School Number	Candidate Number
Surname and Initials	

CHEMISTRY

PAPER 2 3051/2

Thursday 20 MAY 2010 1.50 P.M. – 3.20 P.M.

No additional materials required

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.

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

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

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

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

580023

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 to answer this question.

(a) State the total number of elements listed in The Periodic Table. _____

(b) State the collective name given to the elements on the Periodic Table which are found in Group VII. _____

(c) Name the element located in Group III, period 2. _____

(d) State the number of elements in the Group known as alkali metals. _____

(e) State how many elements in Periods 1, 2 and 3 are gases at room temperature. _____

(f) Name the element whose symbol is **Nb**. _____

(g) State the number of neutrons found in element **Y**. _____

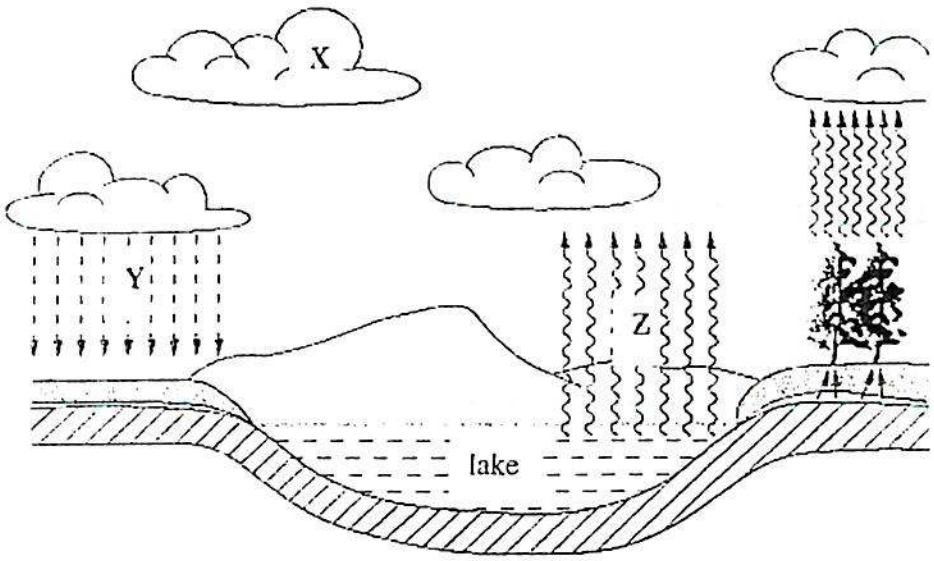
(h) Give the electronic configuration of calcium. _____

(i) Draw a diagram to show only the charges on the ions in CaF_2. _____

[2]

Total marks [10]

2. The diagram represents the water cycle.



(a) Name the processes occurring at **X**, **Y** and **Z**.

X _____

Y _____

Z _____ [3]

(b) Name a process used in the laboratory that consists of processes **Z** and **X**.

_____ [1]

(c) Describe a pure substance.

_____

_____ [1]

(d) Water is called the universal solvent.

Name another solvent and give its use.

name _____ [1]

use _____

_____ [1]

(c) Rainwater contains carbonic acid. Rainwater will dissolve calcium carbonate. The natural water supply in The Bahamas contains calcium.

Calculate the concentration, in mol/dm^3, of the solution formed by dissolving 8 g of calcium carbonate in 500 cm^3 of rainwater. (A_r: Ca = 40, C = 12, O = 16, H = 1)

[3]

Total marks [10]

3. In an imaginary experiment, an observer sits in a control room to view, through a window, what happens in an insulated room. The observer lowers the temperature inside the insulated room.

Given the facts:

– Room temperature: 20 °C;

– Air: mixture of $N_2(g)$, $O_2(g)$, $CO_2(g)$ and other gases.

N_2: mp –210 °C bp –196 °C

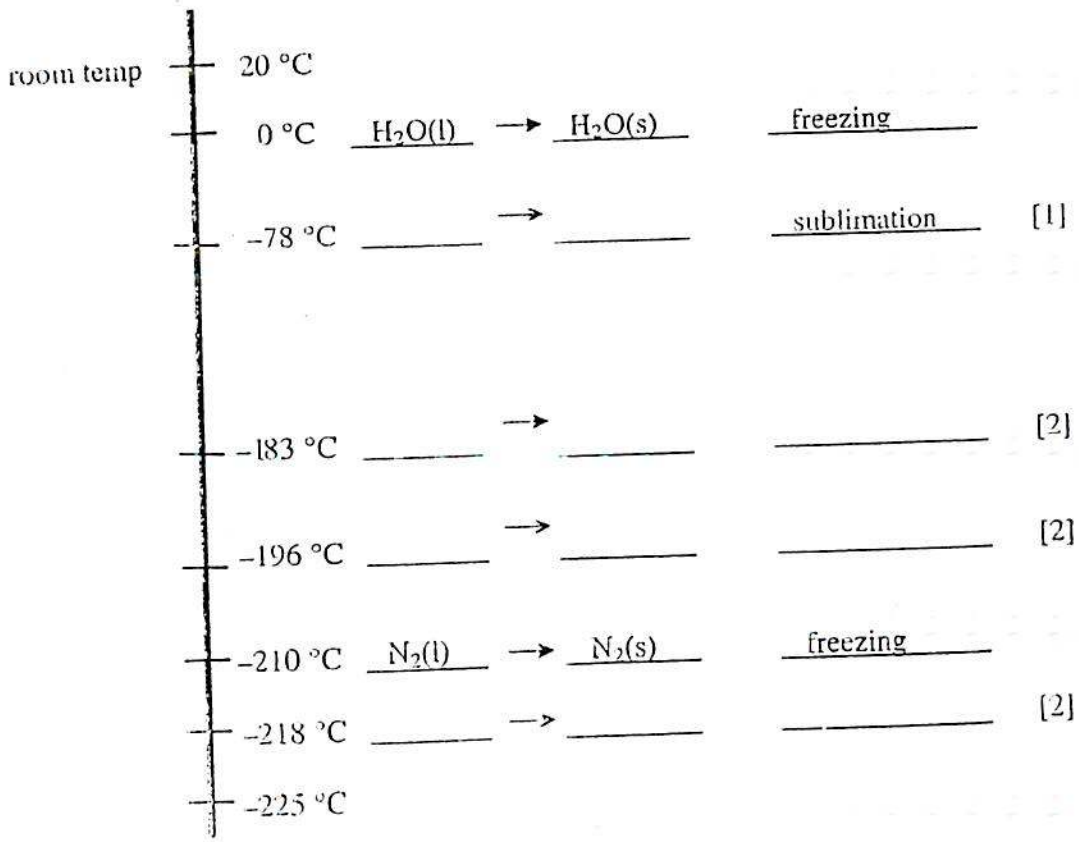
O_2: mp –218 °C bp –183 °C

CO_2 sublimes at –78 °C

(a) Name **ONE** of the other gases.

_____ [1]

(b) Fill in the formulae of the gases and their **state symbol** followed by the **name of the change** that occurs at the stated temperatures, to complete the chart.



(c) What is the state of both nitrogen and oxygen at –200 °C?

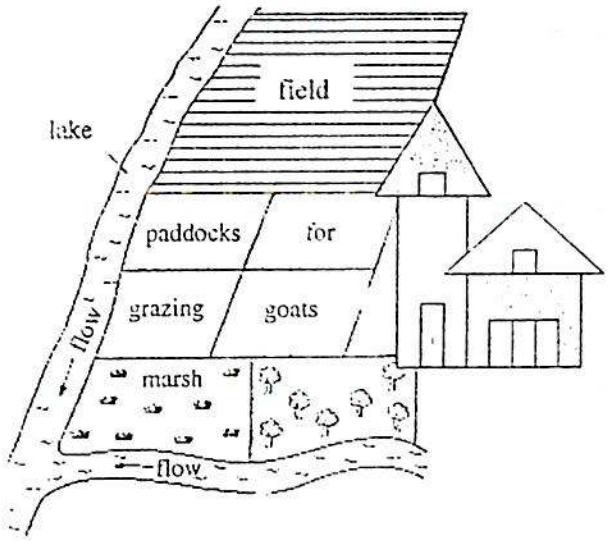
_____ [1]

(d) The air has been cooled to –225 °C. It is allowed to warm up again. State what the observer sees as the temperature of the mixture rises from –200 °C to –195 °C.

_____ [1]

Total marks [10]

4. The diagram shows a small farm next to a body of water.



(a) (i) Identify **TWO** pollutants which might affect the water as a result of modern farm practices.

1 _____

2 _____ [2]

(ii) Name another practice which can contribute to water pollution.

_____ [1]

(b) Eutrophication may occur in the lake as a result of the run-off from the farm. Explain the term ***eutrophication***.

_____

_____

_____

_____ [3]

(c) (i) Name **ONE** pollutant which can cause acid rain.

_____ [1]

(ii) Using the pollutant mentioned in (c) (ii), write a balanced equation to show the formation of acid rain.

[3]

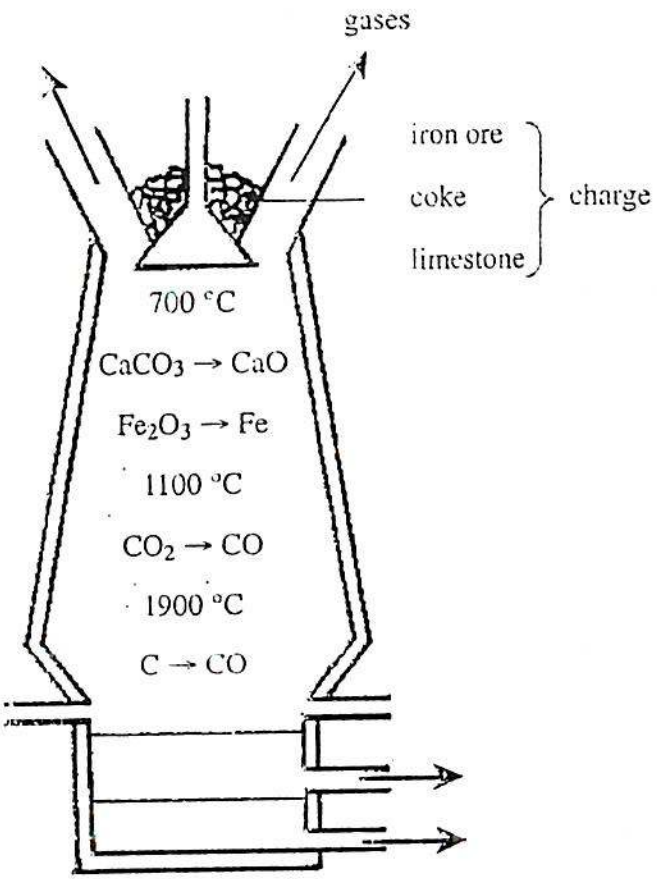
(iii) State **ONE** effect of acid rain on stone buildings.

_____ [1]

Total marks [10]

5. A blast furnace is used to extract iron from its ore using coke, which is essentially carbon.

(a) The reactions written inside the diagram of the blast furnace are incomplete.



(i) Name an ore from which iron is extracted.

_____ [1]

(ii) Name the reducing agent that reduces the iron ore to iron.

_____ [1]

(iii) Write the oxidation number for the carbon in the oxides of carbon.

CO_2 _____ [1]

CO _____ [1]

(b) Steel is an alloy of iron and carbon. It is used in underground pipes or tanks to hold gasoline. These steel pipes are protected from rusting by attaching pieces or rods of magnesium metal. This is known as sacrificial protection.

(i) Explain why magnesium is used.

_____ [1]

(ii) Explain what happens to the magnesium as it protects the steel.

_____ [1]

(c) Other than coke, carbon exists as diamond and graphite.

(i) Relate the properties of diamond and graphite to their structures to complete the table.

carbon allotrope	property	structure
diamond	hard	
graphite		hexagonal planes

(ii) The two forms of carbon listed in the table are allotropes. Name a third allotrope of carbon.

_____ [3]

(d) If the Alchemist had succeeded in changing iron into gold, state how many protons must be added to an iron atom to make it into a gold atom?

_____ [1]

Total marks [10]

6. This question is about acids and bases.

(a) (i) Define a ***strong acid.***

_____

_____ [1]

(ii) Write the name and formula of a strong acid with a basicity of 2.

name _____

formula _____ [1]

(b) Write the **name** and **formula** of the ion that is contained in

		name	**formula**	
(i)	all acid solutions;	_____	_____	[1]
(ii)	all alkaline solutions.	_____	_____	[1]

(c) (i) Name the reaction between an acid and a base.

_____ [1]

(ii) Complete the word equation

acid + base $\longrightarrow$ _____ + _____ [1]

(iii) When the base is a carbonate, state the name and formula of the third product formed.

name _____

formula _____ [1]

(d) (i) Complete the equation.

$H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 +$ _____ [2]

(ii) Name the indicator that is the same colour of magenta (red wine) in alkali.

_____ [1]

Total marks [10]

7. The energy found in petroleum originally came from the Sun.

(a) Name the carbon compound that is transformed using energy from the Sun into substances used as fuels.

_____ [1]

(b) Fractional distillation of petroleum produces alkanes and alkenes.

(i) Explain why the combustion of an alkane is a useful reaction.

_____ [1]

(ii) Balance the equation for the combustion reaction for hexane.

$2\ C_6H_{14} + 26\ O_2 \longrightarrow$ _____ CO_2 + _____ H_2O [1]

(c) The general formula of alkanes is $C_n\ H_{2n+2}$.

(i) Write the formula of an alkane containing 15 carbon atoms.

[2]

(ii) Propane and octane are two alkanes. Name the alkane which has

the shorter carbon chain; _____

the lower boiling point. _____ [1]

(iii) Draw two isomers of butane.

[2]

(d) The carbon compounds known as alkenes form another homologous series.

(i) Define a ***homologous series***.

_____

_____ [1]

(ii) Draw the structural formula of ethene.

[2]

Total marks [10]

8. The diagram shows the reaction of a zinc compound.

zinc compound $\xrightarrow{\text{Devarda's alloy}}$ gas A (pungent odour) $\xrightarrow{\text{add } H_2SO_4 \text{ (aq)}}$ $(NH_4)_2SO_4$ $\xrightarrow{\text{add } BaCl_2 \text{ (aq)}}$ white ppt. **B**

(a) (i) Define an *alloy*.

_____ [2]

(ii) Devarda's alloy is made up of Cu, Al and Zn. It contains more Cu than the other two metals. In a given sample of the alloy it contains 45% Al. Suggest the percentage (%) of Cu and Zn in the alloy.

percentage (%) **Cu** _____ [1]

percentage (%) **Zn** _____ [1]

(iii) Identify these substances.

gas **A**; _____ [1]

white ppt. **B** _____ [1]

(b) Gas **A** reacts with hydrogen chloride, shown by the equation.

gas **A** + HCl (g) ⟶ dense white fumes of solid **C**

When solid **C** is heated it changes directly from a solid to a gas. Name this process.

_____ [1]

(c) (i) Name the element present in the compound $(NH_4)_2SO_4$ which makes it ideal for use as a fertilizer.

_____ [1]

(ii) Calculate the percentage of this element in the compound.

_____ [2]

Total marks [10]

End]