

School Number	Candidate Number
Surname and Initials	

# CHEMISTRY

PAPER 2 3051/2

Monday **23 MAY 2011** 1.50 P.M. – 3.20 P.M.

No additional materials required

<b>MINISTRY OF EDUCATION</b> <b>NATIONAL EXAMINATIONS</b>
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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 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 19 printed pages and 1 blank page.

# The Periodic Table of the Elements

		Group																																																																																															
I	II	III	IV	V	VI	VII	0					0																																																																																					
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	13 Al Aluminum 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18	19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36	37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54	55 Cs Cesium 55	56 Ba Barium 56	57 La Lanthanum 57	58-71 Lanthanoid series	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86	87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103	104 Rf Rutherfordium 104	105 Db Dubnium 105	106 Sg Seaborgium 106	107 Bh Bohrium 107	108 Hs Hassium 108	109 Mt Meitnerium 109	110 Ds Darmstadtium 110	111 Rg Roentgenium 111	112 Cn Copernicium 112	113 Nh Nihonium 113	114 Fl Flerovium 114	115 Mc Moscovium 115	116 Lv Livermorium 116	117 Ts Tennessine 117	118 Og Oganesson 118

\* 58-71 Lanthanoid series  
190-103 Actinoid series

Key

a	X
b	

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

1. The diagram is a part of the Periodic Table but the letters used are **NOT** the symbols of the elements of the Periodic Table.

I																			
														F	D		J		
A	B													E			C		H
						G													

Use the letters given in the table to answer the questions.

- (a) Write the letter which represents an element that
- (i) is a member of the alkaline earth metal family;  
\_\_\_\_\_ [1]
  - (ii) is the most reactive halogen;  
\_\_\_\_\_ [1]
  - (iii) gains two electrons to form an anion;  
\_\_\_\_\_ [1]
  - (iv) has an electronic configuration of 2,8,1;  
\_\_\_\_\_ [1]
  - (v) has four outer shell electrons;  
\_\_\_\_\_ [1]
  - (vi) is the least dense gas at s.t.p.;  
\_\_\_\_\_ [1]
  - (vii) forms an amphoteric oxide.  
\_\_\_\_\_ [1]

- (b) (i) Draw a Lewis dot diagram to show the bonding in the compound formed by **B** and **C**.

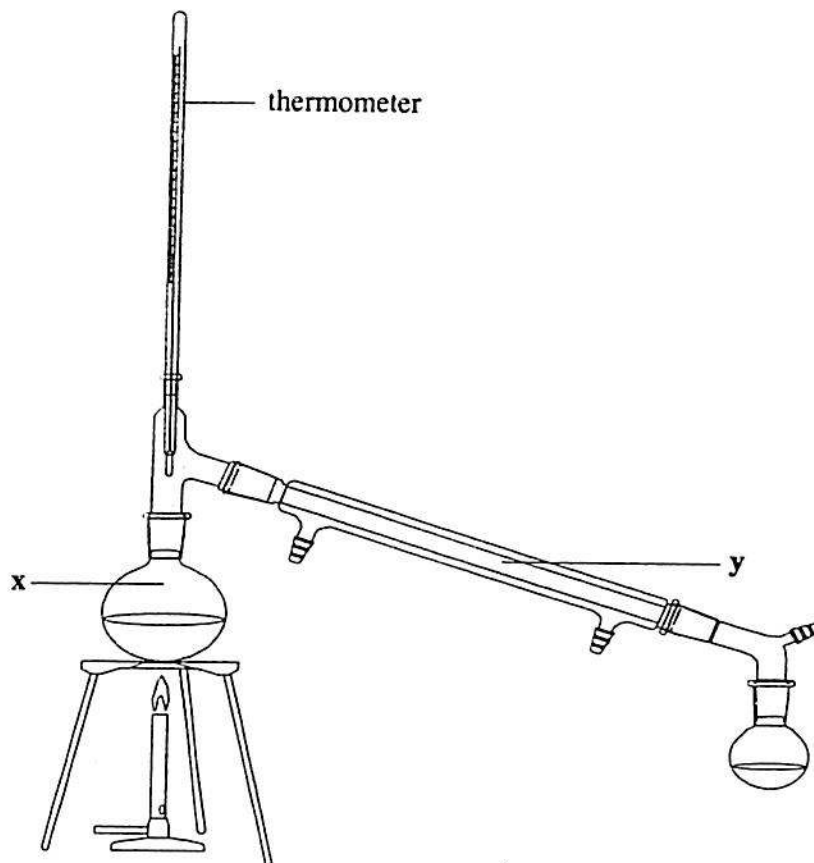
[2]

- (ii) Name the type of bonding shown in your diagram.

\_\_\_\_\_ [1]

**Total marks [10]**

2. A solution containing water is being distilled to get pure water.



- (a) Name the physical processes taking place at **x** and **y**.
- (i) **x**; \_\_\_\_\_
- (ii) **y**. \_\_\_\_\_ [2]
- (b) Indicate **on the diagram**, using the phrase **water in**, where cooling water enters the system. [1]
- (c) Briefly describe how you could confirm that the water collected in the round-bottomed flask is **pure**.

\_\_\_\_\_

\_\_\_\_\_ [2]

- (d) (i) State a method which may be used to obtain common salt from sea water.

\_\_\_\_\_ [1]

- (ii) Name the island of The Bahamas where salt is extracted on a large scale.

\_\_\_\_\_ [1]

- (iii) State **ONE** economic result of having a salt industry in the island.

\_\_\_\_\_ [1]

- (e) The freezing point of water is  $0^{\circ}\text{C}$ . If the temperature of the surroundings is below zero, at  $-2^{\circ}\text{C}$ , salt can be added to melt the ice quickly.

Explain why the ice melts.

\_\_\_\_\_  
\_\_\_\_\_ [2]

**Total marks [10]**

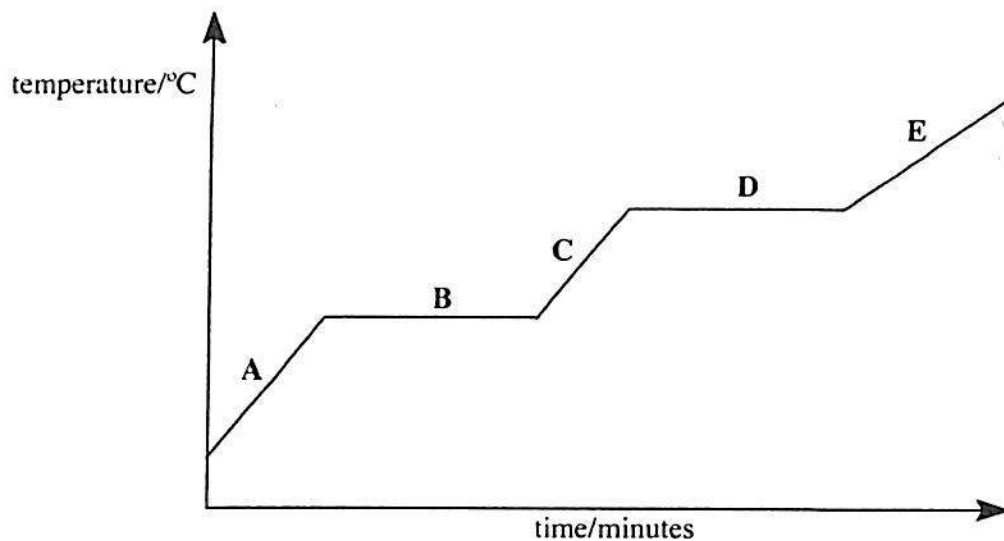
3. Matter can exist in three states: solid, liquid and gas. The Kinetic Theory describes how the various states of matter behave.

(a) Using **one word each time**, fill in the blanks in the following sentence:

The Kinetic Theory of gases states that all gases are made up of small

\_\_\_\_\_ which are in continual \_\_\_\_\_ . [2]

Solid substance **X** is being steadily heated in a container and its temperature is taken every 30 seconds. As the temperature rises, substance **X** changes state.



(b) Name the change of state of substance **X** occurring at point **A** and point **B**.

(i) at point **B**;

\_\_\_\_\_ [1]

(ii) at point **D**.

\_\_\_\_\_ [1]

(c) Heat energy is going into the container containing substance **X** all the time but in sections **B** and **D** of the graph, the temperature does not rise.

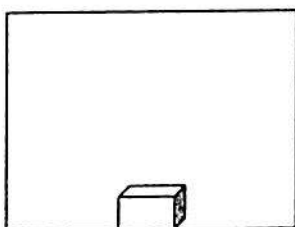
(i) In terms of bonds between particles of substance **X**, explain why energy is being used up in section **B** of the graph.

\_\_\_\_\_  
\_\_\_\_\_ [1]

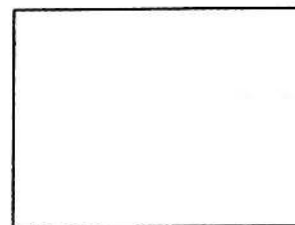
(ii) In the same way, explain why the energy is being used up in section **D** of the graph.

\_\_\_\_\_  
\_\_\_\_\_ [1]

Container 1 shows solid **X** in the container before heating has started, at section **A** of the graph.



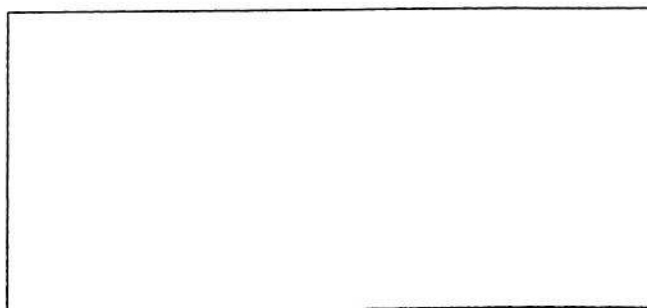
container 1



container 2

(d) In container 2, draw the appearance of substance **X** at section **C** of the graph. [1]

(e) In the box, draw some of the particles of **X** at section **E** of the graph, when the changes of state have finished. Use the kinetic theory to help you.



[1]



(f) The teacher showed the class the heating of solid ammonium chloride. The white crystals turned into a colourless gas. When the gas cooled, white crystals were formed again.

(i) Name the change from a gas to a solid.

\_\_\_\_\_ [1]

(ii) Name another substance which can undergo this type of change.

\_\_\_\_\_ [1]

**Total marks [10]**

4. Scientists have discovered that atoms are made up of many types of subatomic particles.

The three particles that are most important for chemistry are the electron, the proton and the neutron.

- (a) (i) Protons are positively charged and electrons are negatively charged. Why is an atom electrically neutral?

\_\_\_\_\_ [1]

- (ii) The table gives values for subatomic particles in some atoms and ions. Use the Periodic Table printed on page 2 to help you to complete the table. [3]

number of protons	number of neutrons	number of electrons	symbol
9	10	10	
	12	11	Na
25		25	Mn
13	14		Al <sup>3+</sup>

- (b) Neon-20, neon-21 and neon-22 are isotopes of neon, a gaseous element used in coloured lighted signs.

State how these isotopes are

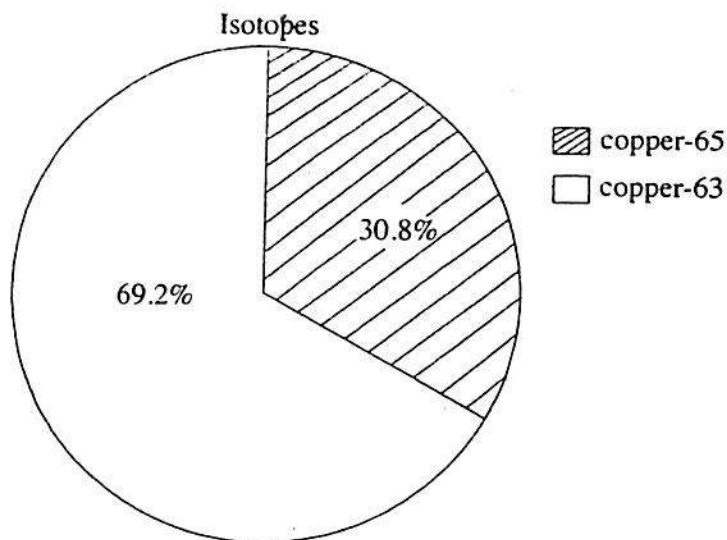
- (i) different;

\_\_\_\_\_

- (ii) similar.

\_\_\_\_\_ [2]

- (c) A sample of copper is a mixture of two isotopes, Cu-63 and Cu-65. Using the information from the chart, calculate the relative atomic mass of a sample of copper.



Use the equation to find the average relative atomic mass of the mixture of isotopes in the sample.

$$\text{average r.a.m.} = \frac{(69.2 \times \dots\dots\dots) + (30.8 \times \dots\dots\dots)}{100}$$

[2]

- (d) A chlorine atom is  $^{17}\text{Cl}_{35}$  and an argon atom is  $^{18}\text{Ar}_{39}$ . A chloride ion formed from  $^{17}\text{Cl}_{35}$  atom and an argon atom both have the same number of one type of subatomic particle.

(i) Name this type of particle.

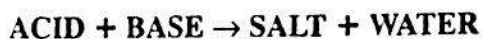
\_\_\_\_\_ [1]

(ii) Explain how a chlorine atom becomes a chloride ion.

\_\_\_\_\_ [1]

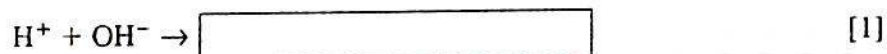
**Total marks [10]**

5. The reaction of an acid with a base produces a salt and water.



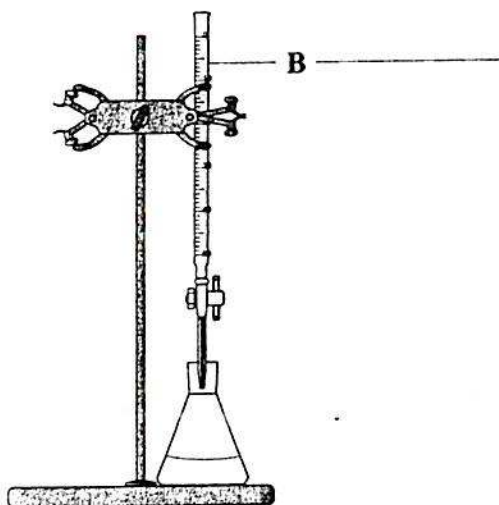
(a) (i) Complete the sentence.,  
When they are dissolved in water, \_\_\_\_\_ produce  $\text{H}^+$   
ions and \_\_\_\_\_ produce  $\text{OH}^-$  ions. [2]

(ii) Complete the chemical equation, by filling in the box for the product.



(iii) Name the type of reaction that takes place in (a) (ii).  
\_\_\_\_\_ [1]

(b) A titration experiment was done using the apparatus in the diagram and the salt made was sodium chloride.



The indicator phenolphthalein turned pink when added to the reactant in the conical flask.

(i) Label the apparatus **B** on the diagram. [1]

(ii) Write the chemical **names** of the two reactants used in the titration to make the salt, sodium chloride.

1 \_\_\_\_\_

2 \_\_\_\_\_ [2]

(iii) Name the reactant placed in the apparatus B.

\_\_\_\_\_ [1]

(c) Antacids are bases that react with hydrochloric acid in the stomach. Aluminium hydroxide, magnesium hydroxide and calcium carbonate are all used as antacids.

(i) Using one of the bases, write a word equation to show how your chosen base reacts with the stomach acid.

\_\_\_\_\_ [2]

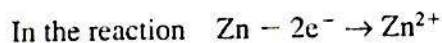
**Total marks [10]**

6. Shipwrecks of Spanish galleons often contain gold and silver treasures. The recovered gold had not changed colour while the silver turned black.

(a) Use the information to compare the reactivity of gold and silver.

\_\_\_\_\_  
\_\_\_\_\_ [1]

(b) Sacrificial zinc blocks are attached to the steel hull of a ship to protect it from corrosion.



electrons supplied by zinc are accepted by steel and protect it from corrosion.

(i) State whether the loss of electrons from zinc is an oxidation or reduction reaction.

\_\_\_\_\_ [1]

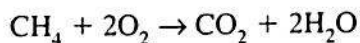
(ii) Name a metal that is used in the same way to prevent corrosion of the steel used in oil pipelines.

\_\_\_\_\_ [1]

(iii) Name **ONE** method other than sacrificial protection that is used to prevent iron from rusting.

\_\_\_\_\_ [1]

(c) A Bunsen burner converts methane,  $\text{CH}_4$ , in natural gas to carbon dioxide and water during combustion, according to the chemical equation:



(i) Calculate the volume of carbon dioxide produced from **2 moles** of methane at RTP. [2]

- (ii) Write the name of the chemical term used to describe this reaction if it produces energy.

\_\_\_\_\_ [1]

- (iii) State whether the removal of hydrogen from methane is an oxidation or reduction reaction.

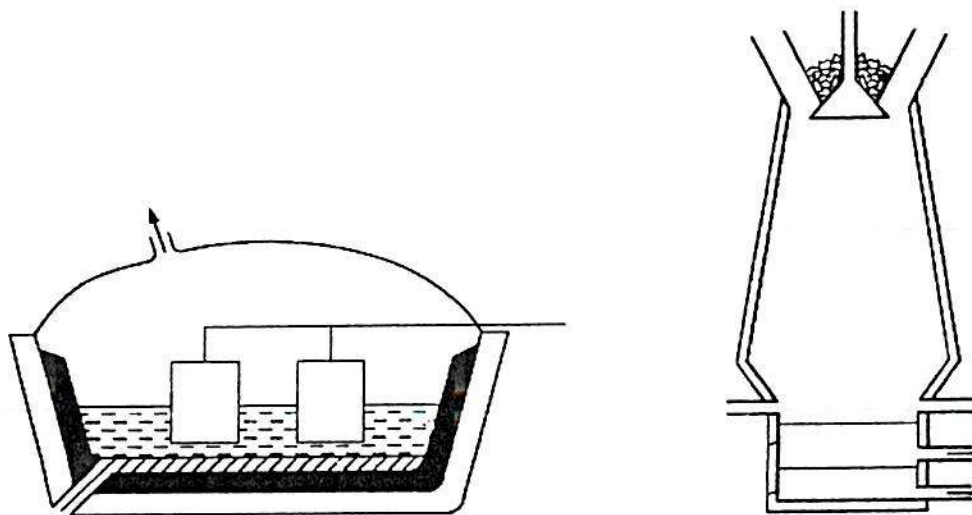
\_\_\_\_\_ [1]

- (iv) Using the outer electrons only, draw a diagram to show the bonding in a water molecule.

[2]

**Total marks [10]**

7. Iron and aluminium are extracted by two different processes as in the diagrams.



- (a) Name the process for the extraction of
- (i) iron \_\_\_\_\_
  - (ii) aluminium. \_\_\_\_\_ [2]
- (b) Fill in the blanks to complete each list of raw materials
- (i) Extraction of iron uses air, carbon, haematite and \_\_\_\_\_ .
  - (ii) Extraction of aluminium uses cryolite and \_\_\_\_\_ . [2]

Iron is extracted by heating with carbon; aluminium is extracted by the electrolysis method.

- (c) Explain the reason for using different methods of extraction for the two metals.

\_\_\_\_\_

\_\_\_\_\_ [2]



- (d) Iron metal became available for use thousands of years before aluminium. Give a reason for this.

\_\_\_\_\_ [1]

- (e) One of the products of electrolysis of aluminium is oxygen which causes the anode to be worn out, by reacting with it. Name a compound produced by the reaction of oxygen with the material of the anode.

\_\_\_\_\_ [1]

- (f) (i) Define the term *alloy*.

\_\_\_\_\_ [1]

- (ii) Name an alloy of iron used in the making of surgical instruments.

\_\_\_\_\_ [1]

**Total marks [10]**

8. Alkanes are saturated hydrocarbons with a general formula  $C_nH_{2n+2}$ . Alkenes are unsaturated hydrocarbons with a general formula  $C_nH_{2n}$ .

(a) (i) Explain why alkenes are known as unsaturated hydrocarbons.

\_\_\_\_\_ [1]

(ii) Work out the formula for an alkene that contains 5 carbon atoms.

[1]

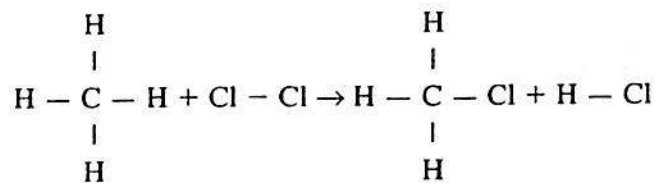
Name this alkene.

\_\_\_\_\_ [1]

(iii) State how the alkanes in gasoline differ from the alkanes in kerosene.

\_\_\_\_\_ [1]

(b) Methane,  $CH_4$ , is an important constituent of natural gas. Chlorine reacts with methane by a photochemical reaction that results in the formation of carbon and hydrogen chlorides.



(i) Name this type of reaction.

\_\_\_\_\_

(ii) Name the organic product of the reaction shown in the equation.

\_\_\_\_\_ [2]

(c) Name the type of reaction when

(i) glucose is converted to alcohol by the addition of yeast;

\_\_\_\_\_

ethene is converted into poly(ethene).

\_\_\_\_\_ [2]

(ii) Name the gas produced in (c) (i) as well as the ethanol.

\_\_\_\_\_ [1]

(iii) State how the alcohol obtained from the reaction of yeast with glucose can be made into a concentrated solution.

\_\_\_\_\_ [1]

**Total marks [10]**

