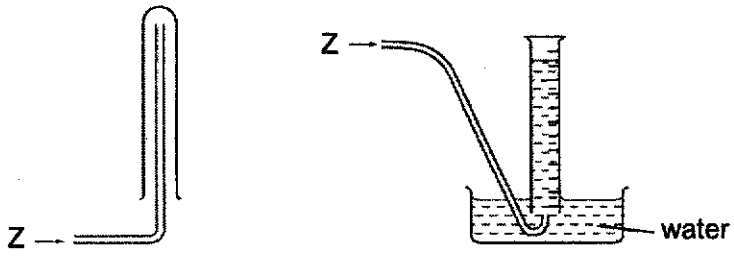
1 Two methods of collecting a gas Z are shown.



Which properties of gas Z are shown by these collection methods?

A Z is denser than air and is soluble in water.
B Z is denser than air and is insoluble in water.
C Z is less dense than air and is soluble in water.
D Z is less dense than air and is insoluble in water.

2 Methanol boils at 65 °C while ethanol boils at 78 °C.

Methanol and ethanol are completely miscible in each other.

Which method is used to separate a mixture of these two liquids?

A crystallisation
B evaporation
C fractional distillation
D paper chromatography

3 Which substance has particles that are close together but still able to move freely at room temperature?

	melting point/ °C	boiling point/ °C
A	-219	-180
B	-23	4
C	-20	77
D	44	280

4 Which compound contains three elements?

A aluminium nitrate
B ammonium sulfate
C potassium oxide
D sodium chloride

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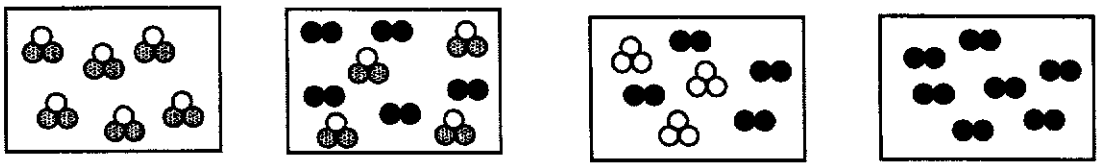
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5 Which of the following shows a mixture of a compound and an element?



A B C D

6 The table below shows the electronic configurations of 4 elements **V, W, X** and **Y** (not their chemical symbols).

Element	electronic configuration
V	2.1
W	2.7
X	2.8.8
Y	2.8.2

Which two elements will combine to form a ionic substance?

A **V** and **X**
B **V** and **Y**
C **W** and **X**
D **W** and **Y**

7 Which letter in the table represents a value of 0?

particle	relative charge	relative mass
electron	**A**	1/1840
neutron	**B**	1
proton	**C**	**D**

8 Four oxides are added separately to aqueous sodium hydroxide.

1	carbon dioxide
2	copper(II) oxide
3	lead(II) oxide
4	potassium oxide

Which oxide(s) react with aqueous sodium hydroxide?

A 1 only
B 1 and 3 only
C 2 and 4 only
D 2, 3 and 4

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9 Which ionic equation represents the neutralisation reaction between dilute nitric acid and aqueous sodium hydroxide?

A $Na^+ + NO_3^- \rightarrow NaNO_3$
B $Na^+ + H^+ \rightarrow H_2O$
C $Na^+ + HNO_3 \rightarrow Na^+ + H_2O$
D $H^+ + OH^- \rightarrow H_2O$

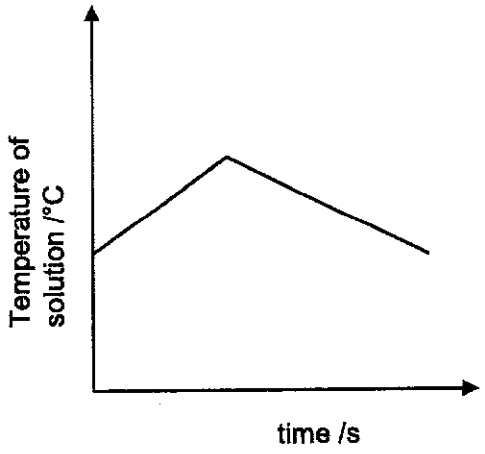
10 Which statement describes reduction?

A Electrons are gained and the oxygen atom is gained.
B Electrons are gained and the oxygen atom is lost.
C Electrons are lost and the oxygen atom is gained.
D Electrons are lost and the oxygen atom is lost.

11 Which process is an endothermic reaction?

A Combustion
B Freezing
C Photosynthesis
D Respiration

12 Two solutions are mixed together and the graph of the temperature of the solution over time is shown below.



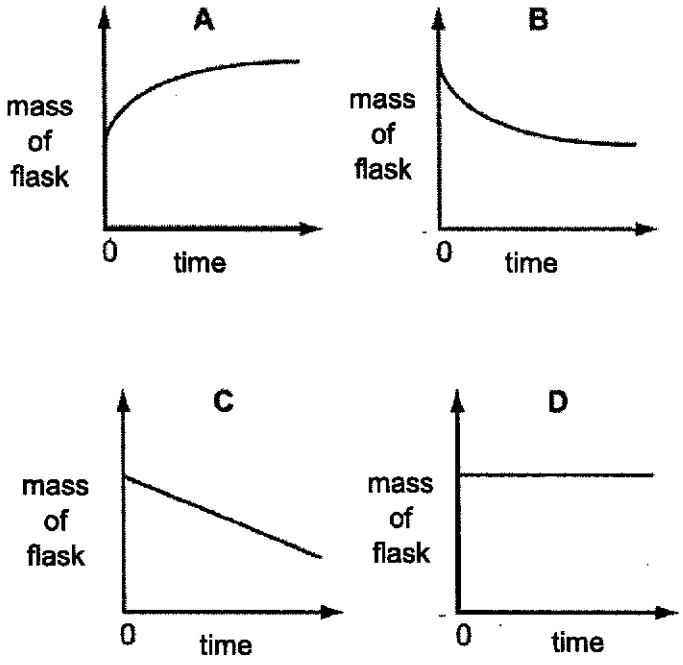
Which statement best describes the above reaction?

	type of reaction	energy change
A	endothermic	energy given out to surroundings
B	endothermic	energy taken in from surroundings
C	exothermic	energy given out to surroundings
D	exothermic	energy taken in from surroundings

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13 Which graph represents the change in mass of flask against time when a conical flask containing crystals of magnesium carbonate reacts with dilute sulfuric acid?



14 Which change in condition decreases the speed of reaction between copper(II) carbonate powder and dilute hydrochloric acid?

A Decreasing the volume of hydrochloric acid.
B Increase the concentration of hydrochloric acid.
C Increasing the temperature.
D Increasing the particle size of copper(II) carbonate.

15 Which solution of nitric acid have the highest concentration?

A 0.10 mol HNO_3 in 0.10 dm^3 of solution.
B 0.10 mol HNO_3 in 100 dm^3 of solution.
C 0.01 mol HNO_3 in 100 cm^3 of solution.
D 0.01 mol HNO_3 in 1000 cm^3 of solution.

16 Which of the following does **not** increase across a period of the Periodic Table?

A the number of electron shells
B the number of valence electrons
C the number of protons
D the nucleon number

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17 Three metals **S**, **T** and **U** were heated separately with the salts of four metals **N**, **P**, **Q** and **R** to find the order of reactivity.

The results are shown in the table.

metal	metal salt			
	N	P	Q	R
S	×	✓	×	✓
T	✓	✓	×	✓
U	×	✓	×	×

key

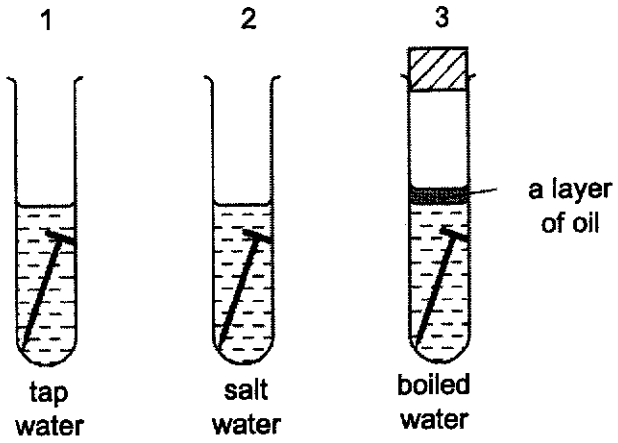
✓ = reaction observed

× = reaction not observed

What is the order of reactivity of the metals from the most reactive to the least reactive?

A S → T → U
B S → U → T
C T → S → U
D U → S → T

18 The diagram shows three experiments to investigate rusting.



In which test tube(s) will the iron nail rust?

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

19 Which statement is **not** a reason for recycling iron?

A Supply of raw metal ores on the earth is diminishing and limited.
B Extracting metals from ores is generally more expensive than recycling.
C Extraction of metal from metal ores requires fossil fuels which are finite.
D Recycling of metal always causes less pollution than extraction from ores.

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20 Dry air is a mixture of nitrogen, oxygen, noble gases and carbon dioxide.

What is the correct percentage of nitrogen, oxygen, noble gases and carbon dioxide in dry air?

A 1% nitrogen, 21 % oxygen, 78% noble gases and carbon dioxide
B 21% nitrogen, 78% oxygen, 1% noble gases and carbon dioxide
C 78% nitrogen, 1 % oxygen, 21 % noble gases and carbon dioxide
D 78% nitrogen, 21 % oxygen, 1 % noble gases and carbon dioxide

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West Spring Secondary School
PRELIMINARY EXAMINATION 2020

Science (Chemistry) **5076/03**

Paper 3 **5078/03**

Name _____ ( ) **Date** 28 Aug 2020

Class _____ **Duration:** 1 hr 15 min

Additional Materials: Laminated Periodic Table

READ THESE INSTRUCTIONS FIRST

Write your index number, class and name on all the work you hand in.
You may use a 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.
Write your answers in the spaces provided on the question paper.

Section B
Answer **both** questions.
Write your answers in the spaces provided on the question paper.

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

FOR EXAMINER'S USE	
Section A	/45
Section B	/20
Total	/65

This document consists of **10** printed pages including this cover page.

Setter Mdm Aishah **[Turn over**

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Section A

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

1 The properties of a substance make it suitable for particular tasks. Complete Table 1.1 by using a suitable substance for each of the tasks shown.

Table 1.1

task	substance needed
to test for the reducing property of sulfur dioxide	
to lower the acidity of soil	
to test the pH of a solution	

[3]

2 Chlorine and fluorine are found in Group VII of the Periodic Table. They show trends in physical properties and similarities in chemical properties.

(a) State the term used to describe the Group VII elements.

.....[1]

(b) Briefly describe one trend in physical property down the group mentioned in **(a)**.

.....

.....[1]

(c) Briefly describe one chemical property of the group mentioned in **(a)**.

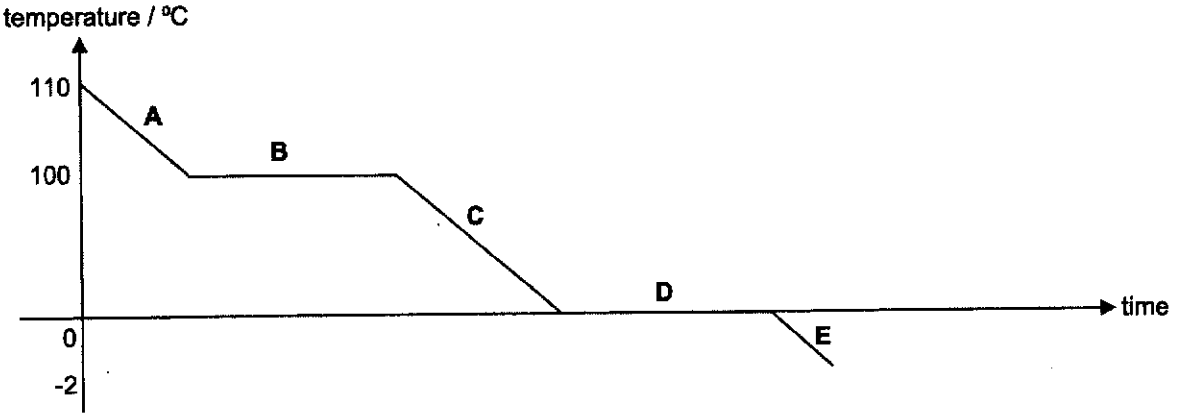
.....

.....[1]

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3 The graph below shows the cooling curve of water, H_2O.



(a) Which region **A**, **B**, **C**, **D** or **E** shows that the particles of water move the fastest? Explain your answer.

.....[2]

(b) Describe and explain the change in movement of the particles of water at region **D**.

.....

.....

.....

.....[3]

(c) State and explain whether this sample of water is pure.

.....[1]

(d) Draw the arrangement of the particles of water at region **C**.

[1]

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4 Table 4.1 lists the number of protons, neutrons and electrons in several different particles.

Table 4.1

particle (not chemical symbols)	number of protons	number of electrons	number of neutrons
F	3	2	4
G	5	5	6
H	8	8	8
I	8	8	9
J	9	10	10
K	10	10	20

Which of the following particles, **F**, **G**, **H**, **I**, **J** and **K** in Table 4.1, fit each of the following descriptions?

(a) an atom with 3 valence electrons .....

(b) an atom of a noble gas .....

(c) an ion of a non-metal .....

(d) atoms of isotopes of the same element ..... and .....

(e) a positive ion .....

[5]

5 The equation below shows a redox reaction.

$$3MnO_2 + 4Al \rightarrow 3Mn + 2Al_2O_3$$

(a) State which substance has been reduced. Explain your answer in terms of **oxidation state.**

.....

.....[2]

(b) State which substance is the oxidising agent. Explain your answer.

.....

.....[2]

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6 Carbon monoxide can be produced through the incomplete combustion of carbon containing compounds as shown in the equation below:

$$4CH_4(g) + 5O_2(g) \rightarrow 2CO(g) + 8H_2O(g) + 2C(s)$$

(a) If 500cm^3 of water vapour (H_2O) was obtained in this reaction, calculate the volume of carbon monoxide produced at room temperature and pressure.

[2]

(b) The carbon monoxide produced is an air pollutant.

(i) State one effect of carbon monoxide on human health.

.....

.....[1]

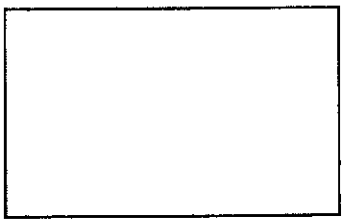
(ii) Name another air pollutant and state its effect on the environment.

.....

.....[2]

7 Steel is an alloy that contains 30% carbon and 70% iron. The two metals are mixed to increase the strength of the materials for daily uses.

Explain, with the aid of a labelled diagram, why steel is stronger than pure iron.



structure of steel

.....

.....

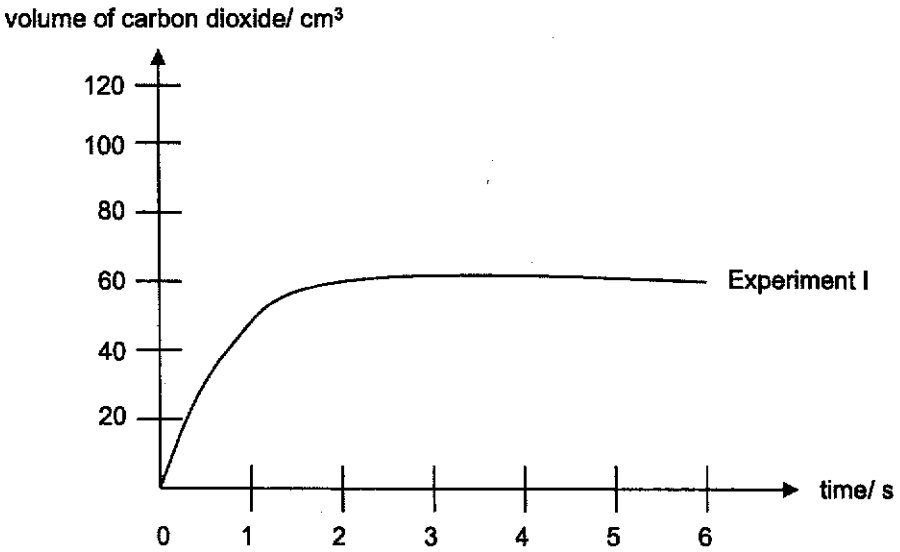
.....

.....[3]

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8 In Experiment I, 5.0 g of calcium carbonate powder is reacted with 3.0 mol/dm^3 excess dilute hydrochloric acid at room temperature and pressure. The following shows the volume of carbon dioxide gas produced over time.



(a) Write a balanced chemical equation, with state symbols, for the reaction between calcium carbonate and hydrochloric acid.

.....[2]

(b) Two other reactions were carried out under the same conditions as Experiment I except the following:

Experiment II	1.5 mol/dm^3 excess dilute hydrochloric acid
Experiment III	10.0 g of calcium carbonate powder

Sketch the graphs for Experiment II and Experiment III on the same axes above.
Label your graphs clearly.

[2]

(c) Explain, in terms of collision between particles, the graph that you have drawn for Experiment II.

.....

.....

.....[3]

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9 Figure 9 describes the reactions between a metal, **L**, with a colourless solution, **M**.

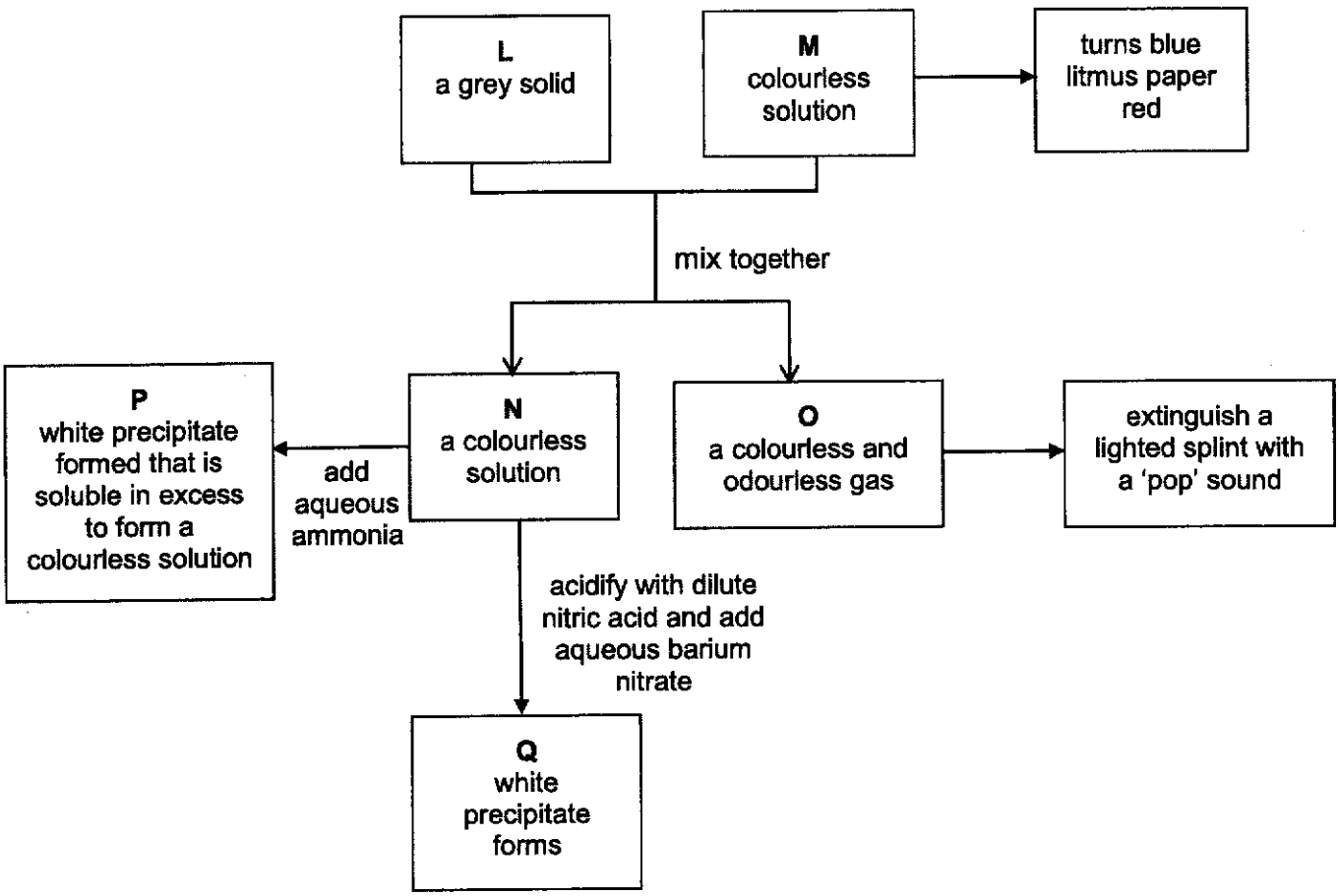


Fig. 9

(a) Suggest the identities of **L**, **M**, **N**, **O**, **P** and **Q**.

L .....

M .....

N .....

O .....

P .....

Q .....

[6]

(b) Write a balanced chemical equation for any **one** of the reactions in Fig. 9.

.....[2]

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Section B

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

10 **(a)** Sodium chloride is a common salt used in our daily lives. We can prepare it in the laboratory by reacting two aqueous solutions together.

Explain why it is not advisable to react sodium metal with hydrochloric acid.

.....[1]

(b) Sodium chloride is also used in the making of insoluble salts such as lead(II) chloride.

(i) Name another reagent that can be used to prepare lead(II) chloride from sodium chloride solution.

.....[1]

(ii) Name the method used to prepare lead(II) chloride from sodium chloride and the reagent mentioned in **b(i)**. List the steps required to prepare lead(II) chloride.

.....

.....

.....

.....[3]

(c) Sodium chloride has a high melting point and is a conductor of electricity when molten.

(i) Explain why sodium chloride has a high melting point.

.....

.....[2]

(ii) Draw a 'dot-and-cross' diagram to show the arrangement of electrons in sodium chloride in the space provided below. You may show the outer shell electrons only.

[Proton numbers: Na, 11; C*l*, 17]

[2]

(iii) Explain why molten sodium chloride can conduct electricity.

.....[1]

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11 Iron is produced in a blast furnace by heating a mixture of its ore, iron(III) oxide, coke and limestone with hot air.

(a) What is the common name of the iron ore?

.....[1]

(b) In the blast furnace, limestone is used to remove acidic impurities from the iron.

Explain how limestone does this. You must include suitable chemical equations in your answer.

.....

.....

.....

.....

.....

.....[4]

(c) The following equation represents the production of iron in the blast furnace.

$$Fe_2O_3 + 3CO \rightarrow 3CO_2 + 2Fe$$

(i) Calculate the number of moles of 3500 g of iron.

[Relative atomic masses: A_r : O, 16; Fe, 56.]

..... moles [1]

(ii) Calculate the mass in grams of iron(III) oxide required in producing 3500g of iron.

[Relative atomic masses: A_r : C, 12; O, 16; Fe, 56.]

mass of iron(III) oxide:.....g [2]

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(d) Iron is extracted from its oxide by reducing it with carbon. Magnesium, on the other hand, cannot. Explain why magnesium cannot be reduced from its oxide using carbon and state how magnesium is extracted instead.

.....

.....

.....[2]

END OF PAPER

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SCIENCE(CHEMISTRY)

Secondary 4EXP / 5NA

MARKING SCHEME FOR P1

1	2	3	4	5	6	7	8	9	10
D	C	C	A	B	D	B	B	D	B

11	12	13	14	15	16	17	18	19	20
C	C	B	D	A	A	C	B	B	D

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WSSS PRELIMS 2020

SCIENCE(CHEMISTRY)

Secondary 4EXP / 5NA

MARKING SCHEME FOR P3

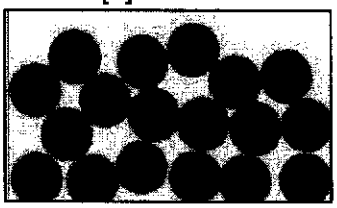
<table>
<tr><th>Q</th><th>Suggested Answers</th><th>REMARKS</th></tr>
<tr><td></td><td>Section A</td><td></td></tr>
<tr><td>1</td><td>
<table>
<tr><th>task</th><th>substance needed</th></tr>
<tr><td>to test for the reducing property of sulfur dioxide</td><td>potassium manganate (VII)</td></tr>
<tr><td>to lower the acidity of soil</td><td>calcium oxide / calcium hydroxide</td></tr>
<tr><td>to test the pH of a solution</td><td>universal indicator</td></tr>
</table>
</td><td>CAO
1 mark each
Total – 3 marks</td></tr>
<tr><td>2</td><td>(a) Halogens [1]

(b) Melting and boiling points increases down the group. / Colour become darker as you go down the group. Any one [1]

(c) A more reactive halogen is able to displace a less reactive halogen from its salt solution. (Halogens undergo displacement reactions.)
Forms an ionic compound with a metal.
Form covalent compound with another non-metal.
Any one [1]</td><td>Total – 3 marks</td></tr>
</table>

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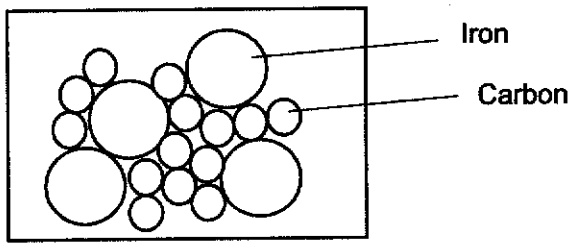
3	**(a)** Region **A.** [1] At this region, the particles are in **gaseous** state. [1] **(b)** At region D, particles are **sliding over each other** [1]. As they **loses kinetic energy** [1], the particles slow down and eventually **vibrate at fixed position** [1]. **(c)** This sample of water is **pure** as its **boiling point is fixed/constant at 100 °C/melting point is fixed at 0 °C.** [1] **(d)** At least 3 rows of particles. Particles must be touching each other but in random positions. [1] 	Total – 7 marks
4	**(a)** G **(b)** K **(c)** J **(d)** H and I **(e)** F	**CAO** 1 mark each Total – 5 marks
5	**(a)** MnO_2 has been reduced [1] the oxidation state of Mn decreases from +2 to 0 in Mn. [1] **(b)** MnO_2 is the oxidising agent [1] as it causes *Al* to gain oxygen to form Al_2O_3 (*Al* oxidation state increases from 0 to +3), hence, *Al* is oxidised. But itself is reduced.[1]	**CAO** Total – 4 marks

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<table>
<tr>
<td>6</td>
<td>
(a) Vol of H_2O = 500/1000 = 0.5 dm^3
Mole ratio,
CO : H_2O [1]
2 : 8
Hence, vol of CO = 2/8 * 0.5 = 0.125 dm^3 / 125 cm^3 [1]

(b) (i) Reduces ability of haemoglobin to carry oxygen to different parts of the body. [1]

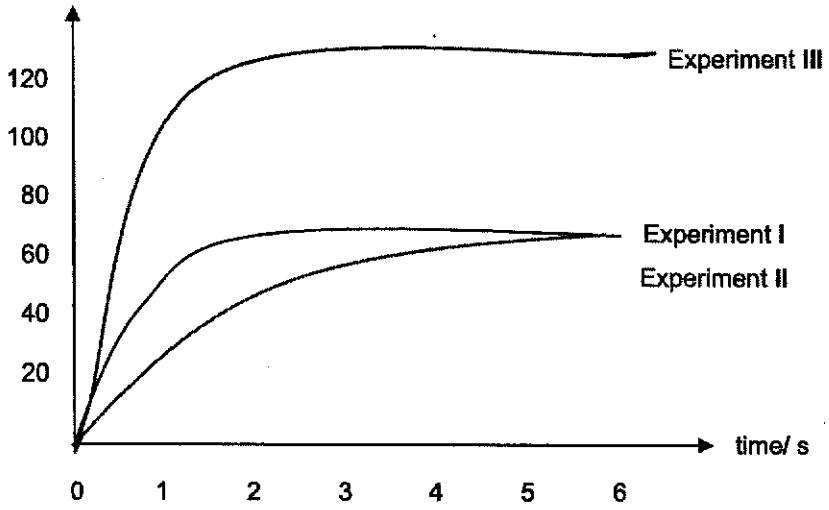
(c)
<table>
<tr><th>pollutant</th><th>effect</th></tr>
<tr><td>Sulfur dioxide</td><td>Combines with oxygen and rainwater to form acid rain, which corrodes buildings and harms aquatic life and plants</td></tr>
<tr><td>Oxides of nitrogen</td><td>Combines with oxygen and rainwater to form acid rain, which corrodes buildings and harms aquatic life and plants</td></tr>
<tr><td colspan="2">Any one [1 mark name of pollutant, 1 mark for correct effect]</td></tr>
</table>
</td>
<td>CAO
Total – 5 marks</td>
</tr>
<tr>
<td>7</td>
<td>
Steel is made up of atoms of two different sizes. The bigger atoms <u>disrupt</u> [1] the systematic arrangement and therefore, <u>prevents the atoms from sliding</u> [1] over one another.



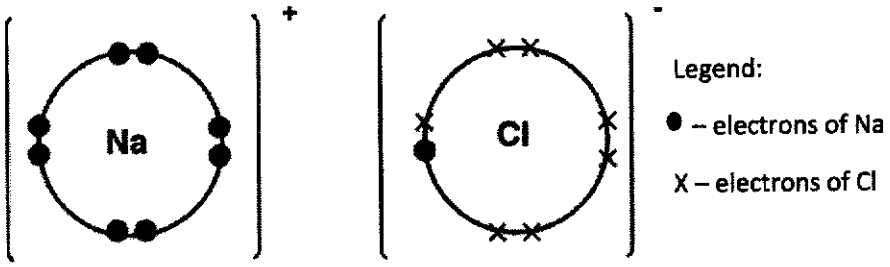
</td>
<td>
• Atoms must be of 2 different sizes.
• Atoms must be close together (touching)
• Atoms must be in random position (not regular pattern)

Total – 3 marks
1 mark for drawing
</td>
</tr>
</table>

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8	**(a)** $CaCO_3$ (s) + 2HCl (aq) → $CaCl_2$ (aq)+ CO_2 (g) + H_2O (l) [2] - 1 mark correct chemical equations - 1 mark balancing + state symbols **(b)** volume of hydrogen/ cm^3  **(c)** In experiment II, the concentration of nitric acid decreases. As such, there are **lesser particles in a given volume [1]** and hence there are lesser collision. As a result, the **frequency of effective collisions decreases** [1] and therefore the **speed of reaction decreases**.[1]	Total – 7 marks Graphs must be labelled. No label -1 [2]
9	**(a)** **L:** zinc **M:** sulfuric acid **N:** zinc sulfate **O:** hydrogen gas **P:** zinc hydroxide **Q:** barium sulfate **(b)** $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2O$ $ZnSO_4 + Ba(NO_3)_2 \rightarrow Zn(NO_3)_2 + BaSO_4$ $ZnSO_4 + 2NH_4OH \rightarrow Zn(OH)_2 + (NH_4)_2SO4$ **Any one** 2 marks for balanced equation	Total – 8 marks

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	Section B	
10	**(a)** Sodium is **a very reactive metal,** hence it is dangerous to add sodium metal to acid in the lab as it may cause an explosion. [1] **(b) (i)** lead(II) nitrate [1] **(ii)** Precipitation [1]. 1. Add roughly equal volumes of sodium chloride solution to a beaker containing roughly an equal volume of lead(II) nitrate solution. 2. Stir and filter the mixture. [1] 3. Wash the residue/precipitate with cold distilled water. 4. Leave the salt to pat dry between sheets of filter paper. [1] If wrong reactants are mentioned, to allow ecf from **b(i)**. **(c) (i)** The sodium and chloride ion in sodium chloride **are held together by strong electrostatic forces of attraction.**[1] Hence, **a lot of energy** is needed to overcome it. [1] **(ii)** [2] 1 mark for Na ion, 1 mark for Cl ion, 1 mark for charges  **(iii)** In molten state, sodium chloride has **free moving ions.** [1]	Total – 10 marks
11	**(a)** Hematite [1] **(b)** Limestone **decomposes** on heating to form calcium oxide and carbon dioxide. [1] $CaCO_3 \rightarrow CaO + CO_2$ [1] Calcium oxide is a basic oxide, which reacts with **acidic impurities to form slag**. [1] $SiO_2 + CaO \rightarrow CaSiO_3$ [1]	Total – 10 marks

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	(c) (i) M_r of iron(III) oxide = (56 x 2) + (16 x3) = **160** no of mol of Fe = 3500/56 = 62.5 [1] **(ii)** Mole ratio; **Fe_2O_3 : Fe** **1: 2** [1] No. of mole of Fe_2O_3 = 1/2 x 62.5 = 31.25mol Mass of Fe_2O_3 = 31.25 x 160 = **5000g** [1] **(d)** Magnesium is a **more reactive metal**. Hence, carbon is not able to reduce it.[1] Instead, magnesium is extracted by **electrolysis**.[1]	

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