GOZO COLLEGE
SECONDARY SCHOOL
Half Yearly Exam 2017

YEAR 9 (FORM 3) **CHEMISTRY** TIME: 1hr30min

Name _____ **Class** _____

Use the **Periodic table**, given below, where necessary.

PERIODIC TABLE

1	2										3	4	5	6	7	0
							1 H 1									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

$\begin{matrix} a \\ X \\ b \end{matrix}$ relative atomic mass
symbol
atomic number

Marks Grid (For Examiners use only)

Question number	1	2	3	4	5	6	7	8	9	**Theory total**
Max mark	10	10	10	10	10	10	20	20	20	**100**
Actual mark										

Theory Paper: 85%	**Practical : 15%**	**Final Score: 100%**

SECTION A: Answer ALL questions in the spaces provided. This section carries 60 marks

1. Matter can exist in one of **3 physical states**, depending on the temperature. Solids, liquids and gases have different properties.

a) Write **YES** or **NO** in the empty boxes of the following table: (0.5m each X10 =5 marks)

PROPERTY	SOLID	LIQUID	GAS
Has a fixed shape			NO
Has a fixed volume (size)	YES		
Can expand (increase in size) on heating		YES	
Can contract (decrease in size) on cooling		YES	
Can be compressed (squashed or squeezed)		NO	YES
Can diffuse (spread out)	NO	YES (slowly)	

b) The properties of the 3 states of matter can be explained by the **Kinetic Particle Theory of Matter.**
Match the properties of the states of matter in **Column A** with the correct explanation given by the kinetic particle theory of matter in **column B.** (1m each X 5 = 5marks)

	Column A		Column B
1	Gases take up the volume of the container.	**2**	The particles are close together and can only vibrate about fixed positions.
2	Solids have a fixed shape.		The particles are close but can move around each other.
3	Liquids diffuse slower than gases.		Forces of attraction between the particles are almost inexistent and so they can move randomly very fast.
4	Liquids can be poured.		On heating, the particles move further away from each other.
5	Gases can be compressed.		Particles move much slower.
6	Matter can expand on heating.		Particles are far apart and so can be pushed closer

2. The changes around us can be classified as **physical or chemical changes.**

a) Sort the following changes as physical or chemical changes (0.5m X 6 = 3 marks)

Change	Physical or Chemical?
Dissolving some copper (II) sulfate crystals in water.	Physical
i) Passing electricity through a wire.	
ii) Burning a piece of magnesium ribbon.	
iii) Heating gently some iodine crystals.	
iv) Cooling water vapour in a Liebig condenser.	
v) Rusting of iron (or steel) nails.	
vi) Formation of salt crystals from seawater in salt pans.	

b) Chemical changes (or chemical reactions) are represented by equations.

Write **balanced chemical equations**, for the following reactions. (Do not include state symbols) (2m each X 3 = 6 marks)

i) iron + sulfur → iron (II) sulfide

ii) sodium + water → sodium hydroxide + water

iii) hydrogen + oxygen → water

c) Balance the following equation:

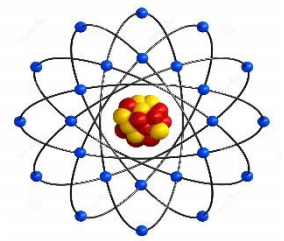
CH_4 (g) + ____ O_2 (g) → CO_2 (g) + ____ H_2O (l) (1mark)

3. a) Write whether the following statements are **TRUE** or **FALSE** (1m each X 5 = 5marks)

Statement	True or False?
i) Metals react by losing their outer shell electrons to form positive ions.	
ii) Non-metals react only by gaining electron.	
iii) Covalent bonding involves sharing of electrons between atoms of non- metals.	
iv) Ionic compounds are usually insoluble in water whereas covalent compounds are soluble.	
v) Ionic compounds are formed by electron transfer from a metal to a non-metal.	

b) Fill in the following table: (0.5m each X 10 = 5marks)

Name of compound	Formula	Ionic/ covalent compound?
Copper (I) oxide	Cu_2O	ionic
Sodium sulfide		
Phosphorus trichloride		
Potassium bromide		
Nitrogen dioxide		
Magnesium fluoride		



4. Each element has its own type of atom, its smallest possible particle. But atoms are themselves built up of even smaller particles, called sub-atomic particles.

a) Fill in the following table about the 3 sub-atomic particles.

0.5m X 4 = 2 marks)

Sub-atomic particle	Charge	Mass (a.m.u.)
Proton	+1	
Neutron		
Electron		Almost zero

b) Complete the following statements: (0.5m X 4 = 2 marks)

i) The protons and neutrons are packed together in the centre of the atom, called the _____

ii) The electrons orbit it at high speeds in paths called _____

iii) The number of electrons is equal to the number of _____ and so the atom is _____ overall.

c) Complete the following table about the atomic structure. (0.5m X 8 = 4 marks)

Name of element	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electronic configuration
sodium		23				2,8,1
fluorine	9			10		

d) In the box below, draw a dot-and-cross diagram to show the bonding between **sodium and fluorine**. Show ALL the shells. (2 marks)

5. Atoms of the same element have the same number of protons but may have different number of neutrons. (0.5m X 5 = 2.5 mark)

a) What are these atoms called? _____

b) The relative atomic mass (RAM) of an element is determined by finding the average mass of all its _____, taking into consideration their relative _____.

c) The relative atomic of sodium is 23. This means that:

- One atom of sodium is 23 times as heavy as 1 atom of _____.
- One atom of sodium is ___ times as heavy as $^{1}/_{12}^{th}$ the mass of a carbon-12 atom.

d) Chlorine exists naturally as 2 types: Cl-35 and Cl-37 occurring at abundances of 75% and 25% respectively. Use this information to calculate the relative atomic mass of chlorine.

_____

_____

_____

_____ (2 marks)

e) Boron is a metalloid element.

i) The table shows information about two types of boron atom. (0.5m X 6 = 3 marks)

Atom	Symbol	Protons	Electrons	Neutrons
Boron-10	$^{10}_{5}B$			
Boron-11	$^{11}_{5}B$			

ii) The relative atomic mass of boron is 10.82. Which type of boron atom, Boron-10 or Boron -11, is more abundant? _____ (0.5 mark)

iii) In the box provided, draw a simple diagram to show how all the sub-atomic particles of a $^{11}_{5}B$ atom are arranged. (2 marks)

6. a) Sort the following substances as compounds or mixtures (0.5m X 7 = 3.5 marks)

Substance	Compound	Mixture
Brass		X
Seawater		
Distilled water		
Sodium chloride (table salt)		
Sucrose (table sugar)		
Tea solution		
Air		
Copper (II) sulfate		

b) Find the relative molecular mass of: (1m x 2 = 2 marks)

Useful information- RAMs: H=1, O = 16, C = 12

i) water (H_2O) =_____

ii) sucrose ($C_{12}H_{22}O_{11}$) =_____

c) When water is added to sugar, a mixture is formed which is called a _____. The solute is the _____ whereas the solvent is the _____. The water

can be separated from this mixture by _____. If only the sugar needs to be recovered, it must be separated by _____ to dryness.

(0.5m X 5 = 2.5 marks)

d) Draw a dot-and-cross diagram to show the bonding in a water molecule (H_2O).
Show only the OUTER shell electrons. (2 marks)

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SECTION B: Answer TWO questions only in the spaces provided.
This section carries 40 marks.

7. (I) The apparatus in diagram A is used to separate a liquid/liquid mixture, while the apparatus in diagram B is used to separate a solid/liquid mixture.

Diagram A

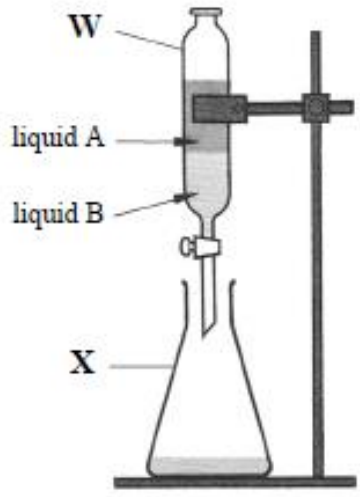
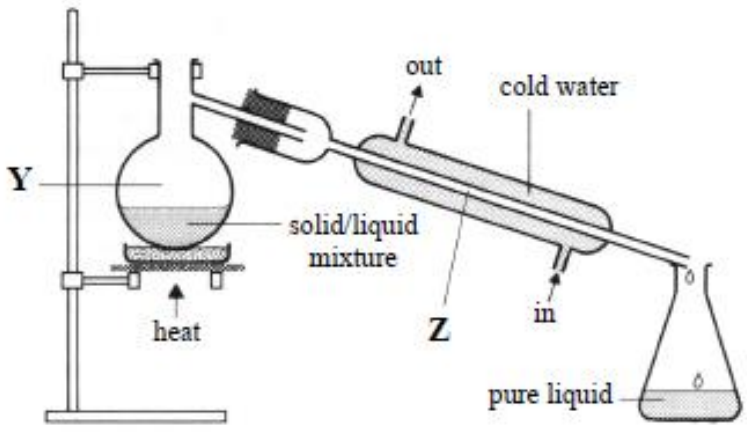


Diagram B



The apparatus in diagram A is used to separate a liquid/liquid mixture, while the apparatus in diagram B is used to separate a solid/liquid mixture.

a. (i) Name the apparatus labelled W and X.

W _____ **X** _____ (2 marks)

(ii) Give an example of a mixture that can be separated as shown in diagram A.

_____ (1 mark)

(iii) What term is used to describe this type of liquid/liquid mixture.

_____ (1mark)

b. (i) What name is given to the method of separation shown in diagram B?

_____ (1mark)

(ii) Give an example of a solid/liquid mixture that can be separated by this method.

_____ (1mark)

(iii) This method of separation involves two 'changes of state'. Write the name of the change of state that takes place at:

Y _____ **Z** _____ (2 marks)

(iv) Identify the mistake in setup B and state how it should be corrected.

_____

_____ (2 marks)

II) Liquids which mix uniformly together are called miscible liquids.

a. Name the separation technique you would use to separate miscible liquids.

_____(1 mark)

b. Name 2 miscible liquids._____(1 mark)

c. Name the piece of apparatus you would add to **diagram 2**, above, to complete the setup so that the separation of the 2 liquids could occur. (1 mark)

_____

d. Do you think it is possible to separate 2 miscible liquids with very close boiling points?

_____(1 mark)

e. Why would you add some anti-bumping granules to the solution?

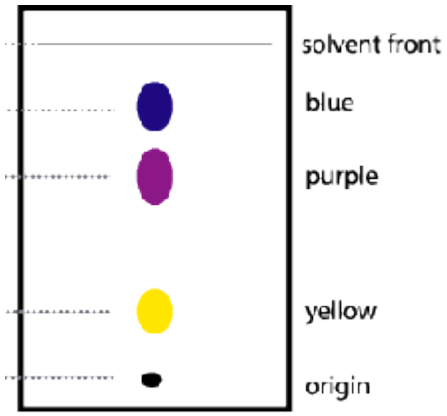
_____(1 mark)

f. Why would you use a round-bottomed flask to heat the solution?

_____(1 mark)

(III) Inks or dyes are usually a mixture of coloured solutes dissolved in a small amount of solvent.

Suzanne, a young chemist like you, wanted to find out what her **black** felt pen ink was made up of. She marked a concentrated spot of the black ink on the base-line (origin) drawn on a strip of appropriate paper and dipped it in some water in a beaker. When the water soaked up to almost the top edge of the paper (solvent front), the paper was removed and allowed to dry. The result she obtained is shown below. Use it to fill in the spaces below: (1m X 4 = 4 marks)



a. This type of separation is called _____

b. The black ink is a mixture of _____*(number)* dyes.

c. The _____ dye is the most soluble in water.

d. The base-line was drawn with a pencil because it is _____ in water.

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8. (I) Mark, another young chemist, was asked to separate a mixture of 3 different solids. The mixture he was provided with was made up of powdered **iron, sulfur and sodium chloride (table salt)**. Before choosing a way to separate each component, Mark thought about their properties.

a) Which substance in the mixture has the property in the table: (3 marks)

Solid	Property
	Soluble in water
	Insoluble in water
	Magnetic substance

b) What does Mark use to separate the iron from the mixture?_____

(1 mark)

c) How does he proceed to separate **sulfur** from salt. *Write 3 important steps he should take*. (3marks)

_____

_____

_____

d) Draw a simple, labelled diagram to show the apparatus used for the separation in (c). (2 marks)

e) Write a sentence to describe what Mark could do to obtain salt after he removed sulfur by using the apparatus above? (1 mark)

_____

f) Mark was also given a mixture table salt and sugar in order to separate them. Would he use water to separate them? Give a reason for your answer.

_____(1 mark)

He found that sugar is soluble in ethanol (alcohol) but salt is insoluble in this solvent. After dissolving this mixture in ethanol and filtering, name which substance would be the filtrate and which would be the residue. (0.5m X2 = 1 mark)

Filtrate = _____ **Residue** =_____

(II) Name the separation method you would use to separate the following mixtures.

Mixture	**Separation technique**
Water from seawater	
Salt from seawater	
Iodine from chalk powder	
Liquid oxygen from liquid air	
Nickel powder from aluminium powder	
Coffee from a solution	
Petrol from crude oil	
Mud from water	

(8 marks)

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9. This question is about **chemical bonding.**

a. The elements magnesium and oxygen react together to form magnesium oxide.

i) Fill in the following about the table about their atomic structure: (0.5m X 8 = 4 marks)

Element	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electron configuration
Magnesium	12	24				
Oxygen	8	16				

ii) Chemists observed that all elements are somewhat reactive except the elements in the last group of the periodic table, called the _____ gases. It was also noted that these elements all have 8 electrons in their outer shells except the first element in this group, helium, which has _____ outer shell electrons. According to chemists, these gases are unreactive because their state of outer shell electrons makes them very stable. Chemists think other elements react with each other so that in the process obtain the electronic configuration of the nearest noble gas. (1 mark)

iii) State how magnesium and oxygen atoms become stable.

Mg_____

O_____ (2 marks)

iii) What type of compound is magnesium oxide? _____(1 mark)

iv) Draw a dot-cross diagram, showing ALL electron shells, to show the bonding in magnesium oxide. (2 marks)

v) Give **two** properties of this type of compound. (2 marks)

_____

_____

b. The elements hydrogen and chlorine react together to form the compound of hydrogen chloride.

The atomic numbers: H = 1, Cl = 17

i) Use the atomic numbers to write the electronic configuration of: (2 marks)

H = _____ Cl =_____

ii) How do hydrogen and chlorine atoms become stable together?

_____(1 mark)

iii) What type of compound is hydrogen chloride?_

_____(1 mark)

iv) Draw a dot-cross diagram, showing OUTER shell electrons only to show the bonding in a molecule of hydrogen chloride. (2 marks)

v) Hydrogen chloride (HCl) and ammonia (NH_3) are both gases.

RAMs: H=1, Cl= 35.5, N= 14,

Find the relative molecular mass of:

HCl = _____

NH_3 = _____ (0.5m X 2 = 1 mark)

Which of the 2 gases would diffuse faster at the same temperature? Why?

_____

_____(1 mark)