3051/2 BGCSE

School Number	Candidate Number

Surname and Initials

CHEMISTRY

PAPER 2 3051/2

Tuesday 19 MAY 2015 1:30–3:00 P.M.

Additional materials:
None

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	
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TOTAL	

This question paper consists of 15 printed pages and 1 blank page.

The Periodic Table of the Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 0
							1 H Hydrogen 1										4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
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	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	Po Polonium 84	At Astatine 85	Rn Radon 86
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89 †															

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

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

Key: a X b — a = relative atomic mass; X = atomic symbol; b = proton (atomic) number

1. Use the Periodic Table on page 2 to answer this question.

(a) (i) Name the element with the symbol Pd. _____ [1]

(ii) State the proton number of the element Ba. _____ [1]

(iii) Name the first element with more than 21 neutrons.

_____ [1]

(iv) Write the atomic symbol of the most reactive halogen.

_____ [1]

(v) Name the element with an electronic configuration of 2,8,3.

_____ [1]

(vi) Calculate the number of neutrons in element Y.

_____ [1]

(vii) Name the element found in Group IV, Period 3.

_____ [1]

(viii) State the total number of electrons in the Ca^{2+} ion.

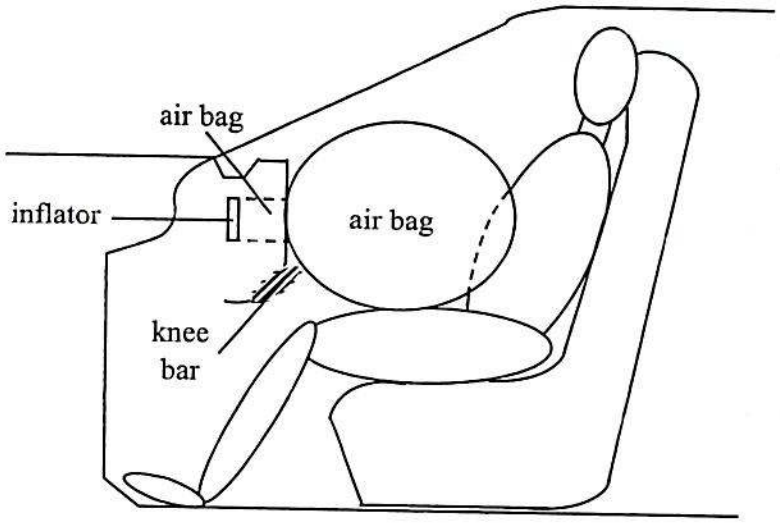
_____ [1]

(b) Draw a dot and cross diagram to show the bonding in K_2S. Only the outer electrons are required.

[2]

TOTAL MARKS [10]

2. Cars are equipped with air bags that prevent both the driver and passenger from being injured in an accident.



(a) (i) The gas that is used to inflate the air bag makes up 78% of the atmosphere. State the name of this gas.

_____ [1]

(ii) Use kinetic theory to write **TWO** statements describing the movement and spacing of the gas molecules in the air bag.

_____

_____

_____ [2]

(iii) Use kinetic theory to explain how the air bag inflates.

_____

_____

_____ [2]

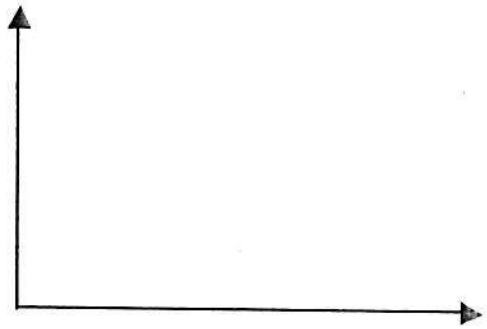
(b) (i) State the name of the scientist who discovered the relationship between volume and pressure for a fixed mass of gas at a constant temperature.

_____ [1]

(ii) Write a mathematical equation to show the relationship described in (b)(i).

[1]

(iii) Label the axis and sketch a graph which illustrates the relationship named in (b)(i).



[1]

(iv) The volume of an inflated air bag is 20 L at 1 atm. After a collision, the volume of the air bag is reduced to 10 L.

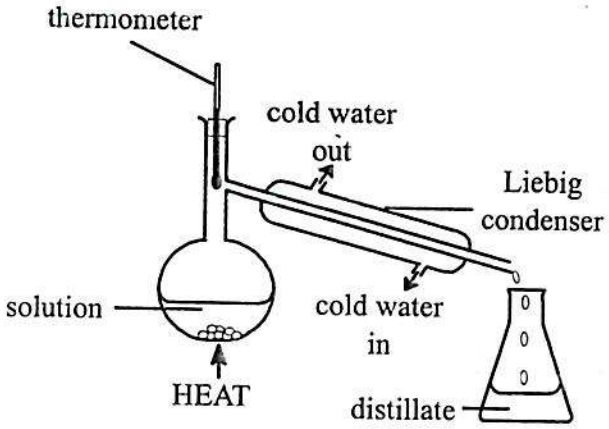
Calculate the collision pressure. Assume that temperature and the amount of the gas remain constant.

[2]

TOTAL MARKS [10]

3. The diagrams show apparatus used to separate different mixtures.

(a) **diagram A**



(i) State the name of the process shown in **diagram A**.

_____ [1]

(ii) Explain why apparatus shown in **diagram A** is **NOT** suitable for separating a mixture of ethanol and water.

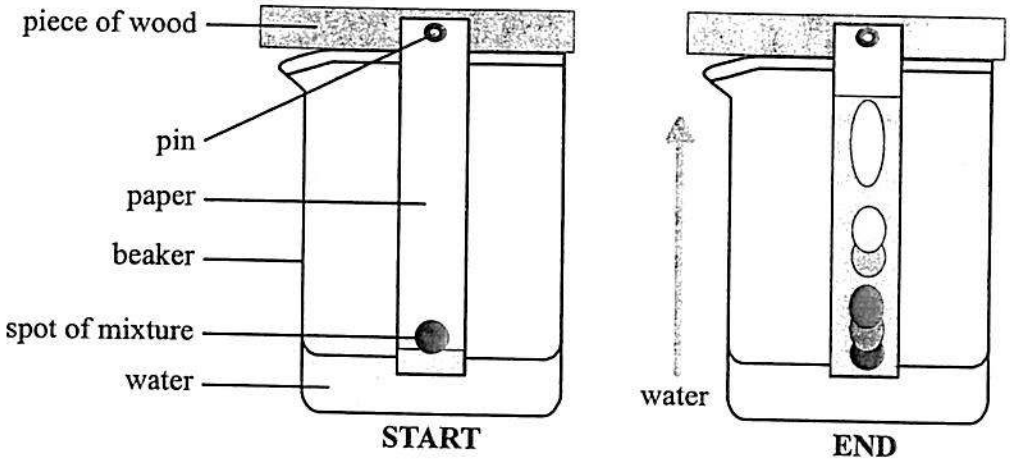
_____

_____ [1]

(iii) Suggest a suitable method for separating these liquids into ethanol and water.

_____ [1]

diagram B



(b) (i) State the type of mixtures the apparatus shown in **diagram B** can be used to separate.

_____ [1]

(ii) Name another separation technique not shown by either **diagram A** or **diagram B**.

_____ [1]

(c) (i) Define the term *mixture*.

_____

_____ [2]

(ii) Name the **two** parts of a solution.

1. _____

2. _____ [2]

(d) Name a method which separates Fe from Fe_2O_3.

_____ [1]

TOTAL MARKS [10]

4. To produce oxygen gas in the laboratory, a scientist decomposes hydrogen peroxide in the presence of manganese dioxide.

(a) (i) State the purpose of the manganese dioxide in the reaction.

_____ [1]

(ii) Other than oxygen, name the product formed when hydrogen peroxide decomposes.

_____ [1]

(iii) Briefly describe a method used to collect the oxygen gas as it is produced.

_____ [1]

Oxygen is a reactive gas found in air. Oxygen reacts with metals and non-metals to form oxides. Metal oxides found within the Earth's crust are called ores.

(b) (i) What percentage of the volume of dry air contains oxygen?

_____ [1]

(ii) Define the term *ore*.

_____

_____ [2]

(iii) Name the ore that is used to make steel.

_____ [1]

Oxides can be classified as acidic, amphoteric, basic or neutral oxide.

(c) Complete the table by filling in each oxide's classification.

name of oxide	oxide classification
calcium oxide	
sulfur trioxide	
zinc oxide	

[3]

TOTAL MARKS [10]

5. Aspirin (acetylsalicylic acid) is an analgesic drug that is widely used throughout the world.

(a) (i) Define the term *analgesic.*

_____

_____ [1]

(ii) Name one possible harmful side effect of using aspirin.

_____ [1]

Aspirin is made by an esterification reaction.

(b) (i) Define the term *ester.*

_____

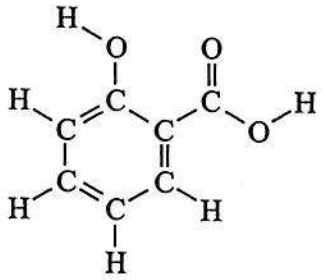
_____ [1]

(ii) Complete the word equation for an esterification reaction.

_____ carboxylic acid ⟶ ester + _____ [2]

Salicylic acid is the name of the acid used to make aspirin. Salicylic acid is classified as a carboxylic acid.

The diagram shows the structural formula of salicylic acid.



(c) (i) Write the functional group of a carboxylic acid.

_____ [1]

(ii) Write the molecular formula of salicylic acid.

[1]

(iii) Calculate the relative molecular mass of salicylic acid.

(Ar: C = 12, O = 16, H = 1)

[1]

Carboxylic acids are weak organic acids that can be found in common household products. Ethanoic acid is an example of a common household carboxylic acid.

(d) Name the reactants needed to form ethanoic acid.

1. _____

2. _____ [2]

TOTAL MARKS [10]

6. The equations show some reactions of acids with water.

Reaction **A**

$HCl(aq) + H_2O(l) \longrightarrow H_3O^+ + Cl^-(aq)$

Reaction **B**

$CH_3COOH(aq) + H_2O(l) \rightleftharpoons H_3O^+(aq) + CH_3COO^-(aq)$

(a) (i) State which reaction shows a strong acid reacting with water.

_____ [1]

(ii) State what difference in reaction **A** and **B** indicates that your answer to (a)(i) is a strong acid.

_____ [1]

(iii) In reaction **B** would you expect to find more CH_3COOH molecules or H_3O^+ ions?

_____ [1]

(b) A solution of $Ca(OH)_2$ of 1 mol dm^{-3} concentration and a solution of NaOH of 2 mol dm^{-3} concentration have the same concentration of negative ions.

Explain this statement.

_____

_____ [1]

(c) A student added 3.25 g of powdered zinc to excess sulfuric acid. Bubbles of gas were observed during the reaction. The zinc disappeared rapidly.

(i) Write the word equation for the reaction.

_____ + _____ ⟶ _____ + _____ [1]

(ii) Give the test and the positive result to identify the gas made in (c)(i).

test _____ [1]

result _____ [1]

[Turn over

(iii) Briefly explain why the colour of the Universal Indicator remains red even though all of the zinc metal has been used up.

_____ [1]

(iv) Calculate the number of moles in 3.25 g of zinc metal.

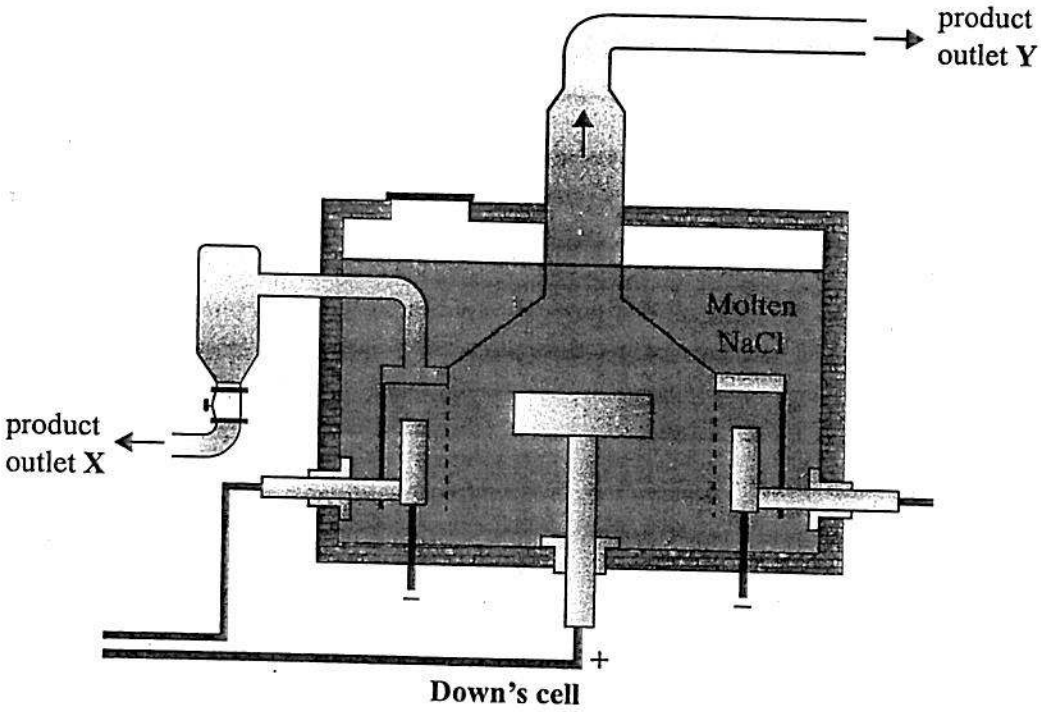
_____ [1]

(v) State the pH value for the excessive sulfuric acid used in the reaction.

_____ [1]

TOTAL MARKS [10]

7. The diagram represents a Down's cell showing the commercial electrolysis of NaCl.



Down's cell

(a) On the diagram label the anode and cathode. [2]

(b) (i) Give a reason why the NaCl must be in the molten state.

_____ [1]

(ii) Write the chemical symbols of the ions present in the electrolyte.

_____ [1]

(iii) Name the products produced at **X** and **Y**.

X _____

Y _____ [2]

(iv) State why the two products formed must be kept separate from each other.

_____ [1]

(c) Flame tests are often used to identify cations such as sodium.

(i) Describe the results of a flame test performed on NaCl.

_____ [1]

(ii) Name a green gas that can bleach damp litmus paper.

_____ [1]

(iii) Name an element in the same Group as sodium which can displace sodium from sodium chloride.

_____ [1]

TOTAL MARKS [10]

8. An industrial process is needed to create the amount of iron used to construct buildings. Once the iron has been produced we must find a way to protect the metal.

(a) (i) Name the industrial process that produces pig iron.

_____ [1]

(ii) Name the form of carbon used in this process.

_____ [1]

(iii) Name the solid by-product produced as the iron is being made.

_____ [1]

(b) One of the reactions taking place as iron is being made is shown below.

$Fe_2O_3 + 3CO \longrightarrow \_\_ Fe + \_\_ CO_2$

(i) Balance the equation by filling in the blanks. [2]

(ii) State the oxidation number assigned to Fe.

_____ [1]

(iii) Name the substance that acts as the reducing agent in the equation.

_____ [1]

(iv) State the **change** in the number of electrons for each oxygen ion.

_____ [1]

(c) (i) State how iron pipes and fences can be prevented from rusting.

_____ [1]

(ii) Other than the method mentioned in (c)(i), state how the hull of a large ship can be prevented from corroding.

_____ [1]

TOTAL MARKS [10]