

Name.....Stream.....

**DEPARTMENT OF CHEMISTRY**

**S.3 CHEMISTRY 545/2**

**TIME: 2 HOURS**

**INSTRUCTIONS**

- Attempt all questions in this paper
- Diagrams must be well drawn
- Use (1 mole of gas at room temperature occupies  $24\text{dm}^3$ , 1 mole of a gas at s.t.p occupies  $22.4\text{dm}^3$ , C = 12, H = 1, O = 16, Ca = 40, S = 32, Na = 23, N = 14, Zn = 65)

1. Tea was placed in a cup of hot water and allowed to stand

(a) State what was observed (2mks)

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(b) Name the process that occurred (1mk)

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(c) States what the process you have named in (b) demonstrates. (2mks)

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2. The number of protons, electrons and neutrons in same particles (A, B, E, G, H and F are shown in the table below

	Particle					
	A	B	E	G	H	F
Protons	6	8	13	11	8	17
Electrons	6	8	10	11	8	18
Neutrons	6	8	14	12	10	18

(a) Identify which one of the particles is

(i) An anion (1mk)

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(ii) A cation (1mk)

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(b) State two particles which are atoms of the same element. (1mk)

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(c) State the types of bond formed when particle A, combines with particle H. (1mk)

- .....
- .....
- (d) Write the formula of the ion formed from particle G. (1mk)
- .....
- .....
3. The general formula of compounds Q and R are  $C_nH_{2n}$  and  $C_nH_{2n+2}$  respectively.
- (a) Write the molecular formula and name of Q and R for  $n = 2$ .
- (i) Q: formula .....( 1/2 mk)  
 Q Name.....(1/2 mk)
- (ii) R: Formula.....(1/2mk)  
 R Name.....(1/2 mk)
- (b) State the structural difference between Q and R. (1mk)
- .....
- .....
- (c) (i) Name a reagent which can be used to distinguish between Q and R. (1mk)
- .....
- .....
- (ii) State what would be observed when the reagent you have named in (c) (i) was treated separately with Q and R. (1mk)
- .....
- .....
4. State where the following oxides are acidic, basic neutral or amphoteric
- (a) ZnO..... (1mk)
- (b) SO<sub>2</sub>.....(1mk)
- (c) CuO.....(1mk)
- (d) CO.....(1mk)
- (e) H<sub>2</sub>O.....(1mk)
5. A compound Y consists of 52.17% Carbon, 13.04% hydrogen and 34.78% oxygen. The molecular mass of Y is 46.
- (a) Determine the empirical formula of Y (3mks)
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- .....
- .....
- .....
- .....
- .....
- (b) Calculate molecular formula of Y (2mks)
- .....
- .....
- .....
- .....

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6. (a) Identify the products formed when the following are reacted with excess oxygen. (2mks)

(i) Carbon

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(ii) Copper

.....  
(b) Write the equation for the reactions that takes place when the above elements are reacted with oxygen. (3mks)

(i) Carbon

.....  
(ii) Copper

.....  
7. Part of the periodic tables is shown below the letter used are not the usual symbols for the elements. Use it to answer the following questions.

<b>F</b>				<b>J</b>			<b>X</b>	
			<b>E</b>				<b>Y</b>	
<b>A</b>	<b>R</b>					<b>G</b>	<b>Z</b>	
<b>B</b>		<b>D</b>						<b>C</b>

(i) Name the group to which X, Y and Z belong? (1mk)

.....  
(ii) Write the formula of the compound formed between hydrogen with G (1mk)

.....  
(iii) State which element has properties similar to those of transition metals. (1mk)

.....  
(iv) State which element you would expect to form a compound with Y, having 1 atom of the element for every 3 atoms of Y. (1mk)

.....  
(v) Give one element which forms an oxide that dissolves in both sodium hydroxide solution and dilute hydrochloric acid. (1mk)

8. Below is the set up of apparatus used to separate a mixture of water and kerosene.

(a) Identify liquid

(i) A.....(2mks)

(ii) B.....(1mk)

(b) (i) State why liquid A forms the upper layer (2mks)

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.....

(ii) State why the two liquids form a liquid junction. (1mk)

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9. Calculate the relative formula mass of the following

(a) Calcium hydrogen sulphate  $\text{Ca}(\text{HSO}_4)_2$  (2 ½ mks)

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(b) Sodium nitrate,  $\text{NaNO}_3$  (2 ½ mks)

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10. (a) Name two crystalline allotropes of carbon. (2mks)

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(b) State two differences between the allotropes you have named in (a) (2mk)

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- (c) Give one use for each of the allotropes. (1mk)

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**SECTION B**

**Attempt all questions from this section**

11. A dry sample of hydrogen can be prepared in the laboratory using Zinc and dilute sulphuric acid in the presence of a catalyst.

- (a) (i) Draw a diagram to show a set up of the apparatus that can be used to prepared dry hydrogen in the laboratory. (3 ½ mks)  
(ii) Name the catalyst used in this reaction. (1mk)  
(iii) Write equation for the reaction leading to the formation of hydrogen. (1 ½ mks)

- (b) Dry hydrogen was passed over heated copper(II) oxide.  
(i) State what was observed. (1mk)  
(ii) Write the equation for the reaction that took place. (1 ½ mks)

- (c) Zinc oxide reacts with hydrogen according to the following equation.  
$$\text{ZnO(s)} + \text{H}_2\text{(g)} \longrightarrow \text{Zn(s)} + \text{H}_2\text{O(l)}$$
  
Calculate the volume of hydrogen gas that is required to react with 2.5g of Zinc oxide at s.t.p. (Zn = 65, O = 16, 1 mole of a gas at s.t.p occupies 22.4dm<sup>3</sup>). (3 ½ mks)

12. (a) Define the term;  
(i) a solute (2mks)  
(ii) a saturated solution (2mks)

(c) The solubility of potassium chloride and potassium nitrate at certain temperatures are shown in the table below.

Temperature (0C)	0	11	15	30	40	50	57
Solubility of potassium chloride in g/1000g of water	27.9	31.0	32.0	36.5	40.0	43.0	45.0
Solubility of potassium nitrate in g/1000g of water	14.0	21.5	25.0	43.0	63.0	84.0	102.0

- (i) Plot on the same axes, a graph of solubility against temperature for the solubilities of potassium chloride and potassium nitrate. (5 ½ mks)  
(ii) From your graph. State which one of the two salts has a solubility which increases less rapidly with increase in temperature. (1mk)
- (d) Determine the temperature at which;  
(i) The solubilities of the two salts are equal (1mk)  
(ii) The solubility of potassium nitrates is 70g/100g of water. (1mk)
- (e) From your graph, determine the solubility at which  
(i) The temperature of the two salts is equal. (1mk)  
(ii) The temperature of potassium nitrate is 45<sup>0</sup>C. (1 ½ mks)

**END**