ALEXANDER ROAD HIGH SCHOOL

MAY 2012 — $1^1/_2$ HOURS

PHYSICAL SCIENCE P.2

CO, MA — TOTAL = 75

GRADE 10

Instructions

- The question paper consists of 7 questions.
- Answer all the questions
- Answer section A on the answer sheet provided
- Answer section B on the folio sheets provided
- A non-programmable calculator may be used
- Number the answers correctly according to the numbering system used on this question paper.
- A data sheet will be provided for your use. DO NOT WRITE ON THEM.
- Round off to two (2) decimal places unless otherwise stated.

SECTION A

- Answer on the answer sheet -

QUESTION 1:

Give ONE word/term for each of the following descriptions. Write only the word/term next to the question number (1.1 – 1.5) on the attached ANSWER SHEET.

1.1 The measure of the average kinetic energy of the particles of a substance.

1.2 The type of reaction where a single compound breaks up to form two or more simple substances.

1.3 The ability of an atom to attract the electrons between the atoms in a molecule

1.4 The law when atoms in a molecule bond in the correct ratio.

1.5 The bond that forms when a negative ion and a positive ion attract electrostatically.

[5]

QUESTION 2: Multiple choice:

Four possible options are provided as answers to the following questions. Each question has only ONE correct answer. Choose the answer and make a cross (X) in the block (A – D) next to the question number (2.1 – 2.5) on the attached ANSWER SHEET.

2.1 The table shows information about six substances A, B, C, D, E and F. (Take room temperature as 25 ^{o}C). Choose the best possible option that is correct for the information.

Substance	Melting point (^{o}C)	Boiling point (^{o}C)
A	-118	-42
B	-114	37
C	17	118
D	36	244
E	300	580
F	808	1465

i) Is a liquid at room temperature.
ii) A substance that will change from a liquid to a solid when placed in a fridge. (temperature 4 ^{o}C)
iii) A substance that will change into a liquid on a warm day.(37 ^{o}C)

A. A,B,C,D and E.
B. Only B
C. F only.
D. Only B, C and D

2.2 What is meant by the term SUBLIMATION? The process of going from a

A. gas to a solid.
B. solid to a gas.
C. liquid to a solid.
D. solid to a liquid.

2.3 The types of bonds between the atoms IN the following molecules or crystals are

	Molecule	Bond type
A	CO_2 and water	Covalent and ionic
B	NaCl and graphite	Ionic and metallic
C	H_2O and diamond	Covalent and metallic
D	Diamond and aluminium	Covalent and metallic

2.4 The covalent bonding between two chlorine atoms occurs when:

A. two half filled p orbitals overlap to form a single bond.

B. two half filled s-orbitals overlap.

C. one atom donates an electron to another to form bond with an oppositely charged ion.

D. a chlorine ion attracts another chlorine ion to form a bond.

2.5 The bucky ball consists of hexagons and pentagons formed by …

A. sixty covalently bonded copper atoms that form a soccer ball shaped sphere.

B. sixty covalently bonded carbon atoms that form a hollow tube.

C. covalently bonded carbon atoms that form a structure similar to a modern soccer ball.

D. ionically bonded carbon atoms in the shape of the Expo centre in Montreal, Canada.

[2 X 5 = 10]
SUB – TOTAL: 15

SECTION B

- Answer all questions on the folio pages provided -

QUESTION 3

3.1 Give the definition of the following

3.1.1 Hydrogen bonding (2)
3.1.2 Metallic bonding (2)
3.1.3 Malleability (2)

3.2 Show by using Lewis structures:

3.2.1 the ionic bond between magnesium and chlorine (4)
3.2.2 the covalent bonding between carbon and oxygen (4)

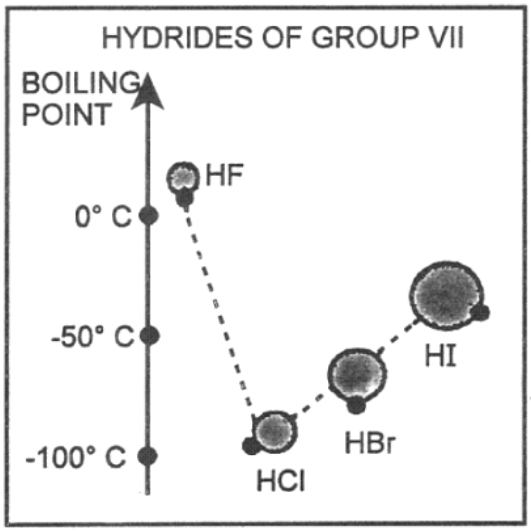
3.3 The following table shows the boiling points of halogens. Study the table and answer the questions that follow:

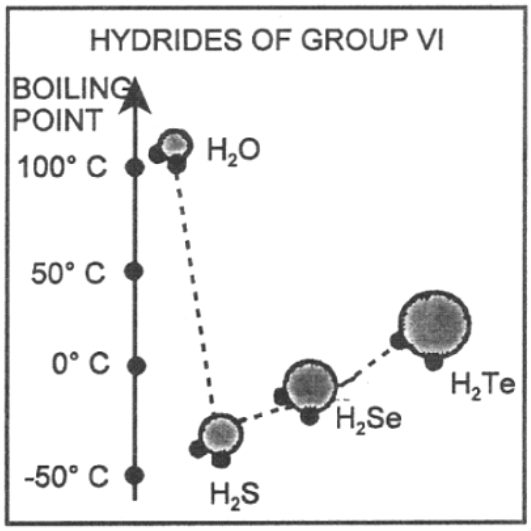
Halogen	Boiling point
F_2	-220
Cl_2	-102
Br_2	58

3.3.1 Describe the trend shortly. (2)
3.3.2 Explain the trend in boiling points. (3)
[19]

QUESTION 4

4. Study the following graphs:



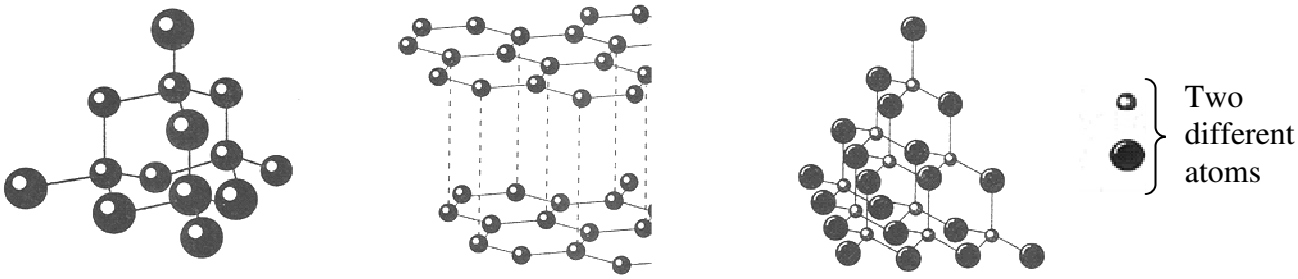


4.1 What do you observe regarding the boiling points of HF and H_2O? (2)

4.2 Give a brief explanation (not more than 2 lines) for this phenomenon. (3)
[5]

QUESTION 5

5. Study the diagrams of giant structures and answer the questions that follow:



A **B** **C**

5.1 Which one of the structures represents diamond? (1)

5.2 What is the atom bonded in A and B? (1)

5.3 What is the difference between A and B concerning electrical conductivity and why are they different (refer to intramolecular aspects)? (3)

5.4 C is used in making a very important everyday substance. Name the everyday substance. (1)

5.5 What type of bond exists between the atoms in molecules A, B and C? (1)

[7]

QUESTION 6 (Start on a new page)

It is sometimes necessary to separate mixtures into their components. Below are five examples of separation techniques.

Method A:	Filtering of a sand-water mixture
Method B:	Distillation of a water-ethanol mixture to remove water. Ethanol boils at 78 °C and water at 100 °C at sea-level. *Distillation is the process by which a liquid solution is heated to produce a vapour which is then condensed.*
Method C:	Separation of sulphur and iron filings by using a magnet
Method D:	Evaporation of a sodium chloride solution
Method E:	Separation of a water-sunflower oil mixture by using a separating funnel

6.1 Are the separation methods of method B and D above physical or chemical processes? Explain. (3)

6.2 Consider method B:

6.2.1 What phase change occurs when a substance boils? (1)
6.2.2 Does condensation require heating or cooling? (1)

6.3.1 State the difference between Melting and Melting point. (3)
6.3.2 Write the balanced chemical equation for the reaction when a mixture of sulphur and iron filings are heated to produce iron(II) sulphide. (3)
6.3.3 Draw an energy level diagram (Aufbau diagram) for the sulphur ion in Question 6.3.2 (2)

6.4 Write down the chemical formula for sodium chloride (1)

6.5.1 Explain briefly why chlorine has a molar mass number of 35,5g on the periodic table and not just 35g or 36g. (2)
6.5.2 68.9257 amu is the mass of 60.4% of the atoms of an element with only two isotopes that appears in nature. The atomic mass of the other isotope is 70.9249

Calculate the relative atomic mass of this element and **NAME** the element. (round off to 4 decimals). (3)

6.6 Consider method E: The sunflower oil has a lower density than water.

6.6.1 Which liquid forms the top layer in the water-sunflower oil mixture? (1)
6.6.2 Is this a homogenous or heterogeneous mixture? (1)
[21]

QUESTION 7

Silicon is second in abundance in the earth's crust, so it is not surprising that we are surrounded by silicon-containing materials. The computer industry was revolutionised by silicon.
[Edited extract from: *Chemistry and Reactivity* by Kotz and Treichel, 5th edition]

7.1 How many valence electrons does an atom of silicon have? (1)

Reasonably pure silicon can be prepared in large quantities in a series of steps started by heating pure silica sand (SiO_2) with purified coke to about 3 000 °C. Coke is a grey, porous solid obtained by the distillation of coal

The reaction is represented by the following unbalanced equation:

$$SiO_2(s) + C(s) \rightarrow \text{silicon liquid} + \text{carbon monoxide gas}$$

7.2 Rewrite the equation and give the chemical formulae of the products. Show the phases of the products in the equation and also balance the equation. (4)

7.3 Give ONE reason why this process is harmful to the environment. (1)

7.4 The principle of **balancing** the above equation is done because of which law. (1)

7.5 Give the chemical name for the reactant above that is not the silica sand. (1)

[8]

TOTAL: 75 MARKS