Student Number	
Mark / 45	

Chemistry

Chemical Earth + Metals

Theory Test • 2006

General Instructions

- Reading time – 5 minutes
- Working time – 70 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 and may be removed for convenience
- Write your Student Number at the top of this page

Total Marks – 45

Part A – 14 marks
- Attempt Questions 1 – 14
- Allow about 20 minutes for this part

Part B – 31 marks
- Attempt Questions 15 – 22
- Allow about 50 minutes for this part

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Part A – 14 marks
Attempt Questions 1 – 14
Allow about 20 minutes for this part

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

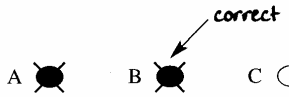
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9

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 – 14

1	**A** ○	**B** ○	**C** ○	**D** ○
2	**A** ○	**B** ○	**C** ○	**D** ○
3	**A** ○	**B** ○	**C** ○	**D** ○
4	**A** ○	**B** ○	**C** ○	**D** ○
5	**A** ○	**B** ○	**C** ○	**D** ○
6	**A** ○	**B** ○	**C** ○	**D** ○
7	**A** ○	**B** ○	**C** ○	**D** ○
8	**A** ○	**B** ○	**C** ○	**D** ○
9	**A** ○	**B** ○	**C** ○	**D** ○
10	**A** ○	**B** ○	**C** ○	**D** ○
11	**A** ○	**B** ○	**C** ○	**D** ○
12	**A** ○	**B** ○	**C** ○	**D** ○
13	**A** ○	**B** ○	**C** ○	**D** ○
14	**A** ○	**B** ○	**C** ○	**D** ○

► ***Mark your answers for Questions 1 – 14 in the Answer Box on page 3.***

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1 Which of the following is a liquid non–metal at 25°C ?

(A) water
(B) mercury
(C) chlorine
(D) bromine

2 Which of the following is **not** a property of metals?

(A) shiny
(B) conducts heat
(C) malleable
(D) brittle

3 Which procedure best describes a method for separating a mixture of liquids?

(A) crystallization
(B) filtration
(C) distillation
(D) froth floatation

4 Which of the following reactions is incorrect?

(A) silver chloride → silver + chlorine + light
(B) copper(II) carbonate + heat → copper(II) oxide + carbon dioxide
(C) magnesium + oxygen + heat → magnesium oxide + light + heat
(D) water + electricity → hydrogen + oxygen

5 Which of the following exists as a covalent lattice?

(A) argon
(B) carbon
(C) hydrogen
(D) mercury

6 Which alloy and property matches its common use?

	Alloy	*Property*
(A)	solder	high melting point
(B)	brass	hardness
(C)	steel	strength
(D)	bronze	low density

7 Which element has the highest electronegativity?

(A) chlorine
(B) iodine
(C) rubidium
(D) sodium

8 Which of the following correctly identifies the conducting species when electricity is passed through these substances?

	Substance		
	mercury	*molten NaCl*	*graphite*
(A)	cations	cations & anions	electrons
(B)	electrons	cations & anions	electrons
(C)	electrons	cations & anions	atoms
(D)	cations	electrons	electrons

9 Which of the following substances does not exist as a molecule?

(A) helium
(B) sodium chloride
(C) carbon dioxide
(D) water

10 How many gaseous elements are there at 25°C ?

(A) 9
(B) 10
(C) 11
(D) 12

11 Which statement best describes Mendeleev's theory for the classification of elements?

(A) The chemical and physical properties of elements vary in relation to their atomic weights.
(B) The physical properties of elements vary in relation to their atomic weight.
(C) The chemical and physical properties of elements vary in relation to their atomic number.
(D) The chemical properties of elements vary in relation to their atomic number.

12 The energy input necessary to extract a metal from its ore may be affected by several factors…

(i) the reactivity of the metal
(ii) the density of the metal
(iii) the magnetic property of the metal
(iv) the chemical composition the of ore

Which factor(s) will have the greatest effect on the size of the energy input?

(A) (i), (ii), (iii) only
(B) (i) and (ii) only
(C) (i) and (iv) only
(D) (i) only

13 Which of the following correctly shows the synthesis of magnesium oxide as an ionic substance?

(A) $Mg + \frac{1}{2} O_2 \rightarrow Mg^{2+} O^{2-}$

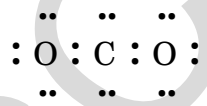
(B) $Mg + O \rightarrow Mg^{+} O^{-}$

(C) $Mg + 2O \rightarrow O^{-} Mg^{2+} O^{-}$

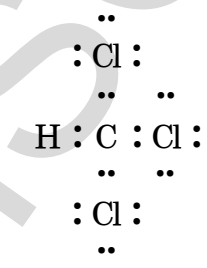
(D) $Mg + O_2 \rightarrow Mg^{2+} O_2^{2-}$

14 Which of the following Lewis electron dot structures is correct?

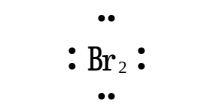
(A)



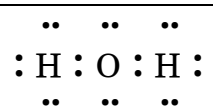
(B)



(C)



(D)



Part B – 31 marks
Attempt Questions 15 – 22
Allow about 50 minutes for this part

► ***Show all relevant working in questions involving calculations.***

Question 15 (3 marks)

(a) Describe the periodic trend for the first ionisation energy of the Group II elements. **(1 mark)**

(b) Explain the implications of this trend for the relative chemical reactivity of the Group II elements. **(2 marks)**

Question 16 (2 marks)

Hundreds of metals and alloys are available to engineers for specific uses.

(a) Suggest **two** relevant characteristics required for a metal used in a knee implant. **(1 mark)**

(b) Suggest **two** relevant characteristics required for a metal used in an exterior door of an aircraft. **(1 mark)**

Question 17 (4 marks)

Five metals A, B, C, D, E are placed in solutions containing cations A^{2+}, B^{2+}, C^{2+}, D^{2+}, E^{3+}.
The results of the experiment are shown below…

	A	*B*	*C*	*D*	*E*
A^{2+}	no visible reaction	reaction observed	no visible reaction	reaction observed	reaction observed
B^{2+}	no visible reaction	no visible reaction	no visible reaction	reaction observed	no visible reaction
C^{2+}	reaction observed	reaction observed	no visible reaction	reaction observed	reaction observed
D^{2+}	no visible reaction	no visible reaction	no visible reaction	no visible reaction	no visible reaction
E^{3+}	no visible reaction	reaction observed	no visible reaction	reaction observed	no visible reaction

(a) List the metals in order of increasing reactivity. **(1 mark)**

(b) For the reaction between B and E^{3+} construct…

(i) a balanced formula equation **(1 mark)**

(ii) two half–equations representing electron transfer **(2 marks)**

Question 18 (6 marks)

Substances P, Q, R and S have the following properties…

Substance / *Properties*	*P*	*Q*	*R*	*S*
Melting point (°C)	660	– 30	854	2700
Electrical conductivity	good conductor when solid or liquid	non-conductor	good conductor when liquid	non-conductor
Solubility in water	insoluble	insoluble	soluble	insoluble

Complete the table classifying the structure of each substance (covalent molecular, covalent network, ionic, or metallic) and give a reason for your classification.

	Structure classification	*Reason for classification*
P		
Q		
R		
S		

Question 19 (4 marks)

Account for the use of an identified metal and non-metal in terms of their physical properties.

		Use	*Physical Property*
Metal			
Non–metal			

Question 20 (4 marks)

During your practical work, you performed a first-hand investigation to determine the percentage composition of a mixture using gravimetric analysis. Describe the mixture you used, the steps in your method, the physical properties that allowed your method to be valid.

Question 21 (4 marks)

(a) The table shows some information about an ion. Complete the table. **(2 marks)**

Charge	1 +
Mass Number	24
Atomic Number	11
Number of neutrons	
Number of electrons	
Number of protons	
Electron configuration	

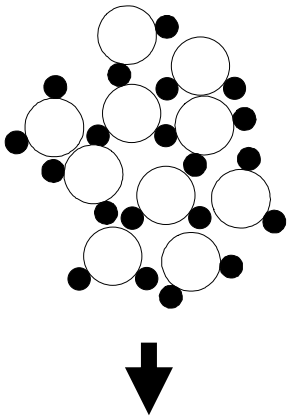
(b) Construct formulae for the products of these synthesis reactions… **(2 marks)**

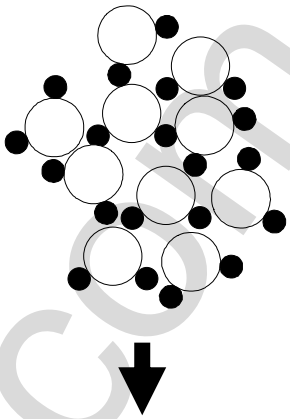
iodine + aluminium	
carbon + sulfur	
phosphate ion + calcium ion	
hydroxide ion + iron(III) ion	

Question 22 (4 marks)

(a) The diagrams show two samples of liquid water containing **ten** molecules… 

Complete the diagrams showing the result after boiling and electrolysis. **(3 marks)**





PARTICLE VIEW AFTER COMPLETE BOILING	PARTICLE VIEW AFTER COMPLETE ELECTROLYSIS

(b) To electrolyse one gram of water requires seven times more energy than to boil one gram of water. Explain the large difference. **(1 mark)**

THE END