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CHEMISTRY**PAPER 2****(80 marks)****Wednesday****21 MAY 2025****1:30 P.M.–3:00 P.M.****(1 hr. 30 mins)****Additional materials:****Calculator**

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 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 [].

Relative atomic masses are given in the Periodic Table printed on page 2

The volume of one mole of gas at room temperature and pressure (r.t.p) is 24 dm³.

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

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



The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
1 H Hydrogen																	
3 7 Li Lithium	4 9 Be Beryllium											5 11 B Boron	6 12 C Carbon	7 14 N Nitrogen	8 16 O Oxygen	9 19 F Fluorine	2 4 He Helium
11 23 Na Sodium	12 24 Mg Magnesium											13 27 Al Aluminium	14 28 Si Silicon	15 31 P Phosphorus	16 32 S Sulphur	17 35.5 Cl Chlorine	10 20 Ne Neon
19 39 K Potassium	20 40 Ca Calcium	21 45 Sc Scandium	22 48 Ti Titanium	23 51 V Vanadium	24 52 Cr Chromium	25 55 Mn Manganese	26 56 Fe Iron	27 59 Co Cobalt	28 59 Ni Nickel	29 64 Cu Copper	30 65 Zn Zinc	31 70 Ga Gallium	32 73 Ge Germanium	33 75 As Arsenic	34 79 Se Selenium	35 80 Br Bromine	36 84 Kr Krypton
37 85 Rb Rubidium	38 88 Sr Strontium	39 89 Y Yttrium	40 91 Zr Zirconium	41 93 Nb Niobium	42 96 Mo Molybdenum	43 101 Tc Technetium	44 101 Ru Ruthenium	45 103 Rh Rhodium	46 106 Pd Palladium	47 108 Ag Silver	48 112 Cd Cadmium	49 115 In Indium	50 119 Sn Tin	51 122 Sb Antimony	52 128 Te Tellurium	53 127 I Iodine	54 131 Xe Xenon
55 133 Cs Caesium	56 137 Ba Barium	57 139 La Lanthanum	72 178 Hf Hafnium	73 181 Ta Tantalum	74 184 W Tungsten	75 186 Re Rhenium	76 190 Os Osmium	77 192 Ir Iridium	78 195 Pt Platinum	79 197 Au Gold	80 201 Hg Mercury	81 204 Tl Thallium	82 207 Pb Lead	83 209 Bi Bismuth	84 209 Po Polonium	85 209 At Astatine	86 210 Rn Radon
87 226 Fr Francium	88 226 Ra Radium	89 227 Ac Actinium															

* 58-71 Lanthanoid series

† 90-103 Actinoid series

a

X

b

a = relative atomic mass

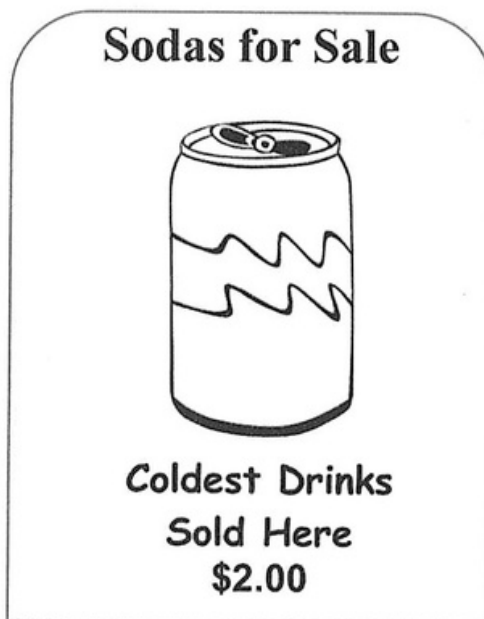
X = atomic symbol

b = proton (atomic) number

71 175 Lu Lutetium	70 173 Yb Ytterbium	69 169 Tm Thulium	68 167 Er Erbium	67 165 Ho Holmium	66 162 Dy Dysprosium	65 159 Tb Terbium	64 157 Gd Gadolinium	63 152 Eu Europium	62 150 Sm Samarium	61 144 Nd Neodymium	59 141 Pr Praseodymium	58 140 Ce Cerium	90 232 Th Thorium	91 238 Pa Protactinium	92 238 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium
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1. As it was a very hot day, a vendor at the school carnival added some salt or sodium chloride, to the ice cooler where he kept his sodas.

He advertised with the sign shown.



- (a) (i) Explain, in terms of melting point, why the vendor's sodas were the coldest sodas at the school carnival.

[1]

- (ii) Sodium chloride is a compound.

Define the term compound.

[2]

- (b) (i) Using only the outer shell electrons, show the bonding that occurs when sodium is combined with chlorine to form sodium chloride (NaCl).

Show the charges on the ions.

[3]

[Turn over]



- (ii) Calculate the molar mass of sodium chloride.

[1]

- (iii) The vendor added 10.9 grams of sodium chloride (NaCl) to the ice cooler.

Calculate the number of moles of sodium chloride that were added to the ice cooler.

[1]

- (iv) Explain why sodium chloride solution conducts electricity.

[2]

TOTAL MARKS [10]



2. Students went on a field trip to obtain a sample of water from Lake Cunningham. The students performed a few simple tests on the water sample.

(a) One student sets up an apparatus to collect the dissolved salts from the brackish water. The dry residue from the lake was tested using a flame test.

(i) How does the student carry out a flame test?

_____ [2]

(ii) The student observed a lilac coloured flame.

Name the ion in this residue sample.

_____ [1]

(b) The student heats a sample of the lake water in an evaporating dish.

The table shows the mass readings the student records before and after heating.

empty evaporating dish / g	23.57
evaporating dish with lake water before heating / g	45.31
evaporating dish with salt residue after heating / g	30.99

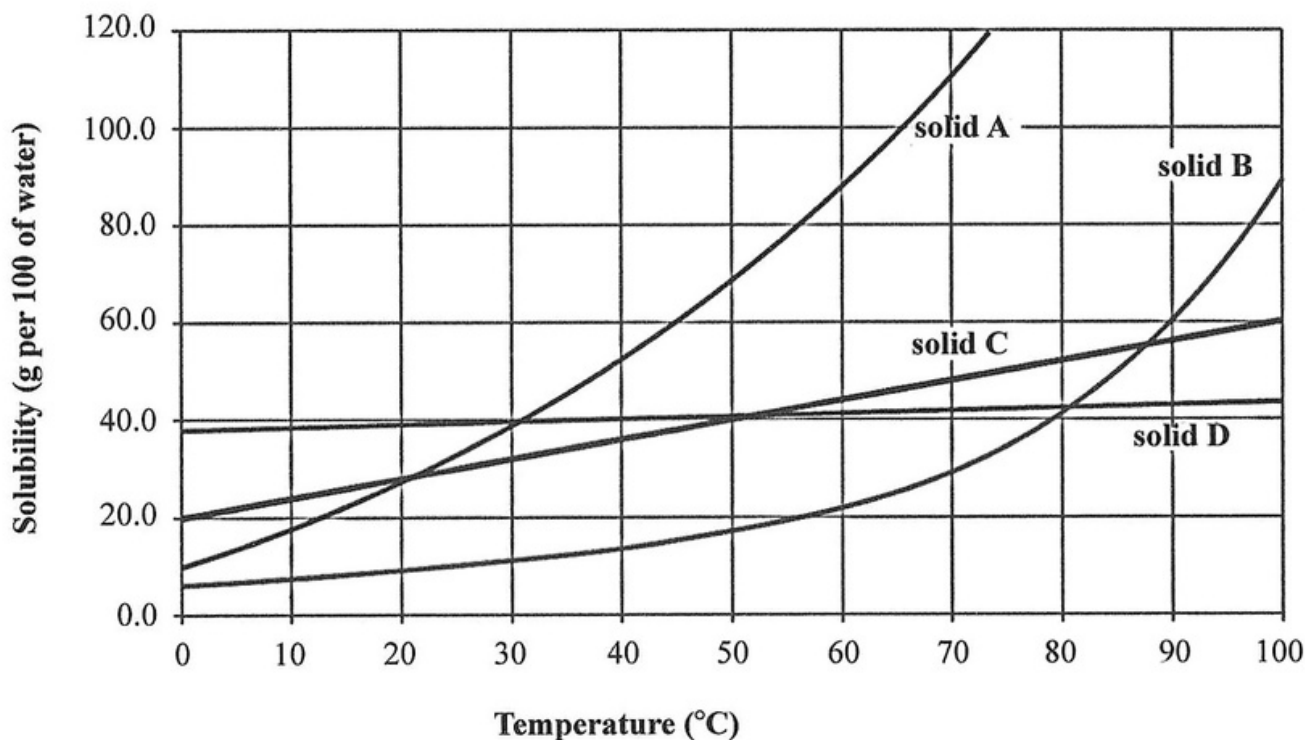
(i) Give the mass of the lake water sample collected.

_____ [1]

(ii) Calculate the amount of residue that was collected in the sample.

_____ [1]

- (c) The main salts found in the residue are tested for their solubility in 100 g of water at various temperatures. Use this solubility curve to answer the questions.



- (i) Name the most soluble salt at 50°C.
_____ [1]
- (ii) Name the salt that changed the least in solubility as the temperature increased.
_____ [1]
- (iii) Determine the amount of solid substance obtained when solid **B** is cooled from 90°C to 55°C.
[2]
- (iv) If solid **A** is a chloride salt with a formula of ACl_2 , suggest the group for solid **A**.
_____ [1]

TOTAL MARKS [10]



3. This question is about the manufacture of sulphuric acid.

- (a) Name the method used to manufacture sulphuric acid from sulphur dioxide.

_____ [1]

- (b) The first step in the process is the production of sulphur dioxide.

The next step is to produce sulphur trioxide.

Write the word equation to produce sulphur trioxide from sulphur dioxide.

_____ [1]

- (c) State the approximate temperature and catalyst needed to produce sulphur trioxide from sulphur dioxide.

temperature _____

catalyst _____ [2]

- (d) Suggest why sulphur trioxide is **not** dissolved in water to form sulphuric acid.

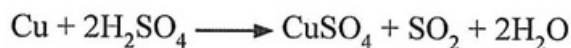
_____ [1]

- (e) State the pH of sulphuric acid.

_____ [1]

- (f) Concentrated sulphuric acid can act as an acid, an oxidizing agent and a dehydrating agent.

- (i) In the equation shown, concentrated sulphuric acid acts as an oxidizing agent.



Name the substance being oxidized.

_____ [1]

- (ii) Describe a reaction in which concentrated sulphuric acid acts as a dehydrating agent. Include the main product of the reaction in your description.

_____ [2]

- (g) Name a fertilizer made from sulphuric acid.

_____ [1]

TOTAL MARKS [10]

[Turn over]



4. Solid copper (II) carbonate undergoes thermal decomposition.

(a) Define thermal decomposition.

_____ [1]

(b) Write the word equation for the thermal decomposition of copper (II) carbonate.

_____ [1]

(c) (i) Name an acid that can be used to produce copper chloride from copper carbonate.

_____ [1]

(ii) Write the formula of the acid and include the state symbol of the acid.

_____ [2]

(d) Sodium carbonate does **not** undergo thermal decomposition. Suggest why.

_____ [1]

(e) One of the substances used in the manufacture of cement is calcium oxide CaO.

(i) Complete the calculation to determine the mass of calcium oxide produced from 250g of calcium carbonate if 100g of CaCO_3 produces 56g of CaO.



$$100\text{g} \longrightarrow 56\text{g}$$

$$250\text{g} \longrightarrow \text{_____}$$

_____ [2]

(iii) State the oxidation state for

Calcium atom _____

Calcium ion _____ [2]

TOTAL MARKS [10]



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5. This question is about the Periodic Table. Letters used do not represent symbols of the elements.

Metal **P**, has atomic number 3, and produces a gas when it is added to water.

- (a) (i) Name the gas produced.
_____ [1]
- (ii) Give **one** other observation you can make when metal **P** is added to water.
_____ [1]
- (iii) Write the electronic configuration for:
an atom of **P** _____
an ion of **P** _____ [2]
- (b) Three elements, with atomic numbers between 10 and 19, are given symbols **X**, **Y** and **Z**.
- (i) Element **X** has two electrons more than a noble gas.
Use the Periodic Table to give the name of element **X**.
_____ [1]
- (ii) Element **Y** is a metal that reacts vigorously with fluorine gas producing a yellow flame.
Name element **Y**. _____ [1]
- (iii) Write the chemical formula of the compound formed when **Y** reacts with fluorine.
_____ [1]
- (iv) Draw the electron configuration of a fluorine atom (Bohr model).



- (v) To which noble gas would the electron configuration of fluoride ion resemble?
_____ [1]
- (iv) An atom of element **Z** gains three electrons to form an ion ($Z + 3e^- \longrightarrow Z^{3-}$).
Name element **Z**. _____ [1]

TOTAL MARKS [10]



6. Bromine does not occur naturally as an element. It occurs as a compound magnesium bromide in sea water. It is extracted from sea water by the oxidation process. Chlorine is used to oxidize the bromide ion from magnesium bromide to bromine.

(a) (i) In terms of electrons, define the term oxidation.

_____ [1]

(ii) Give a reason for the displacement of the bromide ion from its compound by chlorine.

_____ [1]

(b) State **two** ways in which chlorine is used in The Bahamas to prevent the spread of diseases.

_____ [2]

(c) Fluorine, chlorine, bromine, iodine and astatine are a family of elements.

(i) State the name given to this family of elements.

_____ [1]

(ii) The boiling points of some of the members of the family are listed in the table shown.

Predict the boiling point of astatine by filling in the blank in the table.

element	boiling point °C
fluorine	– 188
chlorine	– 35
bromine	59
iodine	184
astatine	_____

_____ [1]

(iii) Suggest the colour of iodine.

_____ [1]



- (d) (i) Draw a molecule of chlorine (Cl_2), showing its outer electrons **only**.

[1]

- (ii) What type of bonding exists between atoms in a molecule of chlorine?

[1]

- (iii) Describe what you would see if damp blue litmus paper is placed in chlorine gas.

[1]

TOTAL MARKS [10]



7. Solutions can be classified as acidic, alkaline or neutral depending on their pH value.

The table shows some solutions and their associated pH.

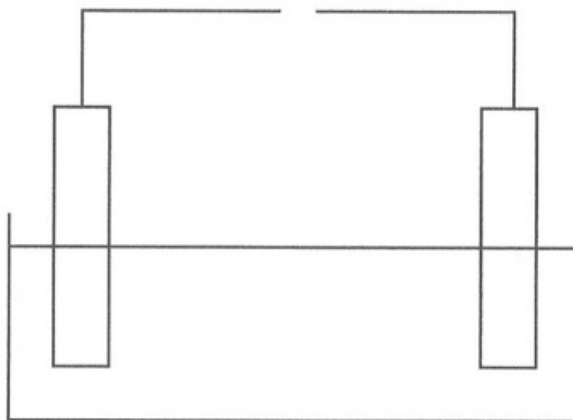
solution	E	F	G	H	J
pH	3.0	9.0	1.5	7.0	5.5

- (a) Use the letters in the table to identify the solution that is:
- (i) most acidic _____
- (ii) neutral _____ [2]
- (b) Write the symbols of ions in solutions, responsible for being
- (i) acidic _____
- (ii) alkaline _____ [2]
- (c) The insoluble salt barium sulphate is made by precipitation.
- (i) Name the **two** soluble salts that can be used to form barium sulphate.
- _____ [2]
- (ii) Write the word equation for the production of barium sulphate using the two soluble salts named in (i).
- _____ [1]
- (iii) Describe how to obtain pure barium sulphate at the end of the precipitation reaction.
- _____
- _____ [1]
- (d) State the name of the reaction between acids and bases. Give the products of this reaction.
- Name _____ [1]
- Products _____ [1]

TOTAL MARKS [10]



8. The diagram shows an electrolytic cell. The electrolyte is sodium chloride solution



- (a) (i) Complete the diagram to show a battery **with charges**, and label the anode and cathode. [2]

- (ii) During electrolysis, explain in terms of electrons what is occurring at the **anode** and **cathode**.

anode _____

cathode _____ [1]

- (b) Graphite is used as an electrode in this reaction.

- (i) Give **one** reason why graphite being a non-metal, is used as an electrode.

_____ [1]

- (ii) State whether electrolysis of sodium chloride solution is an **exothermic** or **endothermic** reaction.

_____ [1]

- (c) Electroplating is an important application of electrolysis.

Example: A metal spoon is electroplated with silver.

- (i) At which electrode would the metal spoon to be electroplated be placed in the cell?

_____ [1]



(ii) What would the other electrode be made of?

_____ [1]

(iii) Name an electrolyte that can be used to electroplate the metal spoon with silver.

_____ [1]

(iv) State **one** reason for electroplating.

_____ [1]

(d) Give **one** use of electrolysis other than electroplating.

_____ [1]

TOTAL MARKS [10]



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