STUDENT NUMBER: _____

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PYMBLE LADIES' COLLEGE

SEMESTER 2, 2002

YEAR 11 ~ CHEMISTRY

QUESTION and ANSWER BOOK

TIME ALLOWED: 2 HOURS 15 MINUTES

TOTAL MARKS 75

DIRECTIONS TO CANDIDATES

ANSWER ALL QUESTIONS

PART A: **15 Multiple Choice questions, each worth one mark. Indicate your answers on the Multiple Choice Answer Sheet provided.**

PART B: **12 Extended response questions. Marks for each question are indicated Answer each question in the space provided.**

A Periodic Table and solubility data are provided.

PART A

Total Marks – 15
Attempt ALL questions

Select the alternative that best answers the question.
Mark your answers on the Multiple Choice Answer Sheet provided.
[Allow about 30 minutes for this part]

1. Matter commonly exists in three states - gas, liquid and solid. In terms of particle theory it is correct to say that gaseous particles are

A. close to one another but free to move

B. closely packed and held in position

C. far apart and move independently of each other

D. easily compressed and are therefore unable to disperse.

2. The group of elements which are all gases at room temperature are

A. nitrogen, selenium, oxygen

B. chlorine, argon, bromine

C. neon, sulfur, argon

D. fluorine, krypton, xenon

3. A student wanted to separate the components of a mixture containing potassium chloride, water and hexane. She also needed to determine the amount of each substance present in the mixture. She knew that potassium chloride was insoluble in hexane and that hexane was immiscible in water. The best techniques to separate the mixture, in the correct order are

A. separating funnel and filtration

B. separating funnel and distillation

C. evaporation and filtration

D. filtration and evaporation

4. Aluminium has an atomic number of 13 and a mass number of 27. How many protons are present in the Al^{3+} ion?

A. 10

B. 11

C. 13

D. 14

5. A substance has a high melting point and is a non-conductor of electricity in the solid and molten state. This substance is most likely to be

A. a covalent molecular substance

B. a metal

C. a covalent network substance

D. an ionic substance

6. The mass of calcium carbonate that contains the same number of mole as are present in 5.6g of calcium oxide is

A. 56g

B. 11.2g

C. 50.0g

D. 10.0g

7. Energy is needed to extract a metal from its ore because

A. heat, electricity and light are different forms of energy which can be changed to chemical energy

B. it takes energy to break the bonds which hold metal ions to the other ions in the ore

C. the metal compound in the ore has higher energy than the uncombined metal

D. heat can melt the uncombined metal from which the ore is made

8. The balanced equation for the reaction of $BaCl_2$ with Na_3PO_4 is

$3BaCl_2(aq) + 2Na_3PO_4(aq) \rightarrow Ba_3(PO_4)_2(s) + 6NaCl(aq)$

What mass of NaCl could be produced from 2 moles of $BaCl_2$ in excess Na_3PO_4? (M_r Na = 23; M_r Cl = 35.5)

A. 58.5 g

B. 117.0 g

C. 175.5 g

D. 234.0 g

9. A sample of sulfide contains 6.70 g of iron and 3.84 g of sulfur. The empirical formula of the sulfide is

A. Fe_7S_4

B. Fe_4S_7

C. Fe_2S_3

D. FeS

10. Under certain conditions iron reacts with water to produce a particular iron oxide (Fe_3O_4) and hydrogen gas. The unbalanced equation is

$$Fe + H_2O \longrightarrow Fe_3O_4 + H_2$$

The set of coefficients which will balance the equation in the order shown are

A. 3, 4, 1, 4

B. 3, 1, 1, 1

C. 6, 4, 2, 6

D. 3, 4, 1, 1

11. Water is essential for living things for many reasons. One of these reasons is because water

A. is found only as a liquid

B. provides a transport system for wastes and nutrients

C. becomes more dense as it solidifies

D. is a product in the process of photosynthesis

12. The element in the following list with the highest first ionisation energy is

A. lithium

B. sodium

C. rubidium

D. caesium

13. In 1869, Mendeleev published his Periodic Table. Mendeleev's table left gaps for elements not yet discovered. One of these elements was germanium. From its position on the current Periodic Table germanium would be

A. a low melting point, molecular element

B. a high melting point, metallic element

C. a high melting point, semi-metallic element

D. high melting point, non-metallic element

14. Select the group in which all the substances have ionic bonds

A. NaF, MgO, RbCl

B. CO_2, HCl, NaCl

C. SiO_2, SiC, BN

D. Al_2O_3, HI, NaI

15. Which of the following bonds is most polar?

A. N-F

B. P-F

C. S-F

D. Cl-F

PART B

Total marks – 60
Attempt ALL questions 16 – 27
Show all relevant working in questions involving calculations.
[Allow about 1 hour and 45 minutes for this part]

16. A neutral atom of an element has the electron configuration;

2, 8, 5

Using this information only (<u>without</u> referring to your periodic table) work out the following quantities for the atom.
In each case explain how you arrived at your answer.
If you decide the quantity cannot be worked out using the above information only, explain why this is the case.

(a) atomic number .....

……...……

(b) total number of electrons. .....

……

(c) relative atomic mass .....

……

(d) number of neutrons in the nucleus .....

……

(e) number of protons in the nucleus .....

……

(5 marks)

17. The world is full of mixtures. Chemists are often called upon to separate the components of mixtures.

Complete the following table:

SEPARATION METHOD	PROPERTY USED IN THE SEPARATION
Evaporation	
Distillation	
Filtration	
Separating Funnel	

(4 marks)

18. Complete the following table

Name of compound	**Formula**
iron(III) nitrate	
	Al_2O_3
dinitrogentetroxide	
	PCl_3

(4 marks)

19. Precipitation reactions are often used to confirm the presence of particular ions in solution.
Lead ions are identified by the bright yellow precipitate that forms in a reaction with iodide ions.

(a) Write a net ionic equation to represent the reaction between lead (II) nitrate and potassium iodide solutions.

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(2 marks)

(b) Similarly, silver ions may be identified by their reaction with chloride ions. Choose suitable compounds to write a balanced equation which illustrates how this could be achieved.

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(2 marks)

20. The following information refers to five different consecutive elements in the Periodic Table. The elements are in random order with fictitious symbols.

Element V is a monatomic gas. It has a relative atomic mass of 39.95.

Element W is a semi metal. It has a metallic lustre and is often used in the computer industry. It is a semi-conductor.

Element X is a green, yellow gas. It exists as diatomic molecules. It forms a compound with sodium with the formula NaX.

Element Y is a red coloured solid. It is a poor conductor of heat and electricity. It forms two compounds with chlorine of formula YCl_3 and YCl_5.

Element Z is a yellow solid. It forms a compound with hydrogen which has the odour of rotten eggs.

Identify each of the elements.

V……

W……

X ……

Y ……

Z ……

(5 marks)

21. (a) Draw the Lewis electron dot structure for the compound methane, CH_4.

(2 marks)

(b) Use Lewis electron dot diagrams to show both the reactants and products when a compound forms from Calcium and Fluorine.

(3 marks)

22. Hydrogen chloride is a gas with a boiling point of -114^{o}C. Lithium chloride is a crystalline solid with a melting point of 610^{o}C.

(a) Identify the type of bonding present in each of these substances.

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(2 marks)

(b) Lithium chloride dissolves in water. Explain how this occurs. Write an equation to represent the process.

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(2 marks)

(c) Hydrogen chloride dissolves in water to form hydrochloric acid. Explain this, using an equation to help you with your explanation.

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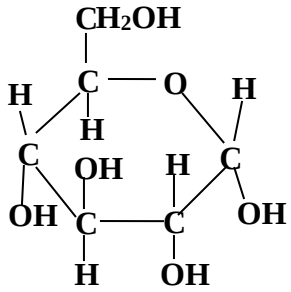
(2 marks)

23. The structure of glucose is drawn below.



(a) Give the empirical formula of glucose.

..... (1 mark)

(b) Calculate the molar mass of glucose.

(1 mark)

(c) Calculate the percentage of oxygen in glucose.

(1 marks)

(d) Explain why glucose is soluble in water.

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(2 marks)

24. Sarah made up a solution of calcium chloride by dissolving 29g of the solid in 500 mL of distilled water.

(a) Calculate the molarity of the calcium chloride solution.

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(2 marks)

(b) Write an equation to show the dissolution of calcium chloride and hence calculate the concentration of chloride ions in this solution.

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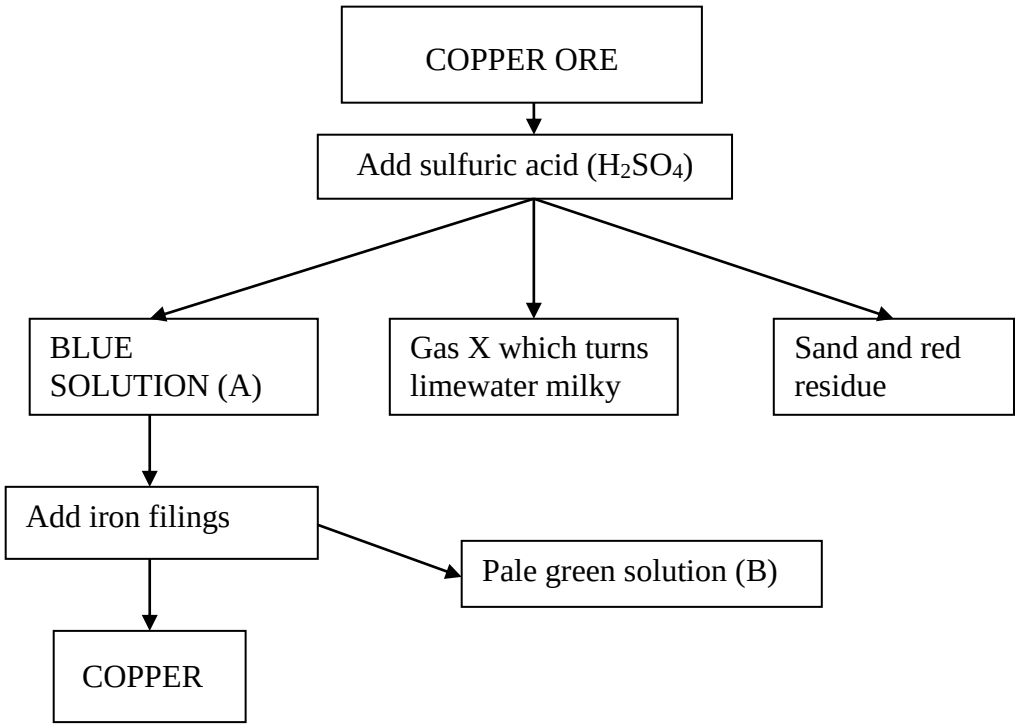
(2 marks)

25. A student carried out an experiment to extract copper from copper ore. She used the steps shown in the flow chart below.



(a) Name gas X ..... (1 mark)

(b) Name the blue solution (A)

..... (1 mark)

(c) Name the pale green solution (B) formed

..... (1 mark)

(d) Assuming that the major compound in the copper ore was copper carbonate, write an equation describing the reaction with sulfuric acid.

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(2 marks)

(e) The reaction of the blue solution with iron filings is an example of a displacement reaction. Write the net ionic equation for this reaction.

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(2 marks)

26. The Table below lists the first ionisation energy for several different elements, all from the same Period of the Periodic table. None of these elements belong to group 8. The letters give no clue to the actual identity of the elements.

ELEMENT	P	Q	R	S	T	U
1^{st} ionisation energy (MJ/mol)	1680	516	382	818	906	715

(a) Which two elements are most likely to be metals? Justify your choice.

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(2 marks)

(b) What trend do you observe in ionisation energy as you go across a period? Explain the reasons for this trend.

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(2 marks)

(c) What trend do you observe in the ionisation energies as you go down group 1 of the periodic table? Explain the reasons for this trend.

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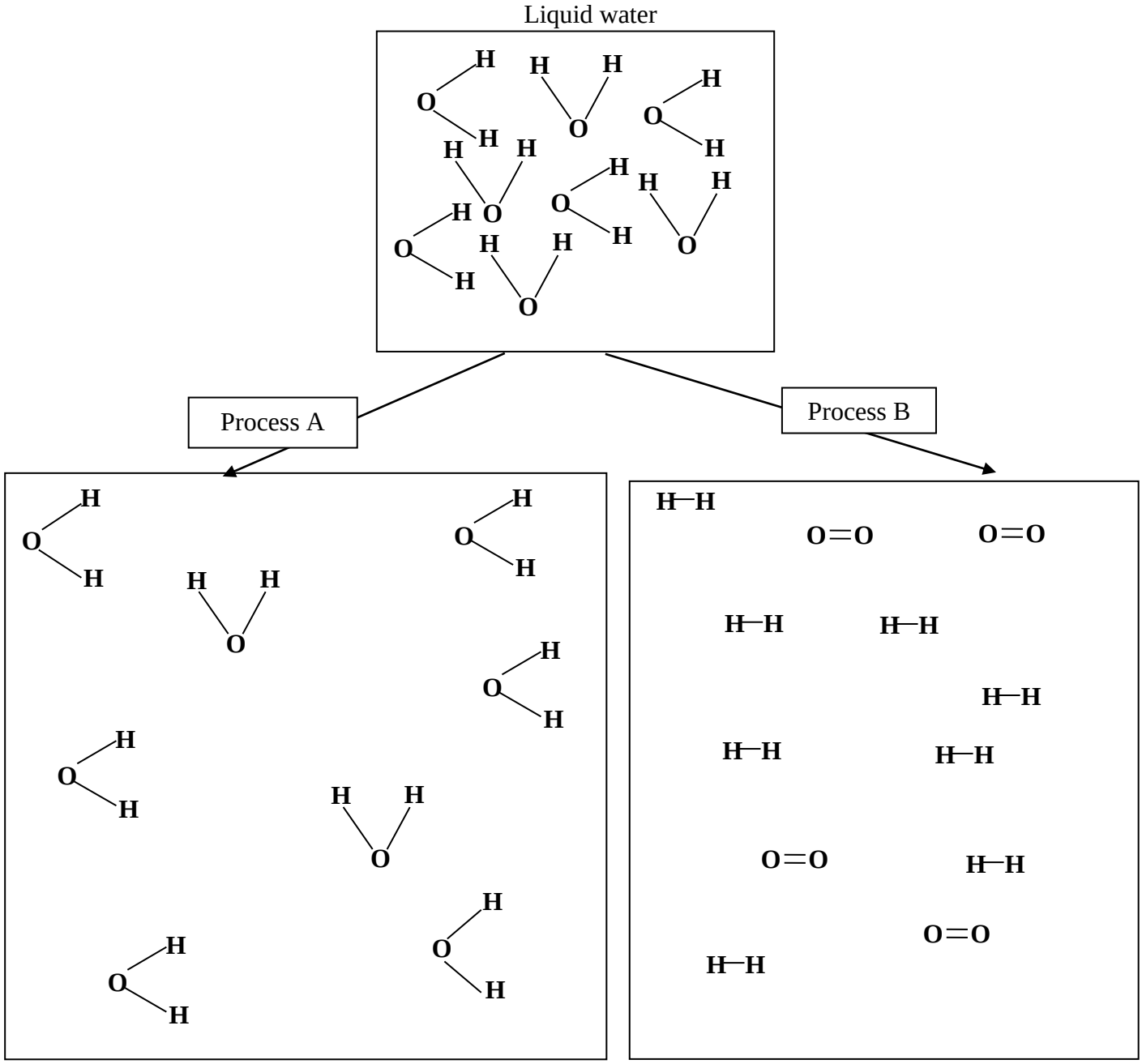
(2 marks)

27. Consider the following diagram.



The diagram represents what happens when two different processes are applied to liquid water.

(a) Name process A .....
($^1/_2$ mark)

(b) Name process B .....
($^1/_2$ mark)

Continued next page

(c) Is process A a chemical or physical change? Justify your answer.

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(2 marks)

(d) Is process B a chemical or physical change? Justify your answer.

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(2 marks)

END OF PAPER