



Established in 1879

Raffles Girls' School

(SECONDARY)

Name: _____

Class: 4 /

Register No: _____

CHEMISTRY RAFFLES PROGRAMME YEAR FOUR

Pen-and-Paper Assessment 1

Tuesday

2 April 2019

1 hour

INSTRUCTIONS TO CANDIDATES

This question paper contains two sections.

Section A - Answer **ALL** the questions and record your answers on the OMR answer sheet.

Section B - Answer **ALL** the questions and write your answers in the spaces provided.

Use only a black or dark blue pen.

Do not use correction tape or fluid.

Omission of essential working or units, or expressing answers with incorrect significant figures will result in a loss of marks.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets [] at the end of each question or part question. The total number of marks for this paper is 40.

A copy of the Periodic Table on page 12 is provided for your reference.

The weightage for this paper is 20%

For examiners' use

Section / Question	Marks Obtained
A	10
B1	9
B2	10
B3	11
Working Statement	
Units	
Significant Figures	
Total marks	40

Parents's / Guardian's Name: _____

Signature: _____

Date: _____

Section A – Multiple Choice Questions [10 marks]

There are 10 questions in this section. Answer all questions. For each question, there are four possible answers (A, B, C, and D). Choose the most appropriate answer and record your choice on the OMR answer sheet.

1. Which of the following is unlikely to react with aqueous sodium hydroxide?

- A carbon dioxide
- B phosphorus(V) oxide
- C zinc oxide
- D copper(II) oxide

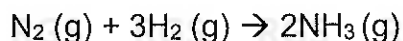
2. Which gas does not change the colour of litmus paper?

- A ammonia
- B carbon monoxide
- C chlorine
- D sulfur dioxide

3. Which of the following contain the greatest number of ions?

- A 2.0 mol of $\text{Al}_2(\text{SO}_4)_3$
- B 3.0 mol of FeCl_3
- C 4.0 mol of $\text{C}_6\text{H}_{12}\text{O}_6$
- D 5.0 mol of NH_4NO_3

4. 7 kg of nitrogen was reacted with 4 kg of hydrogen. 4kg of ammonia was produced. What is the percentage yield for this reaction?



- A 17.6 %
- B 35.3 %
- C 47.1 %
- D 94.2 %

5. Which of the following salts cannot be prepared by titration?

- A ammonium nitrate
- B sodium sulfate
- C potassium chloride
- D zinc nitrate

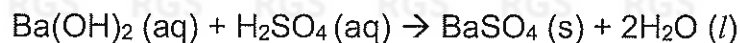
6. The table below shows the results of some tests on separate samples of a colourless solution.

test	observation
Add aqueous sodium hydroxide dropwise until no change is observed.	No precipitate is formed. A colourless and pungent gas is evolved which turns moist red litmus paper blue when the mixture is warmed.
Add 1-2 drops of silver nitrate solution to the sample	White precipitate is formed.

What could be the colourless solution?

- A aluminium nitrate
- B ammonium nitrate
- C aluminium chloride
- D ammonium chloride

7. Dilute sulfuric acid is slowly added to a beaker of aqueous barium hydroxide till excess.



The electrical conductivity of the reacting solution is measured. Which of the following correctly shows the change(s) in electrical conductivity in this reaction?

- A It increases.
- B It decreases.
- C It increases and then decreases.
- D It decreases and then increases.

8. Which of the following is a redox reaction?

- A $\text{NaOH} + \text{HCl} \rightarrow \text{NaCl} + \text{H}_2\text{O}$
- B $\text{FeCl}_3 + 3\text{NaOH} \rightarrow \text{Fe}(\text{OH})_3 + 3\text{NaCl}$
- C $2\text{Na}_2\text{CrO}_4 + 2\text{HCl} \rightarrow \text{Na}_2\text{Cr}_2\text{O}_7 + 2\text{NaCl} + \text{H}_2\text{O}$
- D $2\text{SO}_2 + \text{O}_2 \rightarrow 2\text{SO}_3$

9. Study the following statements about **P**, **Q**, **R** and **S**.

- Carbonate of **S** decomposes to form a compound and a gas only
- Only oxides of **P** and **R** can be reduced by heating with carbon
- **P** and **Q** react with dilute hydrochloric acid but not with cold water
- **R** does not react with dilute hydrochloric acid nor water

The order of increasing reactivity of the four metals is most likely to be

- A $\text{R} < \text{P} < \text{Q} < \text{S}$
- B $\text{R} < \text{S} < \text{P} < \text{Q}$
- C $\text{S} < \text{Q} < \text{P} < \text{R}$
- D $\text{S} < \text{R} < \text{P} < \text{Q}$

10. A sample of flue gas from the power station is bubbled into different solutions and the results are shown in the table.

solution	observation
acidified potassium manganate (VII)	purple solution turns colourless
acidified potassium iodide	colourless solution turns brown
red litmus solution	turns blue
blue litmus solution	turns red

Which are the possible gases present in the sample?

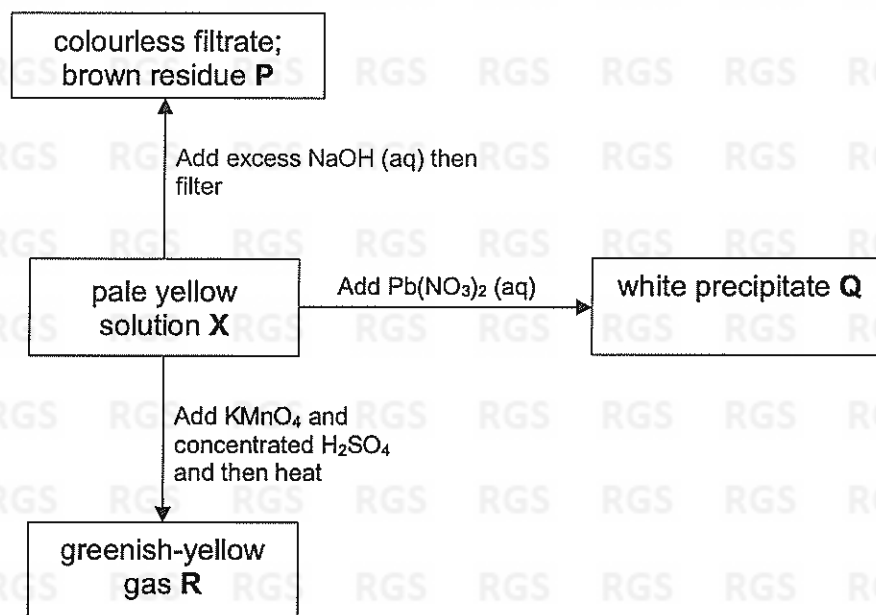
- A sulfur dioxide gas and nitrogen monoxide gas
- B Nitrogen dioxide gas, hydrogen gas and carbon monoxide gas
- C ammonia gas, sulfur dioxide gas and nitrogen dioxide gas
- D ammonia gas, nitrogen monoxide gas and oxygen gas

----- End of Section A -----

Section B (30 Marks)

Answer **ALL** questions and write your answers in the spaces provided.

B1 Solution **X** contains a cation and an anion.



(a) Based on the data given in the scheme above, identify the following substances.

(i) **P** _____

(ii) **Q** _____

(iii) **R** _____

(iv) **X** _____

[4]

(b) Describe a test that may be used to confirm the presence of gas **R**.

[1]

(c) Write an ionic equation for the reaction that formed **Q**.

[2]

- (d) State one observation, if any, when aqueous potassium iodide is added to solution **X**.

[1]

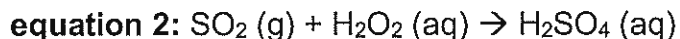
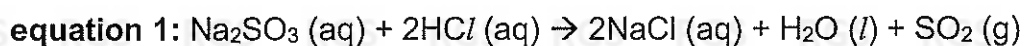
- (e) State one observation, if any, when acidified potassium manganate(VII) solution is added to solution **R**.

[1]

B2 Sodium sulfite is a preservative found in foods and beverages.

A student carried out an experiment to determine the mass of sulfites present in a sample of chicken sausages.

The sulfites present in 5g sample of chicken sausages were extracted and reacted with excess hydrochloric acid as shown in **equation 1**. Sulfur dioxide gas produced was bubbled into a solution of hydrogen peroxide to produce sulfuric acid as shown in **equation 2**.



The amount of sulfuric acid produced in **equation 2** could then be quantitatively determined by titrating with 1.00 g/dm^3 of sodium hydroxide.

The following results were obtained:

	titration 1	titration 2	titration 3
final burette reading/ cm^3	22.00	43.80	25.40
initial burette reading/ cm^3	0.00	22.30	3.80
volume of NaOH used/ cm^3	22.00		

- (a) Complete the table above.

[1]

- (b) Write a balanced chemical equation, with state symbols, for the reaction of sulfuric acid with sodium hydroxide.

_____ [2]

- (c) Calculate the number of moles of sodium hydroxide that was used to react with the sulfuric acid.

[2]

- (d) Calculate the number of moles of sulfuric acid produced in **equation 2**.

[1]

- (e) Calculate the volume of sulfur dioxide produced in **equation 1** at room temperature and pressure.

[1]

(f) Calculate the mass of sodium sulfite present in 5 g of chicken sausages.

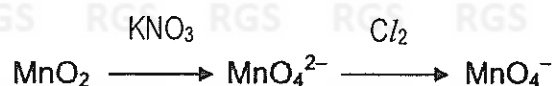
[1]

(g) Given that maximum permissible limit is 500 mg/kg of sodium sulfite in sausages, determine if the sausage sample the student used is suitable for consumption. Show your working.

[2]

- B3 (a)** A student on a field trip at the sea shore found sea shells which had purple markings on their inner surfaces. The inner surfaces were scraped and the scrapings were heated gently and they turned black. The substance was suspected to be manganese(IV) oxide.

Some reactions of manganese(IV) oxide are shown below.



- (i) Find the oxidation numbers of manganese in these compounds or ions.

MnO_4^{2-} : _____

[1]

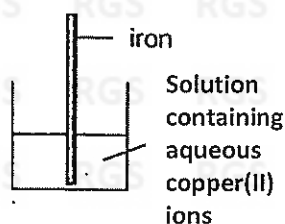
MnO_4^- : _____

[1]

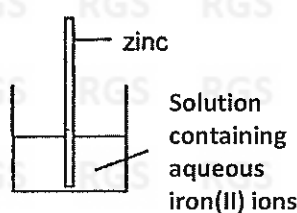
- (ii) State and explain, in terms of oxidation number, the role of aqueous chlorine in the reaction.

_____ [2]

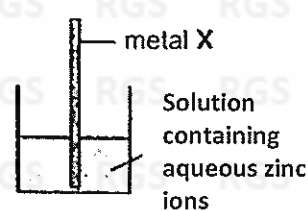
- (b) A student investigated the reactivity of four metals, namely iron, copper, zinc and metal X as shown in the set-ups below.



experiment 1



experiment 2



experiment 3

- (i) Describe and explain two changes that the student would have seen in **experiment 1**.

[3]

- (ii) The student observed that a reaction had happened in **experiment 1** and **2**, but not in **experiment 3**. Arrange the four metals in order of increasing reactivity.

[1]

- (iii) The student conducted another experiment using metal **Y** in a solution containing Zn^{2+} ions.

He recorded the observations as follows:

"A grey deposit was formed on metal Y. No efferverscence was observed."

Suggest an identity for metal **Y**.

[1]

- (iv) From the identity suggested in **b(iii)**, state and explain how the students can find out if there is any remaining Zn^{2+} ions in the solution.

[2]

— End of Section B —

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	2 He helium 4
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium -	85 At astatine -	86 Rn radon -
87 Fr francium -	88 Ra radium -	89-103 actinoids	104 Rf rutherfordium -	105 Db dubnium -	106 Sg seaborgium -	107 Bh bohrium -	108 Hs hassium -	109 Mt meitnerium -	110 Ds darmstadtium -	111 Rg roentgenium -	112 Cn copernicium -	114 Fl flerovium -	116 Lv livermorium -	117 Ts tennessine -	118 Og oganesson -	119 Uue unbinilium -	120 Uuh ununilium -

Key

proton (atomic) number
atomic symbol
name
relative atomic mass

1
H
hydrogen
1

lanthanoids

actinoids

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium -	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium -	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium -	94 Pu plutonium -	95 Am americium -	96 Cm curium -	97 Bk berkelium -	98 Cf californium -	99 Es einsteinium -	100 Fm fermium -	101 Md mendelevium -	102 No nobelium -	103 Lr lawrencium -

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