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CHEMISTRY

PAPER 2
(80 marks)

Friday 19 MAY 2023 1:30 P.M.–3:00 P.M.
(1 hr. 30 mins)

Additional materials:
Calculator

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS
--

BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS AND INFORMATION TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number, candidate number, surname and initials in the spaces provided above.

Answer **ALL** the questions on this paper.

Read each question carefully and make sure you know what you have been asked to do before starting your answer.

The instruction **NAME . . .** requires an answer in words **NOT** chemical symbols.

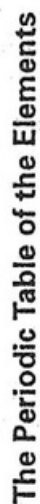
Show **ALL** your working when answering numerical questions. Lines are provided on the question paper for your answers. You should write your answers on these lines only.

A copy of the Periodic Table is provided on page 2.

The mark for each part question is given in brackets [].

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

This question paper consists of 18 printed pages and 2 blank pages.



The Periodic Table of the Elements

Group

Group																	
I	II	III	IV	V	VI	VII	0										
		1 H Hydrogen 1															
7 Li Lithium 3	9 Be Beryllium 4							4 He Helium 2									
23 Na Sodium 11	24 Mg Magnesium 12							20 Ne Neon 10									
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	98 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
87 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89						40 Ar Argon 18									

*58-71 Lanthanoid series
†90-103 Actinoid series

140	Ce	141	Pr	144	Nd	150	Pm	152	Eu	157	Gd	159	Tb	162	Dy	165	Ho	167	Er	169	Tm	173	Yb	175	Lu		
58	Cerium	59	Praseodymium	60	Neodymium	61	Promethium	62	Samarium	63	Europium	64	Gadolinium	65	Terbium	66	Dysprosium	67	Holmium	68	Erbium	69	Thulium	70	Ytterbium	71	Lutetium
232	Th		Pa	238	U		Np		Am		Cm		Bk		Cf		Es		Fm		Md		No		Lr		
90	Thorium	91	Protactinium	92	Uranium	93	Neptunium	94	Plutonium	95	Americium	96	Berkelium	97	Californium	98	Einsteinium	99	Fermium	100	Mendelevium	101	Nobelium	102	Lawrencium	103	

a = relative atomic mass

X = atomic symbol

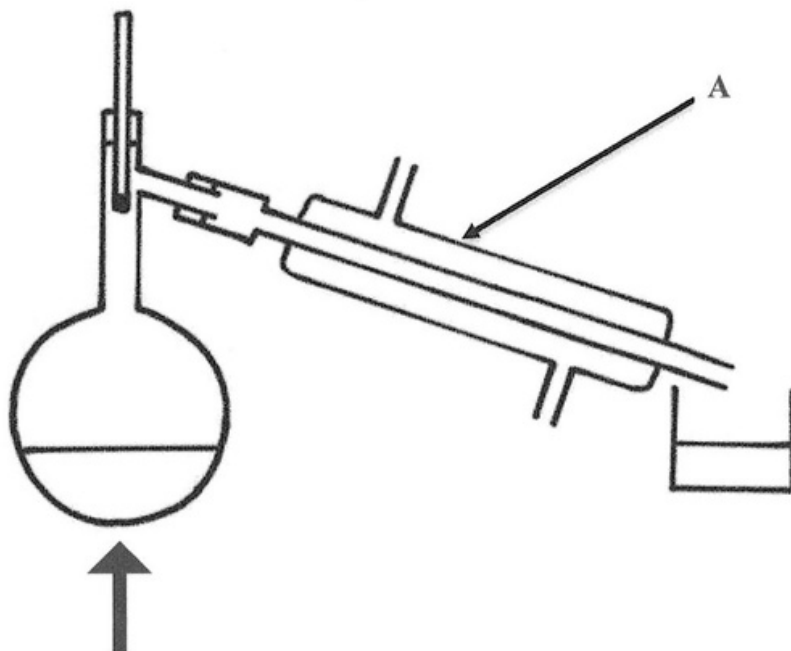
b = proton (atomic) number

Key

X

৭

1. A food chemist extracts substance X that is responsible for the characteristic smell of an orange. It can be done in a laboratory using the process shown in the diagram.



- (a) (i) Name the separation technique.

_____ [1]

- (ii) State the name of the apparatus labelled A.

_____ [1]

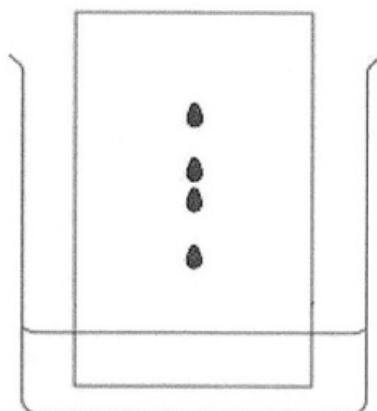
- (iii) Describe how apparatus A works.

_____ [2]



- (b) In an orange flavoured candy, the orange dye provides an authentic orange colour. The food chemist separated the pigments that make up the orange colour using paper chromatography. The results are shown in the diagram.

The orange dye is placed on a line drawn in pencil.



- (i) Add **three** labels to the diagram to show:
- the solvent
 - where the baseline should be
 - where the original position of the spot of the orange dye should be

[3]

- (ii) State the number of different components that make up the ink.

[1]

- (iii) Explain why the baseline must be drawn in pencil.

[1]

- (c) The solvent ethanol was used in this chromatography experiment.

Give one other use for ethanol.

[1]

TOTAL MARKS [10]



2. Atoms are the smallest particles of matter.

(a) These forms of matter are composed of three particles which are known as the electron, proton and neutron.

(i) Complete the table for these particles.

particle	relative mass	charge
electron		
proton		
neutron		

[3]

(ii) State why an atom is electrically neutral.

[1]

(b) Write the electronic configuration for a *Cl* atom.

[1]

(c) Atoms combine by forming bonds to produce new types of particles.

(i) Explain the difference between ionic bonding and covalent bonding.

[2]



- (ii) NCl_3 is a simple covalent molecule.

Draw the dot and cross diagram of one molecule of NCl_3 . Only show outer shell electrons.

[2]

- (iii) State **one** difference in properties between ionic and covalent compounds.

[1]

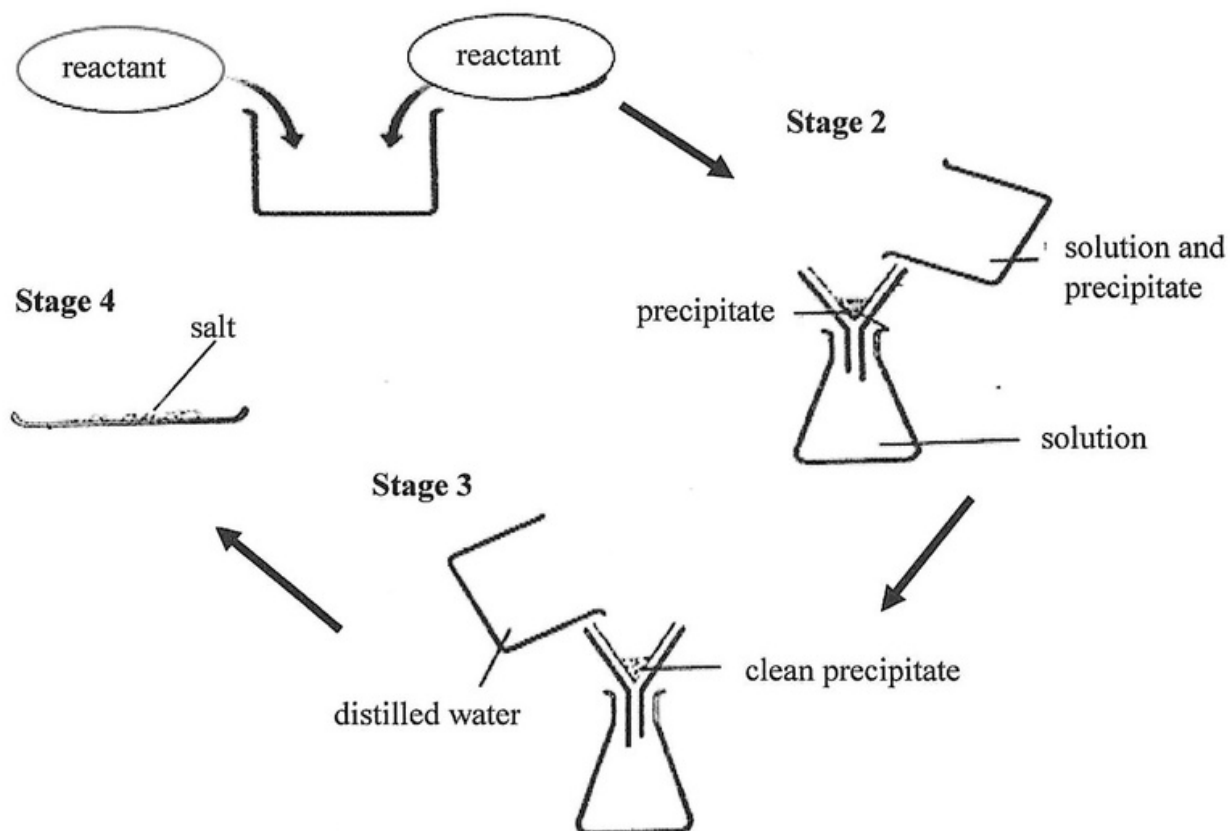
TOTAL MARKS [10]



3. The diagrams show the preparation of an insoluble salt by precipitation.

The reactants are barium hydroxide and sulphuric acid.

Stage 1 Mix the solutions of the reactants



- (a) Name the substances that form the precipitate and the solution.

precipitate _____

solution _____ [2]

- (b) Describe what is occurring in **steps 2 – 4**.

Step 2 _____

Step 3 _____

Step 4 _____

_____ [3]

- (c) Silver chloride is another insoluble salt formed when two soluble salts react.

The word equation shows the reactants and products of this reaction.

soluble salt 1 + **soluble salt 2** → silver chloride + **product 2**
(**product 1**)

Name the soluble salts and the other product formed in this reaction.

soluble salt 1 _____

soluble salt 2 _____

product 2 _____ [3]

- (d) A soluble salt can be formed by adding a soluble base to an acid. This results in neutralisation.

Explain neutralisation in terms of ions.

_____ [2]

TOTAL MARKS [10]



4. (a) Construct a fully labelled diagram of the electrolysis cell to decompose molten sodium chloride.

[3]

- (b) Name the products of the electrolysis of molten sodium chloride.

Product X _____

Product Y _____ [2]

- (c) Aluminium is extracted from its ore by electrolysis

- (i) Name the ore from which aluminium is extracted.

_____ [1]

- (ii) Explain why extracting aluminium from aluminium ore is more expensive than extracting iron from iron ore.

_____ [2]

- (iii) State why it is important to recycle aluminium.

_____ [1]

- (iv) Give **one** reason why aluminium is used in the manufacture of airplanes.

[1]

TOTAL MARKS [10]



5. (a) Calcium and magnesium are found in Group II of the Periodic Table.

(i) Name this group.

_____ [1]

(ii) Give **one** property of elements in this group.

_____ [1]

(iii) Magnesium oxide (MgO) is an ionic compound.

Draw a dot and cross diagram to show bonding in magnesium oxide (MgO).
Only show the outer electrons.

[3]



The table shows melting points and boiling points of some metals and non-metals.

Use the table to answer questions (b) and (c).

Element	Melting point (°C)	Boiling point (°C)
Bromine	-7	59
Chlorine	-101	-34
Fluorine	-220	-189
Mercury	-39	357
Aluminium	660	2467
Neon	-249	-246
Sulfur	115	445

(b) Identify the following substances:

(i) a non-metal that is a liquid at -200°C _____ [1]

(ii) an element that is a solid at 440°C _____ [1]

(iii) an element that is a green-yellow gas at 0°C _____ [1]

(iv) an element that has a full outer shell of electrons

_____ [1]

(v) an element that is a metal and a liquid at 20°C .

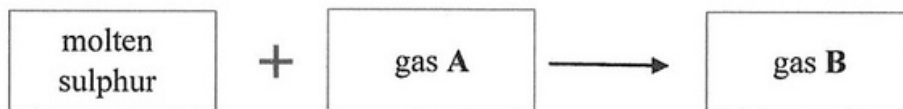
_____ [1]

TOTAL MARKS [10]

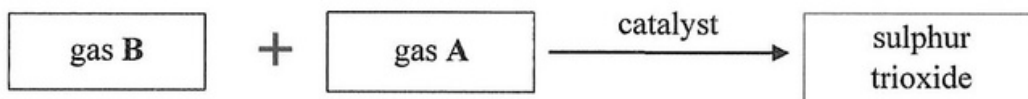


6. The flowchart shows steps in the industrial manufacture of sulphuric acid.

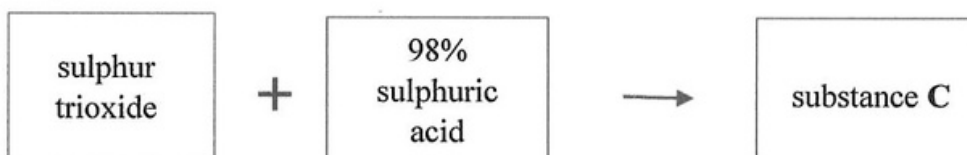
Step 1:



Step 2:



Step 3:



Use the flowchart to answer the questions.

- (a) (i) Name the method used to manufacture sulphuric acid.

_____ [1]

- (ii) Identify the substances A, B and C made during the manufacture.

A _____

B _____

C _____ [3]

- (iii) Name the catalyst used in **Step 2** of the manufacture.

_____ [1]

- (iv) State the temperature that is used for the reaction in **Step 2**.

_____ [1]



- (b) (i) State the colour change of the sugar that is observed when concentrated sulphuric acid is added to sugar.

Colour change _____ to _____ [1]

- (ii) State the chemical property of concentrated sulphuric acid shown when it reacts with sugar.

_____ [1]

- (c) Sulphuric acid is used to make fertilisers.

Give the name of a fertiliser produced using sulphuric acid.

_____ [1]

- (d) A business person wishes to build a sulphuric acid manufacturing plant on an island.

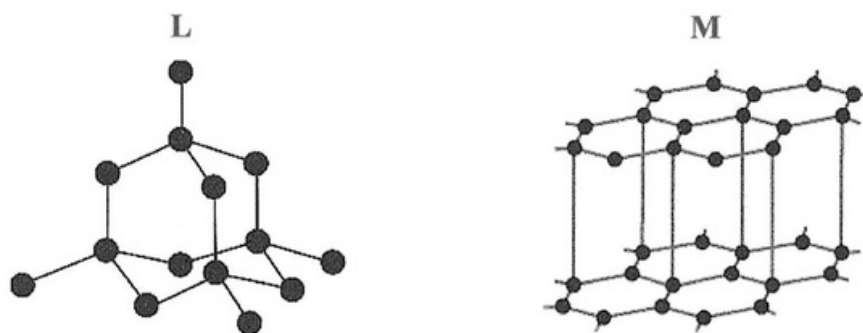
State **one** environmental factor that the business person must keep in mind when they decide on the best place for the factory.

_____ [1]

TOTAL MARKS [10]



7. Structures **L** and **M** are made of the same element.



- (a) State the name of the element that is present in structures **L** and **M**.

_____ [1]

- (b) Name structures **L** and **M**.

L _____

M _____ [1]

- (c) Complete the table about the properties and uses of structures **L** and **M**.

Structure (L or M)	Use	Property
i) _____	Pencils	ii) _____
iii) _____	iv) _____	Shiny
v) _____	Electrodes	vi) _____

[3]



- (d) The diagram shows a molecule of hydrogen.

Hydrogen molecule



- (i) Explain why structure L has a higher melting point than hydrogen.

[3]

- (ii) Give **two** uses of hydrogen.

1. _____

2. _____ [2]

TOTAL MARKS [10]



8. (a) Describe a positive test for the presence of water.

Test _____

Result _____

_____ [3]

- (b) When water is industrially treated, **two** stages of the process are **filtration** and **chlorination**.

- (i) State the purpose of each stage.

1. **filtration** _____

2. **chlorination** _____

_____ [2]

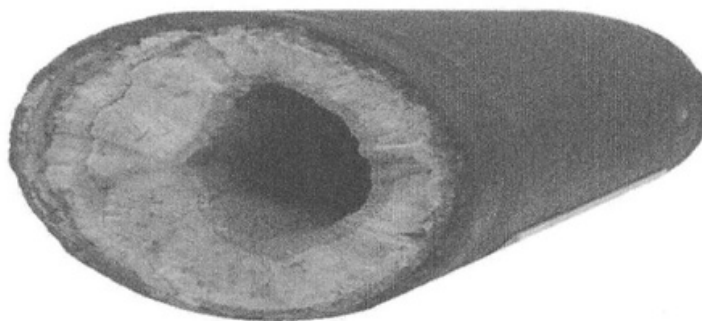
- (ii) Rainwater is a type of water that can be collected for personal use.

State **one** way, other than chlorination or filtration, rainwater can be treated for drinking.

_____ [1]



- (c) Scale deposits can form within pipes due to water hardness.



- (i) State the name of **one** metal ion that causes water hardness.

_____ [1]

- (ii) Describe a test that distinguishes between hard and soft water.

Reagent _____

Result _____

_____ [2]

- (iii) Name **one** method to remove temporary water hardness.

_____ [1]

TOTAL MARKS [10]



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