

GAUTENG DEPARTMENT OF EDUCATION

SENIOR CERTIFICATE EXAMINATION

**OCTOBER / NOVEMBER 2005
OKTOBER / NOVEMBER 2005**

**FUNCTIONAL PHYSICAL SCIENCE SG
(Second Paper: Chemistry)**

TIME: 2 hours

MARKS: 150

REQUIREMENTS:

- An approved (non-programmable scientific) pocket calculator. Candidates must provide their own calculators.

INSTRUCTIONS:

- Write your examination number in the spaces provided on the cover of your **answer book**.
 - Answer ALL the questions.
 - Answer Question 1 by making a cross (X) over letter A, B, C or D on the **answer sheet** on the **inside cover** of your **answer book** to indicate the letter you have chosen.
 - Answer all other questions in the **answer book**. If you need to redo the answer, redo it on a blank page. Number these answers clearly.
 - Information sheets are provided at the end of this paper. They contain equations, formulae and constants. The information may be useful in answering the questions.
 - Rough work may be done on the blank pages at the **back** of the **answer book**.
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QUESTION 1
MULTIPLE -CHOICE QUESTIONS

Study each item and the suggested answers which are indicated by the letters A, B, C and D. Make a cross (X) over the corresponding letter on the answer sheet after you have decided which is the correct one. If more than one cross appears in any answer, no marks will be awarded.

EXAMPLE :

Pure ice melts at:

- A. -4°C
- B. 0°C
- C. 0 K
- D. 4°C

ANSWER:

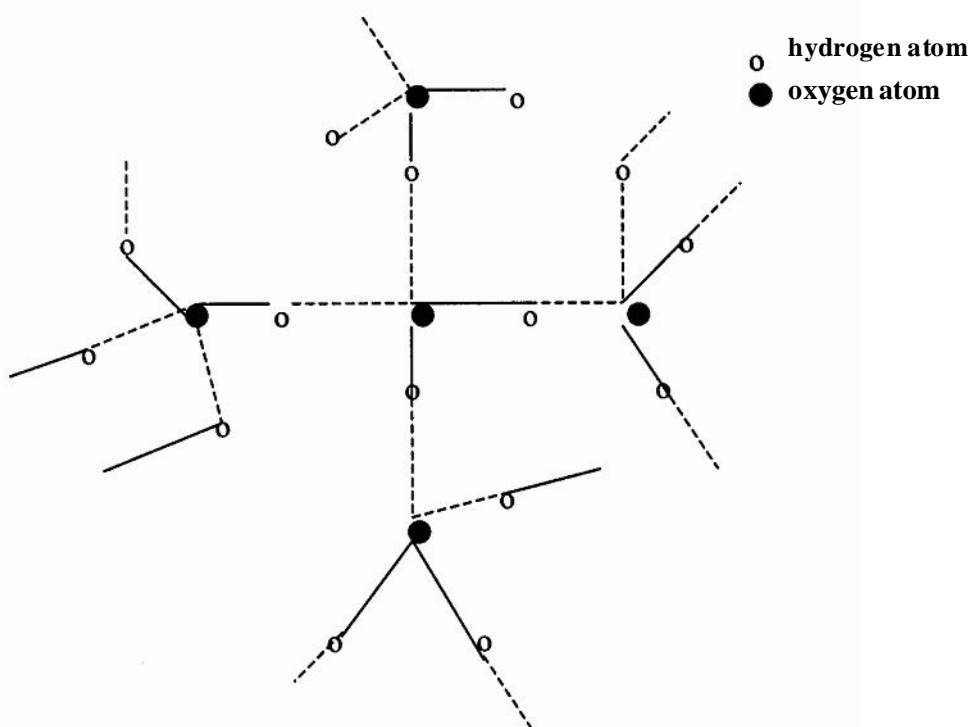
A	B	C	D
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QUESTION 1

- 1.1 An atom has 15 neutrons, 13 electrons and 13 protons. The atomic number and mass number are as follows:

	ATOMIC NUMBER	MASS NUMBER
A.	13	18
B.	13	28
C.	15	13
D.	15	28

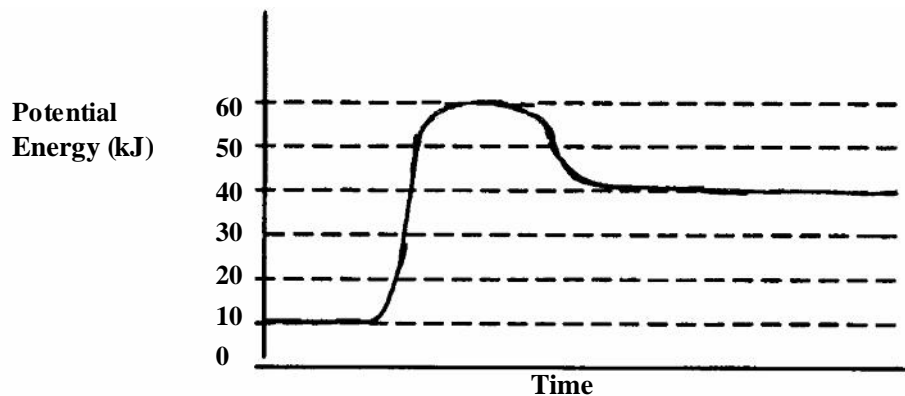
- 1.2 This diagram represents water molecules as ice, at a temperature of more or less -2°C . Each water molecule is surrounded by four other water molecules. The big circles represent oxygen atoms and the smaller circles represent hydrogen atoms.



What do the dotted lines represent?

- A. Ionic bonds
- B. Covalent bonds
- C. Hydrogen bonds
- D. Van der Waals forces

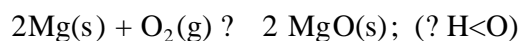
1.3 The following energy diagram is drawn for a specific chemical reaction:



The activation energy of the forward reaction is _____.

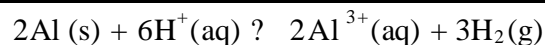
- A. 20
- B. 50
- C. 30
- D. 60

1.4 How can we describe the energy changes that take place in the following chemical reaction which is represented by the following equation?



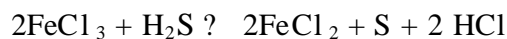
- A. The reaction is endothermic.
- B. The activation energy is negative.
- C. The temperature of the vicinity increases.
- D. The energy needed to break bonds is more than the energy released when bonds form.

1.5 Which atom / ion is oxidised in the reaction below?



- A. Al
- B. H^+
- C. Al^{3+}
- D. H_2

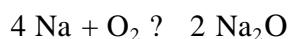
1.6 Consider the equation of the following reaction:



The oxidation number of the oxidising agent changes from _____.

- A. -2 to 0
- B. +3 to +2
- C. +3 to 0
- D. -2 to +2

1.7 Sodium reacts with oxygen to form sodium oxide. The chemical equation for the reaction is:



Which of the following combinations are correct for the above reaction?

	Oxidising agent	Reducing agent
A.	Oxygen	Sodium
B.	Sodium	Oxygen
C.	Oxygen	Sodium oxide
D.	Sodium oxide	Oxygen

1.8 An aqueous copper chloride (CuCl_2) solution is electrolysed. Which one of the following equations best represents the reaction occurring at the cathode?

- A. $\text{CuCl}_2 + \text{H}_2\text{O} \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq})$
- B. $\text{Cu}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Cu}(\text{s})$
- C. $2\text{Cl}^-(\text{aq}) \rightarrow \text{Cl}_2(\text{g}) + 2\text{e}^-$
- D. $\text{Cu}^{2+}(\text{aq}) + 2\text{Cl}^-(\text{aq}) \rightarrow \text{Cu}(\text{s}) + \text{Cl}_2(\text{g})$

1.9 What is the purpose of the salt bridge which connects the two-half cells of an electrochemical cell?

The salt bridge _____ .

- A. provides a passage for the flow of electrons which can be transferred between neighbouring ions.
- B. supplies anions to the positive half cells and cations to the negative half-cell
- C. provides a mechanism by which electrons can be transferred between neighbouring ions
- D. maintains the neutrality of the two half-cells by allowing ions to migrate through it

1.10 Which of the following describes the electron negativity of an atom?

- A. The energy needed by an atom to form an anion
- B. The energy required to remove an electron from an atom
- C. The energy released when an atom gains an extra electron to form an anion
- D. A measure of the displacement of a shared pair of electrons in a bond towards the atom

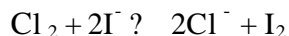
1.11 A property of elements from group VII is that they _____.

- A. are noble gases
- B. have oxidising properties
- C. donate electrons to react with metals
- D. do not react with metals to form bonds

1.12 In which of the following groups will all three elements react strongly with cold water?

- A. Mg, Ca, Fe
- B. Li, Na, K
- C. Cl, F, Br
- D. Fe, Ni, Co

- 1.13 Chlorine water is added to a solution of potassium iodide. The reaction is represented by the following equation:



In this equation _____.

- A. a chlorine molecule is oxidised to chlorine ions
 B. an iodine molecule is reduced to iodine ions
 C. an iodine ion is oxidised to an iodine molecule
 D. iodine ions are reduced to iodine molecules
- 1.14 Which one of the following equations represents a redox reaction?
- A. $\text{Zn} + 2\text{HCl} \rightarrow \text{ZnCl}_2 + \text{H}_2$
 B. $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
 C. $\text{AgNO}_3 + \text{NaCl} \rightarrow \text{AgCl} + \text{NaNO}_3$
 D. $\text{HCl} + \text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+ + \text{Cl}^-$
- 1.15 Which one of the following substances is a halo-alkane?

- A. CH_3COOH
 B. C_2H_2
 C. C_2H_6
 D. CH_3I

15x3=[45]

QUESTION 2 ATOMIC STRUCTURE

- 2.1 Complete the following statements by writing down the missing word in your answer book.
- 2.1.1 An element is composed of small fundamental particles called _____. (2)
- 2.1.2 These particles have a(n) _____ charged nucleus. (2)
- 2.1.3 The nucleus is surrounded with a cloud of charged particles called _____. (2)
- 2.1.4 In their uncombined state these fundamental particles of the elements are normally _____ charged. (2)
- 2.1.5 If one of these particles gains or loses a negatively charged particle, a(n) _____ is formed. (2)

- 2.1.6 When two or more of these particles bond chemically, it takes place in a certain ratio. The formed particle is called a(n) _____. (2)
- 2.2 An element has the following electron configuration $1s^2 2s^2 2p^6 3s^1$.
- 2.2.1 In which group would you find this element? (2)
- 2.2.2 In which period would you find this element? (2)
- 2.2.3 What is the charge of the ion which it will form? (2)
- 2.2.4 Is this element most likely a metal or a non-metal? (2)
- 2.3 The elements of Group II as well as Group VI have a valency of 2.
- 2.3.1 What is meant by the valency of an element? (2)
- 2.3.2 Both groups have the same valency but differ in the way their ions are formed. Explain. (4)
- 2.4 2.4.1 What is meant by the term **excited state**? (2)
- 2.4.2 Is the excited state a stable or unstable state? Explain your answer. (4)
- [32]**

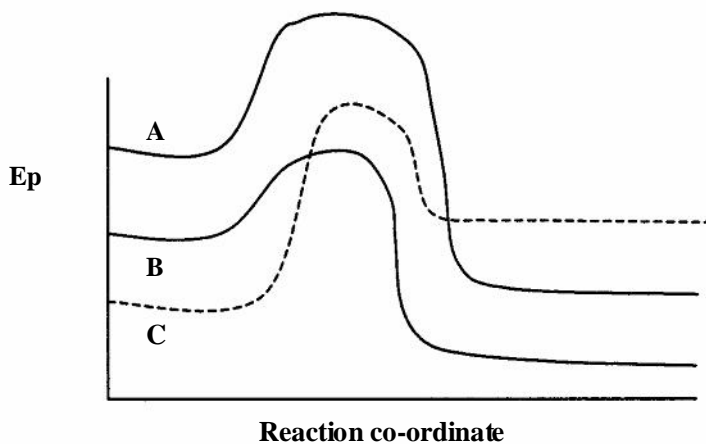
QUESTION 3

CHEMICAL BONDING

- 3.1 Two fluorine atoms combine to form a fluorine molecule.
- 3.1.1 Draw a Lewis diagram for the molecule that is formed. (2)
- 3.1.2 Write down the electron configuration of a fluorine atom. (2)
- 3.1.3 Which orbitals would overlap when fluorine atoms combine? (2)
- 3.1.4 Does this bond have a covalent or ionic nature? (2)
- 3.1.5 What type of intermolecular bonds exists mainly between fluorine molecules? (2)
- [10]**

QUESTION 4
ENERGY AND CHEMICAL BONDING

4.1 Answer Questions 4.1.1 to 4.1.5 by using the symbols **A**, **B** and **C** on the following diagram.

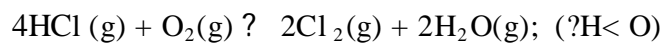


- 4.1.1 Which diagram shows an endothermic process? (2)
- 4.1.2 Which reaction has the smallest activation energy? (2)
- 4.1.3 In which reaction(s) is ΔH negative? (2)
- 4.1.4 In which reaction(s) is ΔH positive? (2)
- 4.1.5 When sugar is dissolved in water, heat is absorbed. Which diagram might illustrate this process? (2)

[10]

QUESTION 5
CHEMICAL EQUILIBRIUM

5.1 Consider the reaction represented by the equation below, which is at equilibrium:



Draw and complete the following table in your answer book.

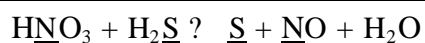
Mark your choice with a tick. You may tick only one option in each row.

	Change	No influence	Forward reaction favoured	Reverse reaction favoured
5.1.1	Container is heated			
5.1.2	Pressure is decreased			
5.1.3	Catalyst is added			
5.1.4	Oxygen is added			
5.1.5	Water is removed			

[10]

QUESTION 6
REDOX REACTIONS

6.1 Write down the following equation in your answer book:



6.1.1 Write down the oxidation number of each of the underlined elements:

N in $\text{H}\underline{\text{N}}\text{O}_3$

S in $\text{H}_2\underline{\text{S}}$

N in $\underline{\text{N}}\text{O}$

S in $\underline{\text{S}}$

(4)

6.1.2 Did N lose or gain electrons?

(1)

6.1.3 Was nitrogen oxidised or reduced?

(1)

6.1.4 Which of N or S is the reducing agent?

(2)

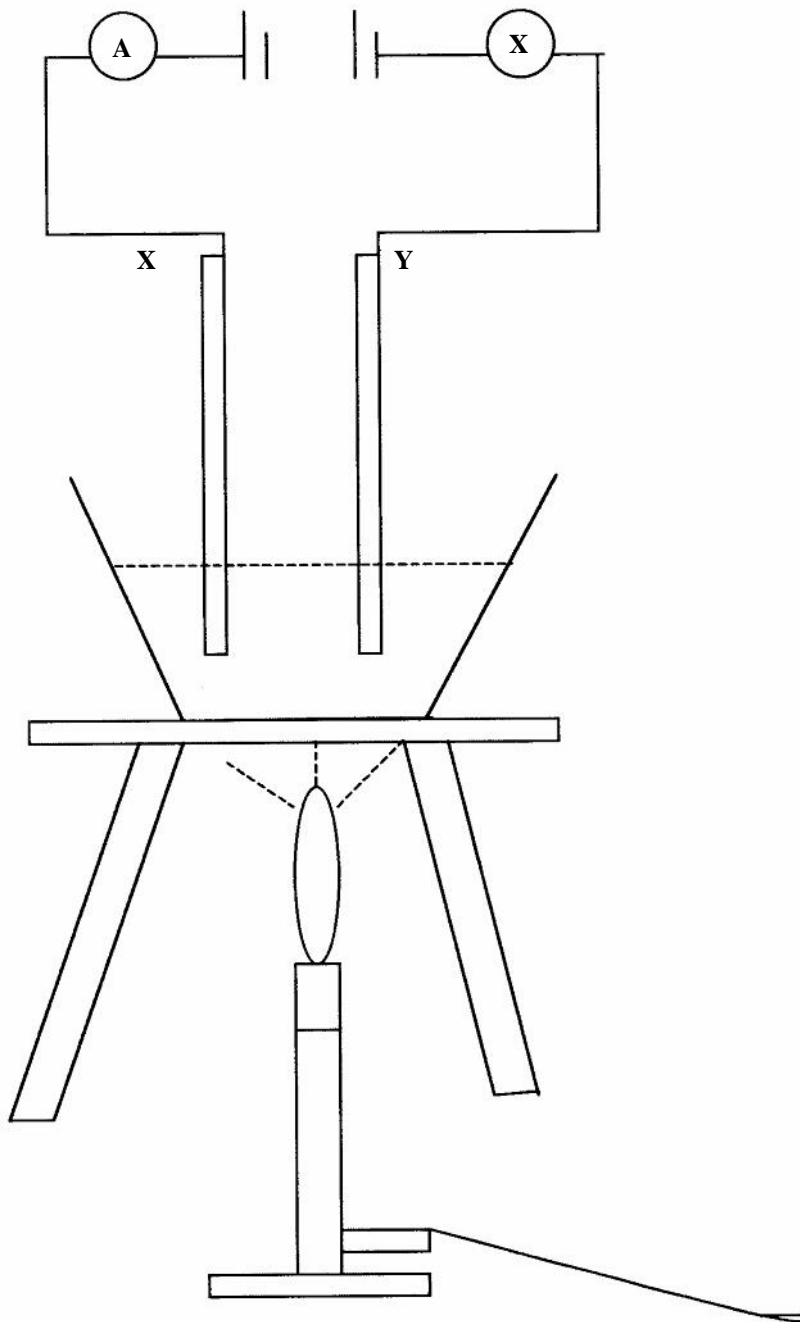
6.1.5 Balance the equation by any means.

(5)

[13]

QUESTION 7
ELECTRO CHEMISTRY

7.1 Lead iodide (PbI_2) is melted and electrolysed in a fume cupboard, as shown in the diagram.



- 7.1.1 What is electrode **X** called? (2)
- 7.1.2 Identify and supply the equation for the half reaction that takes place at
- A. electrode **X**. (3)
- B. electrode **Y**. (3)
- 7.1.3 Identify the oxidising agent. (2)
- [10]**

**QUESTION 8
PROPERTIES OF ELEMENTS OF GROUPS I AND VII**

- 8.1 How do we store sodium in the laboratory? (2)
- 8.2 What will you observe when a small piece of sodium is dropped into a bowl of water? (3)
- 8.3 Write down an unbalanced chemical equation of the reaction that occurs. (2)
- 8.4 Write down an equation for another substance that undergoes a similar reaction to sodium with water. (3)
- [10]**

**QUESTION 9
ORGANIC CHEMISTRY**

- 9.1 Laboratory gas is a mixture of the hydrocarbons butane and propane.
- 9.1.1 What is meant by the term **hydrocarbons**? (2)
- 9.1.2 Write down the structural formula of each of the above gases. (4)
- 9.1.3 Which one's boiling point would be higher? (2)
- 9.1.4 Name two products that form when any hydrocarbon burns completely in oxygen. (2)
- [10]**

TOTAL: 150