



ST. FRANCIS SECONDARY SCHOOL

HALF YEARLY EXAMINATION

CHEMISTRY SPECIMEN PAPER

NAME: _____

CLASS: _____

FORM 3

TIME: 2 hrs

Directions to Candidates:

- **Answer ALL Questions in Section 1 and Section 2.** Write your answers in the spaces provided for Section 1 and write your answers for Section 2 on the lined papers provided. Always use BLUE or BLACK ink to write your final answer. Markings in pencil are considered as rough work.
- The mark allocation is indicated at the end of each question. Marks allocated to parts of questions are also indicated. Make sure you write the number of question and question section in Section B.
- You are reminded of the necessity for **good English** and orderly presentation in your answers. In calculations you are advised to show all the steps in your working.
- **Electronic Calculators** may be used in any part of the examination.
- A **Periodic Table** is provided on the first page.
- Write only your name on the last page but do not put any extra markings. (Page 15)

GOOD LUCK!

PERIODIC TABLE

1	2											3	4	5	6	7	0	
																		4 He 2
7 Li 3	9 Be 4											11 B 5	12 C 6	14 N 7	16 O 8	19 F 9	20 Ne 10	
23 Na 11	24 Mg 12											27 Al 13	28 Si 14	31 P 15	32 S 16	35.5 Cl 17	40 Ar 18	
39 K 19	40 Ca 20	45 Sc 21	48 Ti 22	51 V 23	52 Cr 24	55 Mn 25	56 Fe 26	59 Co 27	59 Ni 28	63.5 Cu 29	65 Zn 30	70 Ga 31	73 Ge 32	75 As 33	79 Se 34	80 Br 35	84 Kr 36	
85 Rb 37	88 Sr 38	89 Y 39	91 Zr 40	93 Nb 41	96 Mo 42	99 Tc 43	101 Ru 44	103 Rh 45	106 Pd 46	108 Ag 47	112 Cd 48	115 In 49	119 Sn 50	122 Sb 51	128 Te 52	127 I 53	131 Xe 54	
133 Cs 55	137 Ba 56	139 La 57	178 Hf 72	181 Ta 73	184 W 74	186 Re 75	190 Os 76	192 Ir 77	195 Pt 78	197 Au 79	201 Hg 80	204 Tl 81	207 Pb 82	209 Bi 83	210 Po 84	210 At 85	222 Rn 86	

Key

<i>a</i>	relative atomic mass
X	symbol
<i>b</i>	atomic number

SECTION 1- Answer all questions in the spaces provided. This section carries 60 marks.

1. Consider the following particles given by the letters A, B, C, D and E in the table below:

Particle	Number of protons	Electron configuration
A	11	2.8.1
B	16	2.8.8
C	17	2.8.7
D	18	2.8.8
E	20	2.8.8

Choose a letter of a particle which is:

- (i) a metal atom _____ (iii) a non-metal atom _____
(ii) a positive ion _____ (iv) a noble gas atom _____

TOTAL- 4marks

2. Boron has two *isotopes*, B-10 and B-11. Boron- 11 makes up 80% of the natural boron.

- a. Define the term isotopes (1)

Calculate the relative atomic mass (R.A.M.) of boron (to TWO decimal places).

(3)

TOTAL- 4 marks

3. All elements are defined as metals, non-metals or metalloids. Silicon is a metalloid where some of its properties resemble those of a metal, others resemble those of non-metals. This table describes some of the properties of silicon.

Silicon	Property
Appearance	Shiny grey solid
Strength	Hard but brittle
Melting point	High (1410°C)
Electrical Conductivity	Low (conducts slightly)

- a) Give two pieces of evidence, from the table, for silicon being a **non-metal**.

(2)

- b) Give ONE property, from the table, which we would normally associate with metals. (1)

c) Give the chemical symbol of silicon: _____ (1)

TOTAL- 4 marks

4. Atomic Structure in Chemistry is crucial in underlining various physical and chemical properties of elements.

a. Complete the following table showing the chemical arrangement of three metals.

	23 11Na	40 20 Ca	64 29 Cu
Atomic number			
Mass number			
Number of electrons			
Number of neutrons			
Group in periodic table			

TOTAL- 15 marks

5. This question is about elements, mixtures and compounds. In the boxes different atoms are represented by • and ○.

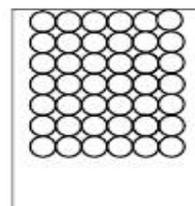
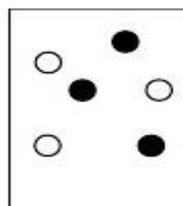
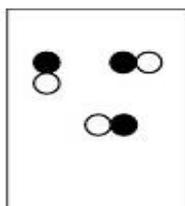
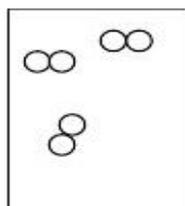
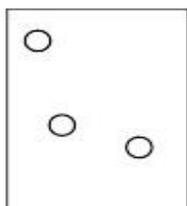
A

B

C

D

E

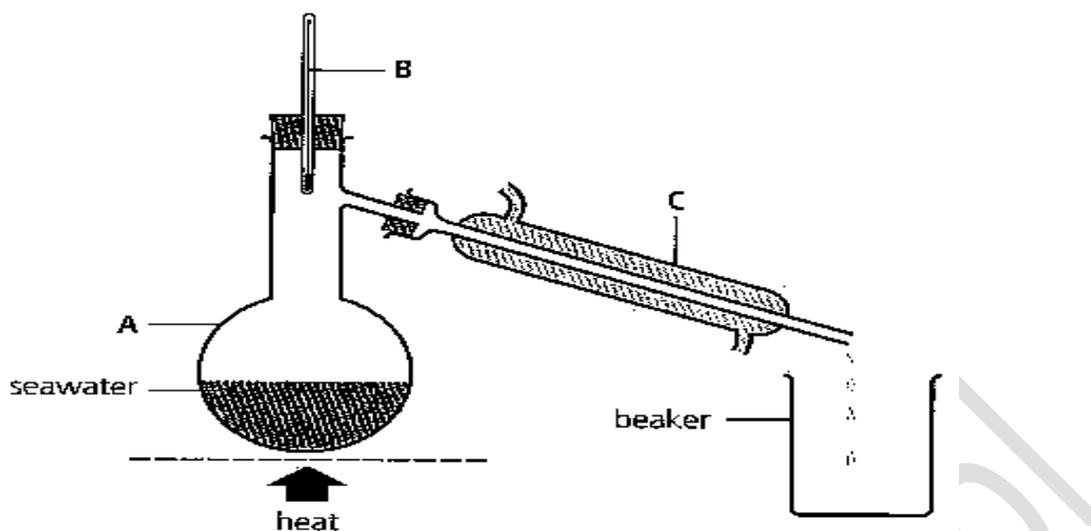


Match the letter on the box to the following descriptions: (*each letter can only be used ONCE.*) (5 marks)

- a) a mixture of elements _____
- b) a solid _____
- c) a compound _____
- d) oxygen (O_2) _____
- e) A homogeneous element made up of single atoms _____

TOTAL- 5 marks

6. Separating Techniques are used to obtain different compounds or elements from a mixture. Sea water can be purified using the apparatus shown below:



i) What is the **maximum temperature** recorded during distillation?

_____ (1)

ii) How does this compare to the boiling point of sea water? Is the boiling point of sea water more or less than this boiling point? (2 marks)

iii) Which is the condenser, A, B, or C? (1)

iv) Where does the supply of cold water enter? (mark with a letter X) (1)

v) Distillation is used rather than filtration, to purify seawater for drinking. Why?

_____ (2)

TOTAL- 5 marks

7. The Kinetic Theory helps explain the existence of substance in different states.

a. In the space below, draw the arrangement of particles in Liquids.



(1 mark)

b. Would the arrangement of particles in solids be the same of that of liquids? Explain in terms of the Kinetic theory.

(2)

c. Ice melts at 0°C to form water. However, often times salt is added to help the melting process. Why is salt added to ice?

(2)

Julia performed an experiment using ***fine granulated sugar*** and ***sugar cubes*** to identify if it is better to use powdered sugar or sugar cubes in her tea. She obtained the following results.

Temperature/°C	Time in minutes for 10 grams of sugar to dissolve	
	Granulated sugar	Sugar Cubes
15	20	25
25	13	17
35	6	11
45	2	5

- a. From the table above Julia can come to a conclusion about which is the best type of sugar to dissolve faster. Which type of sugar is this? How can she tell from the table? (3)

- b. Define the term diffusion. (2)

- c. Diffusion is affected by a number of factors. Which factor is being tested in this experiment? (1)

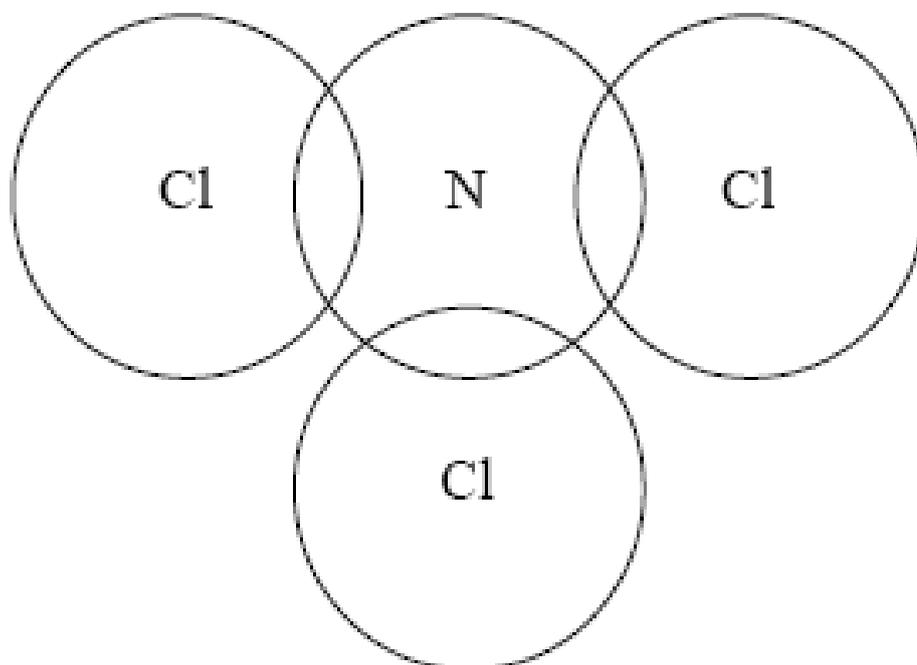
- d. Mention TWO other factors that affect the *rate of diffusion*. (2)

TOTAL- 13marks

8. Elements can bond to each other by means of an ionic or a covalent compound.

a. What is a covalent bond? (1)

b. The diagram below represents the *outer shells of the atoms* in a molecule of nitrogen (III) chloride, NCl_3 . Complete the *dot and cross diagram* to show the electron arrangement. Use ● for Nitrogen and × for chlorine. (3)



c. Do you expect NCl_3 to have a high or a low boiling point? (1)

d. Sodium fluoride is a colourless compound used widely in various applications. It has a very high boiling and melting point and crystallises in a cubic lattice similar to that of common salt.

i. Does sodium fluoride show ionic or covalent nature? From what property described above did you come to this conclusion? (2)

ii. Draw a dot-cross diagram to show the transfer of electrons in the formation of sodium fluoride. You don't need to show the charged particles formed. (3)

TOTAL- 10 marks

SECTION 2- Answer BOTH questions. Start a new question on a separate sheet. Each question carries a total of 20 marks.

Question 1:

1. a. Use the Periodic Table to write the **electronic configuration** for the following elements. Write also the chemical symbols for each element:

Oxygen Chlorine Sodium Argon (6 marks)

b. Use the **dot and cross diagram** to show the electronic configuration of Magnesium. On the same diagram work out the number of **proton and neutrons** and write them in the middle. (3)

(ci) Would you expect **magnesium** to gain, lose or share electrons with Chlorine to form a new compound? Why? (2)

(ii) Would you expect **phosphorus** to gain, lose or share electrons with chlorine? Why? (2)

(iii) Which would have the **higher melting point**: the compound formed from magnesium and chlorine or that from phosphorus and chlorine? Why? (2)

iv) Bonding has an important role as regards electrical conductivity in different materials. Explain why metals can conduct electricity (1)

Read the article below taken from a scientific review and answer the questions.

A new type of Bond (Scientific American, 1st February 2015)

In 1989, when chemists experimenting at a nuclear accelerator in Vancouver observed that a reaction between bromine and muonium – an unstable hydrogen isotope – slowed down when they increased the temperature, they were surprised.

Donald Fleming, a University of British Columbia chemist involved with the experiment, thought that perhaps as bromine

and Muonium co-mingled, they formed an intermediate structure held together by a “vibrational” bond – a bond that other chemists had posed as a theoretical possibility earlier that decade. In this scenario, the lightweight Muonium atom would move rapidly between two heavy bromine atoms. The oscillating atom would briefly hold the two bromine atoms together and reduce the overall energy, and therefore speed, of the reaction.

Based on calculations from experiments and the work of collaborating theoretical chemists at Free University of Berlin and Saitama University in Japan, they concluded that Muonium and Bromine were indeed forming a *new type of temporary bond*. Its vibrational nature lowered the total energy of the intermediate Bromine-Muonium structure – thereby explaining why the reaction slowed even though the temperature was rising.

What type of bond was discovered according to this extract? (1)

Define what an **unstable** isotope is and give the name of the isotope mentioned. (2)

Why do elements form bonds? (1)

Question 2:

a. Have a look at the following diagram:

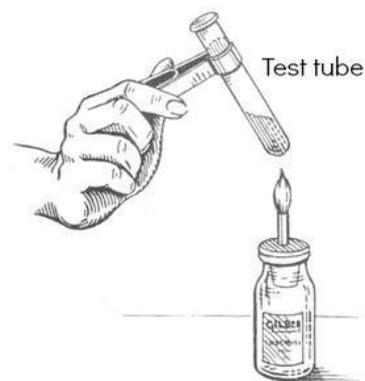
i. What would you **observe** when some iodine crystals are heated? What is this called? (2)

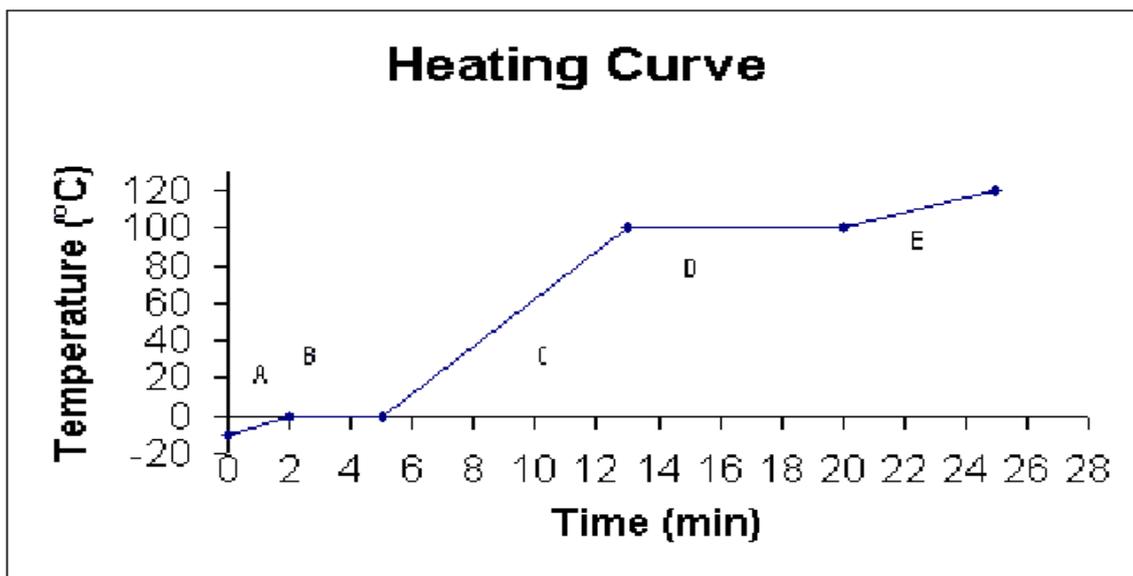
ii. Draw the heating curve of Iodine showing any changes of state (3)

iii. What **change** can be done to the above set up to re-obtain **solid** crystals of iodine? (2)

iv. Name one important **precaution** that one must take when carrying out this experiment. (1)

v. Name one other compound that undergoes the same change as iodine. (1)





This is the heating curve of a *mystery substance*.

- i. What are the melting point and boiling point of the substance? (2)
- ii. Can you identify the substance? (2)
- iii. How long does it take for all the substance particles to boil off. (2)
- iv. Describe in detail a method of how you would obtain such a plot in the lab. (3)

c. Potassium iodide forms a homogeneous solution in water. For this situation name:

- i) The solvent;
- ii) The solute (2)

END OF EXAM PAPER-----Go back and Check your work-----

How would you rate the paper: mark with a tick (✓)

Challenging 	A bit hard 	Up to my level- Just right 	Easy task 

Student name: _____ **Form 3- Chemistry Half-Yearly Exam**

1	2	3	4	5	6	7	8	TOT SEC 1 / 60	Q1	Q2	TOT SEC 2 / 40
4	4	4	15	5	5	13	10		20	20	

Section 1:

Q1: Electronic configuration

Q2: Isotopes

Q3: Metals and non-metals

Q4: Mass and atomic numbers

Q5: Elements/Mixtures and Compounds

Q6: Separation Techniques

Q7: Kinetic Theory and Diffusion

Q8: Bonding

Section 2.

1. Bonding- Ionic and covalent
2. Separation techniques and Kinetic theory

Expert (80-100 marks) Shows an excellent understanding of the basic concepts addressed in the questions and ability to apply knowledge in different areas	Worker (60-79 marks) Shows a good understanding of the basic concepts addressed in the questions and ability to apply knowledge in different areas	Apprentice (< 59 marks) Basic understanding of the areas tested still needs to be developed perhaps through better and frequent revision and more attention in homework
		

Comments: _____

K. Mizzi- Chemistry teacher

St. Francis School