

School Number	Candidate Number
Surname and Initials	

CHEMISTRY

PAPER 2 3051/2

Wednesday **22 MAY 2013** 1:30–3:30 P.M.

No additional materials required

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS
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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 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.

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

This question paper consists of 16 printed pages and 4 blank pages.

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The Periodic Table of the Elements

		Group																																					
I	II	III	IV	V	VI	VII	0																																
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	27 Al Aluminum 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	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	91 Zr Zirconium 40	91 Y Yttrium 39	93 Nb Niobium 41	101 Ru Ruthenium 44	106 Pd Palladium 46	108 Ag Silver 47	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 Cesium 55	137 Ba Barium 56	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	209 Po Polonium 84	209 At Astatine 85	209 Rn Radon 86																										
87 Fr Francium	88 Ra Radium	89 Ac Actinium	89 La Lanthanum	89 Y Yttrium	89 Sc Scandium	89 Ti Titanium	89 V Vanadium	89 Cr Chromium	89 Mn Manganese	89 Fe Iron	89 Co Cobalt	89 Ni Nickel	89 Cu Copper	89 Zn Zinc	89 Ga Gallium	89 Ge Germanium	89 As Arsenic	89 Se Selenium	89 Br Bromine	89 Kr Krypton	89 Rb Rubidium	89 Sr Strontium	89 Y Yttrium	89 Zr Zirconium	89 Nb Niobium	89 Mo Molybdenum	89 Tc Technetium	89 Ru Ruthenium	89 Rh Rhodium	89 Pd Palladium	89 Ag Silver	89 Au Gold	89 Hg Mercury	89 Tl Thallium	89 Pb Lead	89 Bi Bismuth	89 Po Polonium	89 At Astatine	89 Rn Radon

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

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

a	X	b
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140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	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	232 Pa Protactinium 91	238 U Uranium 92	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103

1. (i) Use the Periodic Table to answer this question.
- (a) State the total number of elements that are in Period 3 of the Periodic Table. _____
 - (b) Name an element that is a liquid at r.t.p. _____
 - (c) Name the element that is the least dense gas at r.t.p. _____
 - (d) Name the element that is the most reactive non-metal. _____
 - (e) Give the atomic mass of the element with the symbol Ir. _____
 - (f) Name the element that has stable atoms containing 12 neutrons. _____
 - (g) Clean, dry air contains several **elements**. Name the group to which the third most abundant of these elements belongs. _____
 - (h) Name one of the elements in the compound known as Aragonite. _____ [8]
- (ii) Draw dot and cross (Lewis) diagrams showing the ions or molecules in the substances named below. [2]

sodium fluoride, NaF	fluoride gas, F ₂

TOTAL MARKS [10]

2. Compounds are substances that are made up of two or more different elements. Compounds can exist as salts or molecular compounds.

(a) (i) Give the chemical name for **common salt**.

_____ [2]

(ii) Name the type of bonding that is found in salts.

_____ [1]

(iii) Complete the word equation by inserting one word into each blank.

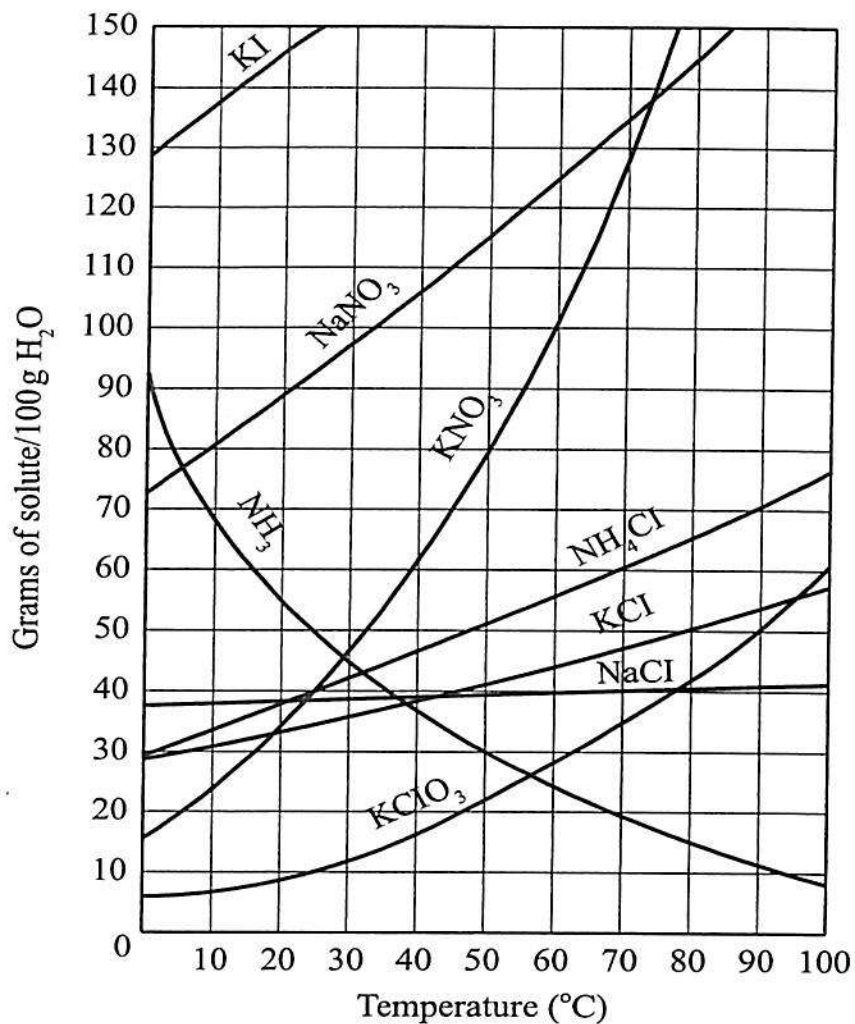
acid + → **salt** + [2]

(b) This question is about covalent and ionic compounds. Use the words printed in bold to fill in the blanks.

physical property	type of compound	
	covalent	ionic
The melting point of the compound is usually high or low		
A compound that is a solid at room temperature can be dissolved in water yes or no (exclude ALL sugars)		
The compound will conduct electricity when it is in the form of a liquid yes or no		

[3]

(c) The graph shows the solubility curves for different substances.



Use the graph to determine solubility.

- (i) Which is the most soluble substance at 10°C, potassium chlorate, potassium nitrate or sodium nitrate?

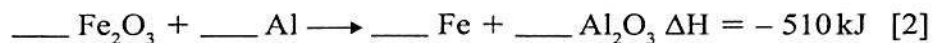
- (ii) State the solubility of ammonium chloride (NH₄Cl) at 80°C.

[2]

TOTAL MARKS [10]

3. At high temperatures iron(III) oxide reacts with aluminium metal according to the chemical equation.

(a) (i) Balance the chemical equation.



(ii) Name the substance that is reduced in the reaction.

_____ [1]

(iii) State the purpose of Al in the reaction.

_____ [1]

(iv) Explain what the symbol $\Delta H = - 510 \text{ kJ}$ means.

_____ [1]

(v) Find the mass of iron which will be produced if 2.50 kg of iron(III) oxide is reacted.

[2]

(b) An alloy is a mixture of metals. Iron is used to make various kinds of steel. One form of steel contains carbon.

(i) Name one metal that can be added to iron to make steel.

_____ [1]

(ii) Give a benefit of adding other metals to iron to make the alloy steel.

_____ [1]

(iii) A common non-steel alloy is bronze. Name the metal which is added to copper to make bronze.

_____ [1]

TOTAL MARKS [10]

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4. (a) The table shows observations made of various solutions. Classify each solution as either an acid or a base.

Complete the table by placing a tick (✓) in the column of the answer you select to indicate whether the observations indicate an **acid** or a **base**.

observations	acid	base
taste sour and turns blue litmus red		
displaces ammonia from its salt		
reacts with iron giving hydrogen		

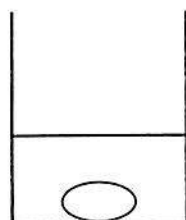
[3]

- (b) Hydrochloric acid and ethanoic acid are both monobasic acids. When tested, hydrochloric acid solution had a pH of 1, ethanoic acid had a pH of 4, even though both were of the same concentration. Explain these results.

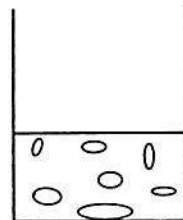
[1]

- (c) The diagram shows the making of a soluble salt.

copper(II) carbonate is added to hydrochloric acid



fizzing is seen as a gas is given



excess copper(II) carbonate remains

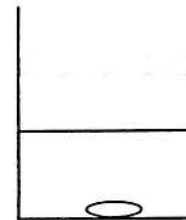


Figure 4.9

- (i) State the colour of Universal Indicator in hydrochloric acid before the copper(II) carbonate is added in Fig. 4.9.

[1]

(ii) Name the gas causing the fizz in the reaction in **Fig. 4.9**.

_____ [1]

(iii) Explain why, at the end of the chemical reaction, some copper(II) carbonate remains in the beaker in **Fig. 4.9**.

_____ [1]

(iv) State how the excess copper(II) carbonate is removed from the mixture.

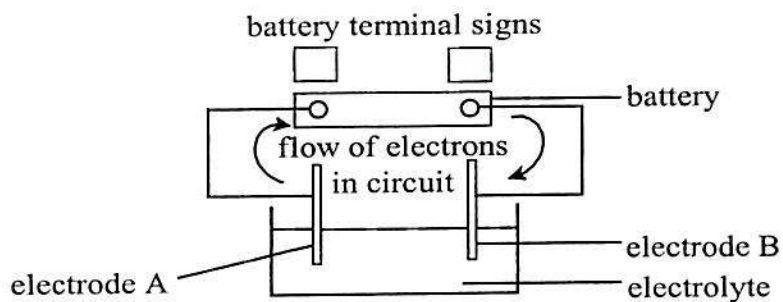
_____ [1]

(v) Describe how crystals of the salt can be obtained from the solution after the excess copper carbonate has been removed.

_____ [2]

TOTAL MARKS [10]

5. The diagram shows the electrolysis of molten sodium chloride.



(a) (i) Copper was chosen because it is an excellent conductor of electricity. State another reason why copper is chosen as the conductor.

_____ [1]

(ii) **On the diagram**, write the battery terminal signs (+ and -) in the two boxes. [1]

(iii) Use your knowledge about the flow of electrons in an electrolysis circuit to give the name of electrode A.

_____ [1]

(iv) The current in the wires is caused by the movement of electrons. State the cause of the current in the electrolyte.

_____ [1]

(b) A student wants to electroplate a piece of copper with silver metal.

(i) Suggest a suitable electrolyte for electroplating copper.

_____ [1]

(ii) Explain where, in the diagram, the piece of copper to be electroplated should be placed.

_____ [1]

- (ii) Give the name and general formula of the homologous series to which both of these compounds belong.

Name: _____

general formula: _____ [2]

- (c) Name the carbon compound formed that forms the largest component of natural gas.

_____ [1]

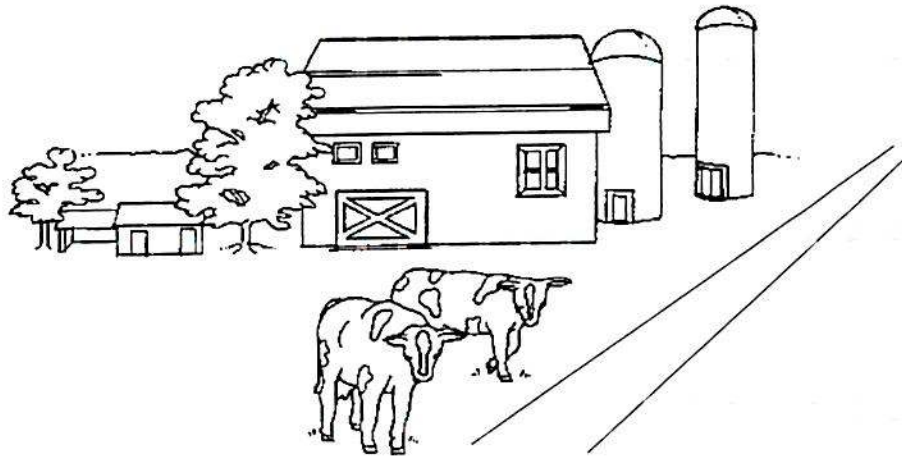
- (d) Name the first member of the **alkene** and **alcohol** series.

alkene series _____

alcohol series _____ [2]

TOTAL MARKS [10]

7. The diagram shows a farm next to a water supply.



Over a period of time, the farmer notices that the water, in the river next to his farm, changes colour and he sees dead fish floating in it. He thinks that pollution has caused these changes.

- (a) (i) Define the term **pollution**.

_____ [2]

- (ii) Name a possible **source** of the pollution seen in the river.

_____ [1]

- (iii) Name **ONE** pollutant from the source mentioned in (a) (ii) that contributes to the pollution seen in the river.

_____ [1]

- (iii) Explain the term **eutrophication**.

_____ [2]

(b) A catalytic converter is a device that is attached to an automobile's exhaust system. A catalytic converter changes harmful pollutants in an automobile's fuel into less harmful substances by oxidation and reduction.

(i) Name a poisonous pollutant made by the combustion of fuel that is oxidised by the catalytic converter.

_____ [1]

(ii) Name the gas that results from the action of the catalytic converter on the pollutant named in (i).

_____ [1]

(iii) Name the metal that can be used as a catalyst in the catalytic converter.

_____ [1]

(iv) Name the environmental problem that the catalytic converter has little or no effect in reducing.

_____ [1]

TOTAL MARKS [10]

8. While doing an inventory of chemicals with students, a chemistry instructor comes across an old container of potassium metal. The students had heard of this metal and were very curious about what it could do. The instructor agrees to demonstrate some of its chemistry if the students could tell him what they already knew about it. Before any investigations the students agree to follow all instructions and safety precautions.

The students knew:

Potassium is stored in oil, is a soft, shiny grey, very reactive metal that they had heard can burn in water (were eager to see if this was true) and its compounds are soluble in water.

The instructor opens the container and shows the students that **the oil had drained away** and the **material** in the container is a **dull grey**. Using forceps the instructor removes a small cylinder of the grey material and scrapes off some of the grey surface matter with an ordinary table knife to reveal a shiny substance underneath. He easily cuts a small disk of the material from the cylinder shaped material.

- (a) State what caused the shiny metal to corrode.

_____ [1]

- (b) Name the dull grey substance. _____ [1]

- (c) The instructor tests the grey material, state the colour of the

(i) flame test, _____ [1]

(ii) litmus in its aqueous solution. _____ [1]

- (d) The shiny material is held together by a metallic bond. Describe how the metallic bond works. You may draw a diagram to help in your description.

_____ [2]

- (e) When small pieces of the shiny metal were added to water a lilac-coloured flame was seen and the students heard a popping sound. The metal disappeared into the water.

Suggest the name of the **final product** that was formed by the reaction, in the water.

_____ [1]

- (f) The instructor agrees to show the curious students what would happen if a small piece of the shiny potassium was added to hydrochloric acid. For safety reasons the instructor uses dilute acid and a small sample of the metal. During the violent reaction between metal and acid, a new compound is formed.

- (i) Name this new compound.

_____ [1]

- (ii) Give the name of the reagent used to identify the anion.

_____ [1]

- (g) Using the Periodic Table identify an element that could displace the cation in the compound made in (f).

_____ [1]

TOTAL MARKS [10]

