Class | Adm No

Candidate Name: _____

Shift
Laboratory

2019 Preliminary Exams
Pre-University 3

H2 CHEMISTRY **9729/04**

Paper 4 Practical **4th Sept 2019**

2 hour 30 mins

Candidates answer on the Question paper.

READ THESE INSTRUCTIONS FIRST

Do not turn over this question paper until you are told to do so

Write your name, class and admission 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, glue or correction fluid.

Answer **all** questions in the spaces provided on the Question Paper.

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.

Qualitative Analysis Notes are printed at the back of the Question Paper.

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.

Question	1	2	3	4	Total
Marks	/18	/22	/9	/6	/55

For Examiners' Use

1 Determination of titration value at equivalence point

The reaction between acid and carbonates is well known. In the presence of excess acid, the following reaction occurs:

$CO_3^{2-}(aq) + H^+(aq) \rightleftharpoons HCO_3^-(aq)$ $\quad pK_a(HCO_3^-) = 10.32$ **equation 1**

$HCO_3^-(aq) + H^+(aq) \rightleftharpoons H_2CO_3(aq)$ $\quad pK_a(H_2CO_3) = 6.37$ **equation 2**

$H_2CO_3(aq) \rightleftharpoons CO_2(aq) + H_2O(l)$ **equation 3**

$CO_2(aq)$ is then released from the solution as $CO_2(g)$, which is observed as effervescence. The entire reaction is known to release heat.

FA 1 is 1.8 mol dm^{-3} of aqueous potassium carbonate, K_2CO_3.
FA 2 is nitric acid, HNO_3, of concentration between 1.9–2.1 mol dm^{-3}.

Assuming that the first equivalent of H^+ fully reacts with CO_3^{2-} before reacting with the HCO_3^- produced, the reaction between **FA 1** and the first equivalent of **FA 2** can be simplified as:

$$CO_3^{2-}(aq) + H^+(aq) \rightarrow HCO_3^-(aq) \qquad \Delta H_{rxn}$$

And the reaction between **FA 1** and the second equivalent of **FA 2** can be simplified as:

$$HCO_3^-(aq) + H^+(aq) \rightarrow H_2CO_3(aq)$$

As the precise concentration of **FA 2** is unknown, determination of ΔH_{rxn} can be done using a thermometric titration to simultaneously determine both the concentration of **FA 2** as well as ΔH_{rxn}. Thermometric titration is a technique whereby equivalence points of a reaction can be located by observing temperature changes, hence eliminating the need for an indicator.

In **1(a)**, you will perform an acid-carbonate thermometric titration. The data from this titration will be used to determine:

- the titration value at the first equivalence point, V_{eq1},
- the precise concentration of **FA 2**, $[HNO_3]$,
- the maximum temperature change, ΔT_{max},
- the enthalpy change of reaction, ΔH_{rxn}.

(a) (i) 25.0 cm^3 of **FA 1** is reacted with **FA 2**.

Calculate the **theoretical volume of** FA 2 needed for the first equivalence point, V_{eq1}', and the second equivalence point, V_{eq2}', of the reaction between **FA 1** and **FA 2**. Assume $[HNO_3]$ to be 2.0 mol dm^{-3}.

Amount of K_2CO_3 reacted = $1.8 \times 25.0 \times 10^{-3} = 0.045$ mol
Amount of H^+ for first equivalence point = 0.045 mol
$V_{eq1}' = \frac{0.045}{2.0} = 0.0225\ dm^3 = 22.5\ cm^3$ **M1**
$V_{eq2}' = 22.5 \times 2 = 45.0\ cm^3$ **M2**

V_{eq1}' = ... cm^3

V_{eq2}' = ... cm^3

[2]

For Examiners' Use

Determination of V_{eq1} and ΔH_{rxn} using thermometric titration

For this experiment, you will need to measure the **maximum temperature** of the reaction mixture when specified volumes of **FA 2** have been added to **FA 1**.

In an appropriate format in the space provided below, prepare a table to record your results. Record all values of temperature, *T*, to 0.1°C, and each total volume of **FA 2** added.

Note: You should aim to perform each subsequent addition of **FA 2** quickly.

1. Fill a burette with **FA 2**.
2. Using a pipette, transfer 25.0 cm^3 of **FA 1** into a Styrofoam cup. Place this cup inside a second Styrofoam cup, which is placed in a 250 cm^3 glass beaker.
3. Stir and measure the temperature of this **FA 1**. Record this temperature.
4. Add 4.00 cm^3 of **FA 2** from the burette to the **FA 1** in the Styrofoam cup.
5. Using the thermometer, stir the mixture thoroughly and record the maximum temperature reached and the volume of **FA 2** added.
6. Repeat steps **4** and **5** until a total volume of 48.00 cm^3 of **FA 2** has been added.

Results

Vol of **FA 2** added / cm^3	Maximum T / °C
0.00	32.7
4.00	33.7
8.00	34.5
12.00	35.0
16.00	35.4
20.00	35.6
24.00	35.6
28.00	35.4
32.00	35.2
36.00	35.0
40.00	34.7
44.00	34.5
48.00	34.2

[2]

(ii) Plot a graph of temperature, *T*, on the *y*-axis, against volume of **FA 2** added, on the *x*-axis on the grid in **Fig. 1.1**.

For Examiners' Use

The temperature axis should allow you to include a point at least 1.0 °C greater than the maximum temperature recorded.

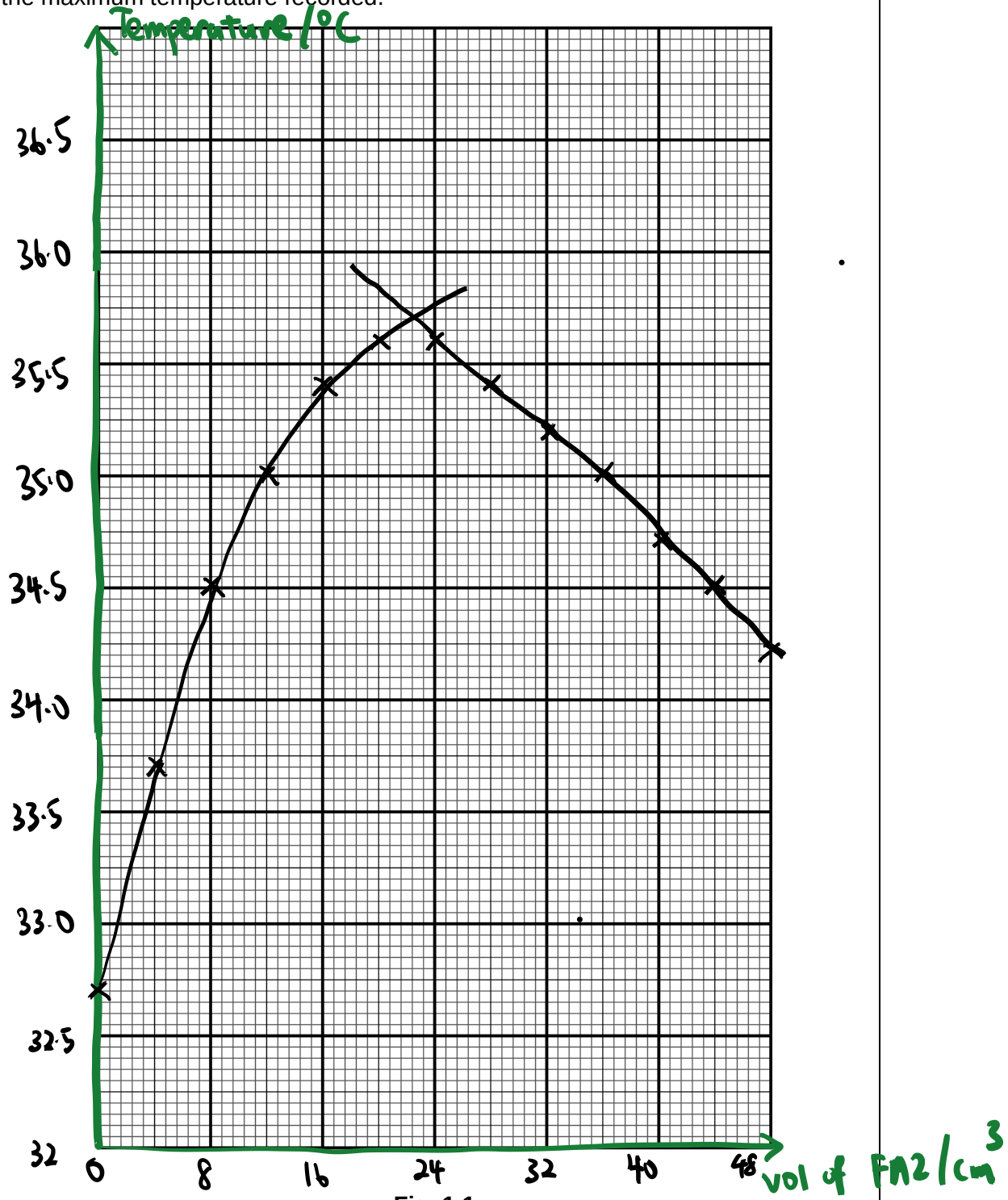


Fig. 1.1

Draw **two** most appropriate best-fit lines in **Fig. 1.1**, taking into account all of your plotted points. Extrapolate (extend) these two best-fit lines until they cross each other. [3]

For Examiners' Use

(iii) From your graph in **Fig. 1.1**, determine:

- the titre at equivalence point, V_{eq},
- the maximum temperature reached, T_{max},
- the maximum temperature change, ΔT_{max}.

On your graph, show clearly how you obtained these values.

ΔT_{max} = 35.7 – 32.7 = 3.0 °C

V_{eq1} = 22.40 cm^3

T_{max} = 35.7 °C

ΔT_{max} = 3.0 °C

[3]

(iv) Determine the concentration of HNO_3, [HNO_3], in **FA 2**.

Amount of K_2CO_3 reacted = 1.8 x 25.0 x 10^{-3} = 0.045 mol

Amount of HNO_3 reacted at V_{eq1} = 0.045 mol

[NaOH] = $\frac{0.045}{22.40\times10^{-3}}$ = 2.01 mol dm^{-3} (3sf)

[HNO_3] in **FA 2** = ... [1]

(v) Determine the enthalpy change of reaction, ΔH_{rxn}.

$$CO_3^{2-}(aq) + H^+(aq) \rightarrow HCO_3^-(aq) \qquad \Delta H_{rxn}$$

Assume that the reaction mixture has a density of 1.00 g cm^{-3} and a specific heat capacity, c, of 4.18 J g^{-1} K^{-1}.

m = 25.0 + 22.40 = 47.4 g

q = mcΔT = (47.4)(4.18)(3) = 594.4 J

$\Delta H_{rxn} = -\frac{q}{n_{LR}} \times \text{CLR} = -\frac{594.4}{0.045} \times 1$ = –13.2 kJ mol^{-1} (3 sf)

ΔH_{rxn} = ... [3]

For Examiners' Use

(b) **(i)** With reference to your graph in **Fig. 1.1**, explain why the titre at second equivalence point, V_{eq2}, cannot be determined from this experiment.

The temperature does not increase / reaction is not exothermic for **equation 2**.

OR There is only one intersection point

OWTTE

[1]

(ii) Suggest, using chemistry concepts, a possible explanation for the observation in **(b)(i)**.

Equation 2 is not exothermic / the temperature does not increase as **equation 3** could be endothermic.

or

pK_a(H_2CO_3) is small compared to pK_a(HCO_3^-) and the energy released from the reaction is used to complete the reaction.

[1]

(iii) The value of V_{eq1} could also have been determined via a regular acid-base titration with a suitable indicator.

Suggest which titration method is likely to give a more accurate value of V_{eq1} and give two reasons for why this is so.

Method:

Accept any reasonable answer for both

Regular titration: heat loss to surroundings does not affect value of V_{eq1} unlike thermometric method; The first equivalent of H^+ fully reacts with CO_3^{2-} before reacting with HCO_3^- may not be true.

Thermometric titration: does not require use of indicator which may affect pH of solution and end point may not match exactly with equivalence point [2]

[Total: 18]

For Examiners' Use

2 Investigation of the kinetics of an acid-carbonate reaction via gravimetric analysis

FA 1 is 1.8 mol dm^{-3} of K_2CO_3.
FA 3 is dilute nitric acid, HNO_3, of concentration 1.0 mol dm^{-3}.

$$K_2CO_3 + 2HNO_3 \rightarrow 2KNO_3 + CO_2 + H_2O$$

The rate equation of the reaction between **FA 1** and **FA 3** is expressed as such:

$$\text{Rate} = k[K_2CO_3]^a[H^+]$$

where *a* represents the order of reaction with respect to K_2CO_3, and is an integer value of either 0, 1, or 2.

The acid-carbonate reaction results in the release of $CO_2(g)$, which escapes the reaction vessel as effervescence. To determine the kinetics of a reaction involving the loss of a gas, gravimetric analysis can be used, where the change in mass of the reaction vessel is monitored over time.

In this experiment, you will use gravimetric analysis to determine the value of *a*.

(a) Determination of orders of reaction via the 'continuous method'

The orders of reaction can be determined via either the 'continuous method' or the 'initial rates method'. In the 'continuous method', a single reaction is carried out and a measurement (e.g. concentration; mass) is monitored over time.

You will be using the 'continuous method' in this part of the experiment, monitoring the change in mass over time.

1. Weigh and record the mass of an empty 100 cm^3 measuring cylinder.
2. Measure out 80 cm^3 of **FA 3** into this measuring cylinder and record the mass of the measuring cylinder with **FA 3**.
3. Measure out 20 cm^3 of **FA 1** using a 25 cm^3 measuring cylinder into an empty 250 cm^3 conical flask. Weigh and record the mass of the conical flask with **FA 1**.
4. Place the conical flask with **FA 1** on the mass balance provided individually.
5. Start the stopwatch and **simultaneously** pour the **FA 3** in the measuring cylinder into the conical flask. **Do not swirl the flask**.
6. Record the mass readings at 10s intervals until 90s has elapsed, then at 30s intervals. Continue taking readings **until it is appropriate to stop**.

   Given that:
   initial mass of conical flask with **FA 1** and **FA 3**
   = initial mass of **FA 3** + initial mass of conical flask with **FA 1**

In an appropriate form in the space on the next page, record all your time values, balance readings, and mass of $CO_2(g)$ evolved.

Results

Mass of empty measuring cylinder / g	
Mass of measuring cylinder + **FA 3** / g	
Mass of **FA 3** added / g	
Mass of conical flask + **FA 1** / g	
Total mass of conical flask + **FA 1** + **FA 3** before reaction / g	213.82

time / s	total mass / g	total mass of CO_2 evolved / g
0	213.82	0.00
10	213.02	0.80
20	212.91	0.91
30	212.84	0.98
40	212.77	1.05
50	212.72	1.10
60	212.68	1.14
70	212.64	1.18
80	212.61	1.21
90	212.59	1.23
120	212.53	1.29
150	212.49	1.33
180	212.47	1.35
210	212.47	1.35
240	212.47	1.35

[6]

(i) Plot a graph of mass of $CO_2(g)$ evolved, *m*, on the *y*-axis, against time of reaction, *t*, on the *x*-axis on the grid in **Fig. 2.1**.

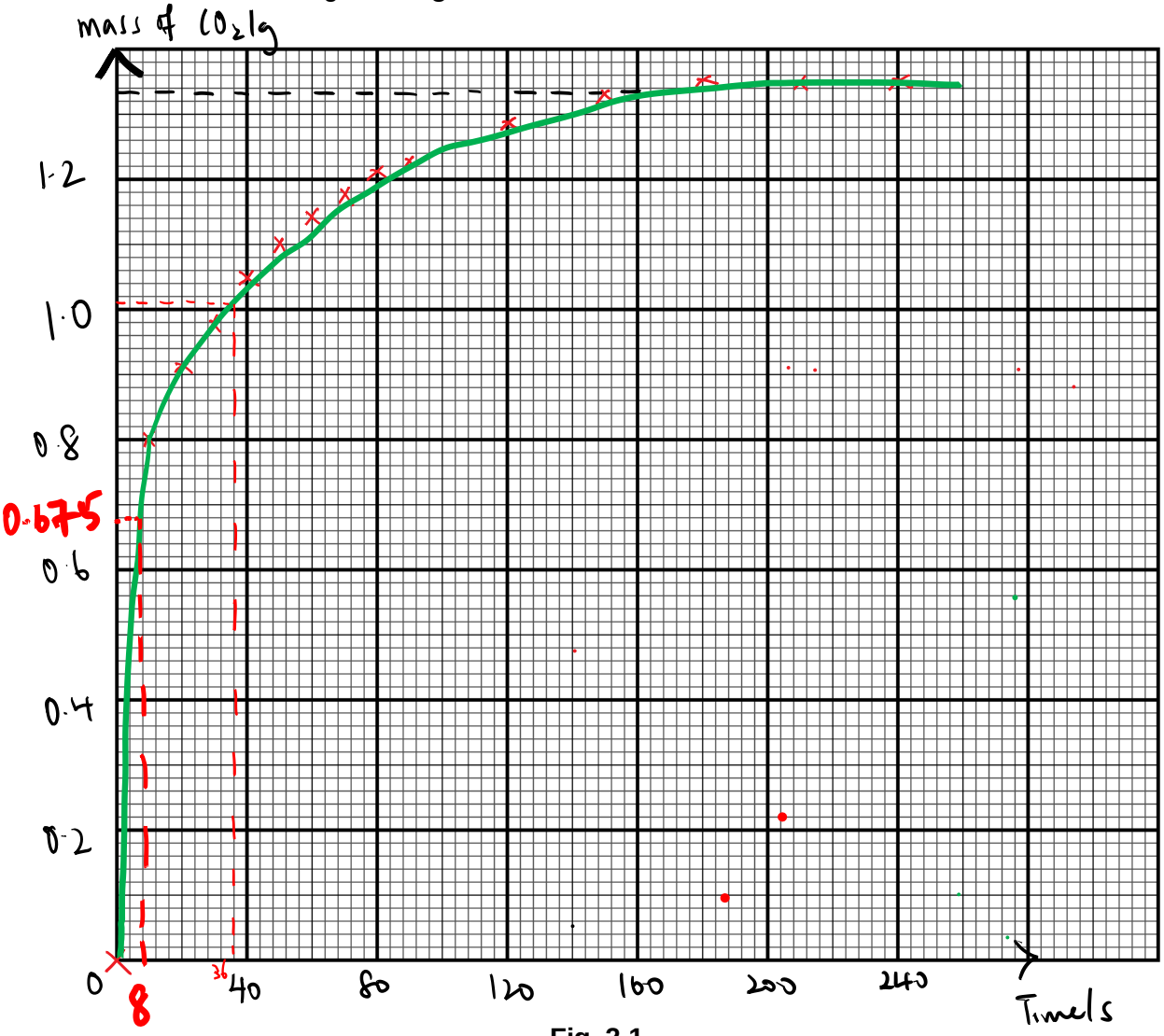


Fig. 2.1

[3]

(ii) By means of a suitable extrapolation drawn on your graph in **Fig. 2.1**, determine a value for the mass of $CO_2(g)$ evolved when the reaction is complete.

mass of $CO_2(g)$ evolved = 1.35 g [1]

(iii) The observed half-life ($t_{1/2}$) of a reaction would be constant if the reaction proceeds with an overall order of 1. The table below shows the percentage of reactants and products in the reaction vessel at different instances of time elapsed:

time elapsed	% of reactants	% of products
0	100	0
$t_{1/2}$ x 1	50	50
$t_{1/2}$ x 2	25	75
$t_{1/2}$ x 3	12.5	87.5
	⋮	
$t_{1/2}$ x ∞	0	100

Assume that the reaction proceeds with an overall order of 1.

Using your answer from **(a)(ii)**, calculate the theoretical total mass of $CO_2(g)$ evolved after the first half-life has elapsed, and then after the second half-life has elapsed.

Mass of CO_2 produced at 1^{st} $t_{1/2}$ = ½ x 1.35 = 0.675 g

Mass of CO_2 produced at 2^{nd} $t_{1/2}$ = ¾ x 1.35 = 1.01 g

total mass of $CO_2(g)$ evolved after first half-life = 0.675 g

total mass of $CO_2(g)$ evolved after second half-life = 1.01 g [1]

(iv) Hence, determine from your experiment whether the acid-carbonate reaction has a consistent half-life, and state if the reaction has an overall order of 1.

Show your working clearly on your graph in **Fig. 2.1** and in the space below.

1^{st} $t_{1/2}$ = 8s

2^{nd} $t_{1/2}$ = 36 – 8 = 28s

Since $t_{1/2}$ is not constant, the reaction does not have an overall order of 1.

[2]

(v) Rate = $k[K_2CO_3]^a[H^+]$, where *a* is an integer value of either 0, 1, or 2.

Identify a possible value of *a*.

a could be 1 or 2

[1]

(b) Planning

The 'initial rates method' can also be used to determine the orders of reaction. Unlike the 'continuous method', multiple reactions have to be carried out, each time varying the concentrations of certain solutions.

Although the initial rate of a single reaction can be determined from the gradient of the tangent to a graph plotted at $t = 0$ (such as in **Fig 2.1**), the process is tedious as the graphs for multiple experiments have to be plotted.

A simplified 'initial rates method' experiment would involve determining the time elapsed for a certain *condition* to be met, then simply taking the reciprocal of time elapsed as the initial rate. A common example of such an experiment is iodine-clock reaction, whereby the time taken for the colouration formed to obscure text is measured.

It is important to keep the measured durations of time elapsed for the reactions short (maximum 120s), or the reciprocal becomes a poor approximation of rate.

(i) Plan an experiment using the simplified "initial rates method" by carrying out multiple reactions to determine the order of reaction with respect to K_2CO_3, *a*, for the reaction between K_2CO_3 and HNO_3.

You may assume that you are provided with

- **FA 1**,
- the same apparatus used in **Experiment 2(a)**,
- 4.0 mol dm^{-3} of nitric acid, HNO_3(aq),
- the glassware and equipment normally found in a school or college laboratory.

In your plan you should include brief details of

- the quantities you would choose for the experiment and why,
- the procedure for the multiple reactions carried out,
- the measurements you would take,
- an outline of how you would use your results to determine the value of *a* non-graphically.

You may wish to consider the best mode of presentation for your answers.

Concentrations chosen depends on [HNO_3] from previous part. Fix mass, **measure time taken to obtain fixed mass**. Pick a fixed mass of longest time allowed (120s) from graph in (a), then use higher concentrations (which will result in shorter times).

Run	Vol of HNO_3 / cm^3	Vol of FA 1 / cm^3	Vol of H_2O / cm^3	Total Vol / cm^3	Time / s	Rate / s^{-1}
1	20.0	20.0	60.0	100.0	120	
2	20.0	40.0	40.0	100.0		
3	20.0	60.0	20.0	100.0		

For a single run,

1. Measure out the volumes of FA 1, HNO_3 and H_2O as indicated in the tables above, using 25.0 / 50.0 cm^3 measuring cylinders.
2. Transfer HNO_3 and H_2O into a 250 cm^3 conical flask first, and place it on a weighing balance.

3. Record the initial mass, and take note of the final mass to stop the stopwatch.
4. Transfer FA 1 into the conical flask and start the stopwatch simultaneously.
5. Stop the stopwatch when 1.29 g of CO_2 is released and record the time elapsed.
6. Repeat steps 1-5 for the different runs.
7. Rate $\propto$ 1/t, thus calculate 1/t

If rate (or 1/t)

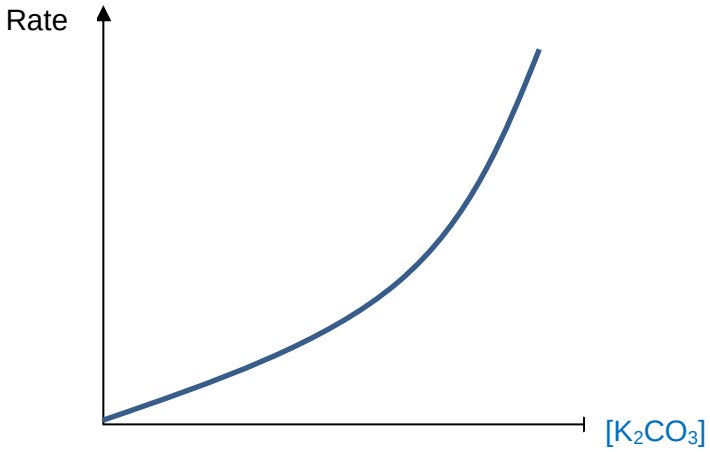
- remains the same from Run 1 to Run 2 to Run 3, reaction is 0^{th} order wrt to K_2CO_3
- doubles from Run 1 to Run 2 to Run 3, reaction is 1^{st} order wrt to K_2CO_3
- more than doubles from Run 1 to Run 2 to Run 3, reaction is 2^{nd} order wrt to K_2CO_3

[6]

(ii) The orders of reaction can also be determined graphically.

Assuming that HNO_3 is in large excess, and *a* = 2, label the x-axis and sketch the expected rate-concentration graph that you would expect to obtain from **(b)(i)**.

Explain your answer briefly.



explanation ……..

……

…….... [2]

When HNO_3 is in large excess, order of reaction wrt to HNO_3 is 0.

∴ Rate = $k[K_2CO_3]^2$ and the graph has a " $y=mx^2$ " shape as rate ∝ $[K_2CO_3]$.

[Total: 22]

For Examiners' Use

3 Qualitative Analysis of an unknown salt mixture

FA 4 is a salt mixture comprising of an insoluble salt and a soluble salt. It contains **two cations** and **two anions**.

(a) Transfer 1 spatula of **FA 4** into a test tube and observe its appearance.

State, with explanation, a possible deduction that can be made about the identity of (at least) one of the ions present in **FA 4**.

It contains a transition metal since it is coloured. [1]

(b) Perform the tests described in **Table 3.1**, and record your observations in the table. Test and identify any gases evolved.

Table 3.1

	tests	observations
1.	To the test tube from **(a)**, add 2 cm depth of HNO_3, then dropwise until all the **FA 4** dissolves. The resulting solution will be known as '**FA 5 solution**'.	A green solution is formed. Gas produced forms a white ppt in $Ca(OH)_2$.
2.	Add about 1 cm depth of **FA 5 solution** to a fresh boiling-tube, followed by NaOH(aq) dropwise, until excess (a further 2 cm depth). Warm the solution gently.	Blue ppt forms, turns deep blue in excess NaOH(aq). Gas produced turns red litmus paper blue.
3.	Add about 1 cm depth of **FA 5 solution** into a test-tube. To this test-tube, add silver nitrate dropwise.	White ppt forms, soluble in excess NH_3(aq).

[4]

(c) Based on your observations, deduce the identities of the ions present in **FA 5**.

cation 1: Cu^{2+} cation 2: NH_4^+ anion 1: CO_3^{2-} anion 2: Cl^-

[2]

(d) Explain in detail, the observations in **(b)(2.)**.

Blue ppt of $Cu(OH)_2$ forms upon addition of NaOH. At the same time, NH_4^+ present in the solution reacts with NaOH to produce some NH_3, which is evolved when the solution is warmed and turns red litmus blue. ;

When more NaOH is added, sufficient NH_3 is produced to form the deep blue complex of $[Cu(H_2O)_2(NH_3)_4]^{2+}$. ; [2]

[Total: 9]

For Examiners' Use

4 Planning

Consider the following organic compounds.

butanal but-3-enol 1-hydroxypropan-2-one propanone

Plan an investigation, using test-tube reactions, which would allow you to identify each of these four organic compounds.

Each compound should be identified by at least one positive test result. It is not sufficient to identify a compound simply by eliminating all the others.

Your plan should include:

- details of the reagents and conditions to be used,
- an outline of the sequence of steps you would follow,
- an explanation of how you would analyse your results in order to identify each compound.

Once a compound has been clearly identified, your plan should concentrate on distinguishing the remaining compounds. [6]

Unknowns: butanal, but-3-enol, 1-hydroxypropan-2-one, propanone
Step 1: Place 1 cm^3 of each unknown into clean test tubes. To each test tube, add of 2 cm^3 of Tollen's reagent, then warm in a water bath for 5 min.
Observation: A silver mirror forms only for butanal. Butanal is identified.

Unknowns: but-3-enol, 1-hydroxypropan-2-one, propanone
Step 2: Place 1 cm^3 of each remaining unknown into clean test tubes. To each test tube, add 1-2 drops of acidified $KMnO_4$, then warm in a water bath for 5 min.
Observation: Purple $KMnO_4$ turns purple for only but-3-enol and 1-hydroxypropan-2-one. Effervescence of a gas that forms a white ppt in $Ca(OH)_2$ observed for only but-3-enol. But-3-enol is identified.

Unknowns: 1-hydroxypropan-2-one, propanone
Step 3: Place 1 cm^3 of each remaining unknown into clean test tubes. To each test tube, add 1-2 drops of acidified $K_2Cr_2O_7$, then warm in a water bath for 5 min.
Observation: Orange $K_2Cr_2O_7$ forms only for 1-hydroxypropan-2-one. 1-hydroxypropan-2-one is identified.

Unknowns: propanone
Step 4: Place 1 cm^3 of the remaining unknown into a clean test tube. To this test tube, add excess 2,4-dinitrophenylhyrazine, then warm in a water bath for 5 min.
Observation: An orange precipitate forms for propanone. Propanone is identified.

other possible solutions include:

Unknowns: 1-hydroxypropan-2-one, propanone
Step ??: Place 1 cm^3 of the remaining unknown into a clean test tube. To this test tube, add 1 spatula of Na(s), test gas evolved with lighted splint.
Observation: Effervescence observed for 1-hydroxypropan-2-one. Gas extinguishes lighted splint with a 'pop' sound. 1-hydroxypropan-2-one is identified.

[Total: 6]

End of Paper 4

Qualitative Analysis Notes

[ppt. = precipitate]

(a) Reactions of aqueous cations

cation	***reaction with***	
	NaOH(aq)	NH_3(aq)
aluminium, Al^{3+}(aq)	white ppt. soluble in excess	white ppt. insoluble in excess
ammonium, NH_4^+(aq)	ammonia produced on heating	–
barium, Ba^{2+}(aq)	no ppt. (if reagents are pure)	no ppt.
calcium, Ca^{2+}(aq)	white ppt. with high [Ca^{2+}(aq)]	no ppt.
chromium(III), Cr^{3+}(aq)	grey-green ppt. soluble in excess giving dark green solution	grey-green ppt. insoluble in excess
copper(II), Cu^{2+}(aq),	pale blue ppt. insoluble in excess	blue ppt. soluble in excess giving dark blue solution
iron(II), Fe^{2+}(aq)	green ppt. insoluble in excess	green ppt. insoluble in excess
iron(III), Fe^{3+}(aq)	red-brown ppt. insoluble in excess	red-brown ppt. insoluble in excess
magnesium, Mg^{2+}(aq)	white ppt. insoluble in excess	white ppt. insoluble in excess
manganese(II), Mn^{2+}(aq)	off-white ppt. insoluble in excess	off-white ppt. insoluble in excess
zinc, Zn^{2+}(aq)	white ppt. soluble in excess	white ppt. soluble in excess

(b) Reactions of anions

ions	***reaction***
carbonate, CO_3^{2-}	CO_2 liberated by dilute acids
chloride, Cl^-(aq)	gives white ppt. with Ag^+(aq) (soluble in NH_3(aq))
bromide, Br^-(aq)	gives pale cream ppt. with Ag^+(aq) (partially soluble in NH_3(aq))
iodide, I^-(aq)	gives yellow ppt. with Ag^+(aq) (insoluble in NH_3(aq))
nitrate, NO_3^-(aq)	NH_3 liberated on heating with OH^-(aq) and Al foil
nitrite, NO_2^-(aq)	NH_3 liberated on heating with OH^-(aq) and Al foil; NO liberated by dilute acids (colourless NO $\rightarrow$ (pale) brown NO_2 in air)
sulfate, SO_4^{2-}(aq)	gives white ppt. with Ba^{2+}(aq) (insoluble in excess dilute strong acids)
sulfite, SO_3^{2-}(aq)	SO_2 liberated with dilute acids; gives white ppt. with Ba^{2+}(aq) (soluble in dilute strong acids)

(c) Test for gases

ions	***reaction***
ammonia, NH_3	turns damp red litmus paper blue
carbon dioxide, CO_2	gives a white ppt. with limewater (ppt. dissolves with excess CO_2)
chlorine, Cl_2	bleaches damp litmus paper
hydrogen, H_2	“pops” with a lighted splint
oxygen, O_2	relights a glowing splint
sulfur dioxide, SO_2	turns aqueous acidified potassium manganate(VII) from purple to colourless

(d) Colour of halogens

halogen	***colour of element***	***colour in aqueous solution***	***colour in hexane***
chlorine, Cl_2	greenish yellow gas	pale yellow	pale yellow
bromine, Br_2	reddish brown gas / liquid	orange	orange-red
iodine, I_2	black solid / purple gas	brown	purple