Student Number	
Theory Mark / 48	

Chemistry

2009 Half Yearly Year 11 Examination

Theory and Data Processing

General Instructions

- Reading time – 5 minutes
- Working time – 80 minutes
- Write using black or blue pen
- Write your Student Number at the top of this page and on the response sheet on page 8.
  A data sheet and a periodic table are provided.

Theory

Total Marks – 48

Part A – 13 marks
Attempt Questions 1 – 13

Part B – 35 marks
Attempt Questions 14-22

Data Processing

Total Marks - 10

Part A- Multiple Choice 12 marks
Attempt Questions 1-12
Allow about 15 minutes for this part

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

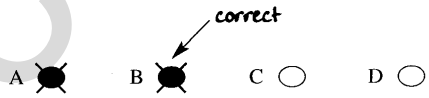
Sample: $2 + 4 =$ (A) 2 (B) 6 (C) 8 (D) 9

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.

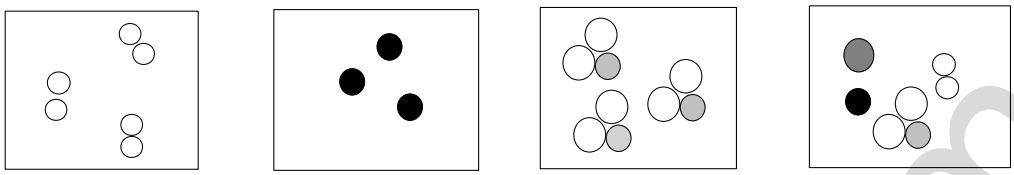
A ● B ⊗ C ○ D ○

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.



▸ **Mark your answers for Questions 1- 12 in the Answer Box on page 8**

1. Which of the diagrams illustrates molecules of an element?



i ii iii iv

(A) i,ii,iii,iv

(B) i,ii and iii only

(C) i, ii, only

(D) iii and iv only

2. If the formula of sodium pyrotantalate is $Na_4Ta_2O_7$, what is the formula of calcium pyrotantalate?

(A) $CaTa_2O_7$

(B) $Ca_2Ta_2O_7$

(C) $Ca_4(Ta_2O_7)_2$

(D) $Ca(Ta_2O_7)_2$

3. The spheres of the earth contain examples of mixtures of elements and compounds. Which choice places the mixtures in the correct sphere?

	biosphere	*lithosphere*	*hydrosphere*	*atmosphere*
(A)	saliva	oceans	underground water	air
(B)	blood	fecal matter	opal	soot
(C)	sap	limestone	ocean	car exhaust
(D)	coal	sweat	glacier	smoke

4. Which separation techniques are suitable for the given mixtures? Assume that both components of the mixture are to be recovered.

Mixture	*sand & gravel*	*dusty air*	*ethanol- water*	*salt solution*
(A)	sieving	filtration	distillation	evaporation
(B)	filtration	filtration	distillation	distillation
(C)	sieving	filtration	distillation	distillation
(D)	filtration	precipitation	distillation	evaporation

5. What is the subatomic particle composition of $^{204}_{81}Th^{4+}$ **?**

	proton	*neutron*	*electrons*
(A)	81	204	81
(B)	81	204	77
(C)	123	81	119
(D)	81	123	77

6. In what increasing order are the elements listed in Mendeleev's periodic table ?

(A) Atomic mass

(B) Atomic number

(C) Mass number

(D) Proton number

7. The data book lists the properties of lithium metal as the following :

(i) density (g/cm^3) = 0.53

(ii) melting point (^oC) = 180

(iii) boiling point (^oC) = 1336

(iv) reacts slowly with water and liquid bromine

Which of the above properties are physical properties?

(A) (i),(ii),(iii),(iv)

(B) (i),(ii),(iii) only

(C) (i) and (iv) only

(D) (iv) only

8. Which of the following compounds contains only covalent bonds?

(A) NH_4NO_3

(B) CuO

(C) Ag_2SO_4

(D) CO_2

9. What is the name of the alloy made up of approximately 70%Pb and 30% Sn?

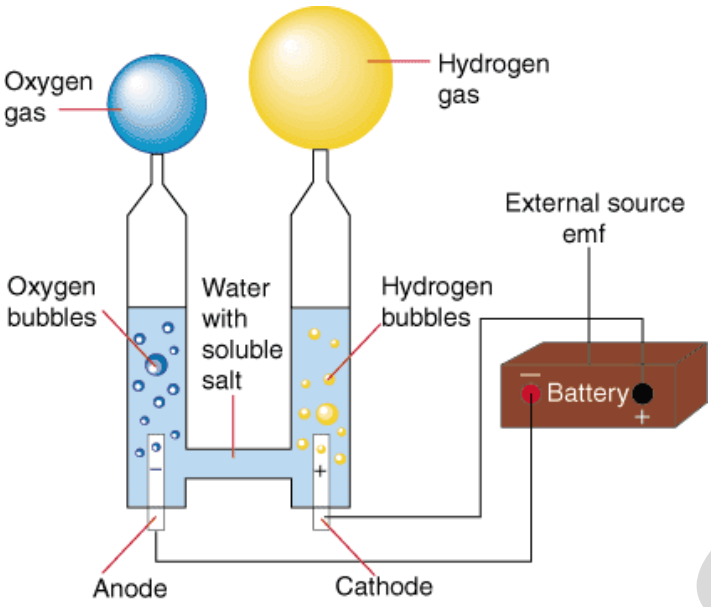
(A) Bronze

(B) Solder

(C) Steel

(D) Brass

10. The electrolysis of water may be represented by the following diagram



Which of the statements about the electrolysis of water is true?

(A) Electrolysis of water is a physical change that produces a soluble salt.

(B) Electrolysis of water is a physical change that produces oxygen and hydrogen.

(C) Electrolysis of water is a chemical change that produces a salt.

(D) Electrolysis of water is a chemical change that produces oxygen and hydrogen.

11. Which half equations correctly describe the electron transfer reaction between magnesium and sulfuric acid ?

(A) $Mg \rightarrow Mg^{2+} + 2e^-$
$H^+ + e^- \rightarrow \frac{1}{2}H_2$

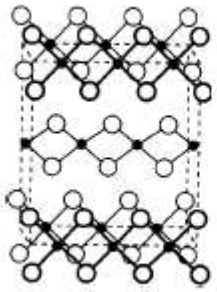
(B) $Mg \rightarrow Mg^{2+} + 2e^-$
$SO_4^{2-} \rightarrow SO_4^{2-} + 2e^-$

(C) $Mg \rightarrow Mg^{+} + e^-$
$2H^+ + 2e^- \rightarrow H_2$

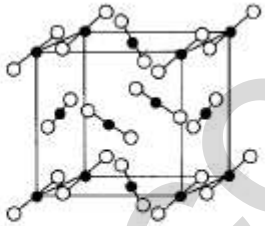
(D) $Mg + 2e^- \rightarrow Mg^{2+}$
$2H^+ + 2e^- \rightarrow H_2$

12. Which of the following diagrams of crystal forms represents the structure of solid carbon dioxide?

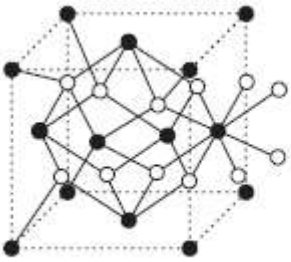
(A)



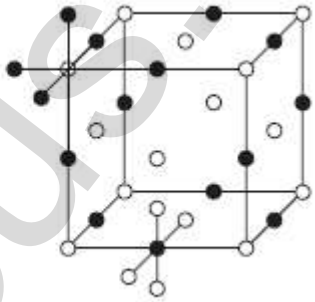
(B)



(C)



(D)



13 Which of the following best describes the trend in atomic radius as you move from left to right across the periodic table?

(A) Atomic radius increases as electrons are added.

(B) Atomic radius increases as electron number decreases.

(C) Atomic radius decreases as electrons are added.

(D) Atomic radius decreases as electron number decreases.

Student number	

Part A: Answer grid for multiple choice questions.

1.	A O	B O	C O	D O
2.	A O	B O	C O	D O
3.	A O	B O	C O	D O
4.	A O	B O	C O	D O
5.	A O	B O	C O	D O
6.	A O	B O	C O	D O
7.	A O	B O	C O	D O
8.	A O	B O	C O	D O
9.	A O	B O	C O	D O
10.	A O	B O	C O	D O
11.	A O	B O	C O	D O
12.	A O	B O	C O	D O
13.	A O	B O	C O	D O

Mark	

Part B. 35 marks
Attempt Questions 14 - 22
Allow about 50 minutes for this part
Show all relevant working in questions involving calculations.

Question 14 (7 marks)

The composition of a mixture consisting of salt, sand and water was quantitatively analysed.

(i). The tube containing the mixture consisting only of salt, sand and water weighed 65.8g.The dry, empty sample tube weighed 15.3 g.

(ii) The mixture was filtered through a weighed filter paper (0.52 g) into an evaporating basin weighing 23.0g.

(iii) The filtrate was evaporated and dried. The residue and the basin weighed 28.0g.

(iv) The filter paper containing the sand was dried. The combined weight of the filter paper and sand was 26.1 g.

(a) Construct a table of results for this determination. (2 marks)

(b) Calculate the percentage composition of the mixture: (3 marks)

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(c) On comparison with the true value it was found that the % salt was lower than the *true* value and the % sand were higher than the true value. Explain the possible sources of these errors. (1 mark)

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(d) Outline how the reliability of the results can be increased? (1 mark)

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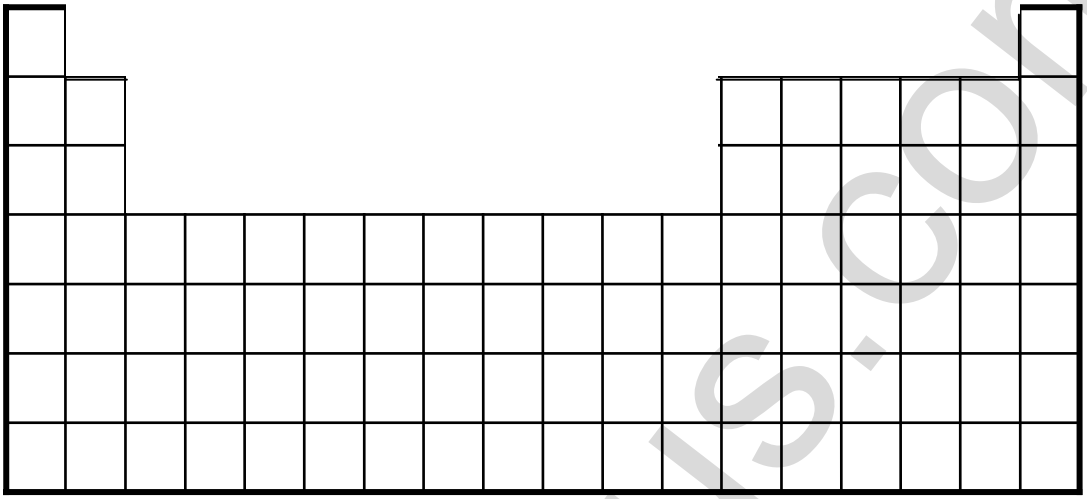
Question 15 (2 marks)

Write Lewis structures for the reactants and products of the reaction of solid sodium metal with chlorine gas.

Question 16 (5 marks)

Given the following outline of a periodic table, label the areas in the table where metals, non-metals and noble gases can be found.



(a) Justify one physical property of a named metal based on its structure.

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(b) Identify the chemical property of one named non- metal based on its electronegativity.

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Question 17 (2 marks)

Lattice energy is the energy released when gaseous ions bind together into a solid ionic compound. The value of the lattice energy is therefore, equal to the energy required to break the bonds between ions in a crystal.

The table shows the lattice energy and the melting point of several Group I chlorides:

Ionic Substance	*Lattice Energy (kJ/mol)*	*Melting point (^oC)*
NaCl	780	801
KCl	710	770
RbCl	686	715
CsCl	651	645

Between which elements is the ionic bond the strongest? Justify the values of the melting point on the basis of the lattice energy.

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Question 18 (4 marks)

During your practical work you performed a first-hand investigation to determine the relative activity of a number of metals.

Outline the procedure you used, identifying the metals tested, and describe the results obtained.

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Question 19 (3 marks)

Complete the table by giving the names or formulae of the following substances.

Name	*Formula*
Sulfur hexafluoride	
Ammonium carbonate	
Barium hydroxide	
	$CuSO_4$
	Na_2S
	N_2O_4

Question 20 (3 marks)

Consider the modified periodic table below.

I	II		III	IV	V	VI	VII	VIII
				P		W	U	
	Q		R	Z	S	T		
							V	
								X
Y								

Use the symbols on the modified table to write the formulae of the following:

(a) An ionic compound .....

(b) A diatomic gas .....

(c) A liquid non-metal .....

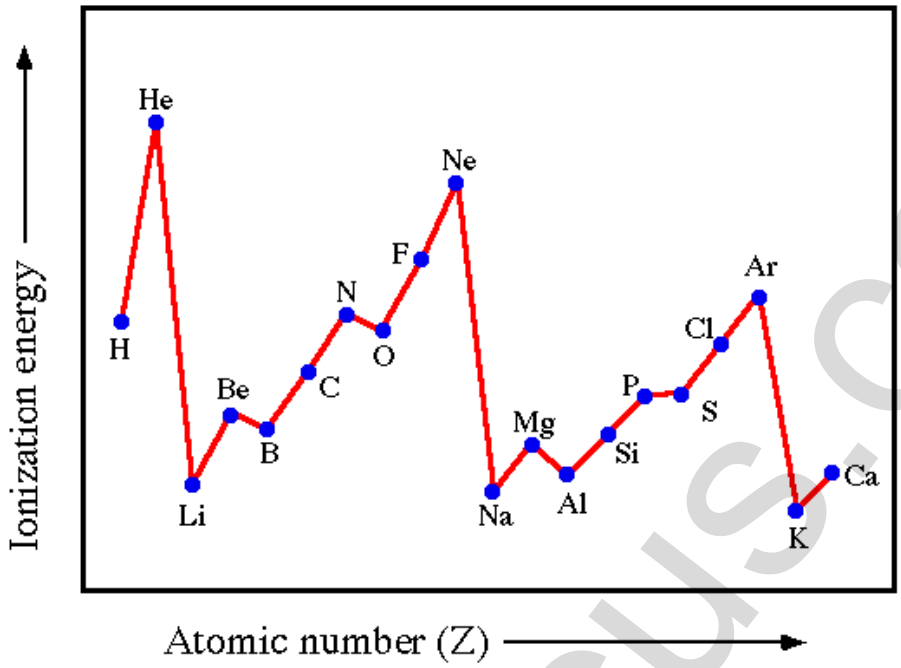
(d) A molecular covalent compound .....

(e) The metal with the lowest ionization energy .....

(f) A covalent network compound .....

Question 21 (5 marks)

Consider the graph of first ionization energies for the first 20 elements.



(a) Write an equation for the first ionization energy of an atom of lithium.(1 mark)

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(b) Explain the relationship between the position of elements on the periodic table and the trends in first ionization energies. (4 marks)

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Question 22 (4 marks)

Sand and salt are two substances common in the lithosphere and hydrosphere. The main chemical substance present in each of these is given below.

Salt - sodium chloride (NaCl)

Sand - silicon dioxide (SiO_2)

Explain, in terms of the structure and bonding of these substances, why

(a) a solution of salt water will conduct electricity (2 marks)

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(b) sand is very hard (2 marks)

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End of Test