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CHEMISTRY

PAPER 1

Tuesday **22 JUNE 1999** 12.30 – 1.45 P.M.

Additional materials:

Personalized answer sheet

Paper for rough work

Periodic Table

MINISTRY OF EDUCATION NATIONAL EXAMINATIONS
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BAHAMAS GENERAL CERTIFICATE OF SECONDARY EDUCATION

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your school number and candidate number in the spaces provided on the answer sheet.

For each question in this paper, **FOUR** suggested answers A, B, C and D are given. You are to choose the most appropriate one and indicate it on the separate answer sheet.

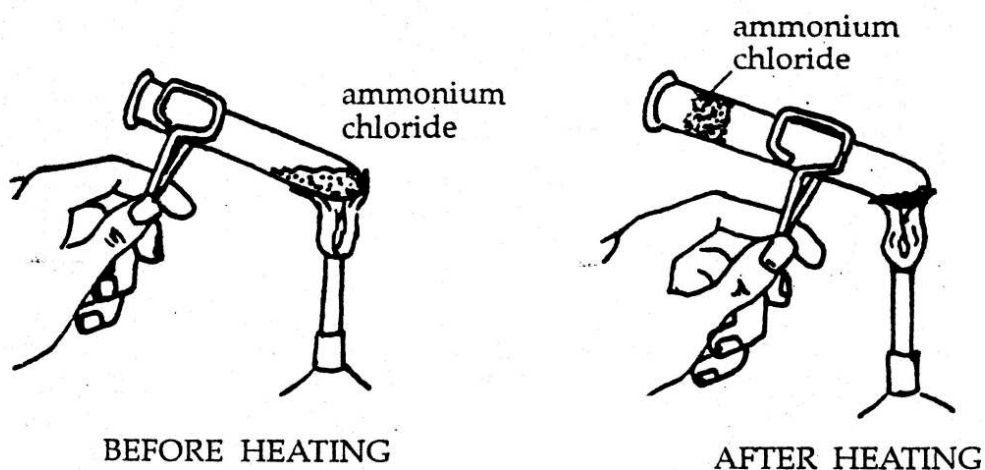
Read the instructions on the separate answer sheet very carefully.

Attempt **ALL** the questions. Marks will **NOT** be deducted for wrong answers. Your total score on this test will be the number of correct answers given.

Relative atomic masses are given in the Periodic Table of elements provided.

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

1. During an experiment the ammonium chloride changed positions without melting.



What is the name given to this change?

- A boiling
- B condensing
- C freezing
- D subliming

2. The table shows the melting and boiling points of some of the substances which may be present in a sample of wine.

substance	melting pt./°C	boiling pt./°C
methanol	-94	65
ethanol	-117	79
water	0	100

What technique should be used to separate this mixture?

- A centrifugation
- B chromatography
- C filtration
- D fractional distillation

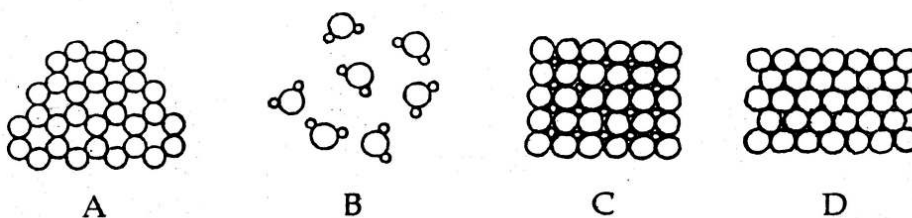
3. Which substance is a mixture?

- A carbon dioxide
- B common salt
- C diamond
- D petroleum

4. Which substance is a liquid at room temperature (20°C)?

substance	melting pt./°C	boiling pt./°C
A	-220	-188
B	-101	-35
C	-7	59
D	114	184

Questions 5 – 7. The structures of four substances are shown below.



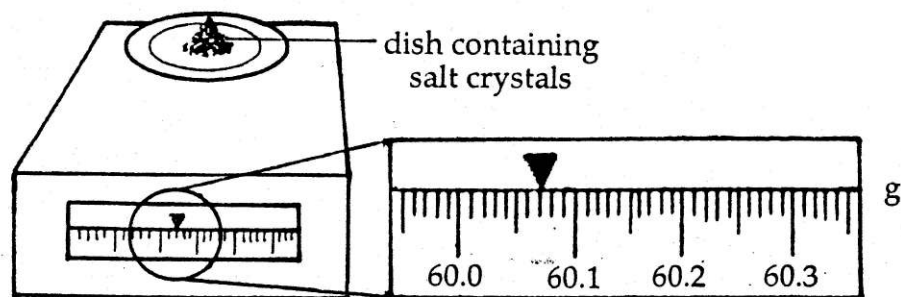
Which of the diagrams shows

5. a substance containing charged particles?

6. a triatomic gas?

7. the molecular structure of pencil "lead"?

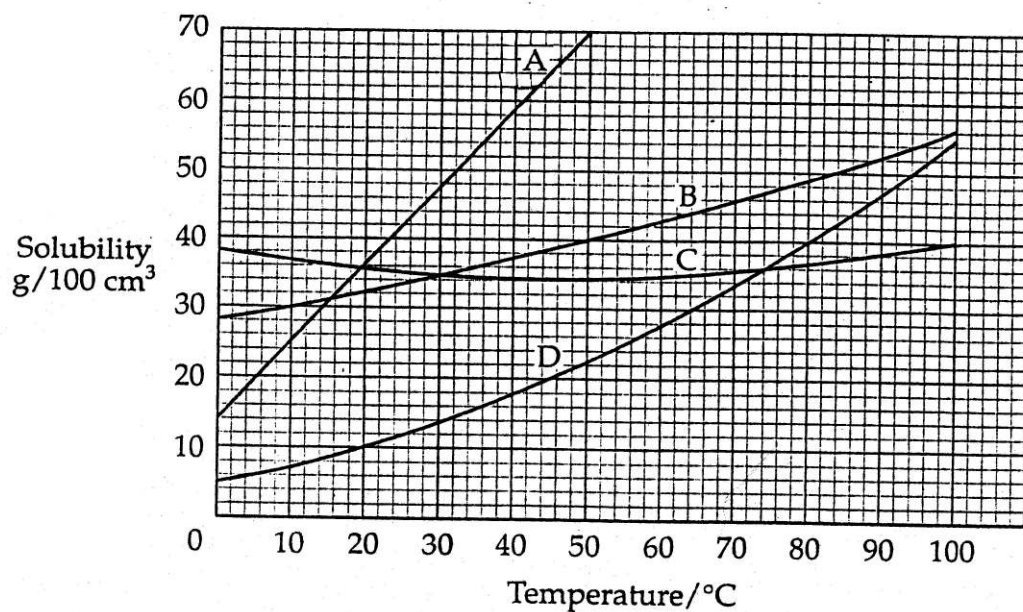
3. The diagram shows an electronic balance in use with the results enlarged to the right.



What is the reading on the scale?

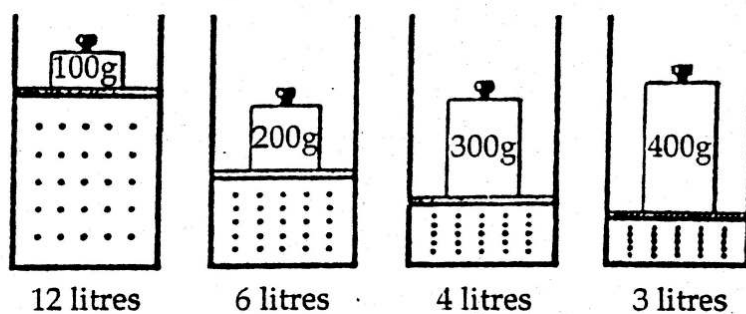
- A 60.70 g
- B 60.52 g
- C 60.07 g
- D 60.01 g

9. The diagram shows the solubility curves for four different salts.



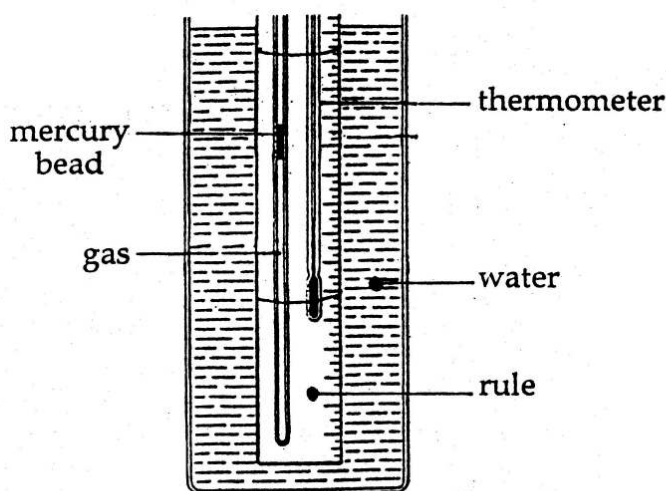
The solubility of which compound increases most rapidly with temperature?

10. The diagrams show the results of different masses resting on a moveable piston originally supported by the same volume of gas.



Which mathematical principle does it follow and after whom is the principle named.

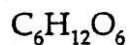
- A $V \propto P$, Boyle
 B $V \propto 1/P$, Boyle
 C $V = P$, Avogadro
 D $V \propto 1/P$, Avogadro
11. The apparatus shown could be used to test one of the gas laws.



Which results are consistent with Charles' Law?

- | | water temperature | gas volume |
|---|-------------------|------------|
| A | constant | decreases |
| B | decreases | constant |
| C | increases | decreases |
| D | increases | increases |

12. How many atoms are contained in one molecule of glucose?



- A 3
- B 24
- C 180
- D 6.02×10^{23}

13. A student wanted to produce nitrogen(IV) oxide by reacting nitrogen(II) oxide with oxygen according to the equation:



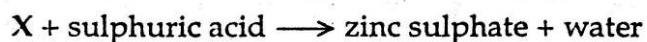
What is the minimum volume of oxygen needed to produce 100 cm^3 of nitrogen(IV) oxide?

- A 25 cm^3
- B 50 cm^3
- C 100 cm^3
- D 200 cm^3

14. What is the ratio of the mass of hydrogen to the mass of oxygen in a water molecule?

	hydrogen		oxygen
A	1	:	4
B	1	:	8
C	2	:	9
D	2	:	1

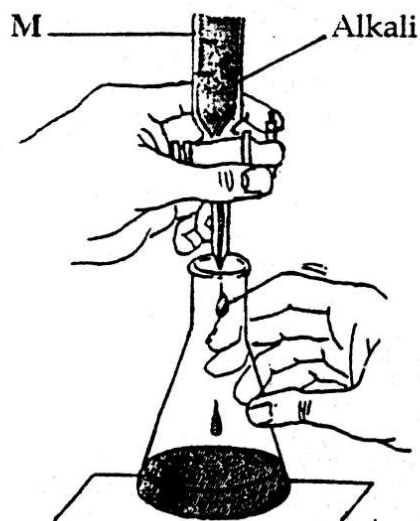
15. What is X in the following equation?



- A zinc metal
- B zinc carbonate
- C zinc hydroxide
- D zinc dioxide

Questions 16 and 17 refer to this diagram.

This apparatus is used for an acid/base titration using litmus as an indicator.



16. What is the name given to the apparatus labelled M?
- A burette
 - B filter funnel
 - C graduated cylinder
 - D pipette
17. What colour change of the indicator would be seen?
- A blue to colourless
 - B blue to red
 - C red to blue
 - D red to colourless
18. Which substance, when dissolved in water, forms a solution with a pH greater than 7?
- A ammonia
 - B hydrogen chloride
 - C sugar
 - D sulphur dioxide

19. What is the formula for the ion that is present in all aqueous solutions?

- A OH^-
- B Cl^-
- C Na^+
- D SO_4^{2-}

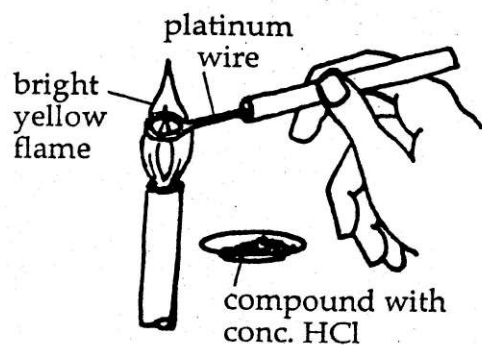
20. Which gas will turn damp litmus paper red?

- A ammonia
- B carbon dioxide
- C hydrogen
- D oxygen

21. A compound dissolves in water to form a green solution. On addition of sodium hydroxide to this solution, a dirty green precipitate forms. Which ion is most likely to be present in the compound?

- A Li^+
- B Fe^{3+}
- C Cu^{2+}
- D Fe^{2+}

22. A flame test was carried out on a compound with this result.



The compound contains

- A calcium ions.
- B chlorine ions.
- C oxygen ions.
- D sodium ions.

23. Which is an exothermic process?

- A ice melting
- B soup boiling
- C water evaporating
- D water vapour condensing

24. What is, respectively, the name given to and the sign of the enthalpy change for a reaction that absorbs energy from the surroundings.

- A endothermic, +
- B endothermic, -
- C exothermic, +
- D exothermic, -

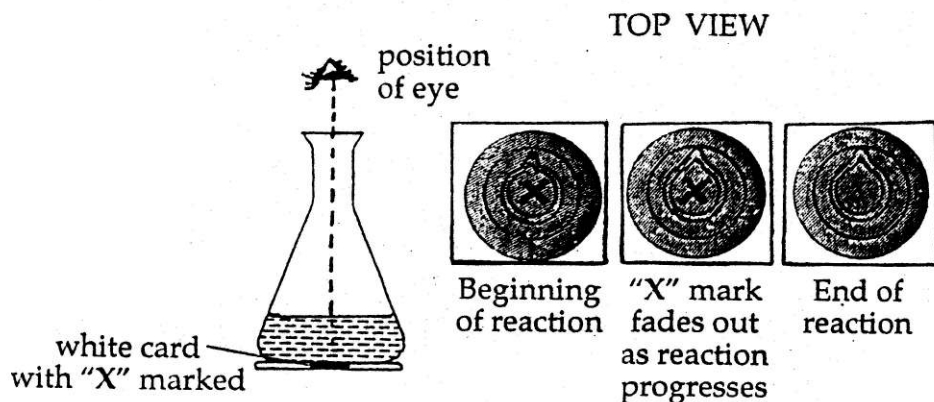
25. What are the products formed when molten copper(II) chloride is electrolysed using carbon electrodes?

	product at anode	product at cathode
A	copper	copper
B	hydrogen	chlorine
C	chlorine	copper
D	oxygen	hydrogen

Questions 26 and 27 are based on the results of this experiment.

The diagram shows the results of viewing an X marked on a white card as hydrochloric acid reacts with sodium thiosulphate.

This is sometimes called "thiosulphate cross"



26. Yellow particles form in the solution during the reaction. These particles are

- A insoluble chlorine
- B insoluble sulphur
- C soluble chlorine
- D soluble sulphur

27. Four different concentrations of hydrochloric acid were used in four different experiments without changing the thiosulphate concentration. The time taken for the cross to disappear was greatest when the acid concentration was

- A 0.50 M
- B 0.75 M
- C 2.00 M
- D 4.00 M

28. A reaction has reached equilibrium. Which statement is correct?
- A The concentration of the reactants is equal to the concentration of the products.
 - B The reaction cannot be reversed.
 - C The reaction has stopped.
 - D The rate of the forward reaction is equal to the rate of the reverse reaction.
29. In the modern Periodic Table the elements are arranged in
- A alphabetical order.
 - B order of increasing metallic properties.
 - C order of increasing atomic number.
 - D order of increasing number of nucleons.

Questions 30 – 33 are based on the diagram below and the copy of the Periodic Table supplied with this examination paper. The diagram shows the first three Periods of the Periodic Table. The letters J to R represent elements but they are not the symbols of those elements.

K	L
R	

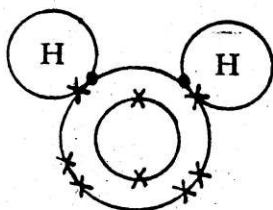
					J
M	N	O	P	Q	

30. How many protons does an atom of J have?
- A 2
 - B 4
 - C 10
 - D 20
31. Which element forms an ion with a single negative charge?
- A J
 - B K
 - C P
 - D Q

32. Which element is found in nature as a monatomic gas?

- A J
- B K
- C M
- D Q

33. The diagram shows a molecule with one atom unlabelled.



Which letter identifies the unlabelled atom?

- A N
- B O
- C P
- D R

34. Which statement about elements in Group VII of the Periodic Table is correct?

	number of outer shell electrons	type of element
A	1	non-metal
B	1	metal
C	7	non-metal
D	7	metal

35. The table gives data about two elements from one group of the Periodic Table.

Physical State at Room Temperature	Colour
gas	yellow/green
solid	grey/black

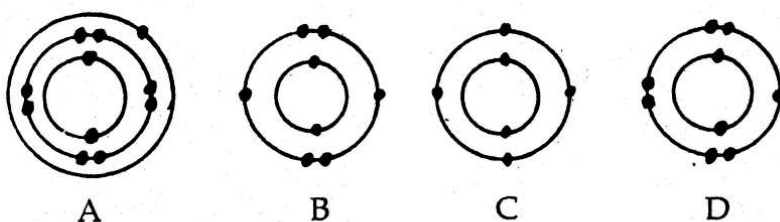
What group are these elements in?

- A Group II
 - B Group IV
 - C Transition elements
 - D Group VII
36. Which process is taking place in the word equation below:



- A decomposition
- B oxidation
- C reduction
- D synthesis

Questions 37 and 38. Study the diagrams, which show the atomic structures of four different elements. The letters A to D are not the chemical symbols of the elements.



Which diagram represents

37. a metal atom?
38. an atom found in all organic compounds?

39. Which symbol represents a metal that can be found uncombined in the earth's crust?

- A Al
- B Au
- C Ca
- D Fe

40. The metal X forms an ionic compound with chlorine which has the formula

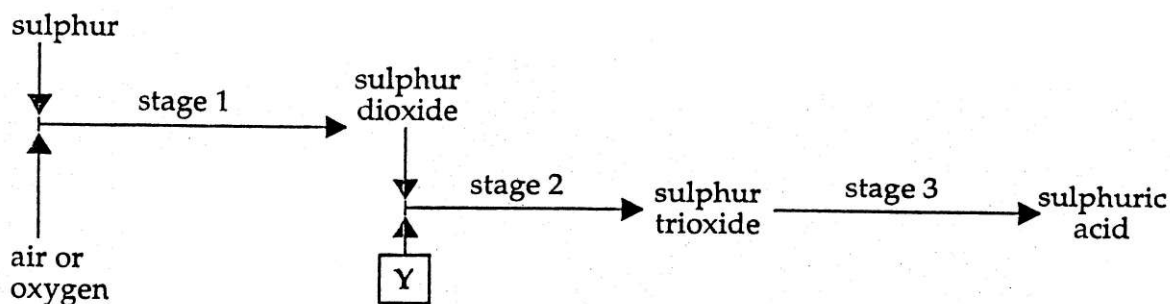


The ion of X in this compound has 28 electrons.

What is element X?

- A iron or Fe
- B magnesium or Mg
- C sulphur or S
- D zinc or Zn

Questions 41 and 42 concern the processes used in the manufacture of sulphuric acid. The diagram gives a simplified outline of this process.



41. Which catalyst is used at stage 2?

- A iron
- B manganese(IV) oxide
- C sulphuric acid
- D vanadium(V) oxide

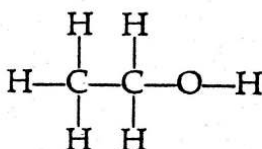
42. What is substance Y?

- A oxygen
- B sulphur
- C sulphuric acid
- D vanadium(V) oxide

43. Which listed organic compound can be polymerised?

- A ethane
- B ethene
- C ethanol
- D ethanoic acid

44. What is the relative molecular mass of ethanol?



- A 23
- B 23 g
- C 46
- D 46 g

45. Why is carbon monoxide toxic?

- A It acidifies the blood destroying blood vessels
- B It causes kidney failure.
- C It induces bone cancer known as leukemia.
- D It preferentially binds with haemoglobin before oxygen.

46. Which ion in the Bahamian water supply is responsible for making it "hard", thus requiring the use of extra soap when washing clothes?

- A calcium
- B carbonate
- C iron
- D sodium

47. Natural, unpolluted rain water is typically acidic. What is the source of this natural acidity?

- A carbon dioxide gas
- B hydrogen chloride gas
- C nitrogen dioxide gas
- D sulphur dioxide gas

48. Plastics that are designed to decompose under the influence of bacteria are said to be

- A biodegradable.
- B biopolymers.
- C photodegradable.
- D thermoplastic.

49. What is the primary source of most of the energy used by the population of the Commonwealth of The Bahamas?

- A coal
- B hydroelectric
- C nuclear
- D petroleum

50. Aspirin is a miracle drug invented in the nineteenth century. Into what group of drugs is it classified?

- A analgesic
- B antibiotic
- C sedative
- D tranquillizer

Surname and Initials

CHEMISTRY

PAPER 2

Tuesday 22 JUNE 1999 1.50 – 3.20 P.M.

Additional materials:
Periodic Table

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 questions on this paper.

Read each question carefully and make sure you know what you have been asked 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 [].

ADDITIONAL INFORMATION

Volume of 1.0 mol of gas at r.t.p. 24,000 cm³.

This question paper consists of 16 printed pages.

1.

Read the list of elements, compounds and mixtures

chlorine	helium	water
gold	magnesium	concrete
sodium chloride	steel	brass
crude oil	ammonia	haemetite
sand	aluminium oxide	solder

Use only the substances found in the list to answer the questions.
Write the name of:

(a) the most reactive metal,

(b) the two elements that are most likely to form an ionic compound,

(c) a gaseous diatomic gas,

(d) an ore of iron,

(e) the least reactive non-metal element,

(f) the substance referred to as "cooking salt",

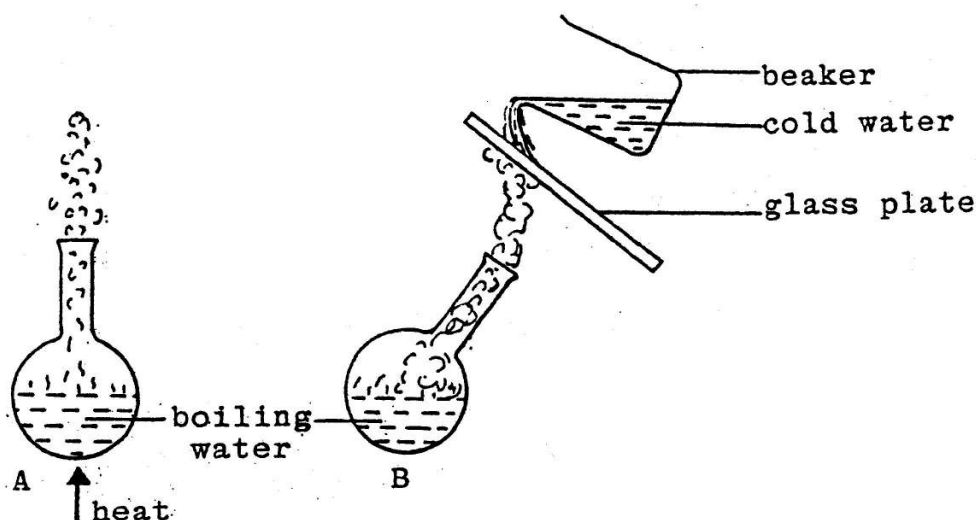
(g) the useful material extracted from bauxite,

(h) a mixture separated by fractional distillation,

- (i) a substance that imparts a yellow-orange colour to a bunsen flame.
-

Total marks [10]

2. The diagram shows the effect of heating and cooling on a sample of water using the conditions as shown in the diagrams.



- (a) (i) A few seconds after the actions taken, as shown in diagram B, what would be SEEN on the glass plate?

_____ [1]

- (ii) Explain your observations in (a) (i), using the kinetic theory.

_____ [2]

- (b) A small quantity of ethanol, at room temperature, was spilt on a person's skin producing a cold sensation.

Explain the effect using the kinetic theory.

_____ [2]

- (c) A person sitting in another room notices the smell of cooking coming from the kitchen.

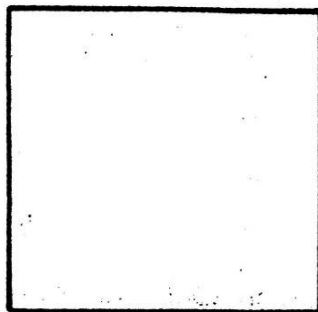
- (i) What is the name given to the movement of the odours through still air?

_____ [1]

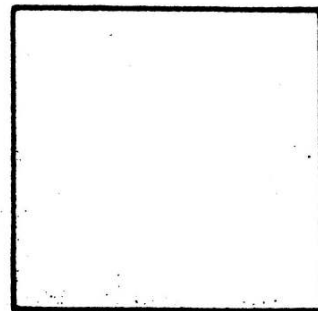
- (c) Describe a third situation, not involving movement of substances through air, that also illustrates your answer to (c)(i)

_____ [1]

- (d) (i) Draw diagrams to show the particle packing in a liquid and a gas.



liquid



gas

- (ii) Which of these states of matter is more compressible? Explain your answer.

_____ [2]

Total marks [10]

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

A																			B
	C												D		E				
F													G			H			
I							J												

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

- (a) Which letter represents an element that

- (i) is a member of the halogen family,

- (ii) loses two electrons to form a cation,

- (iii) is a transition element,

- (iv) is the least dense gas,

- (v) has six outer shell electrons,

- (vi) has an electronic configuration of 2,4

- (vii) is the most electropositive element?

_____ [7]

- (b) (i) Draw a suitable diagram to show the bonding in the compound formed by F and E.

[2]

- (ii) What type of bonding is found in the compound of F and E.

_____ [1]

Total marks [10]

4. This question is about non-metals.

(a) Name:

(i) the Group helium and argon belong to;

(ii) a source for making chlorine gas;

(iii) two oxides that react with water to form acids;

_____ and _____

(iv) the acid formed from one of the oxides named in iii);

(v) a non-metal that can exist as allotropes.

(vi) a non-metal that is a liquid at room temperature and pressure;

(vii) a non-metal used in the manufacture of semiconductors.

_____ [8]

(b) Air is a mixture of gases.

(i) What percentage of the air is oxygen gas?

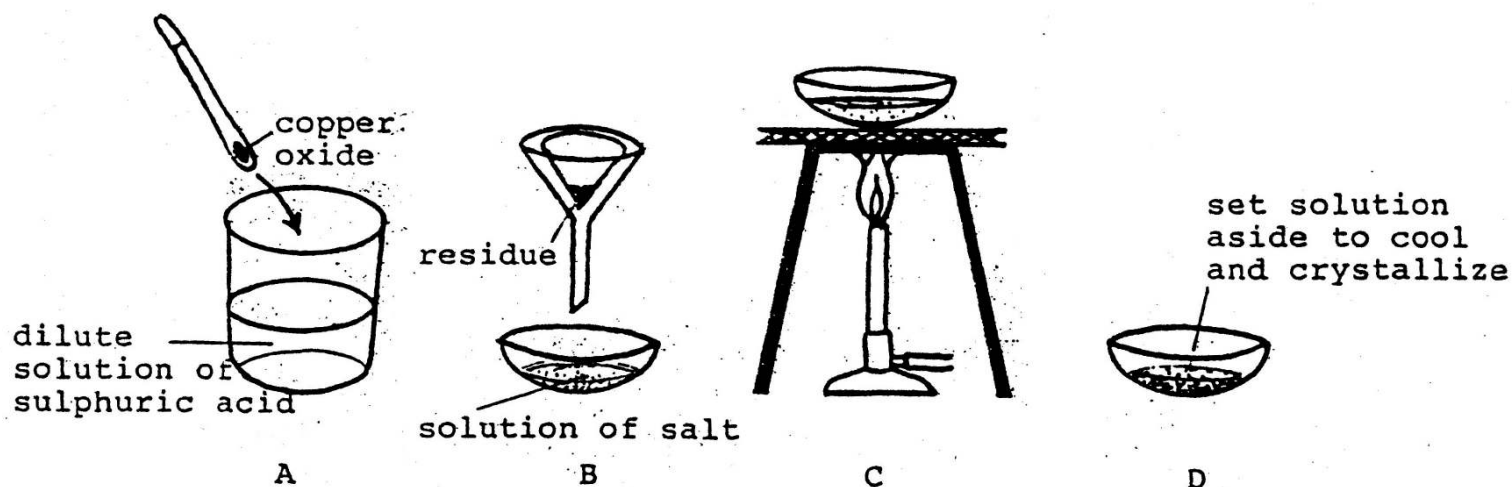
_____ [1]

(ii) Describe a simple test that can positively identify oxygen gas.

_____ [2]

Total marks [10]

5. The diagrams show how to make crystals of a salt by adding excess copper oxide to dilute sulphuric acid.



- (a) (i) What is the name of the residue in part B of the preparation?

_____ [1]

- (ii) What would be the pH of the salt solution in B?

_____ [1]

- (b) Explain why the salt solution is heated in part C.

_____ [1]

- (c) (i) Write the names of the two products formed in this preparation.

copper(II) oxide + sulphuric acid $\rightarrow$ _____ + _____ [2]

- (ii) What is the name given to reactions similar to that shown in (c) (i)?

_____ [1]

- (iii) Write the chemical formula for sulphuric acid.

_____ [1]

(iv) Write the symbol for the ion that makes sulphuric acid, acidic.

_____ [1]

(d) What would be the colour of litmus, in dilute sulphuric acid?

_____ [1]

Total marks [10]

School Number	Candidate Number
Surname and Initials	

CHEMISTRY

PAPER 3

Thursday **1 JULY 1999** 12.30 – 2.00 P.M.

Additional materials:

Lined paper
Graph paper
Periodic table

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 at the top of this page as well as at the top of all lined paper used.

Answer **ALL** the questions in **Section A** in the spaces provided on the question paper and any **TWO** questions from **Section B** on the lined paper provided.

Equations and diagrams should be given wherever they are helpful.

Essential working must be shown.

The intended marks for questions or part of questions are given in brackets [].

Relative atomic masses are given in the Periodic Table of elements provided.

ADDITIONAL INFORMATION

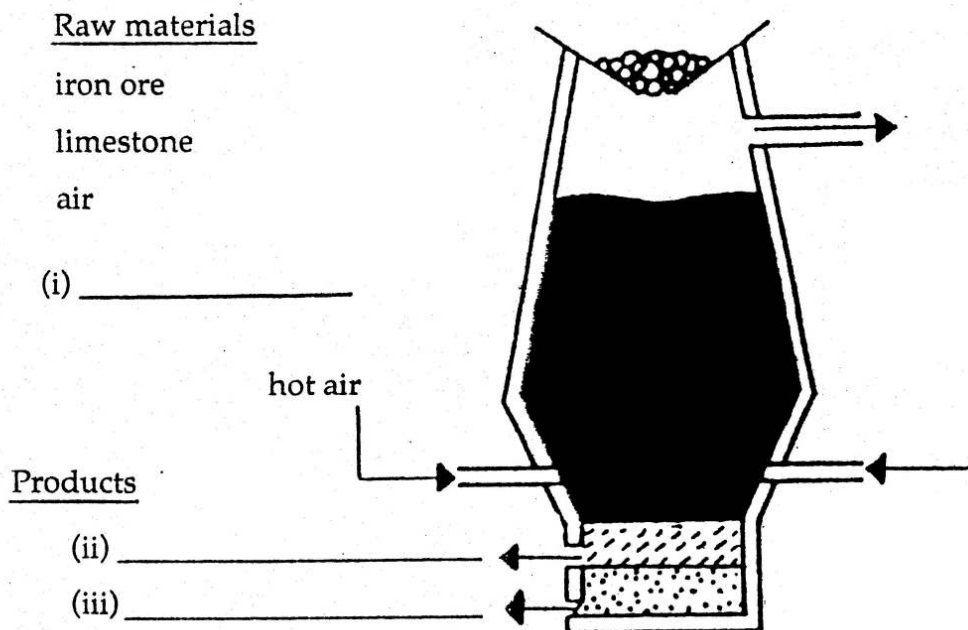
s.t.p. ($t = 0^{\circ}\text{C}$. $p = 760\text{mmHg}$)

The volume of one mole of gas at room temperature and pressure is $24,000\text{ cm}^3$.

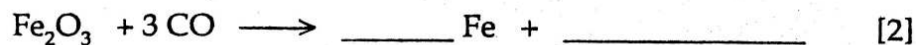
This question paper consists of 13 printed pages and 3 blank pages.

SECTION A

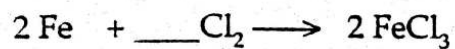
1. The diagram is a simplified blast furnace.



- (a) Complete the labelling of the diagram by writing the name of **ONE** raw material (i) and the **TWO** products (ii) and (iii). [3]
- (b) Name an ore from which iron can be smelted and name the type of reaction that changes the ore to its metal.
- _____
- _____ [2]
- (c) Complete and balance the equation for the conversion of iron ore to iron.



- (d) Iron reacts with chlorine gas according to the equation.



- (i) How many moles of chlorine, Cl_2 , are used per mole of iron?

- (ii) What is the relative molecular mass of iron(III) chloride?

- (iii) How many moles of iron would be used up if 650 g of iron(III) chloride are produced?

_____ [3]

Total marks [10]

2. Tin (an element of Group IV) occurs naturally as the ore cassiterite, SnO_2 . Tin is obtained by reacting this ore with carbon.

- $$\text{SnO}_2 + \underline{\hspace{1cm}} \longrightarrow \underline{\hspace{1cm}} + 2\text{CO} \quad [2]$$

- _____ [2]

- _____ [1]

- 13°C 162°C
grey tin $\Rightarrow$ white tin $\Rightarrow$ rhombic tin

-
- [1]

- | Name | Formula | Melting Point (°C) | Boiling Point (°C) |
|------------------|-----------------|--------------------|--------------------|
| tin(II) chloride | SnCl_2 | 247 | 603 |
| tin(IV) chloride | SnCl_4 | -36 | 114 |

What is the physical state at room temperature (20°C) of

(I) tin(II) chloride? _____

(II) tin(IV) chloride? _____ [2]

(III) Calculate the percentage of tin, by mass, in tin(IV) chloride.

_____ [2]

Total marks [10]

3. A hydrocarbon is known to contain 36 g of carbon and 8 g of hydrogen.

- (a) (i) Using this data, determine the empirical formula of this hydrocarbon.

[2]

- (ii) This hydrocarbon has a relative molecular mass of 44. Determine its molecular formula.

[1]

- (iii) Draw the structural formula of this hydrocarbon.

[2]

- (iv) Name the hydrocarbon and give ONE use for this compound.

name _____

use _____ [2]

- (b) (i) Methane can be used as Bunsen burner fuel. Write a balanced equation for the complete combustion of methane, CH_4 .

[2]

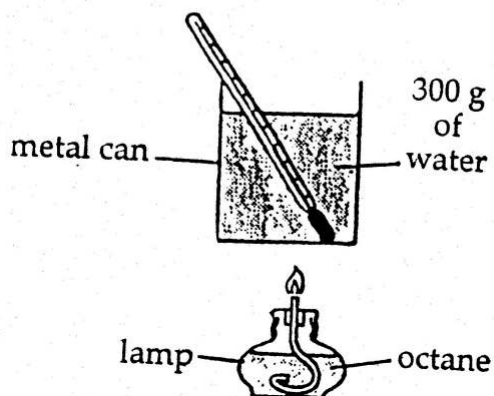
- (ii) What volume of carbon dioxide gas would be produced at r.t.p. if exactly one mole of methane is completely burned?

[1]

Total marks [10]

4. A chemist wanted to determine the heat evolved when one gram of octane, C_8H_{18} , a major component of gasoline, was burned.

The apparatus used is shown below.



The results the chemist obtained are listed below.

MASS OF WATER USED	300.00 g
MASS OF OCTANE & LAMP BEFORE BURNING	35.95 g
MASS OF OCTANE & LAMP AFTER BURNING	34.45 g
INITIAL WATER TEMPERATURE	25.0°C
FINAL WATER TEMPERATURE	45.0°C

The specific heat capacity of water is 4.2J per g per °C.

(a) Calculate:

(i) the mass of octane burnt,

[1]

(ii) the increase in the water temperature

[1]

- (iii) the quantity of heat absorbed by the water,

using $Q = mC \Delta t$

where Q is the quantity of heat,

m is the mass of water,

C is the specific heat capacity of water,

Δt is the change in temperature

[2]

- (iv) the heat given off by 1 g of octane assuming all of the heat evolved is absorbed by the water.

[1]

- (b) Calculate the relative molecular mass for octane C_8H_{18} .

[1]

- (c) The results of this experiment, when compared to other data, were not as accurate. Suggest **TWO** ways to improve the accuracy of this experiment.

[2]

- (d) (i) When octane is burnt in a limited supply of oxygen a poisonous gas is produced. Name this gas.

_____ [1]

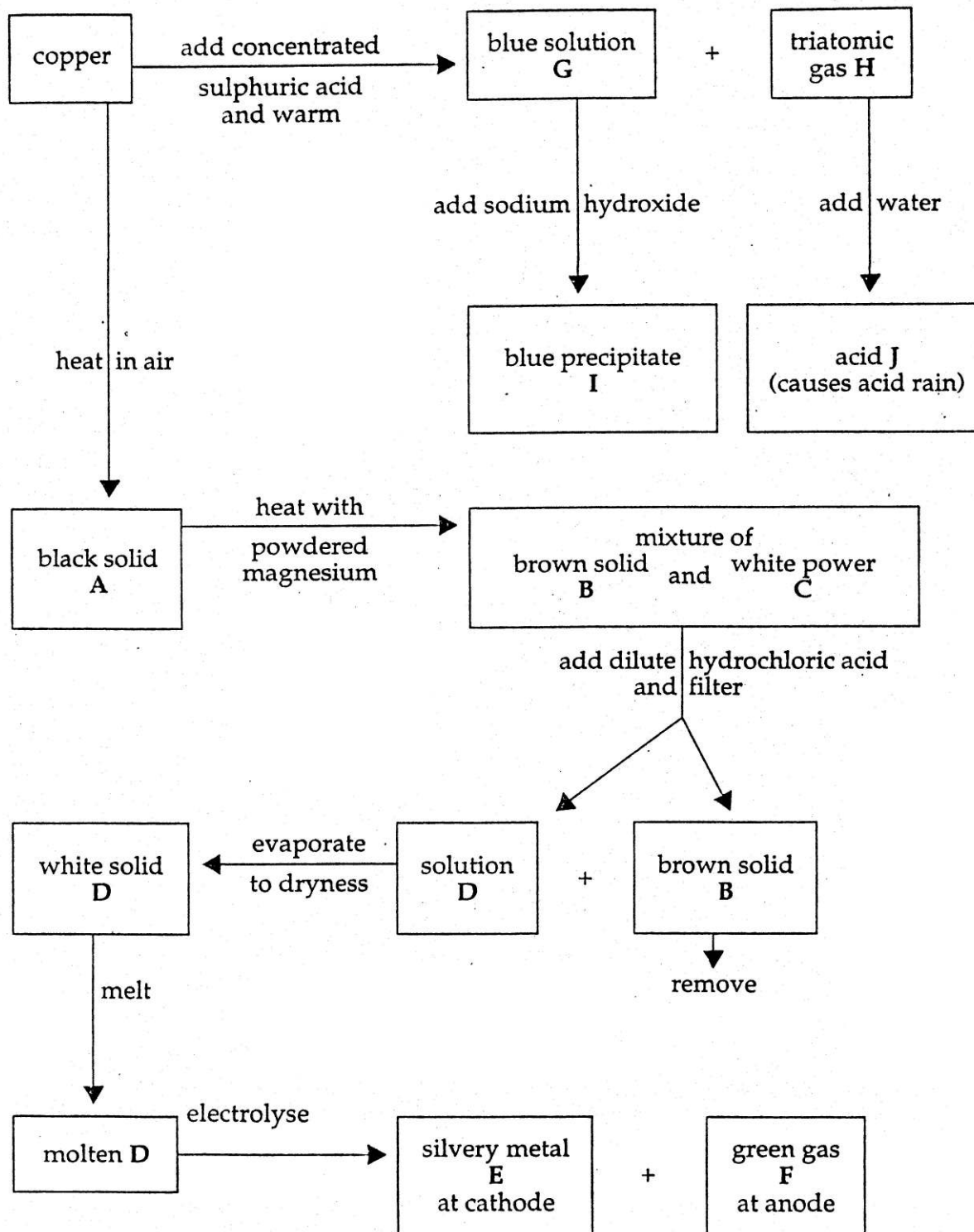
- (ii) Name a fuel that produces only water when completely burned in air.

_____ [1]

Total marks [10]

SECTION B

5. (a) (i) Identify substances A to J.



- (ii) Calculate the maximum mass of black solid A that can be made using 16.0g of copper metal. [2]

(b) Some information is given in the table.

Compound	Solubility in water	Poisonous
barium chloride	soluble	yes
barium nitrate	soluble	yes
barium carbonate	insoluble	yes
barium sulphate	insoluble	no

Write the formula of

(i) barium nitrate,

(ii) barium sulphate.

(iii) Solid barium compounds are opaque to x-rays. Which barium compound would you give a patient who was to have a stomach and intestine x-ray?

(iv) Give a reason for your answer to (iii). [4]

(c) An industrial worker swallowed a small quantity of aqueous barium hydroxide which is poisonous. Magnesium sulphate was administered to the worker.

(i) Explain why magnesium sulphate was administered to the worker.

(ii) Write a balanced chemical equation to show how the magnesium sulphate will work. [4]

Total marks [20]

6. A student performed two experiments to establish how different amounts of manganese(IV) oxide changed the rate of decomposition of hydrogen peroxide. In Experiment A 0.3 g was added to 100 cm³ hydrogen peroxide but in experiment B 0.5 g manganese(IV) oxide was used.

Data was recorded for only the first 210 seconds.

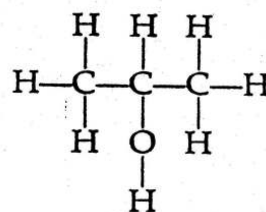
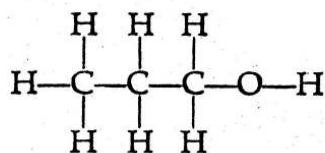
TIME/s		0	30	60	90	120	150	180	210
volume of oxygen/cm ³	EXPT A	0	29	55	79	98	118	133	146
	EXPT B	0	45	84	118	145	162	174	182

- (a) Draw graphs of the volume of oxygen (vertical axis) against time. Use the same axes for both Experiment A and Experiment B. [8]
- (b)
 - (i) What is the purpose of the manganese(IV) oxide?
 - (ii) In which experiment is the reaction proceeding faster?
 - (iii) Explain in terms of particles, why the reaction you have chosen in (b) (ii) is able to proceed faster.
 - (iv) Why do the slopes of the graphs become less steep as the reaction proceeds? [4]
- (c)
 - (i) At exactly 50.0s, what total volume of gas had been produced in Experiment A? Experiment B?
 - (ii) From your graph, find the times taken to produce 118 cm³ of gas in Experiment A and Experiment B. [4]
- (d)
 - (i) Write a balanced chemical equation for the decomposition of hydrogen peroxide.
 - (ii) At the completion of Experiment B, how much of the catalyst remains? Explain your answer. [4]

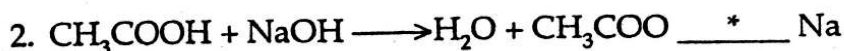
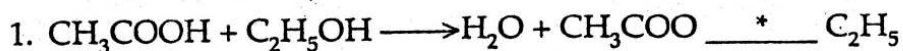
Total marks [20]

7. Diamond and graphite are allotropes;
 Chlorine-35 and chlorine-37 are isotopes;
 But-1-ene and But-2-ene are isomers.

- (a) (i) Explain the meaning of the underlined terms. [6]
 (ii) Draw diagrams to illustrate each mentioned substance showing how they differ. [3]
 (iii) Calculate the relative atomic mass of a sample of chlorine given that the ratio of chlorine-35 to chlorine-37 is 3:1. [1]
 (iv) Explain why both isotopes have the same chemical properties. [2]
 (v) Charcoal is another allotrope of carbon. What volume would be produced at r.t.p. if 456 g of solid charcoal underwent complete combustion? [2]
- (b) The structures of propan-1-ol and propan-2-ol respectively are:



- (i) To which homologous series do they belong? [1]
 (ii) Name the type of compound that is formed if either compound reacts with ethanoic acid. [1]
 (iii) What is the name given to this type of reaction? [1]
 (iv) Here are two reactions of ethanoic acid



State the type of bond marked * in each equation. [2]

Total marks [20]