DIRECTORATE FOR QUALITY AND STANDARDS IN EDUCATION Department for Curriculum Management and eLearning Educational Assessment Unit Annual Examinations for Secondary Schools 2012 FORM 5 CHEMISTRY TIME: 1h 45min Name: \_\_\_\_\_\_ Class: \_\_\_\_\_\_ Useful Data: Atomic numbers and relative atomic masses are shown in the periodic table printed below.

State symbols are expected to be included in all chemical equations.

One mole of any gas occupies 22.4 dm<sup>3</sup> at standard temperature and pressure

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		PERIODIC TABLE															
1	2											3	4	5	6	7	0
		$\begin{bmatrix} 1\\ \mathbf{H}\\ 1 \end{bmatrix}$															<b>He</b> 2
7 <b>Li</b> 3	9 <b>Be</b> 4											11 <b>B</b> 5	$\overset{12}{\underset{6}{\overset{12}{\overset{12}{}}}}$	14 <b>N</b> 7	16 <b>O</b> 8	19 <b>F</b> 9	20 <b>Ne</b> 10
23 <b>Na</b> 11	24 <b>Mg</b> 12											27 <b>Al</b> 13	28 <b>Si</b> 14	31 <b>P</b> 15	32 <b>S</b> 16	35.5 <b>Cl</b> 17	40 <b>Ar</b> 18
39 <b>K</b> 19	40 <b>Ca</b> 20	45 <b>Sc</b> 21	48 <b>Ti</b> 22	51 <b>V</b> 23	52 <b>Cr</b> 24	<sup>55</sup> Mn <sub>25</sub>	56 Fe 26	59 <b>Co</b> 27	59 <b>Ni</b> 28	63.5 <b>Cu</b> 29	65 <b>Zn</b> 30	${\displaystyle \mathop{Ga}_{31}}^{70}$	73 <b>Ge</b> 32	75 <b>As</b> 33	79 <b>Se</b> 34	80 Br 35	<sup>84</sup> Kr <sup>36</sup>
85 <b>Rb</b> 37	88 Sr 38	89 <b>Y</b> 39	91 <b>Zr</b> 40	93 <b>Nb</b> 41	96 <b>Mo</b> 42	99 <b>Tc</b> 43	$\overset{101}{\underset{44}{\mathbf{Ru}}}$	103 <b>Rh</b> 45	106 <b>Pd</b> 46	108 <b>Ag</b> 47	$\overset{112}{\mathbf{Cd}}_{48}$	115 <b>In</b> 49	119 <b>Sn</b> 50	<sup>122</sup> <b>Sb</b> <sub>51</sub>	128 <b>Te</b> 52	127 <b>I</b> 53	131 <b>Xe</b> 54
133 <b>Cs</b> 55	137 <b>Ba</b> 56	139 <b>La</b> 57	178 <b>Hf</b> 72	181 <b>Ta</b> 73	184 <b>W</b> 74	186 <b>Re</b> 75	190 <b>Os</b> 76	192 Ir 77	195 <b>Pt</b> 78	197 Au 79	201 <b>Hg</b> 80	204 <b>Tl</b> 81	207 <b>Pb</b> 82	209 <b>Bi</b> 83	210 <b>Po</b> 84	210 At 85	222 <b>Rn</b> 86

Key

 $\overset{a}{\mathbf{X}}$ 

b

Faraday constant =  $96500 \text{ C mol}^{-1}$ 

relative atomic mass symbol

atomic number

## Marks Grid [ For Examiners use only ]

Question			Sect	tion A			5	Section I	3		
Nº.	1	2	3	4	5	6	7	8	9		
Max Mark	10	10	10	10	10	10	20	20	20		_
Actual Mark											
Theor	Practical: 15%					Final Score: 100%					

	Studen	10
S	ECTION A – Answer ALL questions. This section carries 60 marks.	ounty.com
1	Air is a mixture of gases.	
a	. Which gas makes up about 78% of the air?	[1]
b	. Which gas in the air allows things to burn in it?	[1]
c.	Name one industrial process that can be used to separate the gases present in the air.	
		[1]
d.	Which noble gas is present in the air in the greatest amount?	[1]
e.	Which gas present in the air is one of the starting materials used in the production of	
	nitric acid and most fertilizers?	[1]
f.	Name a gas containing sulfur that causes air pollution.	[1]
g.	Name one other gas that also contributes to air pollution even when present in very	
	small quantities.	[1]
h.	Global warming is probably a result of having an excess of carbon dioxide in the air.	
	This acts as a blanket around the earth preventing the escape of heat. Which words	
	are used with reference to this gas that illustrate this?	[1]
i.	Name one solid substance that is also a major air pollutant.	[1]
j.	Several measures are being taken to cut down air pollution. Name one such measure	
	that is being taken to reduce air pollution from cars.	[1]

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2	The element barium is in Group II of the Periodic Table and its chemical behaviour h very similar to that of calcium.	HINKY COL
а	a. Barium reacts vigorously with cold water.	3
	<ul> <li>(i) Suggest the name of another metal in the same period that also reacts with cold water.</li> </ul>	)
	(ii) Complete the word equation:	
	barium + water + +	[3]
t	b. Use the information below to predict the molecular formulae of barium sulfate and barium phosphate.	
	barium ion: $Ba^{2+}$ sulfate ion: $SO_4^{2-}$ phosphate ion: $PO_4^{3-}$	
	barium sulfate: barium phosphate:	[2]
С	c. Complete the equations below for the action of heat on barium carbonate and barium nitrate. (No need to include state symbols)	
	$BaCO_3 \longrightarrow +$	
	$2Ba(NO_3)_2 \longrightarrow + + + + + + + + + + + + + + + + + + $	[2]
Ċ	1. Barium is used to extract the element americium from americium (III) fluoride.	
	$3Ba + 2AmF_3 \longrightarrow 2Am + 3BaF_2$	
	(i) Complete the equations below by including the electron transfer	
	Ba - $Ba^{2+}$ Equation 1	
	$Am^{-} + $ $\longrightarrow$ $Am$ $\dots$ Equation 2	
	(ii) Which of these equations represents an oxidation?	

[3]

SugentBounts.com Compound Molar Mass Empirical formula **Molecular formula** (g/mol) Hydrazine 32  $NH_2$ Cyanogen 52 CN Benzene 78 CH Nitrogen oxide 92  $NO_2$ Glucose 180  $CH_2O$ [5] b. Zinc phosphide is made by heating zinc and phosphorus together. It is found that 9.75 g of zinc combines with 3.10 g of phosphorus. Relative Atomic Masses: P = 31, Zn = 65(i) Find the number of moles of: • zinc in 9.75 g of the element phosphorus in 3.10 g of the element • (ii) Use your answers to question b. (i) to write down the empirical formula of zinc phosphide. (iii) Calculate the percentage mass of phosphorus in zinc phosphide. [5] 2 g of iron was added to 50  $\text{cm}^3$  of sulfuric acid of concentration 0.5 mol dm<sup>-3</sup>. After 4 the reaction, when all the hydrogen was evolved, the resulting mixture of iron sulfate solution and unreacted iron was filtered. The unreacted iron was dried and weighed. Its mass was 0.6 g. a. What mass of iron took part in the reaction? [1] b. Change your answer to question a. to moles. Relative Atomic Mass of Fe = 56. [2] c. How many moles of sulfuric acid took part in the reaction? [2] d. Write the equation for the reaction, including state symbols. [2] e. What volume of hydrogen calculated at STP is bubbled off during the reaction? [3]

3 a. Complete the table below:

Relative Atomic Masses: H = 1, C = 12, N = 14, O = 16.

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	ide	24.
_		BOLL
)	The position of tin in the reactivity series is:	12
	increasing reactivity	6
a.	The main ore of tin is tin (IV) oxide, $SnO_2$ . Write down a word equation to predict how this ore can be reduced to tin.	
		[1]
b.	For each of the following, decide if a reaction occurs.	
	If the reaction occurs, <b>complete the equation</b> , without including state symbols. If it does not occur, write: <b>no reaction</b> .	
	Note that in any reaction that occurs, tin has a valency of 2.	
	$Fe + SnCl_2 \longrightarrow$	
	$Sn + CuSO_4 \longrightarrow$	
	$Sn + FeSO_4 \longrightarrow$	[3]
C	Aqueous tin (11) sulfate is electrolysed using carbon electrodes. This is similar to the	1e
с.	electrolysis of copper (II) sulfate using carbon electrodes.	
	(i) What is the product at the cathode?	
	(ii) Write the equation for the reaction at the anode. No need to include state sym	nbols.
	(iii) Give the name of the acid formed during this electrolysis.	
		_ [4]
1		
d.	I ne element tin exists in the form of allotropes.	
	• grey tin having a diamond type structure	
	• white tin having a metallic type structure	
	Which allotrope:	
	has giant covalent bonding?	-

6 The list below contains statements, each of which describes **one** of the three elements in the following enclosed rectangles:



Near each statement, write down the name of **one** of these three elements that fits best the description:

It is a solid at room temperature. • It exists in more than one solid form. • It is colourless. • It is a poisonous gas. • It reacts with hydrogen to form water. • It forms a gaseous oxide which causes acid rain when burnt. ٠ It removes the colour from dyes when damp. ٠ It is added to rubber to make it tough and strong. • It is moderately soluble in water. • It relights a glowing splint. ٠

[10]

## SECTION B – Answer TWO questions only on the foolscap provided. This section carries 40 marks.

- StudentBounty.com The chemical name of washing soda is hydrated sodium carbonate. (Na<sub>2</sub>CO<sub>3</sub>.xH<sub>2</sub>O) 7 In a titration experiment to find the value of x, a student found that 2 g of the hydrated compound exactly neutralized 14 cm<sup>3</sup> of hydrochloric acid of concentration 1 mol dm<sup>-3</sup>.
  - a. Describe how this titration can be conducted in a school lab. Your answer should include:
    - a simple diagram of the apparatus, labelled with 2 main items of lab. equipment required.
    - the name of a suitable indicator.

• one essential precaution required for accurate titre values.	[6]
b. Write a balanced equation for the reaction, including state symbols.	[2]
c. How many moles of hydrochloric acid were neutralized?	[2]
d. How many moles of sodium carbonate were used for this neutralization?	[1]
e. Find the mass of sodium carbonate in g equivalent to the answer you found in question d. Relative Atomic Masses: $C = 12$ , $O = 16$ , $Na = 23$ .	[3]
f. What mass of the hydrated sodium carbonate used in this experiment was water?	[1]
g. Change your answer to question f. to moles of water. <b>Relative Atomic Masses: H =1, O = 16.</b>	[2]
h. Calculate how many moles of water are there in 1 mole of hydrated sodium carbonate.	[2]
i. What is the value of x in the formula $Na_2CO_3 \times H_2O_2$ ?	[1]

8 Describe how you would distinguish between the following pairs of substances by a chemical test involving the addition of the same reagent or reagents to both substances of the pair.

a.	Aqueous sodium chloride and aqueous sodium iodide.	[5]
b.	Aqueous iron (II) sulfate and aqueous iron (III) sulfate.	[7]

c. Aqueous aluminium nitrate and aqueous magnesium nitrate. [8]

For each of these 3 experiments, your answer should include:

i. What is the value of x in the formula  $Na_2CO_3.xH_2O$ ?

- the name/s of the test material/s required
- any conditions required for the reaction to proceed, if such conditions exist
- any necessary observations made
- a full equation that illustrates the reaction involved when **each** of the named pair of substances reacts with the test material. Include state symbols.

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- 9 Calcium carbonate reacts with dilute nitric acid to liberate carbon dioxide.
- StudentBounts.com a. Draw a full labelled diagram to show how you would prepare in the laboratory dry carbon dioxide from calcium carbonate and dilute nitric acid. Your apparatus must include:
  - the necessary equipment where the gas is produced
  - the necessary equipment that makes it possible to collect a dry sample of the gas whose changing volume can be measured at equal time intervals. [6]

[2]

- b. Give **two** properties of carbon dioxide.
- c. (i) Write a full balanced equation to represent the reaction. Include state symbols. (ii) Describe what you would **observe** when this reaction is taking place. [3]
- d. (i) Powdered calcium carbonate reacts faster than large pieces. Give two reasons why this happens.
  - (ii) State one other change that can be made to increase the rate of this reaction. [3]
- e. The volume of carbon dioxide produced in this experiment is noted and recorded at half minute intervals. The table below shows the results:

Time / minutes	0	1⁄2	1	11/2	2	21/2	3	31/2	4	41⁄2	5	51⁄2	6
Volume of $\overline{\text{CO}_2 / \text{cm}^3}$	0	8	14	20	25	29	33	36	38	39	40	40	40

- (i) Find the volume of carbon dioxide produced:
  - after the first minute
  - between the first and second minute.
- (ii) State why the answers to question e. (i) are not equal.
- (iii) State why no more carbon dioxide is produced after 5 minutes.

(iv) Calculate the average rate of carbon dioxide produced per minute in this experiment.

Note that the total duration of this experiment is 5 minutes. [6]