JUNIOR LYCEUM AND SECONDARY SCHOOL

ANNUAL EXAMINATIONS 2011

Directorate for Quality and Standards in Education **Educational Assessment Unit**

StudentBounts.com FORM 5 **CHEMISTRY** Class: Name: _____ Useful Data: Atomic numbers and relative atomic masses are shown in the periodic table printed below. One mole of any gas occupies 22.4 dm³ at standard temperature and pressure Faraday constant = 96500 C mol^{-1} O =It State symbols are expected to be included in all chemical equations. PERIODIC TABLE 2 3 4 5 7 0 1 6 4 He Η 1 2 12 **C** 14 **N** 7 20 9 11 16 19 Li Be B 0 F Ne 6 8 9 10 3 4 5 32 **S** 16 24 28 31 40 23 27 35.5 Mg Al Si P Cl Na Ar 15 11 13 14 17 18 12 40 ⁵² **Cr** 65 **Zn** 70 75 79 80 84 39 45 48 **Ti** 51 V 55 59 63.5 73 56 59 Ni K Sc Mn Fe Со Cu Ge Se Kr Ca Ga As Br 19 20 21 22 23 24 25 27 29 32 33 35 36 26 28 31 34 88 89 91 93 96 99 101 103 106 108 112 115 119 122 128 127 131 85 Rb **Y** 39 Nb Mo Sb **I** 53 Sr Zr Tc Ru Rh Pd Ag Cd In Sn Te Xe 50 38 40 41 42 43 46 48 49 51 54 47

Key

184

W

74

186

Re

relative atomic mass а Х symbol

195

Pt

78

197

Au

201

Hg

80

204

Tl

81

207

Pb

82

209

Bi

83

210

At

85

222

Rn

86

210

Po

84

atomic number

190

Os

76

h

192

Ir

77

Marks Grid [For Examiners use only]

178

Hf

181

Ta

73

139

La

57

137

Ba

56

133

Cs 55

Question			Section A Section B								
Nº.	1	2	3	4	5	6	7	8	9		
Max Mark	10	10	10	10	10	10	20	20	20		
Actual Mark											
Theor	ry Pap	er: 85%			Practi	cal: 15%	, D		Final	Score: 100%	6

SECTION A – Answer ALL questions. This section carries 60 marks.

- StudentBounty.com 1 a. Silver conductive adhesive paste and silver conductive ink are two new products that are currently being used extensively in the electronic industry. Which physical property of silver makes these two substances so suitable?
 - [1]
 - b. Silver plating solution is a mixture of ionic silver compounds commonly used in silver plating.

(i) Name one silver compound you expect silver plating solution contains.

(ii) In silver plating, which metal is used as the anode of the electrolytic cell?

(iii) Give one reason why the cathode has to be rotated during electroplating.

[3]

- c. A copper rod, cleaned with abrasive paper was weighed. It was then silver plated in an electrolytic cell and reweighed.
 - (i) Fill in the empty space in the table below:

Mass of copper rod	20.00 g
Mass of silver plated rod	22.16 g
Mass of silver coating	g

- (ii) Give one reason why the copper rod must be cleaned with abrasive paper before it is placed in the electrolytic cell.
- (iii) Calculate the quantity of electricity in Faradays that was needed to cover the copper rod with this thickness of silver. (Relative atomic mass of Ag = 108)

[6]

- 2 a. In the industrial production of chemicals, **catalysts** are often used.
 - Fill in the table below with the name of:
- StudentBounty.com (i) **two** chemicals that are more efficiently produced when a catalyst is used.
 - (ii) the industrial process used to produce each of these chemicals.
 - (iii) the catalyst used for each of these industrial processes.

(i)	Name of chemical	
(ii)	Name of industrial process	
(iii)	Name of catalyst used	

[6]

[1]

- b. In industry, a catalyst must have a high recovery capability. Which one of the statements below indicates best that a catalyst has such a property?
 - It helps the reaction to proceed in a short time. •
 - It is easily and rapidly reused with minimum loss.
 - It provides maximum yield of the desired product.
 - It eliminates unwanted by-products.
- c. Most catalysts used for the industrial production of chemicals are supported catalysts. Alumina, activated carbon, silica and calcium carbonate are often used as promoters or supports for metal catalysts. Give two beneficial effects a supported catalyst has over a non-supported catalyst.

(i)	
(ii)	21

d. A catalytic converter is a device used to reduce toxic emissions from exhaust systems. Platinum, palladium and rhodium are the most common precious metals used in catalytic converters.

Give the name of **one** toxic gas that is broken down into non-toxic components by a catalytic converter.

[1]

StudentBounty.com Aspirin manufactured since 1899 is the most well-known pain killer of our days. The 3 chemical name of the active pain-killing ingredient in aspirin is acetylsalicylic acid.

Formula of aspirin: $C_9H_8O_4$ (Relative Atomic masses: C = 12, H = 1, O = 16) Solubility of acetylsalicylic acid: 1 g / 100 g water at 37°C

- a. Calculate in g the mass of one mole of aspirin.
- b. (i) An aspirin tablet of mass 5 g contains 6% acetylsalicylic acid and 94% binding starch. Calculate the mass of acetylsalicylic acid in one tablet of aspirin.
 - (ii) What is the least mass of water needed to dissolve the active ingredient present in **one** tablet of aspirin at 37°C?

[4]

[2]

c. (i) Use the data in the table below to draw a solubility curve for aspirin. Choose any adequate scale you think is most suitable.

				Τ	'er	np). i	n	°C	1						(0			15			25	5		3	7		50
	So	lul	oil	ity	' iı	n g	g /	1()0	g	w	ate	er			0.	20)	0	.64	4	().8	34		1.	00)	1.10
	_	_	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1			
	_																												
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Temperature in °C

(ii) From your graph, find the solubility of aspirin at 30° C.

- 4 a. Magnesium chloride solution can be prepared by adding an excess of a solid reactant to dilute hydrochloric acid.
- StudentBounty.com (i) Name three different solid reactants that can be added to dilute hydrochloric acid to produce magnesium chloride solution.
 - (ii) Write a balanced equation for the reaction that occurs when one of the reactants you named in a. (i) is added to dilute hydrochloric acid. Include state symbols.

(iii) Why is it necessary to add an excess of the solid reactant to the dilute acid?

(iv) Which method would you use to obtain crystals of hydrated magnesium chloride from an aqueous solution of the salt?

[7]

b. Magnesium chloride is a typical ionic compound formed when one magnesium ion joins to two chlorine ions.

Draw dot / cross diagrams, showing all electron shells to represent the electron configuration and charge of:

- a magnesium ion (Atomic no. of magnesium 12) •
- a chlorine ion (Atomic no. of chlorine 17)

Only one chlorine ion is required.

[3]

	STILL	
a.]	Most metal halides are deliquescent and can be used as drying agents.	TBO.
(i) Explain what deliquescent means.	unty.
(ii) Give the name and formula of one deliquescent metal halide that can be used as a drying agent. 	
١	Name: Formula:	[2]
b. S (i	ome halides are light sensitive and are stored in dark glass bottles.) Explain what light sensitive means.	
(i	i) Give the name and formula of one light-sensitive halide that is stored in a dark glass bottle.	
ľ	Name: Formula:	[2]
c. S ((-	Some halides sublime when heated. i) Explain what sublime means.	
(N	Name: Formula:	[2]
d. (c	Copper is a transition metal that shows more than one valency. Write down the formul of any copper halide where copper shows a valency of 2.	a
e. (i) What is a halogen displacement reaction ?	[1]
(i	i) Write a balanced equation for the reaction that occurs when a supply of chlorine is passed into aqueous potassium iodide. Include state symbols.	
		[3]

- StudentBounty.com Aluminium nitrate nonahydrate (aluminium nitrate 9-water) is a crystalline solid 6 with molecular formula Al(NO₃)₃.9H₂O. When a sample of the hydrated compound was heated to around 50°C, it changed into an **anhydrous** powder. On further heating to 73.5°C, it **melted** and finally **decomposed** at 135°C.
 - a. Explain the terms:
 - (i) anhydrous: (ii) melted: (iii) decomposed: [3]
- b. In the box near each, write down crystalline solid or powder or molten liquid to describe the state of the sample at:
 - (i) $0^{\circ}C$

(ii) room temperature

- (iii) 60° C
- (iv) 100° C
- The formula mass of anhydrous aluminium nitrate is 213. Work out : (i) the formula mass of aluminium nitrate nonahydrate (aluminium nitrate 9-water). Relative atomic masses: H = 1; O = 16.

(ii) the percentage mass of water in the hydrated salt.

[3]

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

7 Crude oil, natural gas and coal are **fossil fuels**. The supply of fossil fuels is limited and so fossil fuels are classified as non-renewable sources of energy.

The components present in crude oil can be separated by fractional distillation. The crude oil is heated and passed into the bottom of a **fractionating column**. The vapour mixture given off rises up the column and the different fractions condense out at different parts of the column. The fractions that come off near the top are light-coloured volatile liquid hydrocarbons. Those removed near the bottom are dark and viscous.

Some fractions may consist of long-chain hydrocarbons which can be broken down into shorter chains by a process known as **cracking**. For example, decane molecules can be converted into smaller **butane** and **propene** molecules by cracking.

a. Read the text and explain the terms in bold with reference to the process of separating crude oil into different components. [10]

[4]

- b. In addition to your explanation, include as well:
 - (i) a labelled diagram of a fractionating column.
 - (ii) examples of long-chain and short-chain hydrocarbons.
 - (iii) names of different fractions and their particular use.
- StudentBounty.com (iv) reference to the saturated nature of alkanes and the unsaturated nature of alkenes.
- You are given a sample of an unknown metallic element X. You are required to conduct 8 practical tests to find out the correct place of X in the reactivity series of metals.

To collect experimental evidence, you decide to conduct the following five tests:

- reacting X with water at room temperature. •
- reacting X with steam.
- heating X strongly over a Bunsen flame.
- adding dilute hydrochloric acid to a sample of X.
- adding hot concentrated sulfuric acid to a sample of X.

Describe with the aid of a **brief explanation** and a **diagram** how **each** of these practical tests can be conducted. For **each** of these five tests, your answer should include:

- (i) the name/s of the product/s.
- (ii) an example of a metal that actually takes part in a similar reaction.
- (iii) a list of any necessary safety precautions you must take during your tests. [20]
- During practical sessions, you have used techniques for the identification of ions. 9

a. Describe techniques which you can use to distinguish between:

- the chlorine ion in magnesium chloride and the iodine ion in magnesium iodide.
- the **zinc** ion in zinc sulfate and the **copper** ion in copper sulfate. •

Each of your techniques must include:

- (i) a fully labelled diagram and a brief explanation of the procedure
- (ii) the names of any chemicals you require for your investigation
- (iii) a balanced equation for each ion you identify. Include state symbols. [16]
- b. Drops of dilute hydrochloric acid followed by an adequate amount of barium chloride solution are added to iron (II) sulfate. The reaction proceeds quickly at room temperature.
 - (i) State what you observe as the reaction proceeds.
 - (ii) Write down a balanced equation for the reaction. Include state symbols. [4]

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