END OF TERM 2 EXAMS-2019

S.3 CHEMISTRY 545/2

2 HOURS

Instructions:

- This paper consists of two Sections **A** and **B**
- **Section A** consists of **10** structured questions. Attempt all questions in this section. Answers to these questions must be written in the spaces provided **ONLY.**
- **Section B** consists of **4** semi-structured questions. Attempt **ONLY TWO** questions from this section. Answers to the questions must be written in the answer booklets provided
- In both sections all working must be shown clearly

SECTION A:

All questions are compulsory

1. When calcium turnings were added into water in a beaker, bubbles of a colourless gas, **X** ,and a cloudy solution formed.

   a) State the identity of :

   (i) Gas **X** (½ mark)

   ……..

   (ii) The cloudy solution. (½ mark)

   …….

   b) Write equation for the reaction leading to the formation of gas **X.** (1½ mark)

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   …….

   c) State.

   (i) How gas **X** could be identified in the laboratory. (1½ marks)

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   ……..

   (ii) One laboratory use of the resultant solution in the beaker. (1 mark)

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   …….

2. a) State the principle on which each of the following methods of separating mixtures works.

   (i) Chromatography (1 mark)

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   …….

   (ii) Fractional Crystallization (1 mark)

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   …….

b) Sate what would be observed and give a reason for your observation, if a mixture of water and the following sub- stand was shaken, then allowed to stand for some time.

(i) Ethanol

- Observation (½ mark)

  …….

- Reason (½ mark)

  ……..

(ii) Eddible oil

- Observation (½ mark)

  ……

- Reason (½ mark)

  …….

c) Name a piece of apparatus that can be used to separate components of the mixture in (b)

(ii) (1 mark)

……..

3. Ethanol obtained from glucose can be converted to ethene as shown below.

$$C_6H_{12}O_6 \xrightarrow{\text{STEP I}} C_2H_5OH \xrightarrow{\text{STEP II}} C_2H_4$$

a) Name the process that takes place in

(i) Step I (½ mark)

……..

(ii) Step II (½ mark)

…….

b) State

(i) One other product formed together with ethanol in step I (½ mark)

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(ii) The conditions for the conversion in step II (1½ marks)

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……

c) Ethene can be converted to a polymer J of relative molecular mass 16,800.

(i) Write the structural formula of **J**. (1 mark)

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(ii) Calculate the number of moles of ethene that make up **J**. (1 mark)

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(iii) Give one disadvantage of continued use of **J**. (½ mark)

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4. a) Name one crystalline and one amorphous allotrope of carbon and in each case state one use of the allotrope that you have named.

(i) Crystalline carbon allotrope. (½ mark)

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Use (½ mark)

……..

(ii) Amorphous carbon allotrope (½ mark)

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Use (½ mark)

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b) Write equation for the reaction to show

(i) Combustion of carbon monoxide (1 mark)

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(ii) Reduction of iron (II, III) oxide by carbon monoxide. (1½ mark)

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c) State one practical application of the reaction in (b) (ii) (½ mark)

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5. Under suitable conditions, hydrogen peroxide, solution $H_2 O_{2\,(aq)}$ can decompose rapidly to produce oxygen.

a) (i) Write equation for the decomposition of hydrogen peroxide. (1½ mark)

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(ii) State two ways in which the decomposition of hydrogen peroxide can be made to occur rapidly. (1 mark)

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……..

b) Burning magnesium ribbon was lowered into a jar of oxygen.

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

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……

(ii) Write an equation for the reaction that took place. (1½ marks)

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6. The atomic numbers of elements **W**, chlorine and **Y** are **15, 17** and **20** respectively.

a) Write the electronic configuration of an atom of element.

(i) **W** (½ mark)

……..

(ii) **Y** (½ mark)

……..

b) State which one of the elements **W** or **Y** would form a chloride which is

(i) A solid with high melting point. (½ mark)

……..

(ii) A volatile liquid at room temperature. (½ mark)

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c) Give reasons for your statement in (b) (1 mark)

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d) State how a chloride ion in aqueous solution can be identified. (1½ mark)

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7. (a) (i) An acid **Q**, with the formula $H_xC_yO_z.n\ H_2O$ contains 26.7% carbon, 2.2% hydrogen and 71.1% oxygen by mass. Determine the empirical formula of **Q** (H=1, C=12, O=16) *(02 marks)*

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(ii) Determine the values of x, y and z in the formula of **Q**. ($H_xC_yO_z = 90$)
(1½ marks)

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(b) $20.0cm^3$ of a solution containing 6.3g of **Q** per litre required exactly 20.15 cm^3 of a 0.1 M sodium hydroxide solution for complete neutralization.

(i) Calculate the concentration of **Q** in moles per dm^{-3} of the solution.
p *(02 marks)*

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(ii) Deduce the value of **n**. *(1½ marks)*

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8. (a) Write the structural formula of

(i) ethene *(1 mark)*

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(ii) ethane *(1 mark)*

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(b) (i) Name one reagent which can be used to distinguish between ethene and ethane. *(1 mark)*

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(ii) State what would be observed if ethene was treated with the reagent you have named in b (i) above. *(1 mark)*

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(c) Write equation for the polymerization of ethene *(1 mark)*

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9. A compound cleaner burnt rubbish at the furthest corner of the school compound. Smoke spread throughout the school.

(a) (i) Name the process by which the smoke spread throughout the school. (01mk)

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(ii) Define the process you have named in (a) (i) (01mk)

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(b) State:

(i) What the process you have defined in (a)(ii) show about smoke? (01mk)

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(ii) One reason why rubbish should not be burnt. (01mk)

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(c) Name one substance which can be used to show that the process you have defined in (a)(i) also takes place in liquids. (01mk)

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10. (a) Diamond and graphite are some of the common allotropes of carbon. State what is meant by the term allotropy. (01mk)

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(b) (i) Graphite crystal is a soft substance while a diamond crystal is very hard.

Give two uses of each allotrope based on the above properties. (02mks)

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(ii) State one other difference between graphite and diamond. (½ mk)

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(c) Carbon – 12 and carbon – 14 are the two common atoms of carbon and carbon – 14 is used extensively in determining the ages of fossils.
State:

(i) One word which means determining the ages of fossils using carbon – 14. (½ mk)

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(ii) One word which means the relationship between atoms like Carbon- 12 and Carbon – 14. (½ mk)

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(iii) The property of carbon – 14 that is applied when it is used in determining the ages of fossils. (½ mk)

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SECTION B

*Answer only **two** questions from this section.*

11. A compound **Q** consists of **26.7%** carbon and **2.2%** hydrogen by mass; the rest being oxygen.

a) Calculate the empirical formula of **Q**. **(H = 1, C = 12, O = 16)** (3½ marks)

b) An aqueous solution of **Q** turns blue litmus paper pale red.

(i) Suggest how the P^H value of a **2M** aqueous solution of **Q** would compare with the P^H value of a **2M** hydrochloric acid. Give a reason for your suggestion. (2 marks)

(ii) Predict how **Q** would react with magnesium powder. (1½ arks)

(iii) Write an ionic equation for the reaction that you have predicted in (b) (ii) (1½ marks)

c) 100cm^3 of a solution containing **4.5g of Q** per dm^3 of solution required exactly **0.12g** of magnesium powder for complete reaction.
(Mg=24, 1 mole of Q reacts with 1 mole of magnesium.)
Calculate

(i) The concentration of **Q** in mole per dm^3. (3 marks)

(ii) The formula mass of **Q**. (2 marks)

d) Determine the molecular formula of **Q.** (2 marks)

12. Under suitable conditions iron can rust.
a) Sate (i) what is meant by the term "rusting." (1 mark)

(ii) The condition(s) necessary for iron to rust. (2 marks)

b) (i) Draw labeled diagram(s) for a set up of an experiment which can be used to show that the condition(s) you have stated in (a)(ii), is / are necessary for iron to rust. (5 marks)

(ii) State and explain observations that would be made if the experimental set up in the diagrams that you have drawn in (b) (i) was allowed to stand for some days. (4 marks)

c) (i) State two methods by which rusting can be prevented. (2 marks)

(ii) Give one reason why rusting must be prevented. (1 mark)

13. (a) Carbon dioxide can be prepared in the laboratory using calcium carbonate and Substance**T**.

(i) Identify **T** and write equation leading to the formation of carbondioxide. *(2½ marks)*

(ii) With the aid of a labeled diagram, describe how you would prepare a dry sample of carbon dioxide starting from calcium carbonate. *(06 ½ marks)*

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

$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$

Calculate the mass of dry calcium carbonate that would be obtained if 600cm^3 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 24.0dm^3 at room temperature). *(02 marks)*

(c) More carbon dioxide was bubbled through a mixture. State what was observed and explain the reaction that took place. *(2½ marks)*

(d) Burning magnesium was lowered into a jar of carbon dioxide. Write an equation for the reaction that took place. *(1½ marks)*

14. (a) Draw a labelled diagram to show the structure of an atom. (2½ mks)

(b) (i) State how the total number of electrons in an atom compares with the total number of protons. (01mk)

(ii) Explain how the comparison you have stated in b(i) affects the charge of the particle. (2½ mks)

(c) The full symbols of two atoms of an element $^{16}_{8}A$ and $^{18}_{8}B$:

(i) State the group in the periodic table to which the element belongs. (01mk)

(ii) Determine the number of neutrons in A and B respectively.(02mks)

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

(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.(1½ mks)

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

(i) Using outer most energy level electrons only, draw a diagram to show the formula of the compound that can be formed when T reacts with X. (02mks)

(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.

END