of two sections A and B
- Section A is compulsory but attempt ONLY TWO questions in section B
- Answers to questions in section A must be written in the spaces provided. Answers to questions in B must be written on answer sheets provided.

1 (a) Name the two major components of air. (Imark)

(b)When a sample of dry air was bubbled through potassium hydroxide solution and the residual gas passed over strongly heated copper metal, a gas G was finally obtained.

(i) Identify G. (1 mark)

(ii) State why air was bubbled through potassium hydroxide solution (1 mark).

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_____

(c) Write equation

(i) to illustrate your answer in (b) above. (1 1/2 marks)

_____

(ii) for the reaction between the residual gas with copper. (1 1/2 marks)

_____

2. When heated, ammonium chloride undergoes sublimation;

(a) (i) State what is meant by the term "sublimation". (1 mark)

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(ii) Write equation to show the effect of heat on ammonium chloride. (1 1/2mk)

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(b) (i) Name the compound other than ammonium chloride which can undergo sublimation. (1 mark)

_____

(ii) State one practical application of sublimation. (1/2 mark)

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3. Calcium carbonate reacts with dilute hydrochloric acid to produce carbon dioxide according to the following equation.

$CaCO_3(s) + 2\ HCl(aq) \longrightarrow CaCl_2\ (aq) + H_2O\ (1) + CO_2(g)$

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(a) Calculate the maximum volume of carbon dioxide in cm^3 that would be produced at room temperature if dilute hydrochloric acid reacted completely with 4.5g of calcium carbonate. (3marks)

(C=12, 0=16, Ca=40, 1 mole of gas occupies 24.0dm^3 at room temperature)

(b) A quantity of dilute sulphuric acid having the same hydrogen ion concentration as that of the hydrochloric acid in (a) above was reacted with 4.5g of calcium carbonate at room temperature.

(i) State how the maximum volume of carbon dioxide produced would compare with your answer in (i) . (1 mark)

(ii) Give reasons for your answer in (b) (i). (1 mark)

4. When hydrogen is burnt in air, a liquid L is formed which can exist both in solid and gaseous states as well.

(c) (i) write equation for the reaction that leads to the formation of L.($1^1/2$ marks)

(b) State what L is called, when it is in the

(i) gaseous state. (1 mark)

(ii) solid State. (1mark)

(c) State one physical property that can be used to determine the purity of L.(1mrk)

5 (a) Monoclinic Sulphur and rhombic Sulphur are crystalline allotropes of Sulphur.

(i) Define the term "allotrope" (1 mark)

(ii) State one difference between monoclinic Sulphur and rhombic Sulphur. (1mark)

(b). Sulphur was burnt in air form a substance X, which under suitable temperature and pressure conditions in the presence of a catalyst, was converted to gas Q in the contact process.

(i) Identify X and Q. (1mark)

(ii) Name the catalyst that was used for converting X to gas Q. (½ mark)

(iii) State the temperature and pressure conditions that favored formation of gas Q.

Temperature. (1mark)

Pressure.

(iv) State the application of the contact process. (1/2mark)

6. (a) Zinc was added to a solution containing copper (ll) ions.

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

(b). When 0.91g of Zinc was added to 50.0cm ^{3} of solution containing 0.25 moles of copper(ll) sulphate per dm ^{3}, the temperature of the solution rose up by 12.9^{0}C

i). Determine the number of moles of zinc which did not react. (Zn=65) (2 marks)

(ii). Calculate the enthalpy of the reaction in kJ mol^{-1} (1 ½ marks)
(Heat capacity of the solution =4.2J/g/^{0}C, density of the solution=1.0gcm $^{-3}$).

7. (a) Graphite and lead (ll) bromide are good conductors of electricity.

Name the particles which are responsible for conducting electricity in

(i) graphite. (1 mark)

(ii) lead(IT) bromide. (1 mark)

(b) State the conditions under which lead (ll) bromide can conduct electricity. (1mk)

(c) Lead (ll) bromide was electrolyzed using carbon as electrodes;

State what was observed at the

(i) anode (½ mark)

(ii) cathode (½ mark)

8 (a) Soap solution was added in magnesium hydrogen carbonate solution.

State what was observed (1mark)

(b) A fresh sample of magnesium hydrogen carbonate solution was heated to boiling point.

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

(ii) Write an ionic equation for the reaction that took place (11/2marks)

(c) Soap solution was added to the resultant mixture in (b) above.

State

(i) What was observed? (1/2tnark)

(ii) a practical application of the reaction in b (i). (1mark)

9. Iron oxide J, is one of the common iron ores. When excess carbon monoxide was passed over 5.8g of a heated sample of J, 4.2g of iron was obtained.

(a) State what is meant by the term "ore." (1 mark)

(b) (i) Determine the mass of oxygen in J. (1 mark)

(ii) Calculate the formula of J. (Fe= 56 (3 marks)

(iii) Name J. (1 mark)

10. (a) Write the structural formula of ethene, C_2H_4. (1 mark)

(b) A drop of bromine was let into a test tube containing ethene.

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

(ii) Write an equation for the reaction that took place. (1mark)

(c) Ethene was burnt in air that contains a small amount of Oxygen.

Write equation for the reaction that took place. (1/2mark)

SECTION B

(Attempt only two questions)

11. (a) Draw a labeled diagram to show the structure of an atom. (2 ½ marks)

(b). (i) State how the total number of electrons in an atom compares with the total number of protons. (1 mark)

(ii) Explain how the comparison you have stated in (b) (i) affects the stability of an atom. (2 1/2marks)

(c) The full symbols of two atoms of an element $^{35}_{17}A$ and $^{37}_{17}B$.

(i) State the group in the periodic table to which the element belongs. (1 mk)

(ii) Determine the number of neutrons in A and B respectively. (2marks)

(iii) (State what the atoms A and B are called. (½ marks)

(d) The atomic numbers of elements T, X and Y are 1, 6 and 11 respectively. Write the electronic structure of the atom of each of the elements. (1 1/2mk)

(e) T can react with both X and Y to form compounds.

(i) Using outermost energy level electrons only, draw a diagram to show the formula of the compound that can be formed when T react with X (2 mks)

(ii) Suggest a suitable solvent for the compounds that can be formed when T reacts with X and Y respectively; and give a reason for your choice of the

solvent in each case. (2marks)

12. (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)

(c)(i) Write equation for the reaction of concentrated nitric acid with carbon.

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

(c). Nitric acid reacts with metals to for 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.

$2Ca(NO_2)_2 \longrightarrow 2CaO(s) + 4NO_2(g) + O_2(g)$

Calculate the mass of calcium nitrate that when heated; would produce 896 dm^3 of nitrogen dioxide measured at s.t.p (3 1/2marks)

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

13 (a) (i) Name two substances that when reacted can be used to prepare lead (ll) sulphate in the laboratory. (1 mark)

(ii) Explain you have how a pure dry sample of lead (ll) sulphate is prepared from the substances named in (a) (i). (7 1/2 marks)

(b) (i) Name One laboratory reagent in each case, which can be used to test for the presence of a sulphate ion and lead(ll) ion. (1 mark)

(iii) State in each case, what would be observed if sulphate and lead(ll) ions were treated separately with the reagent you have named in (b) (i) (2 mks)

(c) Lead (II) carbonate reacts with dilute nitric acid according to the following equation.

$PbCO_3(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(aq) + CO_2(g) + H_2O(l)$

Calculate the volume of a solution contain 0.5 mole of nitric acid dm^{-3} that would react exactly with 5.349 of lead(ll) carbonate.

(Pb -207, O: 16, C 12). (3 1/2 marks)

14. (a) Maize grain contains a compound Y, which can be converted to glucose, fermentation of glucose produces ethanol C_2H_60.

(i) Name compound Y. (1mark)

(ii) Starting from maize grains, outline how a solution of ethanol is prepared in your locality. (No diagram is required) (4marks)

(iii) Write equation for the fermentation of glucose. (1 mark)

(iv) Name the reaction by which ethere can be obtained from ethanol in the presence of sulphuric acid (1mark)

(b) Ethene can react to form a polymer E

Write equation for polymerization of the ethene (1mark)

(c) Determine the number of moles of ethene molecules that reacted to produce E with relative formula mass of 14,000. (H=l, C=12) (2marks).

(d) (i) Other than the polymer of ethene, give one example each of a natural polymer and a synthetic polymer. (2marks).

(ii) Distinguish between the terms "thermosetting" plastic; and thermos softening plastic and give one example in each case. (3marks)

END