Strathfield Girls High School

Student Name

2012

Preliminary Final Examination

Chemistry

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Board-approved calculators may be used
- Write using blue or black pen
- Draw diagrams using pencil
- A Data Sheet and Periodic Table are provided at the back of this paper and can be detached
- The Multiple Choice answer sheet is attached at the back of this paper and should be detached.
- All questions should be answered on this paper.
- All papers should be submitted at the end of the examination. Place multiple choice sheet inside the cover of this paper.

Exam Requirements

- Examination paper containing multiple choice answer sheet, data sheet and periodic table

Pages 2 – 17

Total marks (**75**)

This paper has two parts, Part A and Part B

Part A
Total marks (**20**)

- Attempt questions 1 – 20
- Allow about 35 minutes for this part

Part B
Total marks (**55**)

- Attempt questions 21 – 31
- Allow about 1 hour and 25 minutes for this part.

PART A: 20 MULTIPLE CHOICE questions. Allow about 35 minutes for this part.

Place an X in the correct space on the MULTIPLE CHOICE answer sheet.

1 Crystalline haematite is used as a gem stone and has the formula Fe_2O_3 .
What is the chemical name of this compound?

(A) iron (II) oxide

(B) iron (III) oxide

(C) iron trioxide

(D) iron (II) trioxide

2 Identify the separation technique most appropriate for the following mixtures, in order to obtain each of the components making up the mixture.

	Mixture of two miscible liquids	**A solution of a soluble solid in a liquid**	**Insoluble solid in a liquid**
(A)	Evaporation	Distillation	Filtration
(B)	Filtration	Evaporation	Crystalisation
(C)	Distillation	Evaporation	Sedimentation
(D)	Distillation	Distillation	Filtration

3 Aluminium is a typical metal, with a wide variety of uses.

Some of its properties include:

1. It has a low density.
2. It is a reactive metal.
3. It is a good conductor of heat.
4. An oxide layer forms on its surface and prevents corrosion.

Which of the properties listed above are physical properties?

(A) 1 and 2

(B) 1 and 3

(C) 2 and 4

(D) 1, 2 and 3

4 An element X has a melting point of -39 ^{o}C and a boiling point of 357 ^{o}C. It is shiny and conducts electricity when frozen.
What classifications are correct for this element?

	State at room temperature	Type of substance
(A)	Liquid	Metal
(B)	Solid	Metal
(C)	Liquid	Non-metal
(D)	Solid	Non-metal

5 This question refers to the information in the table below.

Metal	Reacts with water?	Reacts with steam?
1	No	Yes
2	No	No
3	Yes	Yes

What is the order of reactivity of these metals, from least to most reactive?

(A) 1, 2, 3

(B) 2, 1, 3

(C) 3, 2, 1

(D) 1, 3, 2

6 Ice has a lower density than water. Which of the following is the best explanation for this observation?

(A) Molecules of water expand when they freeze.

(B) The covalent bonds in liquid water are stronger than those in ice.

(C) Molecules in ice are not arranged as closely as those in liquid water.

(D) Hydrogen bonds are stronger in liquid water than they are in ice.

7 Which one of the following is true for one mole of oxygen gas, at 100kPa and 25 ^{0}C ?

(A) It has a mass of 16.0 grams

(B) It has a volume of 22.71 L

(C) It contains of 6.02 x 10^{23} atoms of oxygen

(D) It occupies the same volume as 1 mole of nitrogen gas.

8 Nitrogen and chlorine react together as shown.

$$N_2(g) + 3Cl_2(g) \rightarrow 2NCl_3(g)$$

What volume of chlorine is required to produce 16 L of nitrogen trichloride?

(A) 16 L

(B) 24 L

(C) 32 L

(D) 48 L

9 Which scientist is credited with the development of the modern Periodic Table?

(A) Dalton

(B) Mendeleev

(C) Döbereiner

(D) Newlands

10 Two elements are represented as shown below.

$$^{18}_{8}X \qquad\qquad ^{18}_{9}Y$$

What information can be deduced from these symbols?

(A) They represent the same element as their mass numbers are the same.

(B) They represent isotopes of the same element as the atomic numbers are different

(C) They represent different elements because the proton numbers are different.

(D) They represent different elements because their mass numbers are different.

11 50 mL of 0.10 mol L^{-1} solution of magnesium chloride is diluted with 200 mL of water. What is the concentration of the resulting solution?

(A) 0.02 mol L^{-1}

(B) 0.025 mol L^{-1}

(C) 0.04 mol L^{-1}

(D) 0.05 mol L^{-1}

12 Which one of the following chlorides is a polar covalent molecular substance?

(A) SCl_2

(B) $SrCl_2$

(C) CCl_4

(D) NaCl

13 Which of the following lists the elements in order of increasing atomic radius?

(A) Na, Mg, P, Cl

(B) Kr, Ar, Ne, He

(C) Li, Be, Na, Mg

(D) F, N, B, Li

14 What is the main type of force between hydrogen fluoride molecules?

(A) dispersion forces

(B) dipole-dipole attractions

(C) hydrogen bonds

(D) covalent bonds

15 Which process involves the breaking and making of covalent bonds between atoms?

(A) Precipitation of silver chloride

(B) Vaporisation of water

(C) Melting sodium chloride

(D) Electrolysis of water

16 What would be the change in temperature of 1.0 kg of water when it absorbs 100 kJ of heat energy?

(A) 0.024°C

(B) 0.42°C

(C) 24°C

(D) 42°C

17 Consider the following decomposition reactions.

1. $2AgCl(s) \rightarrow 2Ag(s) + Cl_2(g)$
2. $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$
3. $CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$

Identify the type of energy required to carry out these reactions.

	Reaction 1	**Reaction 2**	**Reaction 3**
(A)	Heat	Light	electricity
(B)	Electricity	Heat	light
(C)	Light	Heat	electricity
(D)	Light	Electricity	Heat

18 The mass of 3.01×10^{22} molecules of dinitrogen trioxide is:

(A) 3.8 g

(B) 38 g

(C) 229g

(D) 1520 g

19 P, Q, R and S are elements, each of which has only one possible valency. They are able to form a total of 4 ionic compounds upon combination. The formulae of three of them are: RQ, PQ_3 and P_2S_3. What is the formula of the other compound?

(A) RS

(B) RS_2

(C) R_2S

(D) RS_3

20 A chemistry student conducted solubility tests, in water, on a number of common chemicals (labelled W, X, Y and Z) and recorded her results in the table below:

Chemical Label	Solubility (✓=yes ; ✗ = no)
W	✓
X	✗
Y	✗
Z	✓

Which of the following alternatives identifies chemicals which would have results consistent with those recorded by the student?

	W	**X**	**Y**	**Z**
(A)	NaOH	C_6H_{14} (hexane)	CH_3OH (ethanol)	SiO_2
(B)	KNO_3	SiO_2	C (graphite)	CH_3OH (ethanol)
(C)	$CuSO_4$	$C_6H_{12}O_6$ (glucose)	SiO_2	C_6H_{14} (hexane)
(D)	CH_3OH (ethanol)	C (graphite)	$CuSO_4$	NaCl

Part B:
Questions: 21 – 31
Marks: 55
Time: Allow approximately 1 hour and 35 minutes for this part.

Answer the questions in the spaces provided.
Show all relevant working in questions involving calculations.

Question 21 (4 marks) **Marks**

(a) Using Lewis electron dot diagrams, compare the molecular shapes of water and hydrogen sulfide, H_2S. **2**

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(b) Account for the observation that hydrogen sulfide is a gas at room temperature whereas water is a liquid even though they are molecules of similar molecular mass. **2**

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Question 22 (6 marks) **Marks**

Aluminium can be obtained by mining the ore and by recycling.

(a) Distinguish between the terms ‘ore’ and ‘mineral’. **2**

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(b) Recount the steps taken to recycle aluminium. **2**

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(c) Justify the increased recycling of aluminium. **2**

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Question 23 (8 marks) **Marks**

(a) Magnesium reacts with nitric acid as shown below.

$Mg\,(s) + 2HNO_3\,(aq) \rightarrow Mg(NO_3)_2\,(aq) + H_2\,(g)$

Write the oxidation and reduction half-equations for this reaction. **2**

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(b) A student adds excess magnesium to a beaker containing 0.65 g of HNO_3. All of the nitric acid reacted.

(i) Calculate the number of moles of nitric acid that reacted. **1**

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(iii) Calculate the mass of magnesium that reacted. **2**

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(d) Describe a procedure that the student could use in the school laboratory to obtain the excess magnesium and the magnesium nitrate salt from the reaction mixture. **3**

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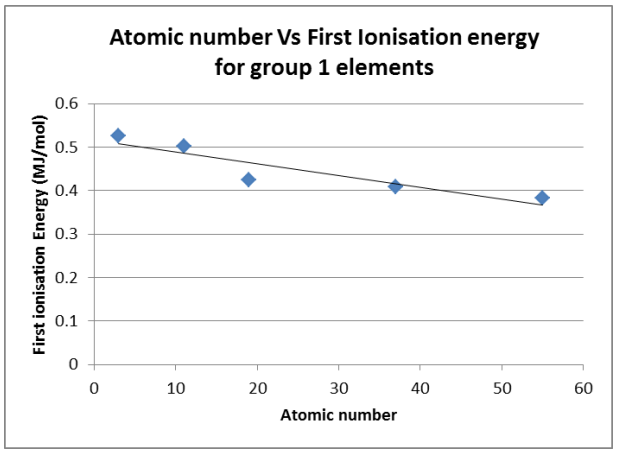
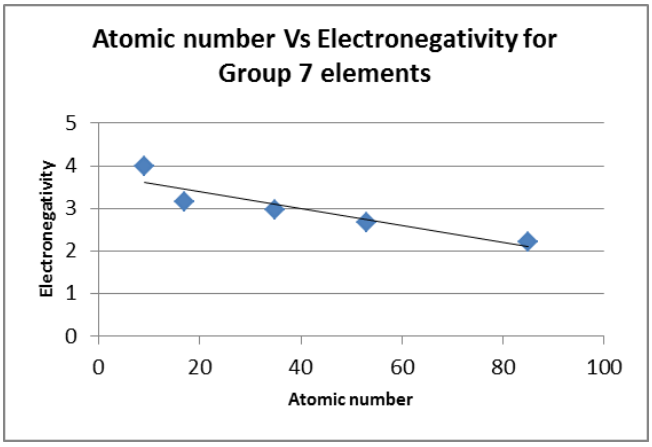
Question 24 (4 marks) **Marks**

Consider the following graphs, which show the trends in first ionisation energy for Group 1 elements and electronegativity for Group 7 elements.





Explain these trends in first ionisation energy and electronegativity.

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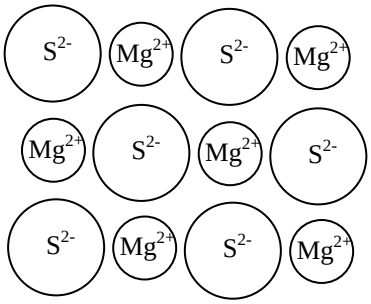
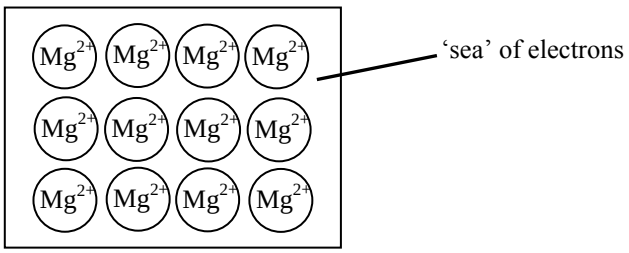
Question 25 (4 marks) **Marks**

Diagrams of a section of magnesium sulfide and magnesium are shown below.





Use the diagrams to explain the differences between magnesium sulfide and magnesium in terms of: **4**

- malleability and
- electrical conductivity.

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Question 26 (5 marks) **Marks**

A chemist analysed an ionic compound containing sodium, sulfur and oxygen and the following percentage masses were obtained:

Sodium = 32.4 %

Sulfur = 22.5 %

Oxygen = 45.1 %

(a) Determine the empirical formula for this compound. **3**

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(b) Explain why the formula of an ionic compound is an empirical formula. **2**

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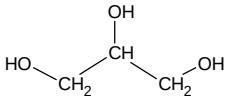
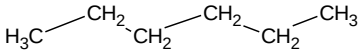
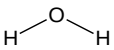
Question 27 (5 marks) **Marks**

The table below shows some basic information about three colourless liquids, arranged alphabetically by name.

Name of chemical	Structural Formula	Boiling Point (^{o}C)
glycerol		290
hexane		68.7
water		100

(a) Describe an investigation that could be used to compare the viscosity of the liquids listed in the table. **3**

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(b) Predict and account for the results you would expect to obtain from this investigation. **2**

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Question 28 (8 marks) **Marks**

Calcium chloride dissolves readily in water. However carbon tetrachloride (CCl_4) is considered to be insoluble in water.

(a) 10.0 g of calcium chloride was dissolved in sufficient water to give a final volume of 250.0 mL. Calculate the concentration of this solution in mol L^{-1}. **2**

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(b) Sketch and name the appropriate piece of glassware used to accurately produce the solution of calcium chloride. **2**

(c) Draw diagrams to show the changes to the particles when solid calcium chloride dissolves in water. **2**

(d) Explain why carbon tetrachloride is insoluble in water. **2**

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Question 29 (2 marks) **Marks**

Outline the contributions of Gay-Lussac and Avagadro to our knowledge of the chemistry of gases. **2**

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Question 30 (4 marks)

Explain how the properties of water are important to the survival of aquatic life. **4**

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Question 31 (5 marks) **Marks**

A student dissolved 3.32 g of lead (II) nitrate in excess water to form a solution. She then made another solution by dissolving 2.49 g of potassium iodide in excess water.
The student then mixed the two solutions together and a precipitate of lead iodide was formed.

(a) Write a net ionic equation for the reaction that occurs. **1**

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(b) By determining the limiting reagent, calculate the mass of lead iodide formed. **3**

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(c) Determine the concentration of the iodide ions remaining in the solution after precipitation has occurred. Justify your answer. **1**

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PERIODIC TABLE OF THE ELEMENTS

KEY

Atomic Number	Symbol of element	Name of element
79	Au	Gold
Atomic Weight	197.0	

1 H 1.008 Hydrogen																	2 He 4.003 Helium
3 Li 6.941 Lithium	4 Be 9.012 Beryllium											5 B 10.81 Boron	6 C 12.01 Carbon	7 N 14.01 Nitrogen	8 O 16.00 Oxygen	9 F 19.00 Fluorine	10 Ne 20.18 Neon
11 Na 22.99 Sodium	12 Mg 24.31 Magnesium											13 Al 26.98 Aluminium	14 Si 28.09 Silicon	15 P 30.97 Phosphorus	16 S 32.07 Sulfur	17 Cl 35.45 Chlorine	18 Ar 39.95 Argon
19 K 39.10 Potassium	20 Ca 40.08 Calcium	21 Sc 44.96 Scandium	22 Ti 47.87 Titanium	23 V 50.94 Vanadium	24 Cr 52.00 Chromium	25 Mn 54.94 Manganese	26 Fe 55.85 Iron	27 Co 58.93 Cobalt	28 Ni 58.69 Nickel	29 Cu 63.55 Copper	30 Zn 65.41 Zinc	31 Ga 69.72 Gallium	32 Ge 72.64 Germanium	33 As 74.92 Arsenic	34 Se 78.96 Selenium	35 Br 79.90 Bromine	36 Kr 83.80 Krypton
37 Rb 85.47 Rubidium	38 Sr 87.62 Strontium	39 Y 88.91 Yttrium	40 Zr 91.22 Zirconium	41 Nb 92.91 Niobium	42 Mo 95.94 Molybdenum	43 Tc [97.91] Technetium	44 Ru 101.1 Ruthenium	45 Rh 102.9 Rhodium	46 Pd 106.4 Palladium	47 Ag 107.9 Silver	48 Cd 112.4 Cadmium	49 In 114.8 Indium	50 Sn 118.7 Tin	51 Sb 121.8 Antimony	52 Te 127.6 Tellurium	53 I 126.9 Iodine	54 Xe 131.3 Xenon
55 Cs 132.9 Caesium	56 Ba 137.3 Barium	57–71 Lanthanides	72 Hf 178.5 Hafnium	73 Ta 180.9 Tantalum	74 W 183.8 Tungsten	75 Re 186.2 Rhenium	76 Os 190.2 Osmium	77 Ir 192.2 Iridium	78 Pt 195.1 Platinum	79 Au 197.0 Gold	80 Hg 200.6 Mercury	81 Tl 204.4 Thallium	82 Pb 207.2 Lead	83 Bi 209.0 Bismuth	84 Po [209.0] Polonium	85 At [210.0] Astatine	86 Rn [222.0] Radon
87 Fr [223.0] Francium	88 Ra [226.0] Radium	89–103 Actinides	104 Rf [261.1] Rutherfordium	105 Db [262.1] Dubnium	106 Sg [266.1] Seaborgium	107 Bh [264.1] Bohrium	108 Hs [277] Hassium	109 Mt [268] Meitnerium	110 Ds [271] Darmstadtium	111 Rg [272] Roentgenium							

Lanthanides

57 La 138.9 Lanthanum	58 Ce 140.1 Cerium	59 Pr 140.9 Praseodymium	60 Nd 144.2 Neodymium	61 Pm [144.9] Promethium	62 Sm 150.4 Samarium	63 Eu 152.0 Europium	64 Gd 157.3 Gadolinium	65 Tb 158.9 Terbium	66 Dy 162.5 Dysprosium	67 Ho 164.9 Holmium	68 Er 167.3 Erbium	69 Tm 168.9 Thulium	70 Yb 173.0 Ytterbium	71 Lu 175.0 Lutetium

Actinides

89 Ac [227.0] Actinium	90 Th 232.0 Thorium	91 Pa 231.0 Protactinium	92 U 238.0 Uranium	93 Np [237.0] Neptunium	94 Pu [244.1] Plutonium	95 Am [243.1] Americium	96 Cm [247.1] Curium	97 Bk [247.1] Berkelium	98 Cf [251.1] Californium	99 Es [252.1] Einsteinium	100 Fm [257.1] Fermium	101 Md [258.1] Mendelevium	102 No [259.1] Nobelium	103 Lr [262.1] Lawrencium

Where the atomic weight is not known, the relative atomic mass of the most common radioactive isotope is shown in brackets.
The atomic weights of Np and Tc are given for the isotopes ^{237}Np and ^{99}Tc.

DATA SHEET

Avogadro constant, N_A ..... 6.022×10^{23} mol^{-1}

Volume of 1 mole ideal gas: at 100 kPa and

at 0°C (273.15 K) ..... 22.71 L

at 25°C (298.15 K) ..... 24.79 L

Ionisation constant for water at 25°C (298.15 K), K_w ..... 1.0×10^{-14}

Specific heat capacity of water ..... 4.18×10^3 J kg^{-1} K^{-1}

Some useful formulae

$$\mathrm{pH} = -\log_{10}[\mathrm{H}^+] \qquad \Delta H = -mC\Delta T$$

Some standard potentials

$K^+ + e^-$	$\rightleftharpoons$	$K(s)$	–2.94 V
$Ba^{2+} + 2e^-$	$\rightleftharpoons$	$Ba(s)$	–2.91 V
$Ca^{2+} + 2e^-$	$\rightleftharpoons$	$Ca(s)$	–2.87 V
$Na^+ + e^-$	$\rightleftharpoons$	$Na(s)$	–2.71 V
$Mg^{2+} + 2e^-$	$\rightleftharpoons$	$Mg(s)$	–2.36 V
$Al^{3+} + 3e^-$	$\rightleftharpoons$	$Al(s)$	–1.68 V
$Mn^{2+} + 2e^-$	$\rightleftharpoons$	$Mn(s)$	–1.18 V
$H_2O + e^-$	$\rightleftharpoons$	$\frac{1}{2}H_2(g) + OH^-$	–0.83 V
$Zn^{2+} + 2e^-$	$\rightleftharpoons$	$Zn(s)$	–0.76 V
$Fe^{2+} + 2e^-$	$\rightleftharpoons$	$Fe(s)$	–0.44 V
$Ni^{2+} + 2e^-$	$\rightleftharpoons$	$Ni(s)$	–0.24 V
$Sn^{2+} + 2e^-$	$\rightleftharpoons$	$Sn(s)$	–0.14 V
$Pb^{2+} + 2e^-$	$\rightleftharpoons$	$Pb(s)$	–0.13 V
$H^+ + e^-$	$\rightleftharpoons$	$\frac{1}{2}H_2(g)$	0.00 V
$SO_4^{2-} + 4H^+ + 2e^-$	$\rightleftharpoons$	$SO_2(aq) + 2H_2O$	0.16 V
$Cu^{2+} + 2e^-$	$\rightleftharpoons$	$Cu(s)$	0.34 V
$\frac{1}{2}O_2(g) + H_2O + 2e^-$	$\rightleftharpoons$	$2OH^-$	0.40 V
$Cu^+ + e^-$	$\rightleftharpoons$	$Cu(s)$	0.52 V
$\frac{1}{2}I_2(s) + e^-$	$\rightleftharpoons$	I^-	0.54 V
$\frac{1}{2}I_2(aq) + e^-$	$\rightleftharpoons$	I^-	0.62 V
$Fe^{3+} + e^-$	$\rightleftharpoons$	Fe^{2+}	0.77 V
$Ag^+ + e^-$	$\rightleftharpoons$	$Ag(s)$	0.80 V
$\frac{1}{2}Br_2(l) + e^-$	$\rightleftharpoons$	Br^-	1.08 V
$\frac{1}{2}Br_2(aq) + e^-$	$\rightleftharpoons$	Br^-	1.10 V
$\frac{1}{2}O_2(g) + 2H^+ + 2e^-$	$\rightleftharpoons$	H_2O	1.23 V
$\frac{1}{2}Cl_2(g) + e^-$	$\rightleftharpoons$	Cl^-	1.36 V
$\frac{1}{2}Cr_2O_7^{2-} + 7H^+ + 3e^-$	$\rightleftharpoons$	$Cr^{3+} + \frac{7}{2}H_2O$	1.36 V
$\frac{1}{2}Cl_2(aq) + e^-$	$\rightleftharpoons$	Cl^-	1.40 V
$MnO_4^- + 8H^+ + 5e^-$	$\rightleftharpoons$	$Mn^{2+} + 4H_2O$	1.51 V
$\frac{1}{2}F_2(g) + e^-$	$\rightleftharpoons$	F^-	2.89 V

Aylward and Findlay, *SI Chemical Data* (5th Edition) is the principal source of data for this examination paper. Some data may have been modified for examination purposes.

Strathfield Girls High School

2012 Preliminary Chemistry

Multiple Choice Answer Sheet

Name:.....

	A	B	C	D
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21. a

Marking Criteria	Marks
• Correctly draws both diagrams showing the unpaired electrons on oxygen AND describes both having a bent shape	**2**
• Identifies bent shape correctly (OR) correct diagrams only	**1**

Sample answer: Both have a bent shape

21. b

Marking Criteria	Marks
• Correctly identifies that water has hydrogen bonding which is stronger than the dipole-dipole bonds in hydrogen sulfide AND that more energy is needed to overcome the stronger H-bonds in water	**2**
• Identifies the bonding between the molecules only	**1**

Sample answer: water has hydrogen bonding between the molecules which is much stronger than the dipole-dipole bonding between the hydrogen sulfide molecules. Thus more energy is needed to overcome the hydrogen bonds in water which is why it is a liquid ta room temperature whilst hydrogen sulfide is a gas at room temperature.

22. a

Marking Criteria	Marks
• Correctly describes a mineral as a crystalline compound found in rocks AND and an ore as a rock which contains metals and minerals in amounts economically worthwhile to extract	**2**
• Identifies one term correctly only	**1**

Sample answer: a mineral is a crystalline compound found in rocks in the Earth's crust whilst an ore is a rock which contains metals and minerals in amounts worthwhile to extract in terms of abundance and market value.

22. b

Marking Criteria	Marks
• Correctly describes the collection and crushing of cans which get sent to be heated AND the removal of paint with the salt	**2**
• Correctly describes one of the above procedures only	**1**

Sample answer: Cans collected and sorted from other materials. Aluminium cans then baled and crushed into blocks and heated in furnace. Dross salt then added to remove paint and re-heated into pure molten aluminium. Molten aluminium poured into ingots to be moulded and cooled. Once cool it is then rolled into thin sheets to be cut, processed and re-used as cans.

22. c

Marking Criteria	**Marks**
• Justifies the recycling of aluminium in terms of two aspects, each outlined below.	**2**
• Identifies two reasons, or outlines one reason.	**1**

Sample answer- Recycling uses less energy than extraction and processing, as a result increased recycling of aluminium will result in fewer CO_2 emissions, resulting in a reduced contribution to global warming. Furthermore, aluminium is a finite resource, and increased recycling will mean that it is depleted more slowly.

23. a.

Marking Criteria	**Marks**
• Correctly writes two half equations	**2**
• Correctly writes one half equation	**1**

Sample answer-

$2H^+_{(aq)} + 2e^- \rightarrow H_{2\,(g)}$ (reduction)

$Mg_{(s)} \rightarrow Mg^{2+}_{(aq)} + 2e^-$ (oxidation)

23. b. i.

Marking Criteria	**Marks**
• Correctly calculates the number of moles of nitric acid.	**1**

$n(HNO_3) = m/MM = 0.65/63.018 = 0.010$ mol of HNO_3 reacted (2 sig fig)

23. b. iii.

Marking Criteria	**Marks**
• Correctly calculates the mass of magnesium that reacted and has correct significant figures	**2**
• Correctly calculates the mass of magnesium that reacted (OR) has correct significant figures	**1**

Sample answer:

Use mole ratio
Mg: HNO_3
1 : 2
Moles of magnesium is 0.5 x moles of HNO_3 = 0.005 mol
m = n x MM = 0.0050 x 24.31 = 0.12 g. (will also accept 0.13g)

23. d

Marking Criteria	**Marks**
• Identifies filtration and evaporation as techniques used to separate Mg and salt respectively AND describes where the components get separated	**3**
• Identifies filtration and evaporation as the techniques used to separate Mg and salt respectively only	**2**
• Identifies one correct separation technique only	**1**

Sample answer: Excess magnesium can be separated using filtration as it is insoluble and will remain in the filter paper as residue. The magnesium nitrate salt is soluble in water and will pass out as the filtrate. This can be separated from water using evaporation, leaving behind the magnesium nitrate salt behind in the evaporating basin as it has a higher boiling point than water.

24.

Marking Criteria	**Marks**
• Explains both trends, including an explanation of first ionisation energy and electronegativity.	**4**
• Explains one trend and includes a correct statement about the other. Includes a definition of one of the terms.	**3**
• Outlines both trends or explains one trend, or includes a definition of first ionisation energy and electronegativity.	**2**
• Outlines one trend or gives one correct definition.	**1**

Sample answer:

First ionisation energy is the energy required to remove one electron from an atom in the gas phase. Moving down Group I of the Periodic Table the valence shell is further and further from the nucleus, and more shielded from its positive charge by full inner shells. As a result the valence electron is held less and less strongly, requiring less and less energy to remove it. Hence the first ionisation energy decreases moving down Group I.

Electronegativity is an atom's affinity for or attraction to an electron. Moving down Group VII the valence shell is also further and further from the nucleus, and shielded from its positive charge by an increasing number of full inner shells. The valence shell of atoms in Group VII requires one extra electron to be full, but because the valence shell is less and less attracted to the nucleus, this extra electron is attracted less and less strongly moving down the group. Hence the electronegativity decreases moving down the group.

25.

Marking Criteria	**Marks**
• Explains the electrical conductivity and malleability (or lack of) of magnesium and magnesium sulfide.	**4**
• Explains one aspect of both substances, and outlines the other aspect for one substance.	**3**
• Outlines both aspects of both substances, or explains one aspect of one substance.	**2**
• Outlines one aspect of one substance.	**1**

Sample answer:

A metal such as magnesium is malleable because when struck, the structure of the lattice is disrupted, but the mobile electrons are able to move between cations to prevent cation-cation repulsion. This prevents the lattice from splitting apart – rather it just changes shape. Magnesium sulfide on the other hand shatters when struck, because the change in the shape of the lattice results in cation-cation and anion-anion repulsion, splitting the lattice apart. Magnesium sulfide has no mobile electrons, and the ions are fixed in place in the solid state. When molten or in solution however, the ions are mobile and so the substance conducts electricity. Magnesium has mobile electrons in the solid state, and so is an electrical conductor.