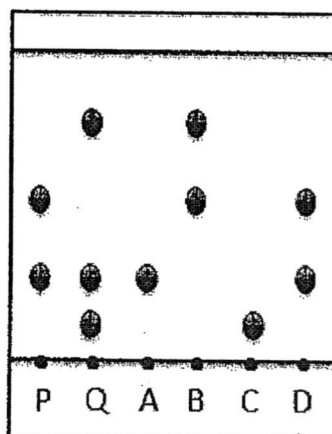


- 21 The table shows the composition of exhaust gases from an internal combustion engine.

gas	% of the gas in the exhaust fumes
gas Y	71
carbon dioxide	14
water vapour	13
carbon monoxide	1
hydrocarbons	0.3
nitrogen oxides	0.2
sulfur dioxide	less than 0.003

What is gas Y?

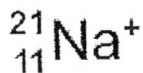
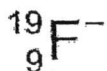
- A ammonia  
 B argon  
 C chlorine  
 D nitrogen
- 22 The diagram below shows a chromatogram. The solvent used was ethanol.



Which of the following statements is **not** correct?

- A Substance A is pure.  
 B Substance P is the same as substance D.  
 C Substance Q contains all the components found in A, B, C and D.  
 D Substance B is more soluble in ethanol than substance A.

- 23 The symbols for two ions are shown.



Which statement is correct?

- A The fluoride ion contains more electrons than the sodium ion.
  - B The sodium ion contains more neutrons than the fluoride ion.
  - C The two ions contain the same number of electrons as each other.
  - D The two ions contain the same number of protons as each other.
- 24 A gas, R, has the following properties:
- 1 a choking smell
  - 2 turns damp blue litmus red, then bleached it
  - 3 does not react with acidified potassium manganate (VII)

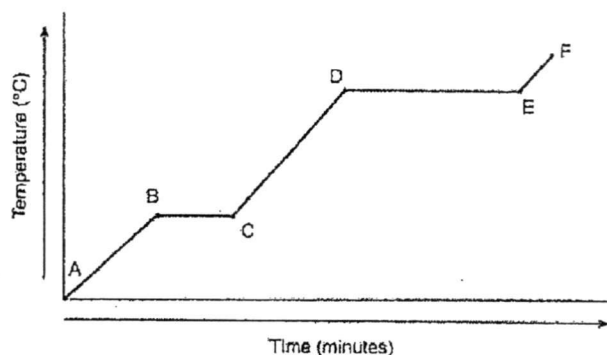
What is R?

- A ammonia
  - B carbon dioxide
  - C chlorine
  - D sulfur dioxide
- 25 Chromium forms the compound chromium(III) sulfate.  
What does the (III) represent?
- A the charge on a sulfate ion
  - B the number of chromium ions combined with one sulfate ion
  - C the number of sulfate ions combined with one chromium ion
  - D the oxidation state of chromium

- 26 Germanium oxide is a white powder.  
 Germanium oxide reacts with concentrated hydrochloric acid.  
 Germanium oxide reacts with concentrated aqueous sodium hydroxide.  
 Germanium oxide does not dissolve when added to water.  
 Which type of oxide is germanium oxide?

- A acidic  
 B amphoteric  
 C basic  
 D neutral

- 27 The following shows the change of temperature with time when ice was heated.



Which entry in the table shows the correct change taking place between the points?

	points	change
A	A to B	Some water molecules are no longer in fixed positions.
B	B to C	The average kinetic energy of the particles remains constant.
C	C to D	The volume of steam is increasing.
D	E to F	Water is boiling.





- 31 An analysis of salt S gave the following results.

Test 1: When solid S was warmed with aqueous sodium hydroxide and aluminium foil, colourless and pungent gas was produced. The gas turns moist red litmus paper blue.

Test 2: When excess aqueous sodium hydroxide was added to a solution of S, a colourless solution was formed.

What could salt S be?

- A zinc nitrate
  - B zinc carbonate
  - C calcium carbonate
  - D calcium nitrate
- 32 Which pair of salts are prepared by the same method?
- A sodium chloride and zinc nitrate
  - B ammonium sulfate and lead(II) chloride
  - C zinc nitrate and iron(II) sulfate
  - D barium chloride and lead(II) sulfate

- 33 Solutions of two chemicals are mixed.

A reaction occurs and the temperature change is measured.

Which statement is correct?

- A If the reaction is endothermic, energy is taken in and the temperature of the mixture decreases.
- B If the reaction is endothermic, energy is given out and the temperature of the mixture increases.
- C If the reaction is exothermic, energy is given out and the temperature of the mixture decreases.
- D If the reaction is exothermic, energy is taken in and the temperature of the mixture increases.

34 Which reaction occurring in the blast furnace is an acid base reaction?

- A  $C + CO_2 \rightarrow 2CO$   
 B  $C + O_2 \rightarrow CO_2$   
 C  $CaO + SiO_2 \rightarrow CaSiO_3$   
 D  $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

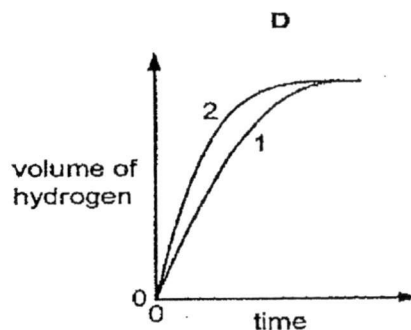
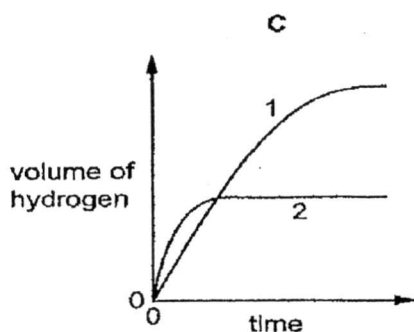
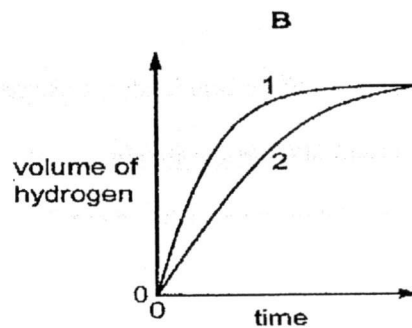
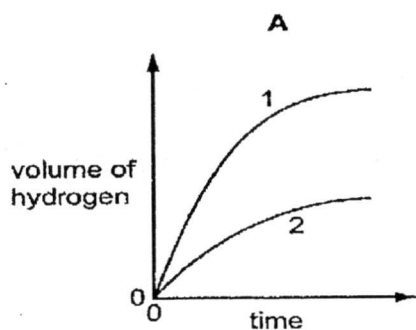
35 Dilute hydrochloric acid was reacted with 1.2 g of magnesium ribbon at room temperature in two experiments, experiment 1 and experiment 2.

In experiment 1, 100 cm<sup>3</sup> of 1 mol/dm<sup>3</sup> of hydrochloric acid was used.

In experiment 2, 50 cm<sup>3</sup> of 2 mol/dm<sup>3</sup> of hydrochloric acid was used.

The volume of hydrogen given off was plotted against time.

Which graph is correct?



- 36 Metal P is more reactive than metal Q which is more reactive than metal R. The sulfates of P and R are colourless; the sulfate of Q is blue.

Which observation is correct when one of these metals was added to the sulfate solution of another metal?

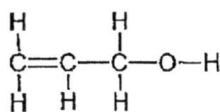
	metal added	solution of sulfate	colour change of solution
A	P	Q	blue → colourless
B	Q	P	colourless → blue
C	Q	R	blue → colourless
D	R	Q	blue → colourless

- 37 Which statement about alkanes is correct?
- A Ethane reacts with chlorine in an addition reaction.
- B Propane has a higher boiling point than butane.
- C The molecule of the alkane that contains 99 carbon atoms has 200 hydrogen atoms.
- D Ethane is the first member of the alkanes series.
- 38 Which fractions obtained from the distillation of petroleum are commonly used as fuels in engines?
- A petrol, diesel and paraffin
- B methane and naphtha
- C naphtha and bitumen
- D petrol, paraffin and bitumen
- 39 Which alcohol will, on oxidation, produce  $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$ ?
- A  $\text{CH}_3\text{OH}$
- B  $\text{CH}_3\text{CH}_2\text{OH}$
- C  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
- D  $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{OH}$

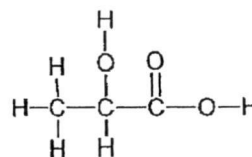
40 An organic compound X has the following reactions:

- neutralises sodium hydroxide
- decolourises aqueous bromine

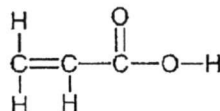
Which of the following structures best represents X?



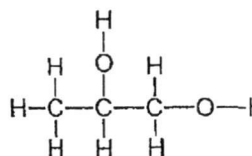
A



B



C



D

\*\*\*\*\*End of Paper\*\*\*\*\*

### Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white



XINMIN SECONDARY SCHOOL

新民中学

SEKOLAH MENENGAH XINMIN

Preliminary Examination 2017

CANDIDATE NAME

CLASS

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INDEX NUMBER

--	--

**SCIENCE (CHEMISTRY)**

**5076/03, 5078/03**

Paper 3

**17 August 2017**

Secondary 4E5N

**1 hour 15 minutes**

Setter: Mrs Jelena Raj

Vetter: Mr Lim Boon Ping

Candidates answer on the Question Paper.

No Additional Materials are required.

**READ THESE INSTRUCTIONS FIRST**

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

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Write in dark blue or black pen.

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

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

You may lose marks if you do not show your working or if you do not use appropriate units.

**Section A**

Answer **all** questions.

**Section B**

Answer any **two** questions.

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

A copy of the Data Sheet is printed on page 16

At the end of the examination, fasten all your work securely together.

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

For Examiner's Use	
Section A	45
Section B	20
Total	65
Parent's Signature	

This document consists of **16** printed pages

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	11 <b>B</b> Boron 5	12 <b>C</b> Carbon 6	14 <b>N</b> Nitrogen 7	16 <b>O</b> Oxygen 8	19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10																																				
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18																																				
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	45 <b>Sc</b> Scandium 21	48 <b>Ti</b> Titanium 22	51 <b>V</b> Vanadium 23	52 <b>Cr</b> Chromium 24	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	59 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36																										
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	89 <b>Y</b> Yttrium 39	91 <b>Zr</b> Zirconium 40	93 <b>Nb</b> Niobium 41	96 <b>Mo</b> Molybdenum 42	101 <b>Ru</b> Ruthenium 44	101 <b>Rh</b> Rhodium 45	103 <b>Pd</b> Palladium 46	106 <b>Ag</b> Silver 47	108 <b>Cd</b> Cadmium 48	112 <b>In</b> Indium 49	115 <b>Sn</b> Tin 50	119 <b>Sb</b> Antimony 51	122 <b>Te</b> Tellurium 52	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54																											
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	139 <b>La</b> Lanthanum 57	178 <b>Hf</b> Hafnium 72	181 <b>Ta</b> Tantalum 73	184 <b>W</b> Tungsten 74	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	201 <b>Hg</b> Mercury 80	204 <b>Tl</b> Thallium 81	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	222 <b>Rn</b> Radon 86																											
223 <b>Fr</b> Francium 87	226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89																																									
*58-71 Lanthanoid series																																											
†90-103 Actinoid series																																											
<table border="1" style="width: 100%; text-align: center;"> <tr> <td>140 <b>Ce</b> Cerium 58</td> <td>141 <b>Pr</b> Praseodymium 59</td> <td>144 <b>Nd</b> Neodymium 60</td> <td>147 <b>Pm</b> Promethium 61</td> <td>150 <b>Sm</b> Samarium 62</td> <td>152 <b>Eu</b> Europium 63</td> <td>157 <b>Gd</b> Gadolinium 64</td> <td>159 <b>Tb</b> Terbium 65</td> <td>162 <b>Dy</b> Dysprosium 66</td> <td>165 <b>Ho</b> Holmium 67</td> <td>167 <b>Er</b> Erbium 68</td> <td>169 <b>Tm</b> Thulium 69</td> <td>175 <b>Lu</b> Lutetium 71</td> </tr> <tr> <td>232 <b>Th</b> Thorium 90</td> <td>231 <b>Pa</b> Protactinium 91</td> <td>238 <b>U</b> Uranium 92</td> <td>237 <b>Np</b> Neptunium 93</td> <td>244 <b>Pu</b> Plutonium 94</td> <td>243 <b>Am</b> Americium 95</td> <td>247 <b>Cm</b> Curium 96</td> <td>247 <b>Bk</b> Berkelium 97</td> <td>251 <b>Cf</b> Californium 98</td> <td>252 <b>Es</b> Einsteinium 99</td> <td>257 <b>Fm</b> Fermium 100</td> <td>258 <b>Md</b> Mendelevium 101</td> <td>260 <b>Lr</b> Lawrencium 103</td> </tr> </table>																		140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	147 <b>Pm</b> Promethium 61	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	175 <b>Lu</b> Lutetium 71	232 <b>Th</b> Thorium 90	231 <b>Pa</b> Protactinium 91	238 <b>U</b> Uranium 92	237 <b>Np</b> Neptunium 93	244 <b>Pu</b> Plutonium 94	243 <b>Am</b> Americium 95	247 <b>Cm</b> Curium 96	247 <b>Bk</b> Berkelium 97	251 <b>Cf</b> Californium 98	252 <b>Es</b> Einsteinium 99	257 <b>Fm</b> Fermium 100	258 <b>Md</b> Mendelevium 101	260 <b>Lr</b> Lawrencium 103
140 <b>Ce</b> Cerium 58	141 <b>Pr</b> Praseodymium 59	144 <b>Nd</b> Neodymium 60	147 <b>Pm</b> Promethium 61	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	175 <b>Lu</b> Lutetium 71																															
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<p><b>Key</b></p> <table border="1" style="width: 100%; text-align: center;"> <tr> <td>a</td> <td>X</td> </tr> <tr> <td>b</td> <td>b</td> </tr> </table> <p>a = relative atomic mass X = atomic symbol b = proton (atomic) number</p>																		a	X	b	b																						
a	X																																										
b	b																																										

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

## Section A

Answer all questions in the spaces provided.

For  
Examiner's  
Use

- 1 The table below describes the reactions of Group II elements when added to cold water.

element	reaction with cold water
beryllium	no reaction
magnesium	very slow reaction
calcium	fairly vigorous reaction
strontium	very fast reaction

- (a) Barium lies below strontium in Group II. Predict, giving a reason, how you would expect barium to react with cold water.

.....  
 .....  
 .....

[2]

- (b) The table below shows some properties of three elements in the Periodic Table.

element	malleable or brittle	melting point (°C)	boiling point (°C)	appearance	electrical conductivity
aluminium	malleable	660	2519	shiny solid	good
silicon	brittle	1414	3265	shiny solid	semi-conductor
phosphorus	brittle	44	280	white solid	poor

Describe how the information in the table shows that silicon is difficult to be classified as a metal or a non-metal.

.....  
 .....  
 .....

[2]

- 2 (a) A chemical company makes salts for use in industries. The table shows some names and formulae of salts with the names of the acids and other compounds used to make them.

Complete the table by filling in the missing information.

name of salt	formula of salt	name of acid used to make salt	name of the other compound used to make salt
sodium sulfate	$\text{Na}_2\text{SO}_4$		
potassium phosphate	$\text{K}_3\text{PO}_4$	phosphoric acid	
silver chloride	$\text{AgCl}$		
calcium phosphate			calcium hydroxide

[4]

- (b) Draw dot-and-cross diagrams to show the bonding in carbon dioxide and sodium oxide. Show only the outer shell electrons.

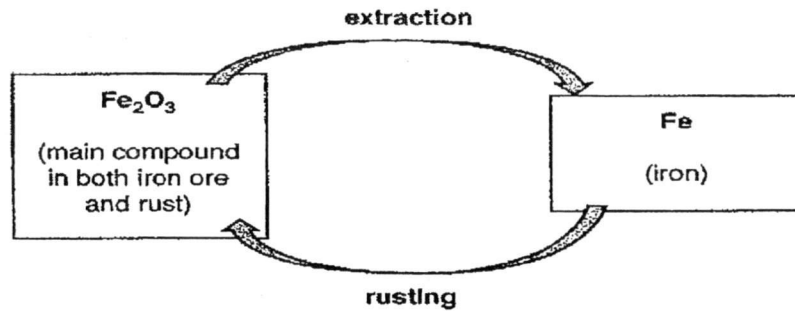
carbon dioxide

sodium oxide

[6]



- 3 (a) The diagram shows the cycle of changes that happen when iron is extracted and then rusts.



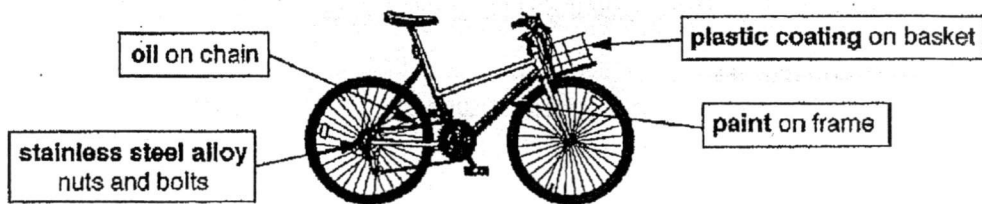
Identify the change that involves oxidation and the change that involves reduction. Give reasons for your answers.

.....

.....

..... [2]

- (b) The diagram shows the rust prevention methods used on different parts of a bicycle.



- (i) What is meant by the term *alloy*?

.....

..... [1]

- (ii) Explain how the oil, the paint and plastic coating slow down rusting.

.....

.....

.....

..... [2]

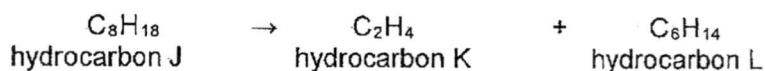
- 4 Aldehydes are a homologous series of organic compounds like alkanes and alkenes. The table shows the names, formulae and boiling points of some aldehydes.

name	formula	boiling point (°C)
methanal	HCHO	-19
ethanal	CH <sub>3</sub> CHO	20
propanal	C <sub>2</sub> H <sub>5</sub> CHO	49
pentanal	C <sub>4</sub> H <sub>9</sub> CHO	103

- (a) Use the information in the table to give two pieces of evidence that suggest that the aldehydes are a homologous series.

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

- (b) The equation shows a reaction involving hydrocarbons.



Choose the correct processes from the box to complete the sentences below.

combustion    hydration    cracking    polymerisation
---

Each word may be used once, more than once or not at all.

- (i) Hydrocarbons K and L are produced from hydrocarbon J

by ..... [1]

- (ii) Poly(ethene) can be produced from hydrocarbon K

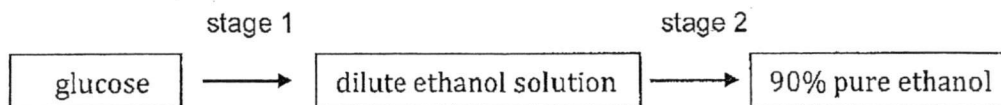
by ..... [1]

- (iii) Describe a test to distinguish between hydrocarbons K and L and give the results of the test.

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

- (c) In some countries, ethanol is made from glucose for use as a fuel.

The flow chart summarises the production process for ethanol.



- (i) Name the processes that take place at stage 1 and 2

stage 1: .....

stage 2: ..... [2]

- (ii) Write a balanced equation for the reaction in stage 1.

..... [1]

- (iii) State two conditions for the reaction to occur.

.....

..... [2]

- 5 Some companies make products to sell to farmers as soil improvers. Some compounds in the products neutralise acidity. The table shows information about some substances that companies use to make these products.

substance	chemical composition	effectiveness at neutralising acidity	other points
limestone	$\text{CaCO}_3$	fair	Insoluble in water. Needs to be ground to very fine powder
quicklime	$\text{CaO}$	very high	Made by heating limestone to a high temperature Reacts exothermically with water to make an alkaline solution
slaked lime	$\text{Ca(OH)}_2$	very high	Made by adding water to quicklime. Slaked lime is an alkali
blast furnace slag	mixture of $\text{CaSiO}_3$ with $\text{CaCO}_3$ and other impurities	fair	Insoluble in water. Impurities include silicon oxides and other non-metal compounds

- (a) Use the information in the table to suggest why limestone is less effective at neutralising acidity than quicklime and slaked lime.

.....

.....

..... [2]

- (b) Slaked lime is made by adding water to quicklime. Write a balanced chemical equation for the reaction. State a test to show that slaked lime is alkaline in nature.

.....  
 .....  
 .....

[2]

- (c) The calcium content of the substances is important as it adds to the mineral content of the soil.

Show by calculation that quicklime has a higher percentage by mass of calcium than both limestone and slaked lime.

[2]

- (d) Explain how blast furnace slag,  $\text{CaSiO}_3$ , is produced during the extraction of iron from haematite.

.....  
 .....  
 .....  
 .....

[2]

- (e) Heating limestone produces quicklime and carbon dioxide according to the equation below.



Calculate the volume of carbon dioxide produced at r.t.p. when 25 tonnes of limestone are heated. (1 tonne = 1000000 g)

[2]

- 6 (a) Acid J has a relative molecular mass of 63. A 500 cm<sup>3</sup> aqueous sample contains 196 g of J.

Calculate the concentration of J in mol/dm<sup>3</sup>.

For  
Examiner's  
Use

[2]

- (b) Name all the products formed when a piece of magnesium carbonate is added to acid J. State the test and the result for any gas that may be evolved.

.....  
.....  
.....

[3]

**Section B**

Answer any **two** questions in this section.  
Write your answers in the spaces provided.

- 7 A student carried out some experiments to place four metals W, X, Y and Z in order of reactivity. The table shows the results.

- KEY:**    ✓ shows a reaction happened  
              x shows no reaction happened  
              --- shows the experiment was not performed

	metal W	metal X	metal Y	metal Z
solution of W nitrate	—	x	x	x
solution of X nitrate	✓	—	✓	✓
solution of Y nitrate	✓	x	—	✓
solution of Z nitrate	✓	x	x	—

- (a) Place the metals in order of reactivity, starting with the most reactive.

.....

[1]

- (b) The student carried out **further** experiments to place metal M in the list. She used dilute hydrochloric acid and samples of the metals. She found out that metal M is the fourth most reactive metal.

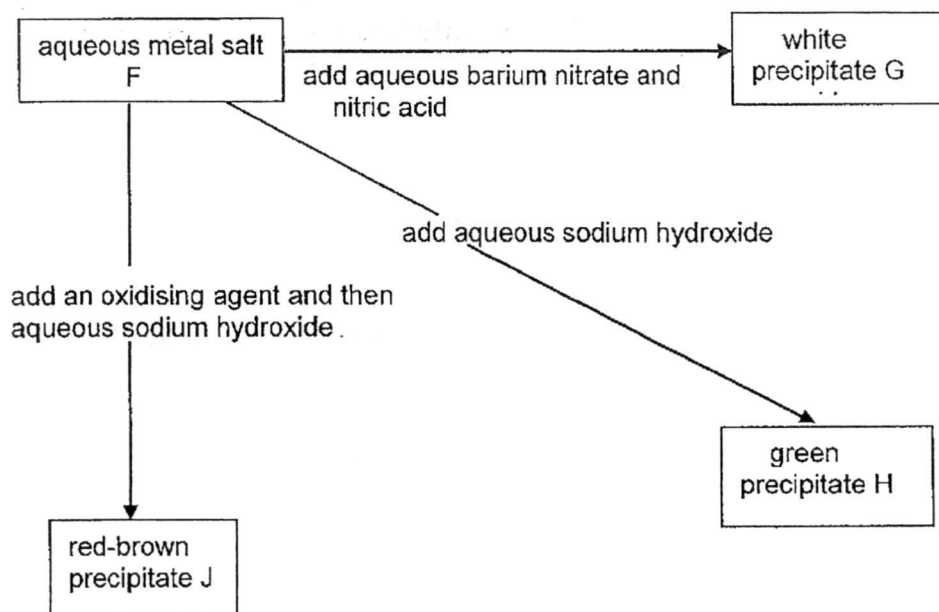
Describe the experiments that the student carried out.

Your answer should include a description of the experiments, the measurements made and how the results showed that metal M is the fourth most reactive metal.

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

[4]

The diagram below shows some reactions of an aqueous metal salt, F.



(c) Name

(i) white precipitate G: ..... [1]

(ii) green precipitate H: ..... [1]

(iii) red-brown precipitate J: ..... [1]

(d) Name and give the formula of the metal salt, F.

..... [2]

- 8 (a) Describe how pure crystals of potassium chloride can be prepared using a solution of potassium carbonate and an acid.

name of acid: .....

method of preparation:

.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....  
.....

[6]

- (b) Explain why potassium chloride has a high melting point.

.....  
.....  
.....  
.....

[2]

- (c) Name an insoluble salt and state the reagents that can be used to prepare the salt.

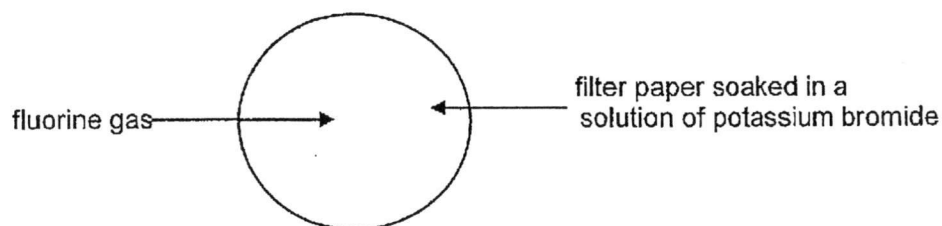
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[2]



- 9 (a) Fluorine is an element in Group VII.

A jet of fluorine is aimed at a filter paper soaked in a solution of potassium bromide.



The solution on the filter paper quickly turns brown.

[5]

- (i) Explain why the solution turns brown.  
Include an equation to support your answer.

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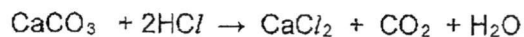
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[2]

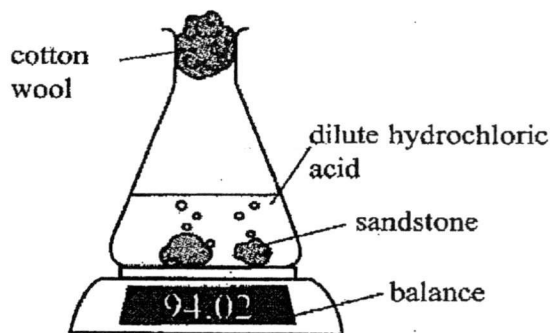
- (ii) Draw a molecule of fluorine showing **all** electrons.

[2]

- (b) Sandstone contains sand (mainly silicon dioxide) and calcium carbonate. Excess sandstone was reacted with dilute hydrochloric acid.



The rate of reaction was followed by measuring the mass lost during the reaction.



This is a table of the results.

time t/minutes	total mass lost/g
0	0.00
4	0.18
8	0.30
12	0.38
16	0.44
20	0.48
24	0.51

- (i) Use information from the table to show that the rate of reaction decreased.

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[2]

- (ii) Explain using ideas about particles colliding, why the rate of reaction decreased.

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[2]

- (iii) Draw a labelled diagram to show a **different** method of following the rate of reaction between sandstone and hydrochloric acid.

[2]

\*\*\*\*\**End of Paper*\*\*\*\*\*

#### Colours of Some Common Metal Hydroxides

calcium hydroxide	white
copper(II) hydroxide	light blue
iron(II) hydroxide	green
iron(III) hydroxide	red-brown
lead(II) hydroxide	white
zinc hydroxide	white



XINMIN SECONDARY SCHOOL

新民中学

SEKOLAH MENENGAH XINMIN

Preliminary Examination 2017

CANDIDATE NAME

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CLASS

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INDEX NUMBER

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**SCIENCE (CHEMISTRY)**

**5076/05**

**5078/05**

Paper 5 Practical Test

29 August 2017

Secondary 4E5N

1 hour 30 minutes

Setter: Mr Lin Shunyi

Vetters: Mrs Jelena Raj / Mr Lim Boon Ping

Candidates answer on the Question Paper.

Additional Materials: As listed in the Confidential Instructions.

**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 on both sides of the paper.

You may use an HB pencil for any diagrams, graphs, tables or rough working.

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

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

Answer **both** questions.

You are advised to spend 45 minutes on each question.

Chemistry practical notes for this paper are printed on page 5.

At the end of the examination, fasten all your work securely together.

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

For Examiner's Use	
Q1	15
Parent's Signature	

- 1 You are provided with a bottle of solution labelled **P** which contains 3 different ions, a bottle containing cobalt(II) chloride solution and a bottle containing magnesium nitrate solution. You are also provided with two unknown metals, **X** and **Y**, marble chips and some pieces of magnesium ribbon.

Carry out the following tests. You should test any gases evolved. Carefully record your observations.

The volumes given below are approximate and should be estimated rather than measured.

	test	observations
(a)(i)	Add about 2 cm <sup>3</sup> of cobalt(II) chloride solution into a clean test-tube.  Add a piece of magnesium ribbon to this test-tube.	
(ii)	Add about 2 cm <sup>3</sup> of cobalt(II) chloride solution into a clean test-tube.  Add a piece of metal <b>X</b> to this test-tube.	
(iii)	Add about 2 cm <sup>3</sup> of cobalt(II) chloride solution into a clean test-tube.  Add a piece of metal <b>Y</b> to this test-tube.	
(iv)	Add about 2 cm <sup>3</sup> of magnesium nitrate solution into a clean test-tube.  Add a piece of metal <b>Y</b> to this test-tube.	

[4]

- (b) From your observations, what can you conclude about the order of reactivities of X, Y, cobalt and magnesium?

Explain how your observations support your conclusions.

.....

.....

.....

.....

[3]

	test	observations
(c)(i)	Add about 2 cm <sup>3</sup> of P into a clean test-tube.  Add a piece of magnesium ribbon.	
(ii)	Add about 2 cm <sup>3</sup> of P into a clean test-tube.  Add some marble chips.	
(iii)	Add about 1 cm <sup>3</sup> of P into a clean test-tube.  Add 1 cm <sup>3</sup> of dilute nitric acid, followed by 1 cm <sup>3</sup> of barium nitrate solution.	
(iv)	Add about 1 cm <sup>3</sup> of P into a clean test-tube.  Add 1 cm <sup>3</sup> of dilute nitric acid, followed by 1 cm <sup>3</sup> of silver nitrate solution.	

(v)	Add 1 cm <sup>3</sup> of the of <b>P</b> into a clean test-tube.  Add aqueous sodium hydroxide slowly, with shaking, until no further change is seen.	
(vi)	Add 1 cm <sup>3</sup> of the of <b>P</b> into a clean test-tube.  Add aqueous ammonia slowly, with shaking, until no further change is seen.	

[5]

- (d) From your observations in part (c), what can you conclude about the ions present in **P**? Explain how your observations support your conclusions.

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[3]

## 2017 4E5N Science (Chemistry) Prelim Exam – Preparation List

### Cobalt chloride solution

- Prepared by dissolving cobalt(II) chloride in water to a concentration of 1M.
- Label the mixture as **cobalt(II) chloride**.

### Magnesium nitrate solution

- Prepared by dissolving magnesium nitrate in water to a concentration of 0.5M.
- Label the mixture as **magnesium nitrate**.

### Solution P

- Prepared by dissolving 50g of copper(II) chloride per 1dm<sup>3</sup> of hydrochloric acid.
- Place mixture in a small plastic bottle labelled **P**.

### Metal X

- Place 3 sheets of tin foil in a plastic vial labelled **X**.

### Metal Y

- Place 3 sheets of zinc foil in a plastic vial labelled **Y**.

### Magnesium ribbon

- Place 3 pieces of magnesium ribbon in a plastic vial labelled **magnesium**.

### Marble chips

- Fill up a third of a plastic vial labelled **marble chips** with marble chips.

### Other chemicals

- Bench reagents (nitric acid, hydrochloric acid, sulfuric acid, aqueous sodium hydroxide, aqueous ammonia and limewater).

### Apparatus

- |                        |  |
|------------------------|--|
| • 10 x test-tubes      | • 1 x Bunsen burner                      |
| • 1 x glass rod        | • 1 x 250 cm <sup>3</sup> beaker         |
| • 1 x test-tube holder | • 1 x safety glasses                     |
| • 1 x test-tube rack   | • a supply of blue and red litmus papers |



## CHEMISTRY PRACTICAL NOTES

## Test for anions

<i>anion</i>	<i>test</i>	<i>test result</i>
carbonate ( $\text{CO}_3^{2-}$ )	add dilute acid	effervescence, carbon dioxide produced
chloride ( $\text{Cl}^-$ ) [in solution]	acidify with dilute nitric acid, then add aqueous silver nitrate	white ppt.
nitrate ( $\text{NO}_3^-$ ) [in solution]	add aqueous sodium hydroxide, then aluminium foil; warm carefully	ammonia produced
sulfate ( $\text{SO}_4^{2-}$ ) [in solution]	acidify with dilute nitric acid, then add aqueous barium nitrate	white ppt.

## Test for aqueous cations

<i>cation</i>	<i>effect of aqueous sodium hydroxide</i>	<i>test result</i>
ammonium ( $\text{NH}_4^+$ )	ammonia produced on warming	-
calcium ( $\text{Ca}^{2+}$ )	white ppt., insoluble in excess	no ppt.
copper(II) ( $\text{Cu}^{2+}$ )	light blue ppt., insoluble in excess	light blue ppt., soluble in excess giving a dark blue solution
iron(II) ( $\text{Fe}^{2+}$ )	green ppt., insoluble in excess	green ppt., insoluble in excess
iron(III) ( $\text{Fe}^{3+}$ )	red-brown ppt., insoluble in excess	red-brown ppt., insoluble in excess
lead(II) ( $\text{Pb}^{2+}$ )	white ppt., soluble in excess giving a colourless solution	white ppt., insoluble in excess
zinc ( $\text{Zn}^{2+}$ )	white ppt., soluble in excess giving a colourless solution	white ppt., soluble in excess giving a colourless solution

## Test for gases

<i>gas</i>	<i>test and test result</i>
ammonia ( $\text{NH}_3$ )	turns damp red litmus paper blue
carbon dioxide ( $\text{CO}_2$ )	gives white ppt. with limewater (ppt. dissolves with excess $\text{CO}_2$ )
chlorine ( $\text{Cl}_2$ )	bleaches damp litmus paper
hydrogen ( $\text{H}_2$ )	"pops" with a lighted splint
oxygen ( $\text{O}_2$ )	relights a glowing splint
sulfur dioxide ( $\text{SO}_2$ )	turns aqueous acidified potassium manganate (VII) from purple to colourless

- 1 x delivery tube for test-tube
- 1 x delivery tube for hard-glass boiling tube
- 1 x retort stand and clamp
- a supply of wooden splints
- a bottle of distilled water
- 1 x tripod stand and wire gauze

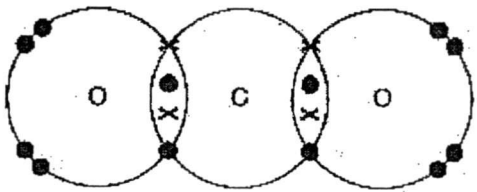
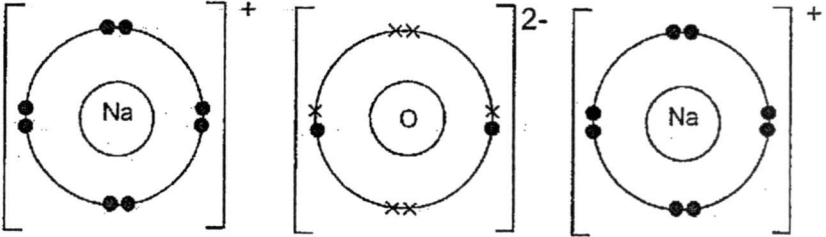
**SCIENCE (CHEMISTRY) PRELIM 2017 EXAM MARK SCHEME**

PAPER 1 [20 marks]

Question	Answer	Question	Answer
1	D	11	A
2	C	12	C
3	C	13	A
4	C	14	C
5	D	15	D
6	B	16	A
7	A	17	C
8	C	18	A
9	B	19	C
10	C	20	C



PAPER 3 [65 marks]

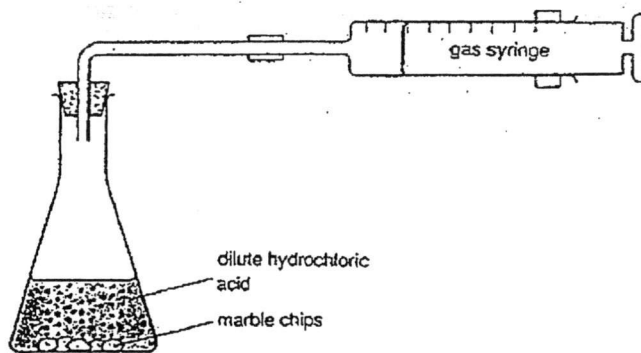
SECTION A [40 marks]			
1	(a)	Violent/extremely vigorous Reactivity increases down Group	1 1
	(b)	It is brittle as non-metal but conducts electricity like metal/ or has high mp like most metals	1 1
2	(a)	sulfuric acid, sodium hydroxide potassium hydroxide hydrochloric acid, silver nitrate $\text{Ca}_3(\text{PO}_4)_2$ , phosphoric acid,	1
	(b)	 <p>Correct number of electrons for carbon – 1m Correct number of electrons for oxygen-1m Covalent diagram-1m</p>  <p>Correct sign - 1m                      2 sodium atoms – 1m Correct number of electrons – 1m</p>	3  3
3	(a)	Extraction is reduction as loss of oxygen atoms Rusting is oxidation as gain of oxygen atoms Deduct ½ m if terms are not stated	1 1
	(b)	(i) Mixture of — ½ m metals or metals and non-metals --- ½ m (both must be given) Term mixture must be stated or no marks  (ii) barrier method or acts as protective coating Prevents oxygen and water from coming into contact with iron	1  1 1
4	(a)	Has general formula/ functional group present/Boiling point shows gradation.	2
	(b)	(i) fermentation (ii) polymerisation	1 1
		(iii) Add aqueous bromine. K decolourises it. Remains reddish brown in L	1 1

	(c)	(i) Fermentation and Fractional distillation	1 1
		(ii) $C_6H_{12}O_6 \longrightarrow 2CO_2 + 2C_2H_5OH$	1
		(iii) yeast, temperature of 37 °C	2
5	(a)	Insoluble in water must be finely powdered	1 1
	(b)	$CaO + H_2O \longrightarrow Ca(OH)_2$ Add litmus paper. It turns from red to blue	1 1
	(c)	% Ca in CaO = $40/56 \times 100 = 71.4$ % Ca in $CaCO_3 = 40/100 \times 100 = 40$ % Ca in $Ca(OH)_2 = 40/76 \times 100 = 52.6$	2
	(d)	Limestone decomposes to lime Lime neutralises acidic impurities to form slag	1 1
	(e)	25 tonnes = 25000000 g Moles of $CaCO_3 = 250000$ Moles of $CO_2 = 250000$ Volume of $CO_2 = 250000 \times 24 = 6000000 \text{ dm}^3$	1  1
6	(a)	Moles of J = $196/63 = 3.11 \text{ mols}$ Concentration = $6.22 \text{ mols/dm}^3$	1 1
	(b)	Magnesium nitrate, carbon dioxide and water Pass gas into limewater White precipitate seen	1 1 1
<b>SECTION C [20 marks]</b>			
7	(a)	W, Z, Y, X	1
	(b)	Into a conical flask, add a $100 \text{ cm}^3$ of $0.1 \text{ mol/dm}^3$ HCl acid Stopper and connect flask to gas syringe. Add 10 g of metal M Note volume of gas collected after 5 minutes.  Repeat experiment with 10 g of metals W, X, Y and Z. Compare the volumes. Metal M gives the volume less than W, X, Y. Z gives the smallest volume.  (or any other appropriate experiment) like displacement	4
	(c)	(i) barium sulfate  (ii) iron (II) hydroxide	

		(iii) iron (III) hydroxide	
	(d)	Iron (II) sulfate, FeSO <sub>4</sub>	2
8	(a)	Dilute hydrochloric acid  Titration: Add acid into burette. Pipette 25.0 cm <sup>3</sup> of aqueous potassium carbonate into conical flask Add 3 drops indicator, methyl orange into flask Titrate acid with alkali till end point. Record volume of acid used. Repeat titration for accuracy  Crystallisation: Add 25.0 cm <sup>3</sup> of potassium carbonate and volume of acid found from titration into evaporating dish No indicator Evaporate to get saturated solution Cool to get crystallise Wash crystals with distilled water pat dry between filter paper	1  3m       2m
	(b)	Positive ions attract negative ions to form Strong ionic bond Lots of energy needed to break ionic bond	1  1
	(c)	Any insoluble salt eg, barium sulfate, silver chloride etc Reagents stated must be aqueous salts or one aqueous salt and one acid	1 1
9	(a)	(i) Fluorine higher than/more reactive than bromine in Group VII. Fluorine displaces bromine from its salt solution $2\text{KBr} + \text{F}_2 \longrightarrow 2\text{KF} + \text{Br}_2$  (ii) 	1  1       2
	(b)	(i) Rate of reaction from 0 to 4 min is 0.18 / 4 = 0.45 g/min Rate of reaction from 4 to 8 min is 0.12/4 = 0.03/min Rate of reaction from 8 to 12 min is 0.08/4 = 0.016/min Some form of calculations shown to show decrease in rate	1  1
		(ii) Molecules of limiting agent, HCl decreases Less effecting collisions per unit volume	1 1

(iii)

Following rate of reaction by measuring gas volume







2017 4E5N Science (Chemistry) Preliminary Examinations – Mark Scheme

(iv)	<p>Add 1 cm<sup>3</sup> of the of P into a clean test-tube.</p> <p>Add aqueous sodium hydroxide slowly, with shaking, until no further change is seen.</p>	<p>Light blue precipitate observed. Insoluble in excess.</p>	[1]
(v)	<p>Add 1 cm<sup>3</sup> of the of P into a clean test-tube.</p> <p>Add aqueous ammonia slowly, with shaking, until no further change is seen.</p>	<p>Light blue precipitate observed. Precipitate dissolves to form a deep blue solution.</p>	[1]
(d)	<p><u>Hydrogen ions</u> must be present because:</p> <p>-in (c)(i), hydrogen gas was evolved on reaction with metal <b>OR</b> -in (c)(ii) carbon dioxide gas was evolved on reaction with a carbonate. <i>Either observation for 1 mark.</i></p> <p>From (c)(iii), <u>chloride ions</u> must be present as a white precipitate was formed on reaction with silver nitrate.</p> <p><u>Copper(II) ions</u> must be present because:</p> <p>-in (c)(iv), the reaction with sodium hydroxide produces a light blue precipitate <b>OR</b> -in (c)(v), the reaction with aqueous ammonia produces a light blue precipitate which dissolves in excess to form a deep blue solution. <i>Either observation fro 1 mark.</i></p>	<p>[1]</p> <p>[1]</p> <p>[1]</p>	