



ST. FRANCIS SECONDARY SCHOOL

YEARLY EXAMINATION 2015 - 2016

CHEMISTRY- SPECIMEN PAPER

NAME: _____

CLASS: _____

FORM 3

TIME: 2 hrs

Directions to Candidates:

- **Answer ALL Questions in Section A and two questions in Section B.** Write your answers in the spaces provided for Section A and write your answers for Section B 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 question number 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		
		<table border="1" style="margin: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">1 H 1</td> </tr> </table>										1 H 1							4 He 2
1 H 1																			
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 A- Answer ALL questions in the spaces provided. This section carries 60 marks.

1. The following table shows the number of sub-atomic particles present in elements A to F.

Element	Protons	Neutrons	Electrons
A	3	4	3
B	4	5	4
C	7	7	7
D	10	10	10
E	12	12	12
F	17	18	17

Use the symbols A to F to answer the following questions:

- a. Which atom represents a **noble gas**? _____(1)
- b. Give the symbol of one atom, which may represent a **metal**. Give one property you expect this element to have. (2)

-
- c. Give the symbol of one atom, which may represent a **non-metal**. Give one property (different from the one above) you expect this element to have. (2)
-

a. Which elements are in the **same group**? Give a reason for your answer. (1)

(6 marks)

2. Copper is a transition metal and it can form an oxide whose chemical name is copper (II) oxide.

a. Write the **chemical formula** of the oxide. _____ (1)

b. Do you expect copper (II) oxide to be a **gas or a solid** at room temperature? Give a reason for your answer. (1)

c. In a report compiled by a Form 3 chemistry student a teacher read this statement:

“Copper (II) oxide is a base because it is not an alkali.”

Is this statement **true or false**? Give a **reason** for your answer. (2)

d. **Name one** other oxide that has similar chemical properties to copper (II) oxide. (1)

(5marks)

3. A number of pupils collected water from four different Maltese villages across the island. The four water samples were tested in 3 ways:

- before treatment,
- after boiling and
- after passing through an ion exchanger.

Equal volumes of each sample **were tested for hardness** by finding the volume of soap solution required to produce 5mm length of lather. Soap was added 1 cm³ at a time. The results are given in the table below.

Water sample	Volume of soap solution added to:		
	Untreated (cm ³)	Boiled (cm ³)	Ion-exchanged (cm ³)
Msida	1	1	1
San Ġiljan	3	1	1
Marsaxlokk	4	2	1
Mellieħa	3	3	1

a. **Name** the apparatus that may be used to: (1)

i. contain the soap solution _____

ii. transfer equal volumes of water in a container

b. Study the table and **identify** the village that has: (5)

i. most hardness _____

ii. a mixture of temporary and permanent hardness. _____

iii. only permanent hardness _____

iv. no hardness _____

v. only temporary hardness. _____

vi. Which **two cations** are responsible for water hardness? (1)

vii. Give the **name and formula** of one substance that causes **temporary** hardness in water. (2)

Name: _____ Formula: _____

viii. Permanent hardness is caused by sulfates. Name **two** ways how **permanent** hardness can be removed. (2)

ix. Name **one advantage** and **one disadvantage** of hard water. (2)

Advantage	Disadvantage

(13 marks)

4. Fill in the blanks with appropriate terms: (3)

Our atmosphere consists of a _____ of gases. The most abundant gas is _____, comprising 78% of the total. _____ is the second most abundant gas with a 21% abundance. When a substance combusts in air one of the products formed is always an _____. One of the gases present in varying concentration produces an acid when dissolved in water. This gas is called _____.

It is known as a _____ and is one of the main culprits for global warming. (3marks)

5. Hydrogen is considered a possible alternative to fossil fuels and its use in cars, boats and aeroplanes will unquestionably be a major step forward in the world of technology. However, hydrogen is not readily available in nature.

- a. Give the names of any **two** compounds, each of which contains hydrogen as one of its constituent elements. (2)

When a metal reacts with an acid, hydrogen gas is given off.

- b. Give a **balanced** equation of the reaction of the metal magnesium with nitric acid. **Include state symbols.** (2)

- c. Describe how to test for the gas produced. (1)

Oxygen is another gas which like hydrogen is transparent and odourless. Its molecule comprises two oxygen atoms held together by a **pair of covalent bonds**.

- (i) What do you understand by covalent bonding?

_____ (1)

(ii) Give a bond diagram of the oxygen molecule (1)

(iii) Give the name of a substance whose molecule is composed of: (2)

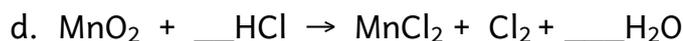
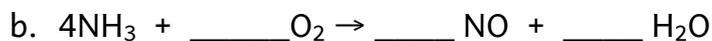
- two atoms held together by **one single** covalent bond _____
- three atoms held together by **two single** covalent bonds _____

(iv) Draw a **dot-and-cross diagram** showing **all** electron shells to represent a nitrogen **molecule**. (Atomic number of nitrogen: 7) (2)

(v) Both nitrogen and silicon dioxide both show covalent bonding. However their **properties vary a lot**. Nitrogen is a gas with a very low melting and boiling point while silicon dioxide or sand is a solid with a moderately high boiling and melting points. This is due to the different type of bonding present. Explain this statement (2)

(13 marks)

6. Complete the balancing of each of the equations. (4)



Trevor decided to prepare the calcium carbonate himself in the lab as he did not have any left. Since calcium carbonate is **insoluble in water** he decides to use the precipitation method for its preparation.

e. Give the names of **two water soluble reagents** that can be used for the preparation of insoluble calcium carbonate salt. (2)

Reagent A: _____

Reagent B: _____

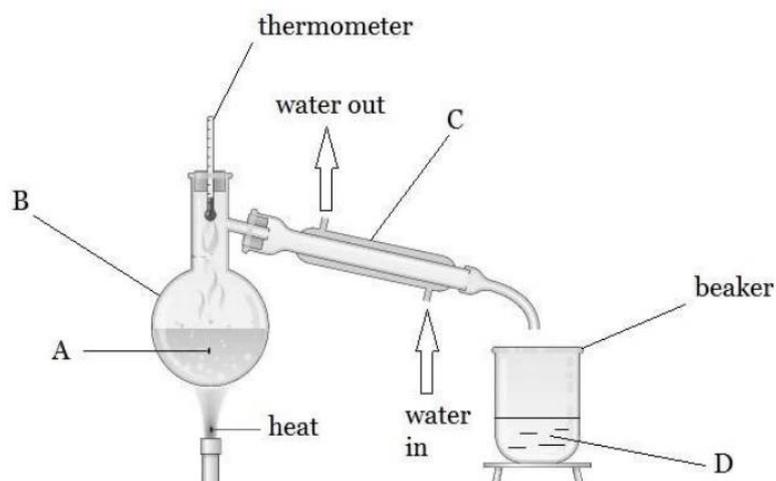
f. Write a **balanced chemical equation** for the reaction between the two solutions. (2)

g. What simple **separation technique** is used to obtain a pure dry form of calcium carbonate?

_____ (1)

(9 marks)

7. Vanessa, a laboratory analyst wants to re-obtain the solvent from a solution of **copper (II) sulfate** using the apparatus shown below:

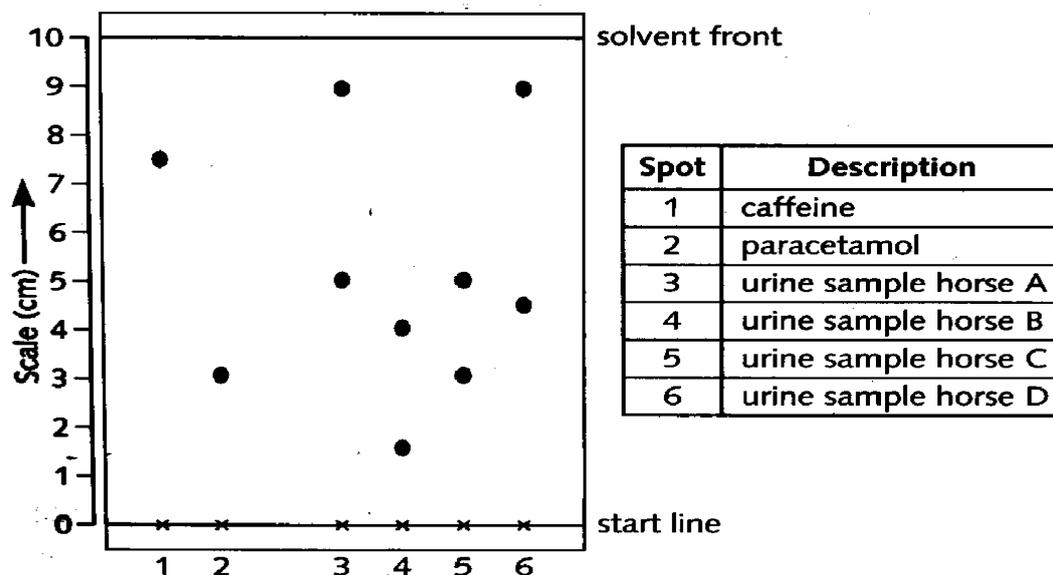


- a. On her science report book, she writes the following sentences. Fill in the spaces below.

This separating technique is called _____ . It is used in this case to obtain solvent D called _____. C is the _____ and is used to _____ the vapour into a _____ . A is a solution of the solute _____ in water. B is called a _____ and the temperature on the thermometer would be _____ °C. (4)

- b. What improvement would be made to this diagram if Vanessa accidentally adds ethanol to A and she needs to obtain **both solvents separately**? (1)

c. Vanessa's manager used her to analyse different urine samples from four race-horses. She needed to see if they contain any caffeine or paracetamol drugs before the final race. Below is her result (the legend/key is on the right).



i. What is the separating technique to obtain the above result called?

_____ (1)

ii. Which of the tested horses' urine samples contain/s the caffeine drug?

_____ (1)

iii. Which of the tested horses' urine samples contain/s paracetamol drug?

_____ (1)

iv. What do you understand by the term 'solvent front'? (1)

(9 marks)

8. Magnesium has **three isotopes**, magnesium-24, magnesium-25 and magnesium-26. In a sample of this metal, the percentage by mass of these isotopes is:

78.99 %, 10.00 % and 11.01 % **respectively**. Calculate the relative atomic mass (R.A.M) of magnesium. Give the answer up to 2 decimal places. Show all necessary working.

(2)

(2 marks)

BLANK SPACE

Section B: CHOOSE **any 2** questions from the 3 questions below. Make sure you answer ALL parts of the question. Start each question on a separate foolscap.

Question 1: This question is about solubility and bonding. You need a graph paper for this question.

The table below gives the data collected by James during a laboratory experiment where he studied the solubility of two different salts- potassium nitrate and sodium chloride. Plot the **solubility curves** of these two salts on the given graph paper.

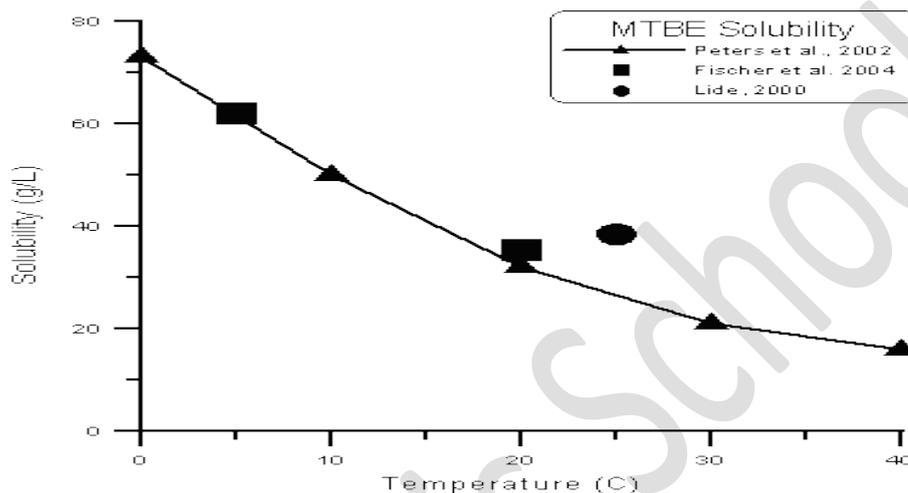
Temperature / °C	Solubility KNO ₃ - Potassium nitrate (g/100ml water)	Solubility NaCl- sodium chloride (g/100ml water)
25	40	40
50	80	40
65	120	42
75	160	43

Plot the experimental data on the grid provided (graph paper). Plot mass of solute/100ml water on the y-axis and the temperature on the x-axis. Remember to give a **Key with your graph**. Construct a solubility graph by **joining the plotted points** on your graph. (7 marks: Plotting (3), Titles and labels of axes (1), correct scale using $\frac{3}{4}$ of the page (1) Key and Neatness/Ordered work (2))

- How is solubility for both solutes effected by an increase in temperature? (2)
- How many grams of KNO₃ can be dissolved in 100ml of water at 40°C **and** 60°C? (2)

c. Define the term **saturated** and **unsaturated** using the 50°C temperature of KNO_3 as examples. (3)

d. This graph shows the solubility of a substance X: From the list provided **choose a possible name** for substance X and **STATE** reason/s for your choice: (2)



- Oxygen
 - Potassium chlorate
 - Potassium chloride
- d. Compare **the bonding present** in NaCl and KNO_3 to that of substance X.

Comment on the type of bonding, structure, melting and boiling temperatures. Also represent the substances using **bonding diagrams/dot-and-cross diagrams** that are clearly labelled (4)

(Total- 20marks)

Question 2: This question is about preparation of salts and general chemistry.

In an analytical laboratory Jerome, the laboratory technician was asked to prepare the following salts using the chemicals in the lab. Your assistance was required for him to be able to prepare and collect PURE samples of **ANY 3 SALTS** listed below:

- a) Calcium carbonate b) Copper (II) sulfate
b) Magnesium chloride d) Sodium nitrate

The relevant reagents listed below were available in the lab for him to choose from:

Calcium, sodium, magnesium, copper, sulfuric acid, nitric acid, hydrochloric acid, carbonic acid, calcium chloride, copper (II) oxide, potassium carbonate, magnesium oxide, sodium hydroxide pellets, sodium hydrogen sulfate.

CHOOSE **3 salts** from the list a-d. Give the name of the salt and

- Describe your **choice of reagents** to prepare the salt.
- Give details on how/why you came to such a choice.
- Describe a method how you would obtain and **collect** the salt. In each case reactions showing state symbols are important to show how the salt is prepared. Colours of reagents/products and are also important.

(12 marks- 4 marks for each salt preparation)

From the reagents listed above, give the **name and chemical symbol**. Each reagent may be used once, more than once or not at all : (8)

- i. A dibasic acid
- ii. A base
- iii. An alkali
- iv. An acid salt
- v. A deliquescent substance
- vi. Name of a coloured compound
- vii. A metal reacting with cold water
- viii. An acid that forms when rainwater dissolves limestone

(Total- 20 marks)

Question 3: This question is about separating techniques and allotropy.

A mixture is composed of **three white solid chlorides**

- Ammonium chloride
- Silver Chloride
- Calcium chloride

Chemical information:

Name	Colour	Solubility in water	Action of heat
Ammonium Chloride	White	Soluble	sublimes
Silver chloride	White	Insoluble	Does not decompose
Calcium chloride	white	Soluble	Does not decompose

- a. Using the information in the table above design a method to separate **ammonium chloride** from the two other compounds. A labelled diagram and an explanation of the method are required to show the appropriate technique. (4)
- b. Once the ammonium chloride was removed, the resulting mixture contains calcium chloride and silver chloride. Describe laboratory techniques that may be used to obtain a sample of **dry calcium chloride** from the mixture. **Labelled diagrams** and an **explanation** that show the appropriate techniques used are required. (6)
- c. Calcium chloride can be used to prepare an insoluble salt- calcium sulfate- also known as gypsum. Give the name of a reagent that can be used together with calcium chloride to give gypsum. (1)
- d. Calcium sulfate occurs in nature as calcium sulfate dihydrate. Give the formula of this naturally occurring compound. What property does this show about calcium sulfate? (2)
- e. Air is a mixture of gases. Explain briefly how the difference in a **physical property** of oxygen and nitrogen enables the two gases to be obtained from air on an industrial scale. *Details of the equipment used are not required.* (2)

e. Water is a universal colourless solvent. However its presence can be tested using both physical and chemical tests. Mention **one physical** and **one chemical test** used to identify water (2)

f. Oxygen and ozone are **allotropes** of the same element.

- Define the term **allotropes** (2)
- Give the name of another element that exhibits **allotropes** (1)

(Total- 20 marks)

-----END OF PAPER-----

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

1	2	3	4	5	6	7	8	TOT SEC 1 / 60	Q1	Q2	TOT SEC 2 / 40
6	5	13	3	13	9	9	2		20	20	

Section 1:

Q1: Elements: Metals and Non-metals

Q2: Bases and oxides

Q3: Water hardness

Q4: Mass and atomic numbers

Q5: The atmosphere

Q6: Acids and bonding

Q7: Balancing and salts

Q8: Isotopes and RMM

Section 2.

1. Solubility and solubility curves; bonding
2. Salts and general chemistry
3. Separating techniques and allotropy

Comments: _____

Revision summer work for students obtaining <50 %:

- May 2015 Paper I no.1, 2, 7a, 8, 12
- September 2015 Paper I no. 1, 4, 5, 6
- Work out Specimen annual paper found on the school website in the download section. <http://saintfrancissecondary.com/notice-board-2/downloads/>

To be handed in at school during September. Ms. K. Mizzi