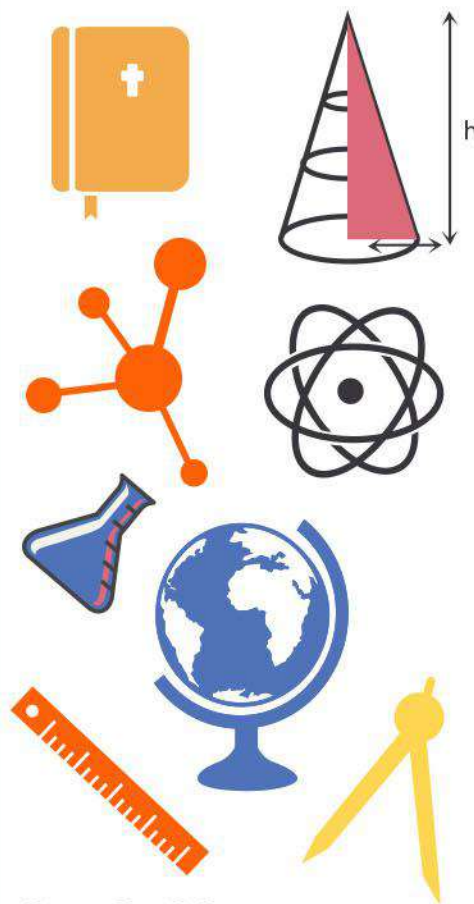
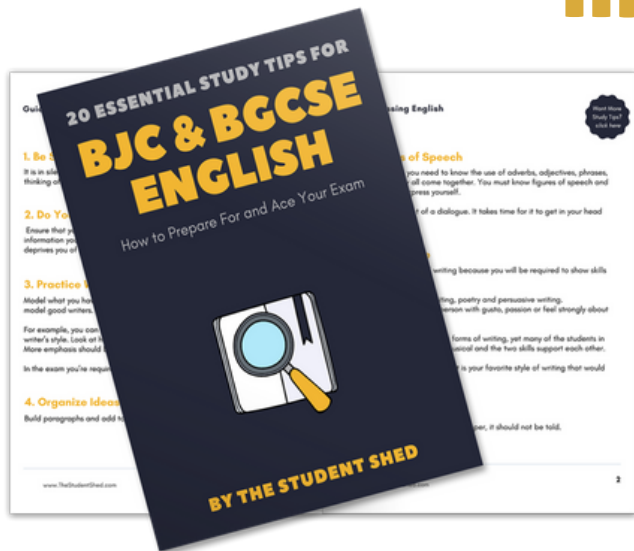


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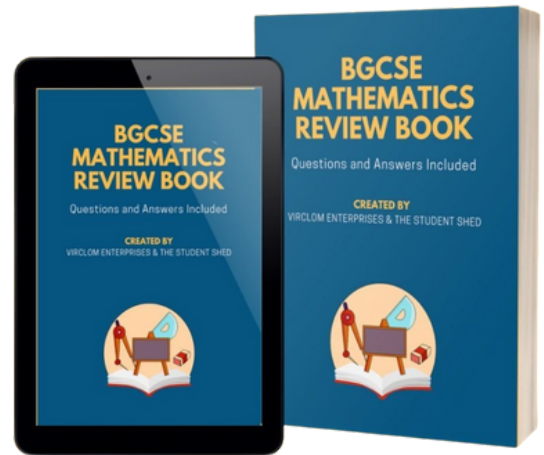


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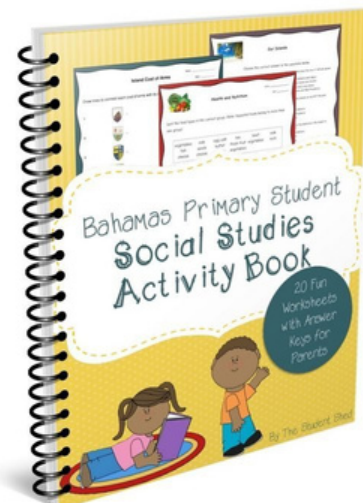
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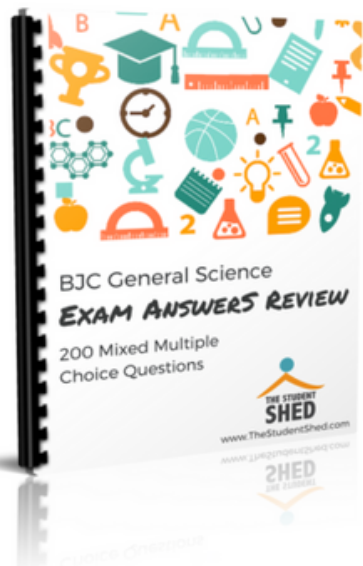
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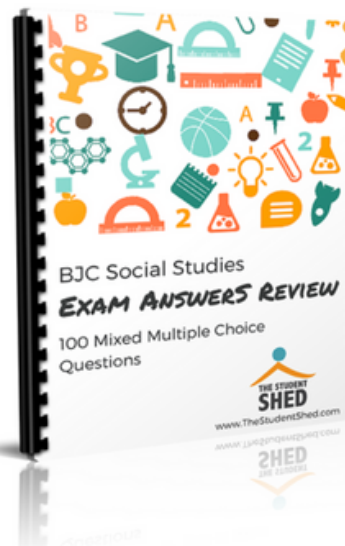
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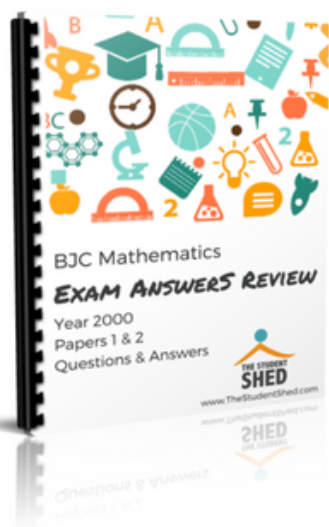
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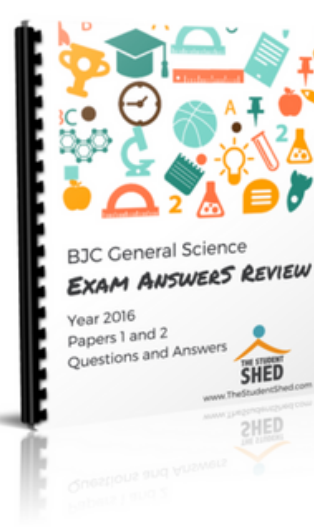
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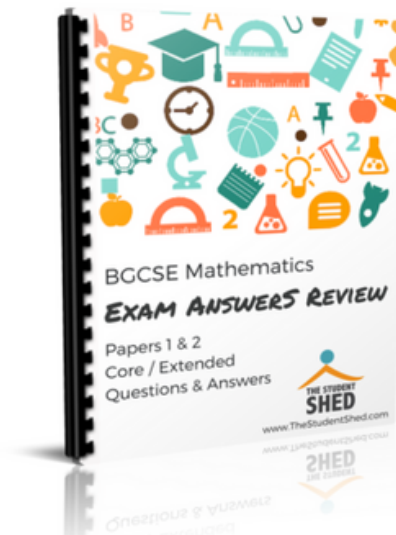
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# CHEMISTRY

## PAPER 1

Tuesday **22 May 2018** 12:00 NOON–1:15 P.M.

Additional materials:  
None

### 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.

For each question in this paper, four suggested answers A, B, C and D are given.

**Circle the letter of the response which you consider to be correct.**

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 on page 2.

The volume of one mole of gas at room temperature and pressure (r.t.p.) is 24 000 cm<sup>3</sup> and at standard temperature and pressure (s.t.p.) is 22 400 cm<sup>3</sup>.



For Examiner's Use	
TOTAL MARKS	



588122

The Periodic Table of the Elements

Group																	
I	II	III	IV	V	VI	VII	0										
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4	<div>1 <b>H</b> Hydrogen 1</div>					<div>4 <b>He</b> Helium 2</div>										
11 <b>Na</b> Sodium 11	12 <b>Mg</b> Magnesium 12						10 <b>Ne</b> Neon 10										
19 <b>K</b> Potassium 19	20 <b>Ca</b> Calcium 20	21 <b>Sc</b> Scandium 21	22 <b>Ti</b> Titanium 22	23 <b>V</b> Vanadium 23	24 <b>Cr</b> Chromium 24	25 <b>Mn</b> Manganese 25	26 <b>Fe</b> Iron 26	27 <b>Co</b> Cobalt 27	28 <b>Ni</b> Nickel 28	29 <b>Cu</b> Copper 29	30 <b>Zn</b> Zinc 30	31 <b>Ga</b> Gallium 31	32 <b>Ge</b> Germanium 32	33 <b>As</b> Arsenic 33	34 <b>Se</b> Selenium 34	35 <b>Br</b> Bromine 35	36 <b>Kr</b> Krypton 36
37 <b>Rb</b> Rubidium 37	38 <b>Sr</b> Strontium 38	39 <b>Y</b> Yttrium 39	40 <b>Zr</b> Zirconium 40	41 <b>Nb</b> Niobium 41	42 <b>Mo</b> Molybdenum 42	43 <b>Tc</b> Technetium 43	44 <b>Ru</b> Ruthenium 44	45 <b>Rh</b> Rhodium 45	46 <b>Pd</b> Palladium 46	47 <b>Ag</b> Silver 47	48 <b>Cd</b> Cadmium 48	49 <b>In</b> Indium 49	50 <b>Sn</b> Tin 50	51 <b>Sb</b> Antimony 51	52 <b>Te</b> Tellurium 52	53 <b>I</b> Iodine 53	54 <b>Xe</b> Xenon 54
55 <b>Cs</b> Caesium 55	56 <b>Ba</b> Barium 56	57 <b>La</b> Lanthanum 57	58 <b>Hf</b> Hafnium 58	59 <b>Ta</b> Tantalum 59	60 <b>W</b> Tungsten 60	61 <b>Re</b> Rhenium 61	62 <b>Os</b> Osmium 62	63 <b>Ir</b> Iridium 63	64 <b>Pt</b> Platinum 64	65 <b>Au</b> Gold 65	66 <b>Hg</b> Mercury 66	67 <b>Tl</b> Thallium 67	68 <b>Pb</b> Lead 68	69 <b>Bi</b> Bismuth 69	70 <b>Po</b> Polonium 70	71 <b>At</b> Astatine 71	72 <b>Rn</b> Radon 72
87 <b>Fr</b> Francium 87	88 <b>Ra</b> Radium 88	89 <b>Ac</b> Actinium 89															

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

a

X

b

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

Key

140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	150 <b>Sm</b> Samarium 62	152 <b>Eu</b> Europium 63	157 <b>Gd</b> Gadolinium 64	159 <b>Tb</b> Terbium 65	162 <b>Dy</b> Dysprosium 66	165 <b>Ho</b> Holmium 67	167 <b>Er</b> Erbium 68	169 <b>Tm</b> Thulium 69	173 <b>Yb</b> Ytterbium 70	175 <b>Lu</b> Lutetium 71
90 <b>Th</b> Thorium 90	91 <b>Pa</b> Protactinium 91	92 <b>U</b> Uranium 92	94 <b>Pu</b> Plutonium 94	95 <b>Am</b> Americium 95	96 <b>Cm</b> Curium 96	97 <b>Bk</b> Berkelium 97	98 <b>Cf</b> Californium 98	99 <b>Es</b> Einsteinium 99	100 <b>Fm</b> Fermium 100	101 <b>Md</b> Mendelevium 101	102 <b>No</b> Nobelium 102	103 <b>Lr</b> Lawrencium 103

1. Which term describes the composition of matter?

- A made up of compounds only
- B made up of elements only
- C made up of mixtures of elements and compounds only
- D made up of tiny particles

2. Which row in the table describes the properties of a liquid?

	shape	volume
A	fixed	changeable
B	fixed	decreased volume
C	takes shape of container	increased volume
D	takes shape of container	fixed

3. The chart shows a solid substance changing directly into a gas.



Which row in the table is the most suitable answer?

	process A	substance
A	evaporation	ice crystals
B	sublimation	iodine crystals
C	evaporation	iodine crystals
D	sublimation	ice crystals

4. Which pair represents Boyle's Law?

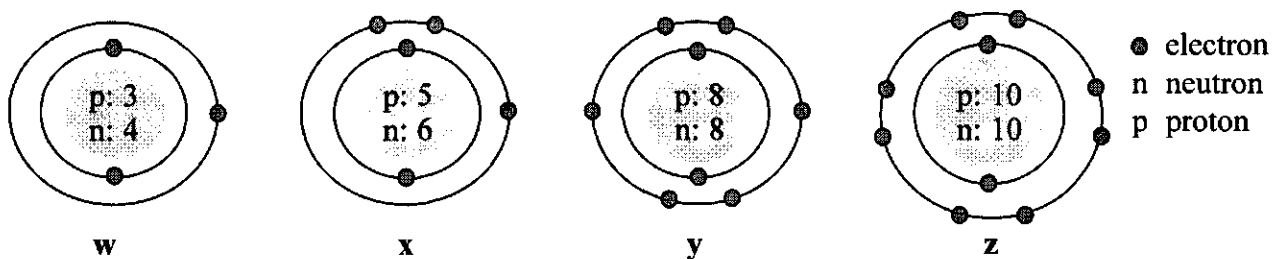
	soluble in water	insoluble in water
A	potassium chloride	barium sulfate
B	silver nitrate	calcium carbonate
C	silver chloride	lead (II) sulfate
D	sodium carbonate	lead (II) chloride





5. Which colour is universal indicator most likely to turn when placed in a solution of calcium hydroxide?
- A blue
  - B green
  - C red
  - D yellow
6. Which method is best suited to separate a mixture of oil and vinegar?
- A chromatography
  - B decantation
  - C distillation
  - D filtration
7. Which type of structure would contain positive ions in a sea of delocalised electrons?
- A aqueous solutions of ionic compounds
  - B covalent compounds
  - C ionic solids
  - D metals
8. Which method is best suited to test the purity of a sample of water?
- A litmus paper
  - B melting and boiling point
  - C pH meter
  - D hydrogen carbonate

The diagrams represent the atomic structures of four different atoms.  
Questions 9–12 are based on the atomic diagrams.



9. Which atomic structure represents a metalloid?

- A      **w**
- B      **x**
- C      **y**
- D      **z**

10. Which atomic structure represents an element that exists in nature as a diatomic gas?

- A      **w**
- B      **x**
- C      **y**
- D      **z**

11. Which type of bonding will take place between atomic structures **w** and **y**?

- A      covalent
- B      hydrogen
- C      ionic
- D      metallic

12. In which period do these atomic structures belong?

- A      1
- B      2
- C      3
- D      4

13. Atoms are made up of subatomic particles.

Which row in the table has the correct information?

	<b>particle</b>	<b>charge</b>	<b>mass relative to a proton</b>
A	electron	– 1	$\frac{1}{1840}$
B	neutron	+ 1	1
C	proton	0	1
D	nucleus	+ 2	3



14. What is the electron configuration for a sulfur ion ( $\text{S}^{2-}$ )?
- A 2, 6
  - B 2, 8, 6
  - C 2, 8, 7
  - D 2, 8, 8
15. Which pair of ions contributes to the hardness of water?
- A  $\text{Na}^+$  and  $\text{K}^+$
  - B  $\text{Na}^+$  and  $\text{Ca}^{2+}$
  - C  $\text{Ca}^{2+}$  and  $\text{Mg}^{2+}$
  - D  $\text{Na}^+$  and  $\text{Mg}^{2+}$
16. Which element is used, in large amounts, by water companies to purify water?
- A chlorine
  - B fluorine
  - C nitrogen
  - D oxygen ( $\text{O}_2$ )
17. Where would you find the smallest atoms of elements in the periodic table?
- A top and left-hand side
  - B top and right-hand side
  - C bottom and left-hand side
  - D bottom and right-hand side
18. Which ion produces a lilac or purple flame in a flame test?
- A  $\text{Ca}^{2+}$
  - B  $\text{K}^+$
  - C  $\text{Mg}^{2+}$
  - D  $\text{Na}^+$
19. Which group contains a liquid non-metal?
- A Group I
  - B Group II
  - C Group VII
  - D Group 0



20. Which element has the same relative atomic mass as argon?
- A calcium
  - B fluorine
  - C potassium
  - D zirconium
21. Which element is a metal and used in the manufacture of an aircraft body?
- A aluminium
  - B arsenic
  - C germanium
  - D silicon
22. What is the product when the acid anhydride,  $\text{HCl}$ , is placed in water?
- A  $\text{HCl}(\text{aq})$
  - B  $\text{HCl}(\text{l})$
  - C  $\text{HCl}(\text{g})$
  - D  $\text{HCl}(\text{s})$
23. What is the basicity of acetic acid,  $\text{CH}_3\text{COOH}$ ?
- A 1
  - B 2
  - C 3
  - D 4
24. What is the pH range of sulfuric acid?
- A 0–2
  - B 4–6
  - C 8–11
  - D 12–14
25. Which two reactants produce magnesium sulfate and water?
- A magnesium metal and sulfuric acid
  - B magnesium hydroxide and sulfuric acid
  - C magnesium metal and hydrochloric acid
  - D magnesium hydroxide and hydrochloric acid



26. Which reagent, when added to a chloride, produces a white precipitate that turns grey in sunlight?
- A ammonium hydroxide
  - B barium chloride
  - C silver nitrate
  - D sodium hydroxide
27. Which of the following has a characteristic which makes it suitable for use in a fire extinguisher?
- A carbon dioxide
  - B hydrogen
  - C oxygen
  - D water vapour
28. Which of the following uses electrolysis?
- I to separate the elements in compounds like water and salt
  - II to extract metals from their ores
  - III to coat a steel ring with a thin layer of silver
- A II only
  - B I and II only
  - C I and III only
  - D I, II and III

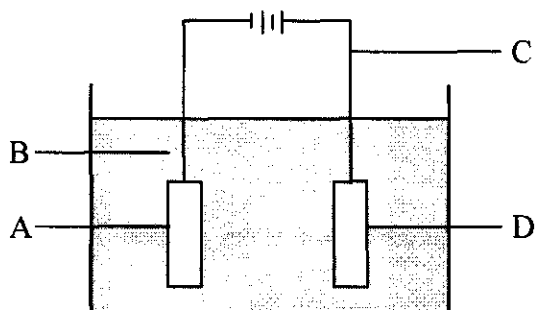


29. What is an example of reduction?

- A chloride ions becoming chlorine atoms
- B iron (II) ions becoming iron (III) ions
- C sodium atoms becoming sodium ions
- D sulfur atoms becoming sulfide ions

The diagram shows an electrolysis cell.

Use the diagram to answer questions 30–31.



Where would

30. oxygen gas be produced if the hydroxide ion is discharged;      A      B      C      D

31. a spoon be placed for electroplating?      A      B      C      D

32. Which factor only affects the rate of a reaction with gases?

- A catalyst
- B pressure
- C surface area
- D temperature

33. Which factor affects the rate by reducing the activation energy?

- A catalyst
- B concentration
- C surface area
- D temperature



34. Which metal reacts most vigorously with water?

- A aluminium
- B caesium
- C magnesium
- D tin

35. Which element is the most reactive?

- A chlorine
- B fluorine
- C helium
- D oxygen

36. The listed pollutants are sometimes found in car exhaust fumes.

- 1 carbon monoxide
- 2 nitrogen oxides
- 3 sulphur dioxide

Which of these pollutants are products of the combustion of the fuel?

- A 1 and 2 only
- B 1 and 3 only
- C 2 and 3 only
- D 1, 2 and 3

37. Which raw materials are used in the manufacture of iron?

- A bauxite and lime
- B bauxite and limestone
- C hematite and lime
- D hematite and limestone

38. Which pure form of carbon conducts electricity?

- A coal
- B diamond
- C graphite
- D soot





39. Which substance is **not** an alloy?
- A brass
  - B bronze
  - C lanthanum
  - D steel
40. Which substance is aluminium commercially extracted from?
- A bauxite
  - B haematite
  - C magnetite
  - D siderite
41. What is the mass of one mole of lithium hydroxide (LiOH)?
- A 24 g
  - B 25 g
  - C 31 g
  - D 47 g
42. What is the volume occupied by  $6.02 \times 10^{23}$  molecules of carbon dioxide (CO<sub>2</sub>) at room temperature and pressure?
- A 22.4 dm<sup>3</sup>
  - B 44 dm<sup>3</sup>
  - C 88 dm<sup>3</sup>
  - D 24 000 dm<sup>3</sup>
43. What happens to an atom when a covalent bond is formed?
- A lose electrons
  - B lose protons
  - C share inner-shell electrons
  - D share valence electrons



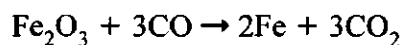
44. How many moles are in 0.85 g of ammonia (NH<sub>3</sub>)?

- A 2.0 moles
- B 0.2 moles
- C 0.05 moles
- D 0.005 moles

45. Which process is an exothermic process?

- A evaporation of rubbing alcohol from skin
- B liquid wax changing to solid wax
- C photosynthesis in a green leaf
- D sublimation of dry ice

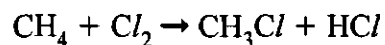
46. The reaction for the extraction of iron is given in the equation.



Which row in the table describes the reaction?

	<b>Fe<sub>2</sub>O<sub>3</sub></b>	<b>CO</b>	<b>reducing agent</b>	<b>oxidising agent</b>
A	iron is reduced	carbon is oxidised	iron	carbon monoxide
B	iron is oxidised	carbon is reduced	iron	iron (III) oxide
C	iron is reduced	carbon is oxidised	carbon monoxide	iron (III) oxide
D	iron is oxidised	carbon is reduced	carbon monoxide	carbon monoxide

47. The equation shows a reaction.



Which type of reaction is represented by this equation?

- A addition
- B substitution
- C polymerization
- D hydrogenation



48. Which formula represents an alkane?

- A  $\text{C}_3\text{H}_6$
- B  $\text{CH}_3\text{OH}$
- C  $\text{C}_6\text{H}_{14}$
- D  $\text{C}_8\text{H}_{14}$

49. Which compound has the highest boiling point?

- A butane
- B hexane
- C octane
- D propane

50. Which waste material is non-biodegradable?

- A broken wooden chair
- B chicken bones from dinner
- C fallen trees and leaves from a hurricane
- D used plastic water bottles



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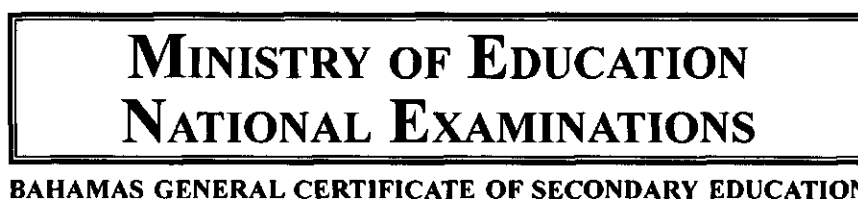
School Number	Candidate Number
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# CHEMISTRY

## PAPER 2

Tuesday **22 MAY 2018** 1:30 P.M.–3:00 P.M.

Additional materials:  
None



### 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.

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

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

FOR EXAMINER'S USE	
1	
2	
3	
4	
5	
6	
7	
8	
<b>TOTAL</b>	

This question paper consists of 18 printed pages and 2 blank pages.



588123

The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
<div><div>1</div><div>H</div><div>Hydrogen</div><div>1</div></div>																	
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	10 20 Ne Neon
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	18 40 Ar Argon
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 Fr Francium	88 226 Ra Radium	89 227 Ac Actinium															
<div>*58-71 Lanthanoid series</div> <div>+90-103 Actinoid series</div>																	
58 140 Ce Cerium	59 141 Pr Praseodymium	60 144 Nd Neodymium	61 152 Eu Europium	62 150 Sm Samarium	63 152 Gd Gadolinium	64 157 Tb Terbium	65 159 Dy Dysprosium	66 162 Ho Holmium	67 165 Er Erbium	68 167 Tm Thulium	69 169 Yb Ytterbium	70 173 Lu Lutetium					
90 232 Th Thorium	91 232 Pa Protactinium	92 238 U Uranium	93 238 Np Neptunium	94 238 Pu Plutonium	95 238 Am Americium	96 238 Cm Curium	97 238 Bk Berkelium	98 238 Cf Californium	99 238 Es Einsteinium	100 238 Fm Fermium	101 238 Md Mendelevium	102 238 No Nobelium	103 238 Lr Lawrencium				

a

X

b

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

1. This question is about the Periodic Table.

(a) Use the Group name to identify

(i) the group with the most reactive metal;

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

(ii) the group that contains coloured non-metals;

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

(iii) the least reactive group.

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

(b) (i) State the number of neutrons found in the element polonium.

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

(ii) Name an element that can replace diamond in jewels.

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

(iii) State the valency of the element zinc.

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

(iv) Name the element whose ion turns brick red in a flame.

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





- (c) (i) Construct the bonding diagram for the compound, ammonia,  $\text{NH}_3$ .

[2]

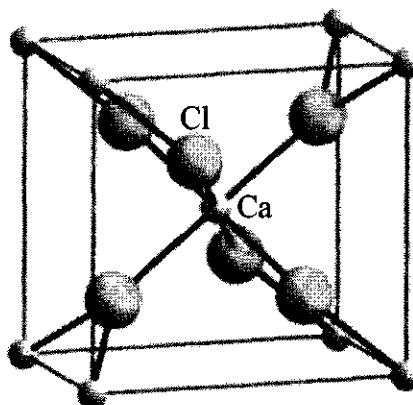
- (ii) Give **one** use for ammonia,  $\text{NH}_3$ .

[1]

**TOTAL MARKS [10]**



2. The diagram shows the lattice structure of calcium chloride.



- (a) (i) Describe the movement and spacing of the particles that make up this lattice.

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

- (ii) Calcium chloride is used to melt ice.

Explain the effect calcium chloride has on the melting point of ice and predict the new melting point.

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

- (b) (i) Write the electronic configuration for calcium and chlorine.

calcium \_\_\_\_\_

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

- (ii) State the type of bonding in calcium chloride.

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

- (iii) Draw the Lewis dot bonding diagram for calcium chloride; use only outer shell electrons.

[2]

- (iv) Explain why calcium chloride conducts electricity when it is molten or dissolved in water.

[1]

**TOTAL MARKS [10]**



3. Acids and alkalis can be prepared by dissolving their oxides in water.

The list shows five oxides.

hydrogen dioxide  
potassium oxide  
sodium oxide  
sulfur dioxide  
sulfur trioxide

**These oxides maybe used once, more than once or not at all.**

- (a) Two oxides on the list will react with water to form acids.

- (i) Name the two oxides and the acids they form.

oxide

acid

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[2]

Two oxides on the list will form a soluble base.

- (ii) Name the two oxides and the bases they form.

oxide

base

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

[2]

- (iii) State the chemical classification of soluble bases.

\_\_\_\_\_

[1]

- (iv) Using an acid from (a)(i) and **one** soluble base from (a)(ii), write a word equation for their reaction.

\_\_\_\_\_

[2]

- (b) (i) State the colour of damp blue litmus when placed in hydrogen chloride gas.

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

- (ii) Name the alkaline gas that reacts with hydrogen chloride to produce a thick white smoke.

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

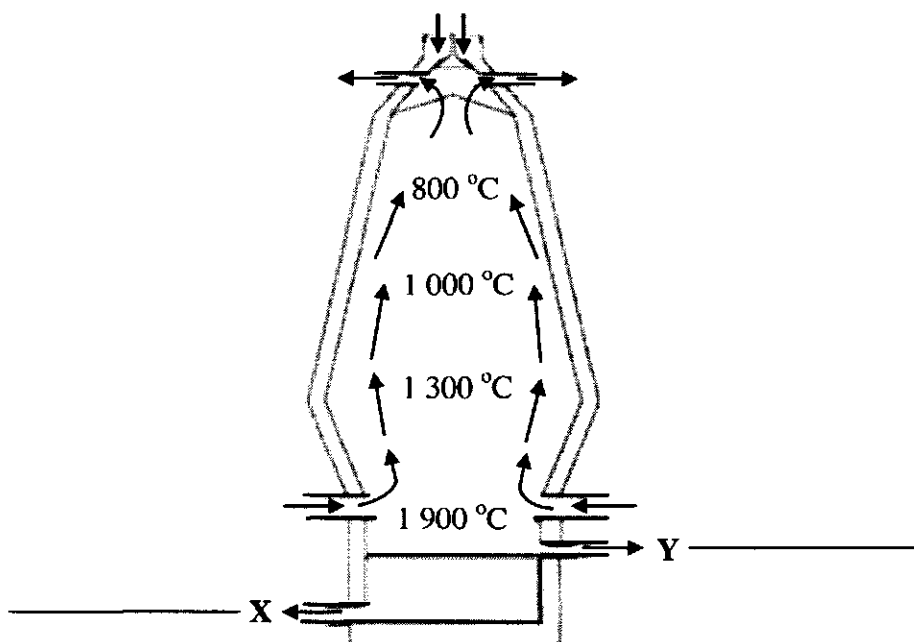
- (iii) Give the chemical name of this thick white smoke.

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

**TOTAL MARKS [10]**



4. The diagram shows a blast furnace.



- (a) (i) Write the names of the material leaving the blast furnace at X and Y in the blank spaces on the diagram. [2]

- (ii) Iron is extracted from its ore by heating the ore with carbon in the blast furnace.

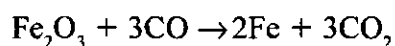
Name the ore of iron used in the blast furnace.

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

- (iii) Name the chemical compound, which may be found in Bahamian rock that is used in the blast furnace.

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

- (b) The equation for the reduction process is shown.



- (i) Calculate how many moles of iron will be produced from 2 moles of iron (III) oxide.

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

- (ii) Calculate the mass of the iron produced from your answer in (b)(i).

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

- (c) Metals like gold and silver were extracted and used since ancient times; however metals like sodium, calcium and aluminium were extracted only recently.

- (i) State what this indicates about the reactivity of metals extracted in ancient times and metals extracted in recent times.

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

- (ii) Suggest why metals like sodium, calcium and aluminium were extracted fairly recently.

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

- (d) Iron and aluminum are industrially important metals.

- (i) State a property of iron that makes it useful in construction.

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

- (ii) State a property of aluminium that makes it useful in the manufacturing of aircrafts.

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

**TOTAL MARKS [10]**

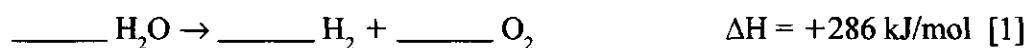




5. Hydrogen is the most abundant element in the universe. Free hydrogen is very rare on Earth, but compounds containing hydrogen are common. Water is the most abundant compound which contains hydrogen. Hydrogen can be produced by the electrolysis of water.

The equation shown represents the reaction.

- (a) (i) Balance the equation.



- (ii) State whether the reaction shown is endothermic or exothermic. Explain your answer.

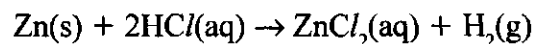
\_\_\_\_\_ [1]

- (iii) Describe the test to identify hydrogen gas and give its positive result.

test \_\_\_\_\_

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

- (b) Hydrogen can be prepared in the laboratory.  
The reaction is shown in the equation.



Calculate the number of moles in 6 000 cm<sup>3</sup> of hydrogen produced at r.t.p.

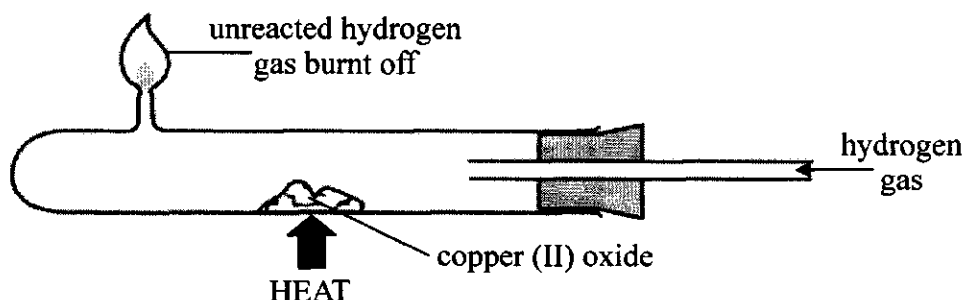
\_\_\_\_\_ [1]

- (c) Large quantities of hydrogen are used in manufacturing of ammonia.

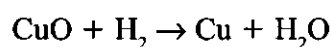
Name the process of manufacturing ammonia.

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

- (d) The diagram shows an experiment in which hydrogen gas is passed over heated black copper (II) oxide until all of the copper (II) oxide changes to copper.



The equation represents the reaction in the experiment.



- (i) From the equation, state what is happening to the movement of electrons in the copper atom in CuO.

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

- (ii) Briefly explain why the unreacted hydrogen is burnt off.

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

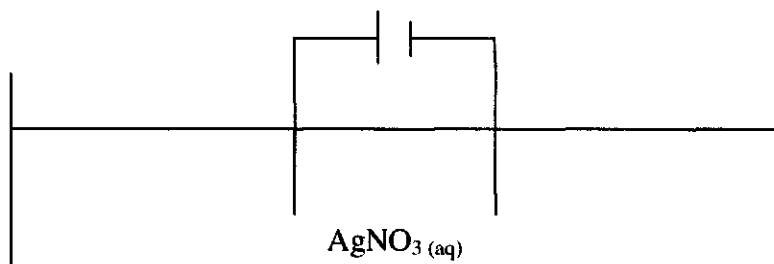
- (e) Calculate the **two** missing values from the results of the experiment.

mass of empty apparatus	= 24.25 g
mass of apparatus + copper (II) oxide before heating	= 44.25 g
mass of apparatus + copper after heating	= 40.25 g
mass of copper (II) oxide before heating	= 20.00 g
mass of copper after heating	= _____ g
mass of oxygen removed	= _____ g [2]

**TOTAL MARKS [10]**



6. Electroplating is a commonly used technique to change surface properties of metals and plastics. This technique improves the properties of the original metal.



- (a) On the diagram:
- (i) draw the electrodes needed to electroplate a spoon with silver metal. [1]
  - (ii) label the electrodes drawn on the diagram. [1]
- (b) (i) Name the electrolyte.  
\_\_\_\_\_ [1]
- (ii) Write the symbols of the ions in the electrolyte.  
\_\_\_\_\_ [2]
- (c) (i) Name the electrode at which the metal forms an ion.  
\_\_\_\_\_ [1]
- (ii) Name the electrode at which reduction occurs.  
\_\_\_\_\_ [1]
- (d) Name an industry where electroplating with chromium would be useful.  
\_\_\_\_\_ [1]

- (e) Explain why a plastic trophy is coated with graphite before it is electroplated with silver.

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[2]

**TOTAL MARKS [10]**



7. This question involves organic compounds.

ethane –  $C_2H_6$ 

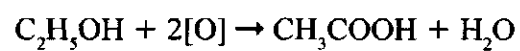
**methane – CH<sub>4</sub>**

**propane – C<sub>3</sub>H<sub>8</sub>**

- (a) (i) List **one** source of methane.  
\_\_\_\_\_ [1]
- (ii) State **one** commercial use of propane.  
\_\_\_\_\_ [1]
- (b) (i) Write the name and general formula of the homologous series the above organic compounds belong to.  
homologous series \_\_\_\_\_  
general formula \_\_\_\_\_ [2]
- (ii) Write the chemical formula for the fourth member of this organic series.  
\_\_\_\_\_ [1]
- (iii) Draw the structural formula for (b) (ii).  
  
  
  
  
  
  
  
  
  
[2]
- (c) (i) Complete the word equation.  
methane gas + bromine gas  $\rightarrow$  \_\_\_\_\_ + hydrogen bromide [1]
- (ii) State what happens to the colour of bromine water when methane is reacted with the bromine water.  
\_\_\_\_\_  
\_\_\_\_\_ [1]



- (d) A bottle of wine left open becomes sour after a while.  
This equation represents the reaction.



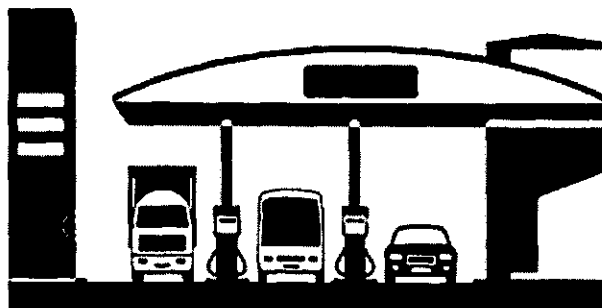
Name the type of reaction that is shown in this equation.

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

**TOTAL MARKS [10]**



8. Many vehicles use petrol or gasoline as fuel for their engines.



- (a) (i) Name the harmful metal that is no longer added to gasoline.  
\_\_\_\_\_ [1]
- (ii) State the effect this metal has on developing infants.  
\_\_\_\_\_ [1]
- (iii) Name an alternative fuel other than unleaded petrol and diesel that is used in modern cars.  
\_\_\_\_\_ [1]
- (b) (i) Complete the word equation for the complete combustion of an alkane.  
alkane + oxygen  $\rightarrow$  \_\_\_\_\_ + \_\_\_\_\_ [2]
- (ii) When gasoline is combusted in insufficient oxygen, a poisonous gas is produced.  
Name this poisonous gas.  
\_\_\_\_\_ [1]
- (iii) State the effect of this poisonous gas on humans.  
\_\_\_\_\_ [1]



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Surname and Initials	
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# CHEMISTRY

## PAPER 3

**Monday 4 JUNE 2018 12:00 NOON–1:30 P.M.**

**Additional materials:**  
**Graph paper**

### 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 submitted.

Answer **ALL** the questions in **Section A** in the spaces provided on this question booklet and any **TWO** questions from **Section B** on the lined pages provided at the back of this question booklet.

Equations and diagrams should be given wherever they are helpful.

Essential working must be shown.

The intended marks for each question or part question are given in brackets [ ].

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

### ADDITIONAL INFORMATION

s.t.p. ( $t = 0^{\circ}\text{C}$ ,  $p = 1 \text{ atm.}$ )

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

For Examiner's Use	
Section A	
1	
2	
3	
4	
Section B	
5	
6	
7	
TOTAL	

**This question paper consists of 13 printed pages, 4 lined pages and 3 blank pages.**

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

**Key**

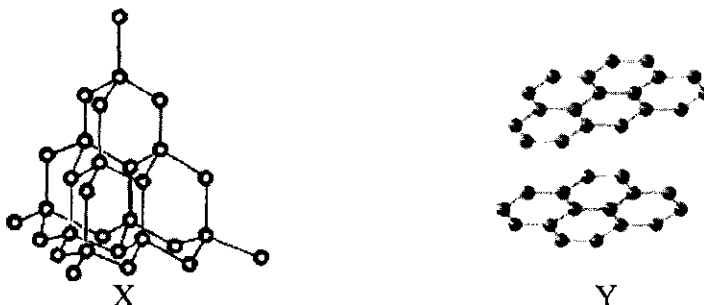
<b>a</b>	<b>a</b> = relative atomic mass
<b>X</b>	<b>X</b> = atomic symbol
<b>b</b>	<b>b</b> = proton (atomic) number

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### SECTION A

Answer **all** questions.

- 1 Allotropes and isotopes are important terms in Chemistry.



Allotropes are different forms of the same element in the same state.

- (a) (i) Name the **two** allotropes shown.

X \_\_\_\_\_

Y \_\_\_\_\_

[2]

- (ii) State **one** property and **one** use of the **two** allotropes shown.

allotrope	property	use
X		
Y		

[4]

- (b) The element carbon has two naturally occurring isotopes, C – 12 (98.93%) and C – 13 (1.07%).

- (i) State whether you expect the relative atomic mass of naturally occurring carbon to be closer to 12 or 13. Explain why.

\_\_\_\_\_

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

- (ii) Calculate the relative atomic mass of naturally occurring carbon. Give your answer to four significant figures. [3]

**TOTAL MARKS [10]**

2. Fractional distillation of crude oil is an important process in organic chemistry.

- (a) (i) Explain how fractional distillation is used to separate the components in crude oil.

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

- (ii) State **one** way in which the molecular structure of the components in crude oil are similar and **one** way in which they are different.

Similarity \_\_\_\_\_

\_\_\_\_\_

Difference \_\_\_\_\_

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

- (b) Halogens combine with alkanes and alkenes to form compounds referred to as alkyl halides.

- (i) Write a symbolic equation to show:  
the first step in a substitution reaction between ethane and bromine.

the addition reaction between ethene and bromine.

[2]

- (ii) State how these reactions can be used to distinguish between alkanes and alkenes.

test results for alkanes \_\_\_\_\_

\_\_\_\_\_

test results for alkenes \_\_\_\_\_

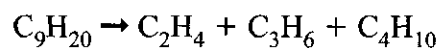
\_\_\_\_\_ [1]

(c) Cracking is the breaking of long chain and less useful hydrocarbons to produce short chain and more useful hydrocarbons at high temperatures using a catalyst.

(i) Name the catalyst used in the process of cracking.

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

(ii) One of the substances produced during cracking is ethene,  $C_2H_4$ .  
Use the equation to calculate the volume of ethene gas, produced at room temperature and pressure from 160 grams of nonane,  $C_9H_{20}$ .



[2]

**TOTAL MARKS [10]**

3. A student used 25 cm<sup>3</sup> of a solution containing 3.7 g per dm<sup>3</sup> of calcium hydroxide, Ca(OH)<sub>2</sub> to neutralise 20 cm<sup>3</sup> of hydrochloric acid, HCl (aq) in a titration experiment.

(a) Name two specially designed **measuring apparatus** that should be used for titration experiments.

1. \_\_\_\_\_

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

(b) Universal indicator is used in the experiment.

State the colour of universal indicator at the endpoint of the titration.

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

(c) (i) Write a balanced equation showing the reaction between calcium hydroxide and hydrochloric acid.

[2]

(ii) Calculate to convert g/dm<sup>3</sup> into mol/dm<sup>3</sup> and then determine the number of moles of calcium hydroxide used in the experiment.

[2]

(iii) Calculate the number of moles of hydrochloric acid that is needed to react with the calcium hydroxide used in the experiment.

[1]

(iv) Based on your answer in (c)(iii) calculate the concentration of the hydrochloric acid.

[1]

(d) Name the compound made when carbon dioxide gas, CO<sub>2</sub> is bubbled into calcium hydroxide solution, Ca(OH)<sub>2</sub>.

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

**TOTAL MARKS [10]**



4. This question is about metals, non-metals and hydrogen.

(a) Copper can be used to make electrical wires, hot water pipes and cooking pots. It is malleable and can be easily bent and shaped into a cooking pot, when a force is applied.

(i) Explain in terms of particle movement, why copper metal can be used to make pots.

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

(ii) Give **one** other reason why copper is used to make cooking pots.

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

(b) In an environmentally conscious world, hydrogen could replace fossil fuels as the energy source for heating, transportation and industrial processes. When hydrogen is burnt in air to release energy, the main by-product is water. Cars that run on hydrogen are now being built.

(i) Write a balanced equation for the reaction between hydrogen and air.

[1]

(ii) Give **one** reason why using hydrogen as a fuel is better in an environmentally conscious world.

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

(iii) Calculate the volume of oxygen needed at r.t.p. to burn 0.5 g of hydrogen.

[3]

- (c) (i) Draw the Lewis Dot structure for hydrogen bromide gas,  $\text{HBr(g)}$ .

[1]

- (ii) Draw the Lewis Dot structure for hydrobromic acid,  $\text{HBr(aq)}$ .

[1]

**TOTAL MARKS [10]**

## SECTION B

Answer any **two** questions.

5. This question is based on the manufacture of ammonia and sulfuric acid.

(a) An investor wants to build an ammonia plant in one of the Family Islands.

(i) State **one** environmental factor and **one** economic factor to be considered when determining the location of the ammonia plant. [2]

(ii) Write a balanced chemical equation for the manufacture of ammonia by the Haber process. [2]

(b) The table shows the percentage yield of ammonia at different temperatures and pressures.

temperature / °C	100	200	300	400	500
pressure / atm	percentage yield of ammonia				
100	79	50	25	13	6
300	87	66	40	21	12
400	91	78	55	32	20

Use information from the table and Le Chatelier's Principle to explain why the percentage yield of ammonia

(i) increases with different pressures; [2]

(ii) decreases with different temperatures. [2]

A chemical engineer discovered that the best conditions for the manufacture of ammonia are 450 °C and 200 atm.

(iii) Suggest a reason why the engineer will **not** increase the pressure to achieve a higher yield of ammonia. [2]

(c) Sulfuric acid is made by the Contact process.

(i) Write a balanced chemical equation showing sulfur dioxide reacting to produce sulfur trioxide. [2]

(ii) Assuming that this reaction goes to completion and occurs at r.t.p, find the volume of sulfur trioxide that will be produced from 48 dm<sup>3</sup> of sulfur [1]

(iii) Approximately 30% of the sulfur trioxide made in (c)(i) is collected. Calculate the actual volume of sulfur trioxide collected. [1]

- (iv) 100 g of a catalyst is used in the reaction in (c) (i).  
Name the catalyst used and state how much of it is left at the end of the reaction. [2]
- (v) State the effect a catalyst has on the yield and the rate of sulfur trioxide production. [1]
- (d) State why sulfur trioxide gas is dissolved in 98.8% sulfuric acid and not in water. [1]
- (e) Ammonia and sulfuric acid are used to produce fertilisers such as ammonium sulfate and sodium nitrate.

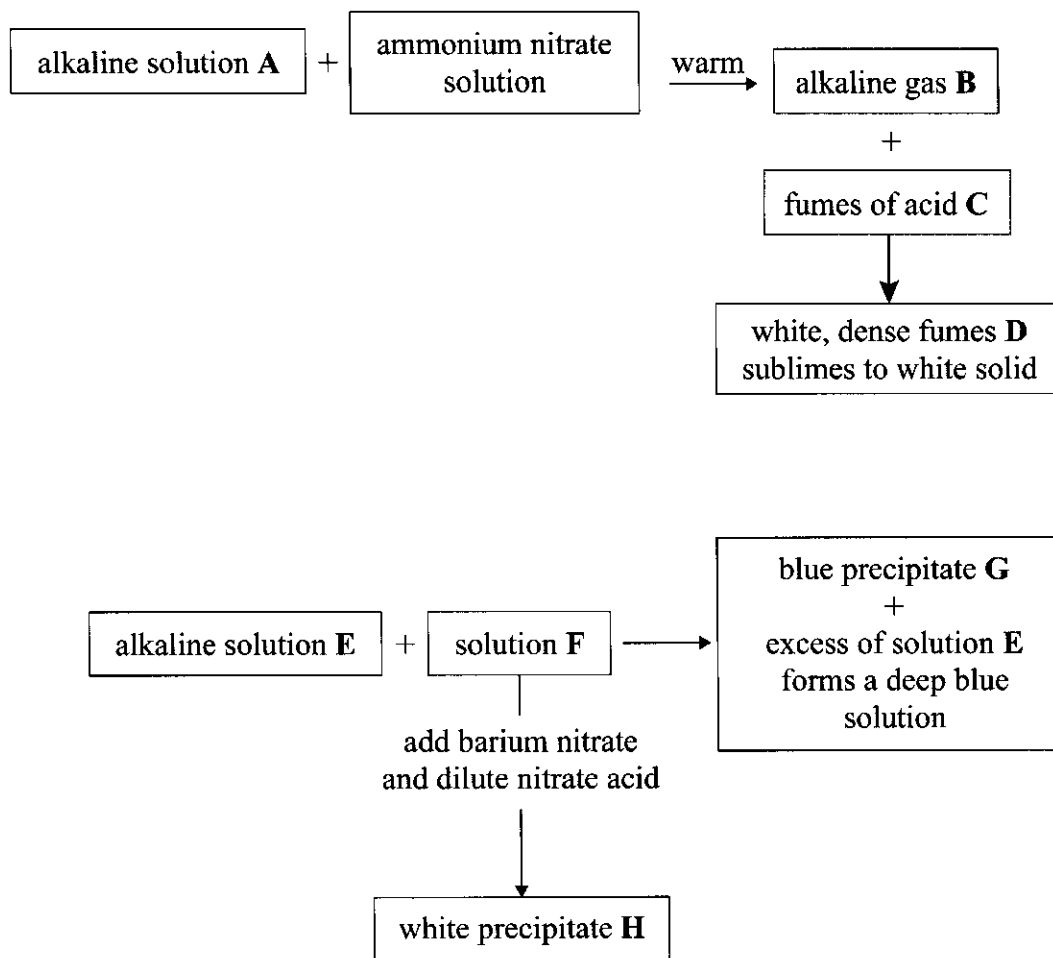
Calculate which fertiliser, ammonium sulfate or sodium nitrate, contains the largest percentage of elemental nitrogen. Show your working. [2]

**TOTAL MARKS [20]**

6. A BGCSE class investigates three substances using a flame test. The class records a description of the substances tested and the results of the flame test.

	description of substance	flame test
1	An octopus has blood that is blue and not red because it contains <b>metal X</b> in the compound that carries oxygenated blood.	blue-green flame
2	Chemical fertilisers and matches contain nitrates of <b>metal Y</b> .	lilac flame
3	Glass and water softener contains carbonate of this <b>metal Z</b> .	golden yellow flame
(a)	Use the results of the flame tests to identify the metal ions <b>X</b> , <b>Y</b> , and <b>Z</b> by writing the symbols of the metal ions. [3]	
(b)	(i) Find the empirical formula of the compound in dry bleaching powder where the percentage is 81.07% Ba and 18.93% O. [3]	
	(ii) Ethylene glycol is used as antifreeze. The molar mass is 62 g/mol and the empirical formula is: CH <sub>3</sub> O. Determine the molecular formula of ethylene glycol. [2]	
(c)	Bromine is obtained from sodium bromide in seawater by a displacement reaction with chlorine.	
	sodium bromide + chlorine gas → sodium chloride + bromine	
	(i) Write a balanced equation for the reaction. [2]	
	(ii) State what this reaction indicates about the reactivity of the halogens. [1]	
	(iii) Write the test and the positive result for the chloride ion in water. [1]	

(d) The flow chart shows a series of chemical reactions.



Identify the names of the substances **A – H** in the flow chart.

[8]

**TOTAL MARKS [20]**

7. A student investigates the rate of reaction of magnesium in **equal volumes** of two different acids. The **same mass** of magnesium ribbon is used. The two acids used are hydrochloric acid (HCl) and ethanoic acid (CH<sub>3</sub>COOH) at r.t.p. All of the magnesium reacted completely in hydrochloric acid, but some magnesium was left unreacted in the ethanoic acid.

The results obtained for both investigations are recorded in the table.

time/s	0	20	40	60	80	100	120	140	160
<b>hydrochloric acid</b>									
total volume of H <sub>2</sub> (g) / cm <sup>3</sup>	0	20	40	60	79	95	100	100	100
<b>ethanoic acid</b>									
total volume of H <sub>2</sub> (g) / cm <sup>3</sup>	0	4	8	12	19	29	42	57	57

- (a) (i) Plot a graph of the volume of hydrogen collected in each experiment using the same axes. Indicate the name of each acid on the curve drawn. [6]

From your graph determine the volume of hydrogen produced at

- (ii) 130 s in the experiment with ethanoic acid; [1]
- (iii) 180 s in the experiment with hydrochloric acid. [1]
- (b) State which acid, from the results of this experiment, appears to be highly ionised. Give a reason for your answer. [1]
- (c) (i) Write a balanced equation for the reaction between magnesium and hydrochloric acid. [2]
- (ii) Calculate the mass of magnesium used in the reaction with hydrochloric acid. [2]
- (iii) In the reaction with ethanoic acid, 0.003 g of magnesium was left unreacted. Determine the mass of magnesium that reacted with ethanoic acid. [2]
- (d) Explain, in terms of the collision theory, the effect of increasing temperature on the final results of this experiment. [3]
- (e) (i) State the test and result for the hydrogen gas that was produced in the experiment. [1]
- (ii) Give **one** industrial use of hydrogen gas. [2]

**TOTAL MARKS [20]**

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Question .....  
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[illegible]

Question .....  
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