

Visit
FREETESTPAPER.com
for more papers



Website: freetestpaper.com

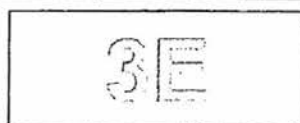


[Facebook.com/freetestpaper](https://www.facebook.com/freetestpaper)



[Twitter.com/freetestpaper](https://www.twitter.com/freetestpaper)

Name: _____	Class: Sec _____	Index No.: _____
-------------	------------------	------------------



**CORAL SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2016**

**CHEMISTRY
5073/01**

Paper 1

14 October 2016

SECONDARY 3 EXPRESS

Duration: 45 minutes

Additional Material: OTAS Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

There are **thirty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C and D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the OTAS sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 13.

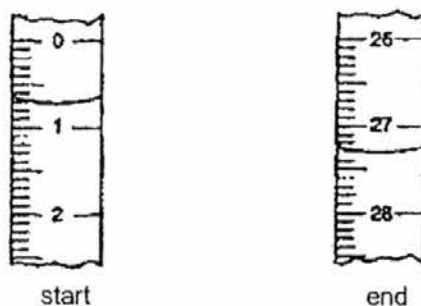
The use of an approved scientific calculator is expected, where appropriate.

This question paper consists of **13** printed pages, including this page.

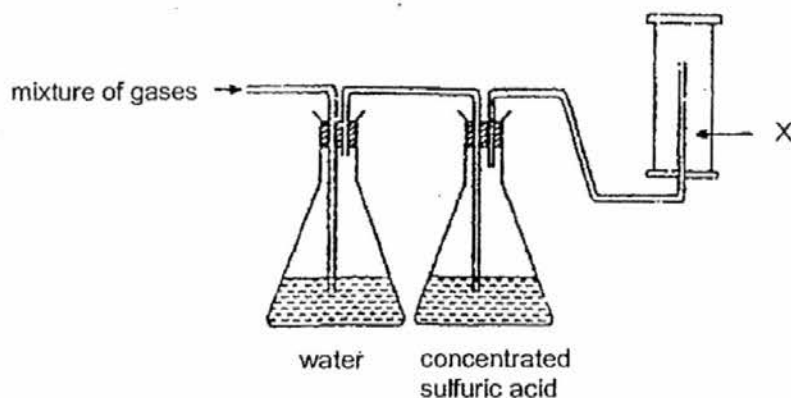
[Turn over]

- 1 The diagram shows the level in the burette filled with dilute hydrochloric acid at the start and end of titration.

What volume of acid was added from the burette?



- A 25.8 cm³
B 26.6 cm³
C 27.3 cm³
D 27.4 cm³
- 2 The apparatus below is used to obtain a dry sample of gas X from a mixture of gases.



What is the gas collect at X?

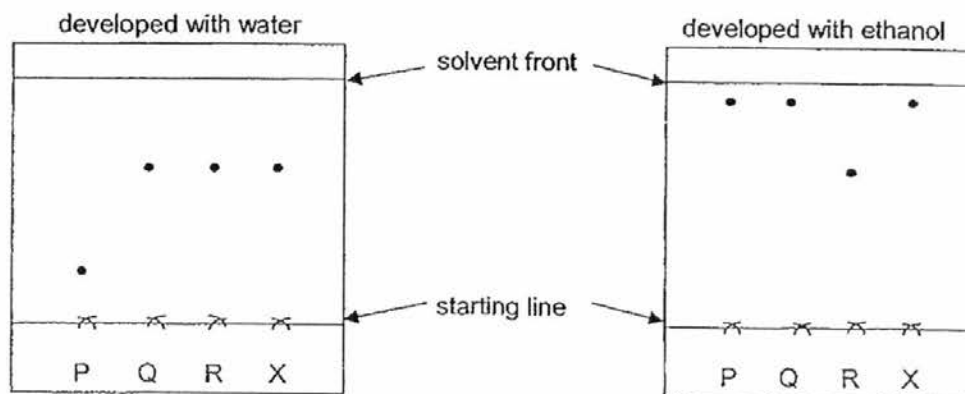
- A ammonia
B argon
C helium
D hydrogen chloride

- 3 The boiling point of water is 100°C . The melting point of sodium chloride is 801°C .

Which of the following is most likely to be the boiling point of seawater?

- A 96°C
B 104°C
C 796°C
D 805°C
- 4 It was suspected that an unknown substance X was one of the three substances P, Q or R. Spots of each substance were put on the starting lines of two pieces of chromatography paper. One paper was developed with water and the other with ethanol.

The diagram shows the final chromatograms.



What is substance X?

- A P
B Q
C R
D P or Q

- 5 Zinc is purified by fractional distillation in a fractionating column made of silicon carbide. Zinc boils at 908 °C.

Which of the following statements is **true**?

- A The boiling point of silicon carbide is slightly higher than zinc.
 - B The boiling point of silicon carbide is slightly lower than zinc.
 - C Silicon carbide has a structure similar to diamond.
 - D Silicon carbide has a structure similar to carbon dioxide.
- 6 The table below shows the melting and boiling points of four metals.

metal	melting point / °C	boiling point / °C
caesium	29	685
potassium	63	766
rubidium	39	701
sodium	98	890

How many metals will be in the molten state when heated to 35 °C?

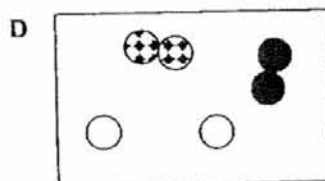
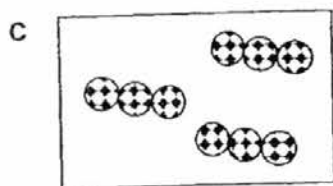
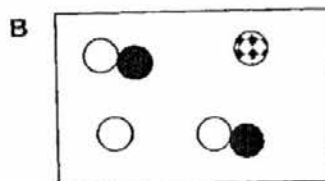
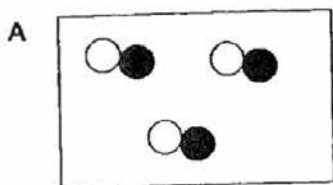
- A 1
 - B 2
 - C 3
 - D 4
- 7 Which statement explains why a solid is denser than a liquid?
- A The particles in a solid have more energy than those in a liquid.
 - B The particles in a solid are heavier than those in a liquid.
 - C The particles in a solid are closer together than those in a liquid.
 - D The particles in a solid are held together by stronger forces of attraction.

- 8 A new substance was discovered and a series of experiments were conducted on it.

Which observation suggests that the substance **cannot** be an element?

- A It is broken down into two products when heated.
- B It dissolves in water to give a colourless solution.
- C When exposed to air, it changes colour gradually.
- D When heated in air, it could form two oxides.

- 9 Which of the following diagram shows the particles in hydrogen chloride?



- 10 An element, R, has p protons and n neutrons in its nucleus.

Which row gives a possible correct number of protons, neutrons and electrons in a positive ion of an isotope of R?

	protons	neutrons	electrons
A	p	$n + 1$	$p - 1$
B	p	$n + 1$	$p + 1$
C	$p + 1$	n	$p + 1$
D	$p + 1$	n	$p - 1$

- 11 Three elements X, Y and Z have consecutive, increasing proton numbers.

If element X is a noble gas, what will be the symbol for the ion of element Z in its compounds?

- A Z^{2-}
 - B Z^{2+}
 - C Z^+
 - D Z^-
- 12 In which compound does one of the atoms **not** achieve the electronic configuration 2,8?
- A CF_4
 - B CO_2
 - C MgO
 - D PF_3
- 13 Aluminium melts at $660^\circ C$ while sodium melts at $98^\circ C$.
- Which statement best explains why aluminium has a higher melting point than sodium?
- A Aluminium has a smaller atomic radius than sodium.
 - B Aluminium has a stronger metallic bond than sodium.
 - C Group I metals have low densities.
 - D Group I metals are soft.

- 14 Four substances have the following properties

substance	property
M	conducts electricity only in aqueous state
N	conducts electricity in both solid and molten states
O	conducts electricity in both molten and aqueous states
P	does not conduct electricity in any state

What could these four substances be?

	M	N	O	P
A	NaOH	CO	Mg	H ₂ SO ₄
B	CO	H ₂ SO ₄	NaOH	Mg
C	H ₂ SO ₄	Mg	NaOH	CO
D	Mg	NaOH	H ₂ SO ₄	CO

- 15 Which particles are responsible for the conduction of electricity in calcium chloride?
- A electrons only
 B electrons and positive ions
 C negative ions
 D negative and positive ions
- 16 Which of the following shows the correct structure for hydrogen peroxide?
- A H—O—H—O
 B H—O—O—H
 C O—H—O—H
 D O—H—H—O
- 17 Antimony oxide has the formula Sb₂O₃ while potassium dichromate has the formula K₂Cr₂O₇.
 What is the formula of antimony dichromate?
- A SbCr₂O₇
 B Sb₂Cr₂O₇
 C Sb₂(Cr₂O₇)₃
 D Sb₃(Cr₂O₇)₂

18 What is the ionic equation for the reaction of barium carbonate with sulfuric acid?

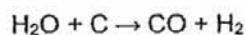
- A $\text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- B $\text{Ba}^{2+} + \text{SO}_4^{2-} \rightarrow \text{BaSO}_4$
- C $\text{H}^+ + \text{OH}^- \rightarrow \text{H}_2\text{O}$
- D There is no ionic equation for the reaction.

19 One mole of sodium sulfate, Na_2SO_4 , is dissolved in water.

How many moles of ions does the solution contain?

- A 1
- B 2
- C 3
- D 7

20 The reaction when steam is passed over hot coke is shown in the reaction below.



What is the total volume of gases formed from 9 g of steam?

- A 12 dm^3
- B 24 dm^3
- C 36 dm^3
- D 48 dm^3

21 Milk of magnesia is a suspension of magnesium oxide in water and is used as a medicine.

What is it most likely used for?

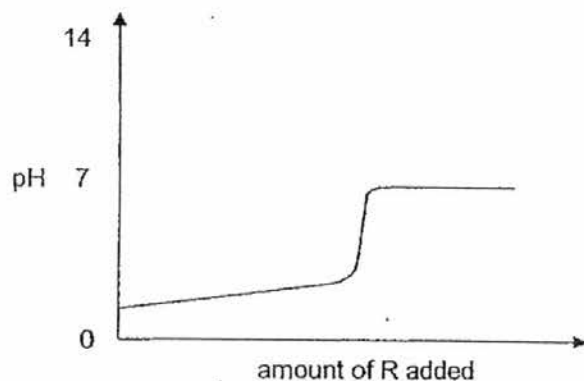
- A curing headaches
- B as an antiseptic
- C neutralizing stomach acids
- D soothing insect bites

- 22 A metal forms an oxide which dissolves in water.

What is the colour observed when a few drops of Universal indicator are added to the solution?

- A red
 - B green
 - C blue
 - D violet
- 23 What does the term *strong acid* mean in relation to nitric acid?
- A Each molecule of acid produces two hydrogen ions in water.
 - B It is fully ionised in an aqueous solution.
 - C It forms a solution of pH 1.
 - D It forms a solution of pH 5.

- 24 The following graph shows the change in pH as substance R is added to hydrochloric acid.



Which statement best explains the shape of the graph?

- A R neutralises the acid to form a neutral salt.
- B R is an insoluble salt.
- C R is a soluble base.
- D R is an insoluble carbonate.

- 25 Which of the following gives the highest concentration of hydrogen ions?
- A dissolving 1 mole of ethanoic acid in 100 cm³ of water
 - B dissolving 1 mole of carbon dioxide gas in 100 cm³ of water
 - C dissolving 1 mole of hydrogen chloride in 100 cm³ of water
 - D dissolving 1 mole of sulfuric acid in 100 cm³ of water
- 26 Five students each dissolved an antacid tablet in 100 cm³ of water. They then titrated 25.0 cm³ of their tablet solutions with dilute hydrochloric acid, using the same indicator.

The results are shown in the table below.

student	1	2	3	4	5
final reading/ cm ³	24.5	25.5	24.4	24.6	21.4

Which statement could explain the result obtained by student 5?

- A The conical flask was rinsed with the tablet solution.
- B The conical flask was rinsed with hydrochloric acid.
- C The burette was washed out with hydrochloric acid.
- D The pipette was washed out with the tablet solution.

- 27 The table below indicates which anions will form precipitates with the three metal cations given.

metal cations present	anions		
	carbonate	chloride	sulfide
barium	√	x	x
cadmium	√	x	√
silver	√	√	√

key

√ = forms precipitate

x = does not form precipitate

A student has a solution containing dissolved salts of all three metals, namely barium, cadmium and silver. He wishes to separate solid compounds of each metal from the solution by filtration.

In what order must he add the anions in order to filter out a compound of each metal at each step?

- A carbonate, chloride, sulfide
 - B carbonate, sulfide, chloride
 - C chloride, carbonate, sulfide
 - D chloride, sulfide, carbonate
- 28 The most suitable method to prepare lead(II) chloride crystals is to react hydrochloric acid with
- A lead metal.
 - B lead(II) oxide.
 - C lead(II) carbonate.
 - D lead(II) nitrate.
- 29 Which of the following shows a correct use of a noble gas?
- A Neon is used in advertising lights.
 - B Helium is used in the extraction of iron.
 - C Argon is used in combustion reactions.
 - D Krypton is used to fill lightbulbs.

30 Which row shows the correct order of the relative size of the following ions and atoms?

	increasing size →			
A	Li^+	Na^+	Na	K
B	Li^+	Na	Na^+	K
C	K	Na^+	Na	Li^+
D	K	Na	Na^+	Li^+

~ END OF PAPER ~

The Periodic Table of the Elements

The Periodic Table of the Elements

Group

I	II	III										IV	V	VI	VII	0					
		1 H hydrogen 1														4 He helium 2					
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	13 Al aluminium 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
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	29 P phosphorus 15	30 S sulfur 16	31 Cl chlorine 17	32 Ar argon 18	33 K potassium 19	34 Ca calcium 20	35 Sc scandium 21	36 Ti titanium 22
39 K potassium 19	40 Ca calcium 20	41 Sc scandium 21	42 Ti titanium 22	43 V vanadium 23	44 Cr chromium 24	45 Mn manganese 25	46 Fe iron 26	47 Co cobalt 27	48 Ni nickel 28	49 Cu copper 29	50 Zn zinc 30	51 Ga gallium 31	52 Ge germanium 32	53 As arsenic 33	54 Se selenium 34	55 Br bromine 35	56 Kr krypton 36	57 La lanthanum 57	58 Ce cerium 58		
85 Rb rubidium 37	86 Sr strontium 38	87 Y yttrium 39	88 Zr zirconium 40	89 Nb niobium 41	90 Mo molybdenum 42	91 Tc technetium 43	92 Ru ruthenium 44	93 Rh rhodium 45	94 Pd palladium 46	95 Ag silver 47	96 Cd cadmium 48	97 In indium 49	98 Sn tin 50	99 Sb antimony 51	100 Te tellurium 52	101 I iodine 53	102 Xe xenon 54	103 La lanthanum 57	104 Ce cerium 58		
133 Cs caesium 55	134 Ba barium 56	135 La lanthanum 57	136 Ce cerium 58	137 Pr praseodymium 59	138 Nd neodymium 60	139 Pm promethium 61	140 Sm samarium 62	141 Eu europium 63	142 Gd gadolinium 64	143 Tb terbium 65	144 Dy dysprosium 66	145 Ho holmium 67	146 Er erbium 68	147 Tm thulium 69	148 Yb ytterbium 70	149 Lu lutetium 71	150 Hf hafnium 72	151 Ta tantalum 73	152 W tungsten 74		
171 Fr francium 87	172 Ra radium 88	173 Ac actinium 89	174 Th thorium 90	175 Pa protactinium 91	176 U uranium 92	177 Np neptunium 93	178 Pu plutonium 94	179 Am americium 95	180 Cm curium 96	181 Bk berkelium 97	182 Cf californium 98	183 Es einsteinium 99	184 Fm fermium 100	185 Md mendelevium 101	186 No nobelium 102	187 Lr lawrencium 103	188 Rn radon 86	189 La lanthanum 57	190 Ce cerium 58		

*58-71 Lanthanoid series

†90-103 Actinoid series

Key

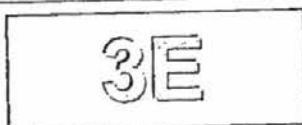
a = relative atomic mass
 X = atomic symbol
 b = proton (atomic) number

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

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

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

Name: _____	Class: Sec _____	Index No.: _____
-------------	------------------	------------------



**CORAL SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2016**

**CHEMISTRY
5073/02**

Paper 2

7 October 2016

SECONDARY 3 EXPRESS

Duration: 1 hour 30 minutes

Candidates must answer ALL questions in the space provided in the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Section A [50 marks]

Answer **all** questions in the spaces provided.

Section B [20 marks]

Answer **all** questions in the spaces provided.

The number of marks is given in brackets [] at the end of each question or part question.

A copy of Periodic Table is printed on page 14.

The use of an approved scientific calculator is expected, where appropriate.

For Examiner's Use		
Section	Question(s)	Marks
A	1 – 6	
B	7	
	8	
Total Marks		

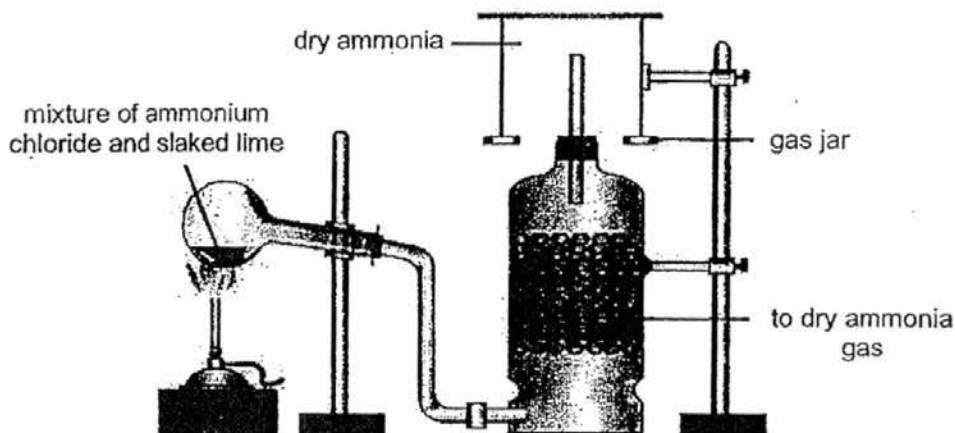
This question paper consists of 14 printed pages, including this page.

[Turn over

SECTION A

Answer **all** questions in this section in the spaces provided.
The total mark for this section is 50.

- 1 The diagram shows a laboratory preparation of ammonia gas.



- (a) Suggest the name of the chemical present in slaked lime.
..... [1]
- (b) A student tried to dry the ammonia gas obtained using concentrated sulfuric acid.
- (i) Explain why his attempt was unsuccessful.
..... [1]
.....
- (ii) Suggest another chemical to dry the ammonia gas.
..... [1]
- (c) The industrial manufacturing of ammonia is carried out using the Haber process. In this reaction, nitrogen and hydrogen gas are mixed together to form ammonia gas.
- (i) State the arrangement and movement of particles in the gases.
..... [2]
.....

- (ii) Complete the table to show the formula and M_r of the three gases.

gas	formula	M_r
ammonia		
hydrogen		
nitrogen		

[2]

- (iii) Hence, arrange the three gases in increasing rate of diffusion.

..... [1]

- (iv) 36 moles of ammonia gas were produced in the process.

Calculate the volume occupied by the gas at room temperature and pressure.

[1]

2 Silicon is an element in Group IV of the Periodic Table.

- (a) Silicon has three naturally occurring isotopes. The abundance of each isotope is given below.

isotope	relative abundance/ %
^{28}Si	92.2
^{29}Si	4.7
^{30}Si	3.1

- (i) Explain what is meant by the term 'isotopes'.

.....
 [2]

- (ii) Using the Periodic Table and ^{28}Si as reference, complete the following table.

number of protons	
number of electrons	
number of neutrons	

[1]

- (iii) Using the information on the relative abundance of isotopes, find the average mass of silicon, correct to 1 decimal place.

Show your working clearly.

[2]

- (b) Silicon reacts with chlorine on heating to form silicon(IV) chloride, SiCl_4 , which has a simple molecular structure.

- (i) Suggest **two** physical properties of silicon(IV) chloride.

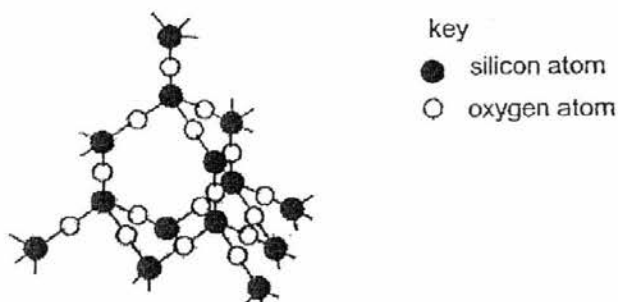
.....
 [2]

- (ii) Draw a 'dot-and-cross' diagram for silicon(IV) chloride.
 You only need to show the outer shell electrons for each atom.

[2]

- (c) Silicon(IV) chloride reacts with water to form silicon(IV) oxide.

Part of the structure of silicon(IV) oxide is shown below.



Predict **one** property of silicon(IV) dioxide and explain your answer, in terms of structure and bonding.

.....

 [2]

- 3 Since 1850, most books have been printed on acidic paper which becomes brittle and disintegrates over time.

Paper tends to be acidic from chemicals added to the paper to reduce absorbency and minimize bleeding of inks. These chemicals, in the presence of moisture, generates sulfuric acid.

Acids also form in paper by the absorption of air pollutants- mainly sulfur dioxide. The fact that books are usually more brown and brittle along the edges than in the centre clearly illustrates this absorption of pollutants from the air.

By treating books with diethyl zinc vapour, the acids in the paper are neutralized and books can be preserved. Diethyl zinc contains 52.8 % of zinc, 39.0 % of carbon and 8.20 % of hydrogen by mass.

When diethyl zinc passes through the closed books, it reacts with the small amount of water in the paper to form zinc oxide and ethane gas, C_2H_6 . The zinc oxide then neutralizes the acid in the paper.

- (a) Use the data to show that the empirical formula of diethyl zinc is ZnC_4H_{10} .

[2]

- (b) Explain why pollutants like sulfur dioxide can contribute to acids forming in the paper.

.....
 [1]

- (c) The molecular formula of diethyl zinc is the same as the empirical formula.

Write a balanced chemical equation, with state symbols, for the reaction of diethyl zinc with water.

..... [2]

- (d) The total moisture content of the book was found to be 1.2 g.

Calculate the mass of diethyl zinc vapour required to react with this quantity of water.

[2]

- 4 Sea salt, sodium chloride is easily obtained by evaporation of seawater.

This salt can be made in the laboratory by titration of the reagents.

- (a) Name the reagents that can be used to prepare sodium chloride.

..... [2]

- (b) Briefly explain the processes required to obtain the salt solution. In your answer, specify the apparatus required to measure the reagents.

.....

 [4]

- (c) A student suggested using the reaction of sodium and acid to prepare the salt as titration of the reagents will not be required.

- (i) Name the gas evolved in this reaction and describe a test for the gas.

..... [2]

- (ii) Explain why the student says that titration of the reagents is not required if sodium is used.

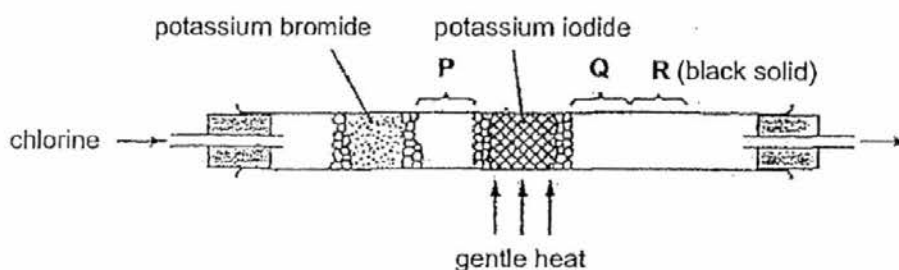
..... [1]

- (iii) Give **one** reason why this reaction is not used to prepare sodium chloride.

.....

..... [1]

- 5 In an experiment to study the relative reactivity of halogens, chlorine is passed through the tube containing potassium bromide and potassium iodide.



After a short while, coloured vapours are seen at **P** and **Q**.

- (a) Identify the black solid **R**.

..... [1]

- (b) (i) State the colours observed at **P** and **Q**.

P:

Q: [2]

- (ii) Explain why these coloured vapours are observed at **P** and **Q**.

.....

..... [2]

6 Elements in Group II of the Periodic Table are known as the alkaline earth metals.

They behave very similarly to those in Group I.

(a) Explain the trend of reactivity down Group II.

.....
.....
..... [2]

(b) Barium, an alkaline earth metal, is stored in the same way as sodium.

(i) How is barium stored?

..... [1]

(ii) What can you infer about the reactivity of barium?

..... [1]

(c) Alkaline earth metals obtained the term 'earth' in their name because their oxides melt at very high temperature that they remain as solids ('earths') in fires.

(i) Explain, using its structure and bonding, why oxides of Group II elements have a high melting point.

.....
.....
..... [2]

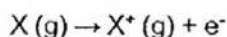
(ii) Using barium as an example, suggest how alkaline earth metals acquired the term 'alkaline'.

.....
.....
..... [2]

SECTION B

Answer **all** questions in this section in the spaces provided.
The total mark for this section is 20.

- 7 Ionisation energy is defined as the energy required to remove the most loosely held electron from one mole of gaseous atoms to produce 1 mole of gaseous ions each with a charge of 1+.



Graph 7.1 shows the trend of ionisation energy.

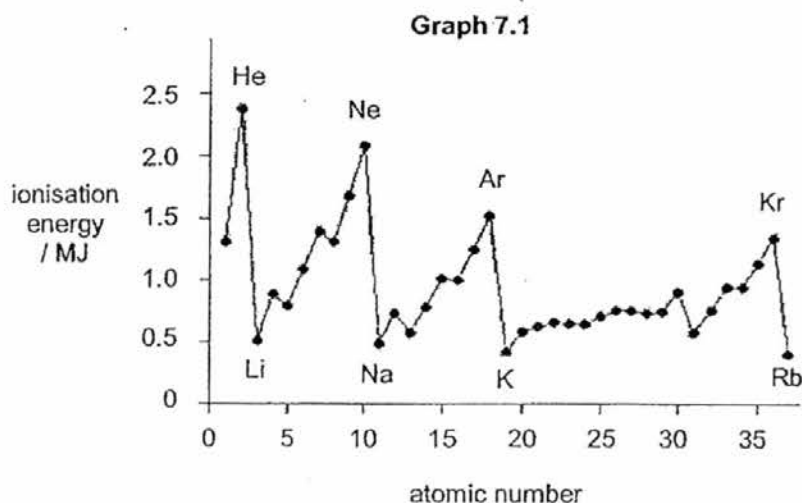


Table 7.1 shows the atomic radius of elements in Period 2.

Table 7.1

element	atomic radius/ nm
lithium	152
beryllium	111
boron	88
carbon	77
nitrogen	70
oxygen	66
fluorine	64
neon	51

- (a) Identify the element with the highest ionisation energy and suggest a reason for its high ionisation energy.

.....
 [2]

- (b) What trends are shown in **Graph 7.1** and **Table 7.1**?

.....

.....

.....

[2]

- (c) How is the ionisation energy of an atom affected by its atomic radius in general?

Use evidence from the information to explain your reasoning.

.....

.....

.....

.....

.....

[3]

- (d) In a chemical reaction, ionisation energy is important in order to predict whether various atoms make covalent or ionic bonds with each other.

Use evidence from **Graph 7.1** to help explain how ionisation energy can help predict whether atoms make covalent or ionic bonds with each other.

.....

.....

.....

.....

.....

.....

.....

.....

[4]

- 8 The use of invisible ink is one of the ways to hide secret messages.

The idea behind the design of invisible inks is a fairly simple one. All it requires is a colourless substance that produces a coloured product when a "revealer" is applied.

- (a) Phenolphthalein, an acid-base indicator, which is colourless in solutions with pH less than 10 and pink in solutions with pH above 10 is a suitable candidate for making an invisible ink.

- (i) Suggest a suitable revealer for the invisible ink made of phenolphthalein.

..... [1]

- (ii) The revealed message was left in the open to dry. After a few days, it was noticed that the ink started to fade.

Explain what could have happened.

.....

 [2]

- (b) A student has been tasked to design a new invisible ink and its revealer.

He found the following chemicals in the laboratory:

dilute sulfuric acid	calcium carbonate	copper(II) oxide
sodium hydroxide	blue litmus solution	chromium(III) carbonate
lead(II) nitrate	potassium iodide	barium nitrate

- (i) Complete the following table to show **two** pairs of chemicals that could act as the invisible ink and the revealer. Explain why these pairs of chemicals are chosen.

ink number	invisible ink	revealer	reason for choice
e.g.	hydrochloric acid	iron(II) hydroxide	iron(II) chloride which is green in colour is formed.
1			
2			

[4]

- (ii) Write a balanced chemical equation for the reaction between one of the invisible ink and revealer selected in (b)(i).

.....

..... [2]

~ END OF PAPER ~

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

Key

a	X
---	---

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

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

Answer Scheme for End of Year Examinations 2016
Sec 3 Express Pure Chemistry (5073)

Paper 1 (30 marks)					
1	B	11	B	21	C
2	C	12	D	22	D
3	B	13	B	23	B
4	B	14	C	24	D
5	C	15	D	25	D
6	A	16	B	26	B
7	C	17	C	27	D
8	A	18	D	28	D
9	A	19	C	29	A
10	A	20	B	30	A

Paper 2: Section A (50marks)														
No	Answer	Mark												
1a	Calcium hydroxide/oxide.	1												
1b (i)	Ammonia is a basic gas/alkaline gas and will be <u>neutralised</u> by sulfuric acid.	1												
1b (ii)	Calcium oxide/Calcium chloride	1												
1c (i)	They are <u>arranged randomly</u> and <u>far apart</u> and <u>move rapidly in all directions</u> .	1 1												
1c (ii)	<table border="1"> <thead> <tr> <th>gas</th><th>formula</th><th>M_r</th></tr> </thead> <tbody> <tr> <td>ammonia</td><td>NH₃</td><td>17</td></tr> <tr> <td>hydrogen</td><td>H₂</td><td>2</td></tr> <tr> <td>nitrogen</td><td>N₂</td><td>28</td></tr> </tbody> </table>	gas	formula	M _r	ammonia	NH ₃	17	hydrogen	H ₂	2	nitrogen	N ₂	28	1 mark for correct formula 1 mark for correct M _r
gas	formula	M _r												
ammonia	NH ₃	17												
hydrogen	H ₂	2												
nitrogen	N ₂	28												
1c (iii)	Nitrogen, ammonia, hydrogen	1												
1d	864 dm ³	1 (no marks if no/wrong units)												
		Total 9 marks												

2a (i)	Atoms of the <u>same element</u> with the <u>same number of protons but different number of neutrons</u> .	1 1
2a (ii)	p = 14, n = 14, e = 14	1
2a (iii)	(0.922 × 28) + (0.047 × 29) + (0.031 × 30) = 28.1	1 mark for working 1 mark for correct answer
2b(i)	Low melting and boiling point/Does not conduct electricity in any state/Insoluble in water	1 1

2b(ii)		1- correct bonding 1- correct number of electrons shared																				
2c	Hard/High melting and boiling point. Because it has a giant molecular structure and a lot of energy is needed to overcome the strong covalent bonds holding the atoms together. OR Does not conduct electricity in any states. All valence electrons of silicon are used for bonding. There is no free electrons to carry the charge.	1 1 OR 1 1																				
		Total 11 marks																				
3a	<table border="1"> <tr> <td></td> <td>Zn</td> <td>C</td> <td>H</td> </tr> <tr> <td>%</td> <td>52.8</td> <td>39.0</td> <td>8.2</td> </tr> <tr> <td>Ar</td> <td>65</td> <td>12</td> <td>1</td> </tr> <tr> <td>No. of mol</td> <td>0.812</td> <td>3.25</td> <td>8.2</td> </tr> <tr> <td>Simplest ratio</td> <td>1</td> <td>4</td> <td>10</td> </tr> </table> Empirical formula: $\text{ZnC}_4\text{H}_{10}$		Zn	C	H	%	52.8	39.0	8.2	Ar	65	12	1	No. of mol	0.812	3.25	8.2	Simplest ratio	1	4	10	1 1
	Zn	C	H																			
%	52.8	39.0	8.2																			
Ar	65	12	1																			
No. of mol	0.812	3.25	8.2																			
Simplest ratio	1	4	10																			
3b	Sulfur dioxide is a non-metal oxide . Hence it is acidic.	1																				
3c	$\text{ZnC}_4\text{H}_{10}(\text{g}) + \text{H}_2\text{O}(\text{l}) \rightarrow \text{ZnO}(\text{s}) + 2\text{C}_2\text{H}_6(\text{g})$	1- balanced 1- state symbols																				
3d	Number of mol of water = $\frac{1.2}{18} = 0.0667$ No. of mol of diethyl zinc = 0.0667 Mass = $0.0667 \times (65 + 48 + 10) = 8.20 \text{ g}$	1 1																				
		Total 7 marks																				
4a	Sodium hydroxide/Sodium carbonate Hydrochloric acid	1 1																				
4b	Fill up the burette with sodium carbonate/sodium hydroxide OR hydrochloric acid Pipette 25 cm^3 of dilute hydrochloric acid OR sodium carbonate/sodium hydroxide into a conical flask. Add a suitable indicator and titrate till the indicator changes colour. Repeat the experiment without the indicator.	1 1 1 1																				
4ci	Hydrogen gas. The gas should extinguish a lighted splint with a pop sound.	1 1																				
4cii	Sodium is a solid reagent, it will remain undissolved when added in excess. Sodium is a highly reactive metal and the reaction	1																				

4ciii	would be too <u>vigourous/explosive</u> .	1
		Total 10 marks
5a	Iodine	1
5bi	A reddish brown vapour is observed at P. A purple vapour is observed at Q.	1 1
5bii	Since chlorine is <u>more reactive than bromine</u> , it will <u>displace bromine</u> from potassium bromide, resulting in <u>bromine</u> produced at P. <u>Bromine then displaces iodine</u> from potassium iodide to <u>form iodine</u> , resulting in a purple vapour at Q.	1- state reactivity 1- explaining products are as a result of displacement.
		Total 5 marks
6a	Reactivity <u>increases</u> down Group II. Since <u>atomic radius increases down</u> Group II, it becomes easier to lose their valence electrons, hence reactivity increases.	1 1
6bi	They are stored under oil.	1
6bii	Barium is <u>very</u> reactive.	1
6ci	Group II oxides are ionic compounds and they have a <u>giant ionic lattice structure</u> . Melting involves <u>overcoming the strong electrostatic force of attraction between oppositely charged ions</u> . Hence a lot of heat energy is required.	1 1
6cii	Barium reacts with water to form <u>barium hydroxide and hydrogen gas</u> . Since barium hydroxide is <u>a soluble base</u> , an alkaline solution is formed.	1 1
		Total 8 marks

Paper 2: Section B (20marks)					
No	Answer				Mark
7a	Helium It is a <u>noble gas/has a stable electronic configuration/full valence shell</u> . Hence a lot of energy is required to remove an electron from it.				1 1
7b	Graph 7.1 shows that <u>ionisation energy increase across a period</u> while graph 7.2 shows <u>atomic radius decrease across a period</u> . <i>Many students tried to write the trend across the table and the graph. But that is for 7c.</i>				1 1 1
7c	In general, <u>the larger the atomic radius, the lower the ionisation energy</u> . <u>For example</u> , lithium has the largest atomic radius of Period 2 but the lowest ionisation energy. <u>This is because the larger the atomic radius, the further the valence electron from the nucleus, hence less energy is required to remove the valence electron</u> .				1 (use info.) 1
7d	Ionic compounds are formed by transfer of electrons while covalent compounds are formed by sharing of electrons. OR Ionic compounds are formed between a metal and non-metal while covalent compounds are formed between 2 non-metals. Metals tend to have a <u>lower ionisation energy</u> than the non-metals. Hence it requires <u>less energy for the metal to lose its electron to the non-metal</u> , forming ionic compounds. While between 2 non-metals they tend to have <u>high ionisation energies</u> hence, a lot of energy is required for it to form ions. Hence they tend to share electrons.				1 (define what are ionic/covalent bonds) 1 (metals have low IE) 1 (explain how IE is important to electron transfer/sharing) 1 (non-metals have higher IE) Total 11 marks
8a (i)	Sodium hydroxide/Potassium hydroxide Or any other strong alkali.				1
8a (ii)	The revealer may have been <u>neutralized by carbon dioxide</u> present in the air. Hence the <u>pH was lowered</u> and the colour is not as strong.				1 1
8bi	ink number	invisible ink	revealer	reason for choice	Any 2 options. 2 marks each. 1 mark for correct revealer and

8bii	1	Dilute sulfuric acid	Blue Litmus solution	Acid will turn blue litmus red.	invisible ink. 1 mark for correct explanation. Colour of products is required for litmus ONLY. No marks if revealer and ink are incorrect. Total for qns: 4
	2	Dilute sulfuric acid	Copper(II) oxide	They react to form the blue copper(II) sulfate	
	3	Potassium iodide	Lead(II) nitrate	The yellow lead iodide is formed	
	4	Dilute sulfuric acid	Chromium(III) carbonate	Chromium sulfate is formed. Chromium is a transition metal, hence chromium carbonate is coloured.	
	H ₂ SO ₄ + CuO → CuSO ₄ + H ₂ O OR 2KI + Pb(NO ₃) ₂ → PbI ₂ + 2KNO ₃ OR 3H ₂ SO ₄ + Cr ₂ (CO ₃) ₃ → Cr ₂ (SO ₄) ₃ + 3H ₂ O + 3CO ₂				1- correct formula 1- balanced Total 9 marks