Student Number	
Mark / 25	

Chemistry

The Chemical Earth and Metals
Modules Test • 2002

General Instructions

- Reading time – 5 minutes
- Working time – 40 minutes
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- A data sheet and a Periodic Table are provided at the back of this paper
- Write your Student Number at the top of this page

Total Marks – 25

Part A – 4 marks
- Attempt Questions 1 – 4
- Allow about 5 minutes for this part

Part B – 21 marks
- Attempt Questions 5 – 8
- Allow about 35 minutes for this part

Part A – 4 marks
Attempt Questions 1–4
Allow about 5 minutes for this part

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

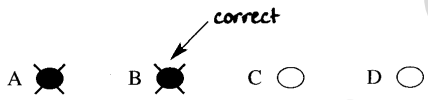
Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

A ○ B ● C ○ D ○

If you think you have made a mistake, put a cross through the incorrect answer and fill in the new answer.

A ● B ⊗ C ○ D ○

If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



Answer Box for Questions 1–4

1	**A** ○	**B** ○	**C** ○	**D** ○
2	**A** ○	**B** ○	**C** ○	**D** ○
3	**A** ○	**B** ○	**C** ○	**D** ○
4	**A** ○	**B** ○	**C** ○	**D** ○

Mark your answers for Questions 1 – 4 in the Answer Box on page 2.

1 In which of the following is nitrogen one of the most abundant elements*?*

(A) atmosphere
(B) biosphere
(C) hydrosphere
(D) lithosphere

2 Phosphorous acid has the formula H_3PO_3. What is the formula for calcium hydrogen phosphite*?*

(A) Ca_2HPO_3
(B) $Ca(HPO_3)_2$
(C) $Ca(HPO_3)_3$
(D) $CaHPO_3$

3 In the history of metal use, aluminium is a late entry. Which of the following statements best explains the difficulty of extracting a metal like aluminium*?*

(A) The metal has a low abundance in the earth's crust.
(B) The metal has a high reactivity.
(C) The metal has a low density.
(D) The metal has a high melting point.

4 The diagram represents a block of neighbouring elements on the Periodic Table (none are noble gases). Which of the elements has the highest electronegativity*?*

L	**M**
Q	**R**

(A) L
(B) M
(C) Q
(D) R

Part B – 21 marks
Attempt Questions 5 – 8
Allow about 35 minutes for this part

Question 5 (6 marks)

(a) Compare the electrical conductivity of solid sodium chloride and molten sodium chloride and give reasons for your answer. **(2 marks)**

_____

_____

_____

_____

(b) Draw the Lewis electron dot structure for sodium chloride. **(1 mark)**

(c) Summarise the differences between the boiling and the electrolysis of water as an example of the difference between a physical and chemical change. Record your answer in a table. **(3 marks)**

Question 6 (4 marks)

The properties of substances Y, Z, and L are given in the table.

PROPERTY	Y	Z	L
melting point (°C)	801	498	– 114
boiling point (°C)	1465	954	78
density (g cm^{-3})	5.4	5.8	0.785
solubility in water at 25°C	soluble	insoluble	soluble
solubility in water at 100°C	soluble	soluble	soluble

(a) Identify the best technique to separate Z from a mixture of Y, Z, L and water. **(1 mark)**

_____

(b) Draw and label the assembled equipment for the separation technique identified in (a). **(2 marks)**

(c) Which element, Y, Z or L, is a liquid at room temperature? **(1 mark)**

_____

Question 7 (7 marks)

(a) Write a balanced chemical equation showing the extraction of an ancient metal. **(1 mark)**

_____

(b) Australia is the world's third largest producer of lead. Huge smelters are located at Mt Isa, Q and Port Pirie, SA where lead is extracted from lead(II) sulfide. Identify an environmental problem associated with this process. **(1 mark)**

_____

(c) Explain why energy input is necessary to extract a metal from its ore. **(1 mark)**

_____

_____

(d) Alloys of lead are used in the plumbing and electronics industries.

Identify a property of lead alloys which relates to their use. **(1 mark)**

_____

(e) Pure lead plates immersed in dilute sulfuric acid are used in car batteries to make electricity.

(i) Write a balanced chemical equation showing the reaction of lead with sulfuric acid. **(1 mark)**

_____

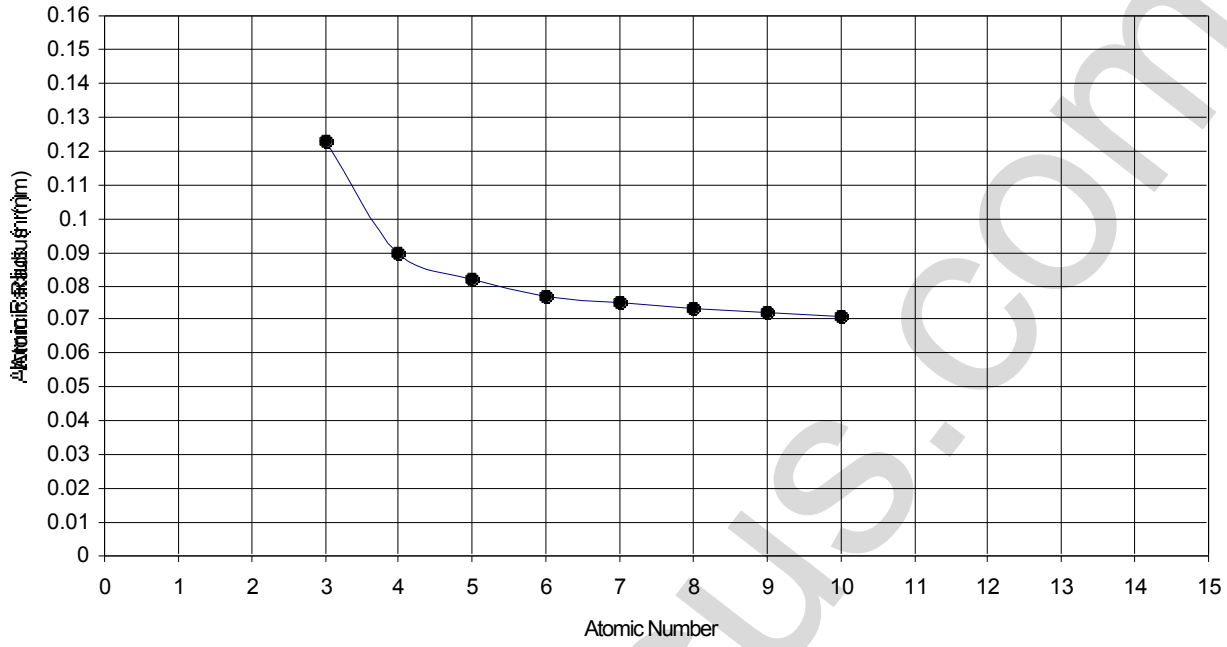
(ii) Write two half equations to represent the electron transfer reactions occurring when lead reacts with sulfuric acid in reaction (i). **(2 marks)**

_____

_____

Question 8 (4 marks)

The atomic radii of period 2 elements are shown in the graph.



(a) Plot a new point on the graph showing the *relative* value for the atomic radius of sodium. **(1 mark)**

(b) Plot a new point on the graph showing the *relative* value for the atomic radius of a lithium ion, Li^+. **(1 mark)**

(c) Sketch a curve on the graph showing the *relative* trend in ionisation energy values for period 2 elements. **(1 mark)**

(d) The ionisation energy for chlorine is 1260 kJ mol^{-1} . Which of the following equations correctly represents the ionisation process*?* **(1 mark)**

(i) $Cl_{(g)} + 1260\ kJ \rightarrow Cl^+_{(g)} + e^-$

(ii) $Cl_{2\,(g)} \rightarrow 2Cl^+_{(g)} + 2e^- + 1260\ kJ$

(iii) $Cl_{2\,(g)} + 2e^- \rightarrow 2Cl^-_{(g)} + 1260\ kJ$

(iv) $Cl_{2\,(g)} + 2e^- + 1260\ kJ \rightarrow 2Cl^-_{(g)}$

Answer _____

– End of Test –