

STATHFIELD GIRLS HIGH SCHOOL

YEAR 11 YEARLY EXAM 2004

Name _____

Teacher _____

PRELIMINARY CHEMISTRY

General Instructions

- Reading time – 5 minutes
- Working time – 2 hours
- Write using blue or black pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- A **data sheet** and **Periodic Table** are provided with this paper
- Write your name and teacher's name on this paper

Total Marks – 75

Part A – 15 marks

- Multiple choice questions
- Attempt Questions 1–15
- Allow about 25 minutes for this part

Part B – 60 marks

- Extended answer questions
- Attempt Questions 16–27
- Allow about 1 hour and 35 minutes for this part

PART A – Multiple Choice

- Questions 1 to 15 inclusive are each worth 1 mark.
 - Allow about 30 minutes for this section.
 - For each question choose the best alternative of those given and indicate your choice by placing a cross (X) in the appropriate space on the answer sheet.
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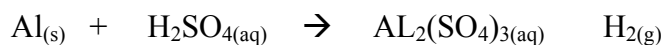
1. Use the Periodic table provided to identify the element with the electron configuration of 2,8,7.
 - (a) carbon
 - (b) chlorine
 - (c) fluorine
 - (d) neon
2. The formula for potassium sulfate is
 - (a) P_2SO_4
 - (b) KSO_4
 - (c) K_2SO_4
 - (d) K_2S
3. Which list contains only pure substances?
 - (a) copper wire, sucrose, graphite
 - (b) diamond, common salt, air
 - (c) petroleum, copper wire, diamond
 - (d) steel, graphite, water
4. Which of the following statements best describes why metals are better conductors of electricity than non-metals.
 - (a) metallic bonds are stronger than covalent bonds
 - (b) metals have higher melting points than non-metals
 - (c) metals have delocalised valence electrons
 - (d) metal atoms are smaller than non-metal atoms
 - (e)
5. Identify the chemical change in the changes listed below.
 - (a) condensation of water vapour
 - (b) electrolysis of water
 - (c) dissolving of sugar in water
 - (d) evaporation of water

6. Identify the group in which all of the substances have covalent bonds.
- (a) diamond, graphite, carbon dioxide, potassium fluoride
 - (b) hydrogen iodide, water, calcium chloride, paraffin wax
 - (c) iodine, ice, zinc sulfide, ethanol
 - (d) ammonia, oxygen, water, methane
7. A student conducted an experiment on the solubility of various substances in water. Which set of results is correct?

Solubility in water			
Sodium chloride	sucrose	silicon dioxide	cellulose
(a) soluble	not soluble	soluble	not soluble
(b) not soluble	soluble	soluble	not soluble
(c) soluble	soluble	not soluble	not soluble
(d) not soluble	not soluble	soluble	soluble

8. An atom (X) has 12 neutrons and 11 protons and in its nucleus. The formula of its sulfide would be:
- (a) X₂S
 - (b) XS
 - (c) XS₂
 - (d) X₂S₂

- 9.. Identify the molar ratios of reactants to products in the reaction represented by the unbalanced equation;



	Reactants	Products
(a)	1 : 1	1 : 1
(b)	2 : 3	1 : 3
(c)	3 : 2	3 : 1
(d)	3 : 2	1 : 2

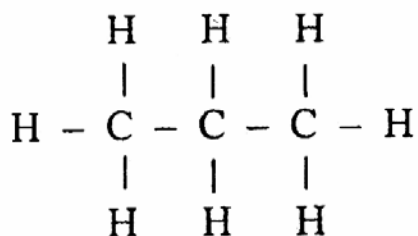
10. Which is the strongest attractive force that exists between hydrogen fluoride molecules?

- (a) ionic bonds
- (b) dispersion forces
- (c) dipole-dipole forces
- (d) hydrogen bonds

11. Which of the following is an empirical formula?

- (a) H₂O₂
- (b) N₂O₄
- (c) C₂H₆
- (d) Na₂O

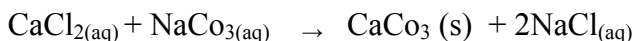
12. Below is the structural formula of a hydrocarbon.



The systematic name for this compound is

- (a) propane
- (b) pentane
- (c) butane
- (d) propene

13. The reaction between calcium chloride and sodium carbonate solutions produces a precipitate of calcium carbonate:



If 50 mL of 0.5 mol L⁻¹ calcium chloride solution was reacted with excess sodium carbonate solution, how many moles of calcium carbonate would be precipitated?

- (a) 0.025 mol
- (b) 2.33 mol
- (c) 25 Mol
- (d) 233 mol

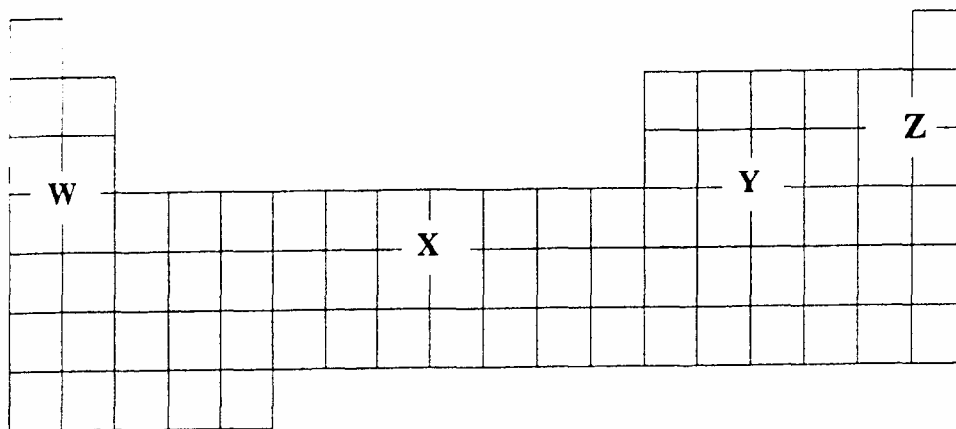
14. A small piece of each metal listed in the table below was added to dilute hydrochloric acid at room temperature. The observations from each experiment are given in the following table.

Metal	Reaction
Q	Bubbles of a colourless gas were given off very vigorously. Test tube became hot.
R	No apparent reaction
S	Tiny bubbles appear on the metal
T	Bubbles of a colourless gas given off at moderate rate. Test tube became warm.

From the information presented in the table, which series of metals is in order from most reactive to least reactive?

- (a) Q, R, S, T
- (b) Q, T, S, R
- (c) R, S, T, Q
- (d) R, T, Q, S

15. In the outline of Periodic table below, four regions have been marked W, X, Y and Z



In which region would you find a semi metal?

- (a) W
- (b) X
- (c) Y
- (d) Z

PART B – 60 marks

- **Questions 16-28 are extended response question**
 - **Answer the question in the space provided in this paper**
 - **Allow about 1 hour and 30 minutes for this part**
 - **Show all relevant working in question involving calculations.**
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Question 16 (4 marks)

You are provided with a mixture of sand, salt and water.

(a) Draw a labelled diagram of the equipment you would use to separate the sand from the salt and water.

(b) If the total mass of the mixture provided was 250 g and the mass of the dry sand obtained was 58.8 g , calculate the percentage (%) of sand in the original mixture.

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Question 17 (3 marks)

(a) Identify the electron configuration of an atom of aluminium

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(b) With the aid of electron dot formulae, describe the formation of an aluminium ion.

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Question 18 (6 marks)

The table below provides some data for two different compounds, X and Y.

Compound	melting point (°C)	boiling point (°C)	solubility in water
X	712	1418	soluble
Y	-164	-152	insoluble

Use the data to determine the bonding present in each substance and justify your choice.

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Contrast the expected electrical conductivity of compounds X and Y, and relate the conductivity to the type of bonding present in each of the compounds.

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Question 19 (5 marks)

A student performed a first-hand investigation to measure and identify the mass of the elements in magnesium oxide.

The information she recorded is as follows:

Mass of dry crucible + lid	= 32.14 g
Mass of dry crucible + lid + magnesium	= 32.63 g
Mass of dry crucible + lid + magnesium oxide	= 32.95 g

(a) Determine the empirical formula of magnesium oxide. (Show all working).

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(b) Calculate the volume of oxygen taken from the air during this experiment when measured at 25°C and 100 kPa.

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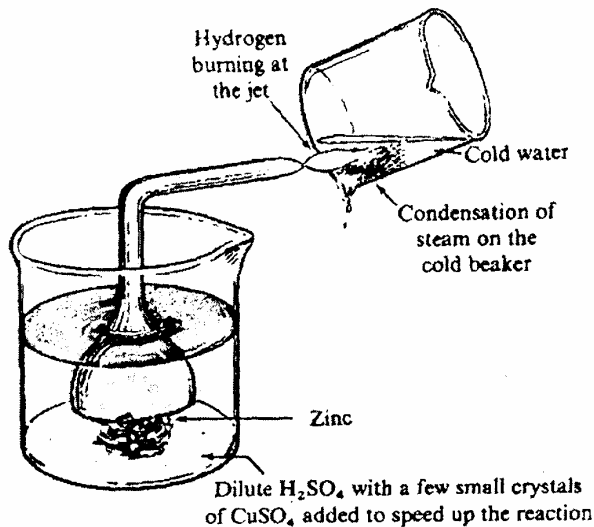
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Question 20 (7 marks)

Hydrogen gas was produced from a chemical reaction using the apparatus shown in the diagram below. This hydrogen gas was combusted in air producing steam, as shown in the diagram, and the steam was then condensed to water.



- (a) Construct an equation for the chemical reaction used to produce the hydrogen gas in this apparatus.

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- (b) 1.0 g of water was formed by combustion of the hydrogen gas produced in this apparatus.
- (i) Calculate the moles of hydrogen gas needed to produce 1.0 g of water.
- (ii) Determine the mass of zinc needed to produce 1.0 g of water.

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- (c) Identify ONE hazard and outline how you would reduce the risk associated with this hazard

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Question 21 (5 marks)

(a) Proceeding from left to right across the third period (Na to Ar) of the Periodic Table describe the trends in

- (i) first ionisation energy
- (ii) atomic radius

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(ii).....
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(b) Explain the trend in electronegativity down group VII of the Periodic Table.

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Question 22 (5 marks)

(a) Calculate the mass of barium chloride crystals ($\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$) required to prepare 200 mL of solution with a concentration of 0.50 mol L^{-1}

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(b) This solution is diluted to a volume of 500 mL. Determine the chloride ion concentration in the diluted solution

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Question 23 (6 marks)

- (a) Explain with the aid of a diagram how the bonding between molecules of water arises.

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- (b) Explain why the boiling point of water is higher than the boiling point of hydrogen sulfide, a molecule of similar size and mass to the water molecule.

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- (c) Describe and explain the changes in particle arrangements as dissolution occurs when a compound such as sodium chloride is added to water.

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Question 24 (4 marks)

- (a) An aquarium tank holds 70 litres of water. Calculate how much heat energy is needed to heat the tank from 18.2^oC to 26.5^oC. The specific heat capacity of water is 4.18 J g⁻¹K⁻¹

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- (b) In practice it is found that the amount of heat energy required is 20% greater than the calculated amount. Identify a reason for this difference.

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Question 25 (5 marks)

A student added solid lead (II) nitrate 200 mL of water in order to make a saturated solution.

(a) Write an ionic equation to show the dissolving of lead (II) nitrate in water.

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The student took exactly 20 mL of the saturated solution and added an excess of sodium sulfide solution to precipitate all the lead as lead sulfide. The resulting mixture was filtered and the mass of solid lead sulfide was found to be 8.61 g.

(b) Write an ionic equation to show the precipitation of lead sulfide.

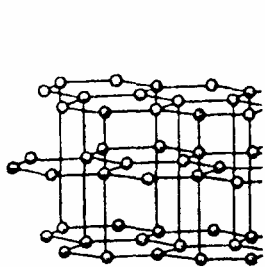
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(c) Calculate the concentration of the saturated solution of lead nitrate in mol L⁻¹.

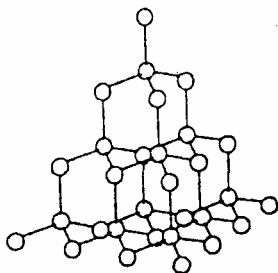
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Question 26 (3 marks)

The diagram below shows two allotropes of carbon – graphite and diamond



graphite



diamond

Account for the difference and use of graphite and diamond in terms of their structure and bonding

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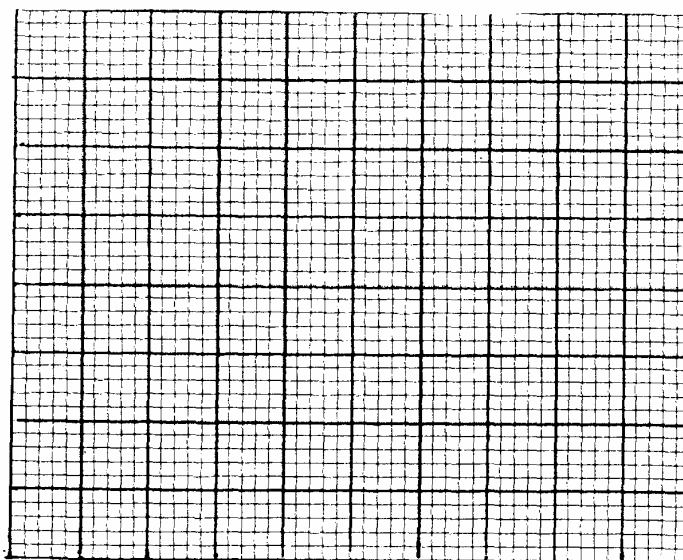
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Question 27 (7 marks)

A student wished to investigate the effect of concentration on the rate of a reaction. She decided to react marble chips (calcium carbonate) with hydrochloric acid to two different concentrations and measured the volume of gas produced over 20 second intervals. Her results are shown in the table below.

Time (seconds)	Volume of gas produced using 0.5mol L^{-1} hydrochloric acid (mL)	Volume of gas produced using 1.0mol L^{-1} hydrochloric acid (mL)
0	0	0
20	6	11
40	12	20
60	18	26
80	22	29
100	26	30
120	29	30
140	30	30
160	30	30

- (a) Plot a graph of each set of results on the graph paper provided. Indicate which line graph represents which concentration of hydrochloric acid.



Question 27 continued.

(b) Explain the shape of the graph for the 0.5 mol L^{-1} hydrochloric acid solution.

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(c) Write a conclusion for the experiment

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End of paper.....