ANG MO KIO SECONDARY SCHOOL
PRELIM EXAMINATION 2024
SECONDARY FOUR EXPRESS
CHEMISTRY [6092/03]
ANSWER SCHEME

Paper 3: Chemistry Practical [40 Marks]
Note: Overall deduct 1 mark if no 3 sf.
Note: Overall deduct 1 mark if no unit.

<table>
<tr><td>1(a)</td><td>Results

<table>
<tr><td>Titration Number</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>Final burette reading / cm^3</td><td>23.60 [shift 1]
23.80 [shift 2]</td><td>23.60 [shift 1]
23.80 [shift 2]</td><td></td></tr>
<tr><td>Initial burette reading / cm^3</td><td>0.00</td><td>0.00</td><td></td></tr>
<tr><td>Volume of potassium manganate(VII) used / cm^3</td><td>23.60 [shift 1]
23.80 [shift 2]</td><td>23.60 [shift 1]
23.80 [shift 2]</td><td></td></tr>
<tr><td>Best titration results (√)</td><td>√</td><td>√</td><td></td></tr>
</table>

• Correct headings with units of measurement [1]
• All burette readings for all accurate titres in titration table are recorded to nearest 0.05 cm^3 [1]
• Accuracy of titration results [2]
- for the average titre within 0.20 cm^3 of Supervisor's average value score 2 marks
- for the average titre within 0.30 cm^3 of Supervisor's average value score 1 mark
• At least two titre values are within 0.20 cm^3 [1]</td><td>5</td></tr>
<tr><td>1(b)</td><td>Average volume of G
= (23.60 + 23.60) / 2
= 23.60 cm^3</td><td>1</td></tr>
<tr><td>1(c)</td><td>Number of moles of H
= 0.08 mol/dm^3 x (25 / 1000)
= 0.00200 mol (3sf)</td><td>1</td></tr>
<tr><td>1(d)</td><td>manganate(VII) ions : iron(II) ions
MnO_4^- : Fe^{2+}
1 : 5
Moles of manganate(VII) ions
= 0.002 ÷ 5 = 0.0004 [1]
number of moles of manganate(VII) ions in 1 dm^3
= 0.0004 ÷ (23.60/1000)
= 0.0169491
= 0.0169 mol [1]

Note: E.C.F allowed if working is correct. (if 1c is wrong)</td><td>2</td></tr>
<tr><td>1(e)</td><td>Number of moles of manganate(VII) ions in 250 cm^3 of G
= 0.0169 ÷ 4
= 0.004225 mol
= 0.00423 mol</td><td>1</td></tr>
</table>

<table>
<tr><td></td><td>Note: E.C.F allowed if working is correct. (if 1d is wrong)</td><td></td></tr>
<tr><td>1(f)</td><td>Mr of Manganese = 55
Mass of manganese in 2.12g
= 55 x 0.00423
= 0.23265 g
= 0.233 g
Note: E.C.F allowed if working is correct. (if 1e is wrong)</td><td>1</td></tr>
<tr><td>1(g)</td><td>percentage by mass of manganese in mangalloy
= (0.233 / 2.12) x 100%
= 10.99% = 11.0% [1]
Note: E.C.F allowed if working is correct. (if 1f is wrong)</td><td>1</td></tr>
<tr><td>1(h)</td><td>Percentage mass will be <u>higher.</u> [1]
The number of moles of G will be higher as concentration is divided by a lower volume.</td><td>1</td></tr>
<tr><td>2(a)</td><td>
<table>
<tr><th>total volume of Q added /cm^3</th><th>highest temperature reached/°C [shift 1]</th><th>highest temperature reached/°C [shift 2]</th></tr>
<tr><td>0.00</td><td>31.5</td><td>31.5</td></tr>
<tr><td>5.00</td><td>33.5</td><td>33.5</td></tr>
<tr><td>10.00</td><td>35.0</td><td>35.5</td></tr>
<tr><td>15.00</td><td>36.0</td><td>36.5</td></tr>
<tr><td>20.00</td><td>37.0</td><td>37.5</td></tr>
<tr><td>25.00</td><td>36.5</td><td>37.0</td></tr>
<tr><td>30.00</td><td>36.0</td><td>36.5</td></tr>
<tr><td>35.00</td><td>35.0</td><td>36.0</td></tr>
<tr><td>40.00</td><td>34.5</td><td>35.5</td></tr>
</table>

All temperature readings are recorded to nearest 0.5 °C [1]
All data completed with correct trend [1]

Note: As vol. of Q increases, temperature increases,
As Q = 20.00 cm^3, temperature is the highest.
As vol. of Q continues to increases, temperature decreases.

Minus 1 mark if there are 3 or more constant temperatures for the upward/downward trends respectively.
</td><td>2</td></tr>
<tr><td>2(b)</td><td>Plotting of graph
Labelled axes with units of measurement and appropriate scale for axes [1]
All points plotted accurately [1]
2 Best-fit straight lines (intersect) [1]
Note: wrong scale if students starts from 0^{O}c for the y axis.</td><td>3</td></tr>
<tr><td>2(c)</td><td>Temperature change <u>increases</u> until neutralisation [1] then <u>decreases as more Q is added because reaction has stopped. [1]</u>

Marker's: remarks:
1) <u>Most</u> students did not read explain the trend. They only describe the trend.</td><td>2</td></tr>
</table>

2(d)	values from graph with units **and** indication shown Rejected: if not indicated on the graph. Check for 2dp. (overall minus one mark)	1
2(e)	Experimental error: heat loss to the surroundings Impact: temperature recorded may be lower than actual	1 1
3(a)	Gas evolved turns **damp/moist** red litmus paper blue. (✓) Gas evolved is ammonia. (✓) Reject: Effervescence White precipitate formed when gas is bubbled through limewater. (✓) Gas evolved is carbon dioxide. (✓) Solid changes from white to yellow on heating. (✓) Reject: orange/ reddish-brown on heating – (when X not heated strongly) Solid changes from yellow (ecf colour from above) to white/ pale orange/ orange-white/ pinkish white/ pale pink on cooling/ after some time. (✓) Reject: pale yellow – solid has not cooled sufficiently Water droplets seen at the mouth of the test tube. (✓) 5✓ [4] ; 4✓ [3] ; 3✓ [2] ; 2✓ [1] (students need to identify at least one gas to get full marks) Marker's: remarks: 1) many students did not read instructions that they have to identify the gases. 2) many students did not read instructions that they have to identify the gases. 3) Many students test positive for hydrogen gas. 4) Many students did not write 'damp / moist " for red litmus.	4
3(b)	Effervescence. (✓) Gas evolved produced forms white precipitate with limewater. (✓) Gas evolved is carbon dioxide. (✓) Solid dissolves to form colourless solution/ solid partially dissolves to form colourless solution (✓) Effervescence wrong spelling – penalise once. 4✓ [2] ; 2 – 3✓ [1] Rejected: illegible handwritings, esp on the word" effervescence ". Marker's: report : 1) Many students test positive for hydrogen gas. 2) Many students scribble " effervescence ". Strictly no mark awarded	2
3(c)	White precipitate forms, (reject solid) (✓) Ppt dissolves in excess NaOH (aq) to form colourless solution. (✓) Gas evolved on warming, turns damp/ moist red litmus paper blue. (✓) Gas evolved is ammonia. (✓)	2

	4✓ [2] ; 2 – 3✓ [1] Marker's: remarks 1) **Majority of the students** did not use QA list and give incomplete answers. 2) **Half of the students** claim ppt. is insoluble in excess. 3) Many students did not write 'damp / moist " for red litmus.	
3(d)	White precipitate forms, (✓) ppt dissolves in excess NH_3 (aq) to form colourless solution (✓) 2 ✓ [1] Marker's: remarks: 1) **Majority of the students** did not use QA list and give incomplete answers. 2) **Half of the students** claim ppt. is insoluble in excess.	1
3(e)	No precipitate formed / No observable change [1] Reject: White precipitate, soluble A: No visible change / solution remains colourless. Marker's: remarks: 1) Accept: No visible change. / No change is observed Reject: No Change	1
3(f)	NH_4^+, Zn^{2+}, CO_3^{2-} [1]	1
4	***heating to dryness method*** **max [6]:** - weigh (any) sample of washing soda (let mass be a) - heat (to remove water of crystallisation) in evaporating dish/crucible - let cool and reweigh - repeat heating - to constant mass (let mass be b) - appropriate calculation suggested for the percentage of water: (a-b)/a x 100% OR ***mass of water method*** **max [6]:** - weigh (any) sample of washing soda (let mass be a) - heat to remove water of crystallisation in round bottom flask in a simple distillation set up - cool / condense water vapour in condenser - continue until no more water collected as distillate - weigh mass of water collected (let mass be b) - appropriate calculation suggested for the percentage of water b/a x 100% Wrong method zero mark. : Add water / reacts acid etc/	1 1 1 1 1 1 1 1 1 1 1 1

Paper 3: Practical Preparation List

Label	per candidate	identity	notes
H	150 cm^3	**H** is a solution which initially contained 0.0800 mol/dm^3 iron(II) ions dissolved in an unknown acid	freshly prepared solution) dissolve 27.0 g of hydrated iron (II) sulfate, $FeSO_4.7H_2O$ in 1 dm^3 of approximately 0.5 mol/dm^3 sulfuric acid, labelled **H**
G	150 cm^3	0.020 mol/dm^3 potassium manganate (VII)	Solution of 0.020 mol/dm^3 potassium manganate (VII) (3.2 g $KMnO_4$ dissolved in 1 dm^3 of distilled water), labelled **G**.
P	150 cm^3	1.00 mol/dm^3 hydrochloric acid	
Q	100 cm^3	1.2 mol/dm^3 aqueous sodium hydroxide	
~~**R**~~	2.00g mixture of two carbonates: $(NH_4)_2CO_3$ $ZnCO_3$	0.6 g 1.4 g	Place this mixture of carbonates in a small plastic vial.

Note: Some variation in the above concentrations is acceptable but it is essential that 25.0 cm^3 **H** reacts with between 23.0 cm^3 ad 27.0 cm^3 of **G** (or 20.0 cm^3 of **H** reacts with between 18.0 cm^3 and 22.0 cm^3 of **G**.

The standard bench reagents specifically required are listed below for the use of **each candidate**. If these chemicals are to be made available from communal supply, the attention of the invigilator should be drawn to the fact that such as arrangement may lead to contamination of reagents and promotes the chances for malpractice between candidates.

label	**identity**	**notes**
dilute hydrochloric acid	1.0 mol/dm^3 HCl	Dilute 85 cm^3 of concentrated (35 – 37%; approximately 11 mol/dm^3) hydrochloric acid to 1 dm^3.
dilute nitric acid	1.0 mol/dm^3 HNO_3	Dilute 64 cm^3 of concentrated (70% w/v) nitric acid to 1 dm^3.
aqueous ammonia	1.0 mol/dm^3 NH_3	Dilute 56 cm^3 of concentrated (35%) ammonia to 1 dm^3.
aqueous sodium hydroxide	1.0 mol/dm^3 NaOH	Dissolve 40.0 g of fresh NaOH in each dm^3 of solution. **Care:** *the process of solution is exothermic and any concentrated solution is very corrosive.*
aqueous barium nitrate	0.1 mol/dm^3 $Ba(NO_3)_2$	Dissolve 26.1 g of $Ba(NO_3)_2$ in each dm_3 of solution.
limewater	saturated aqueous calcium hydroxide, $Ca(OH)_2$	Prepare fresh limewater by leaving deionised water to stand over solid calcium hydroxide for several days, shaking occasionally. Decant or filter the solution

List of apparatus per candidate:

1 x 50 cm^3 measuring cylinder
1 x polystyrene cup
1 x 100 cm^3 beaker
2 x boiling tubes
3 x teat pipettes
2 x 250 cm^3 beaker
1 x retort stand
1 x clamp
1 x Bunsen burner
1 x lighter
1 x thermometer
1 x glass rod
1 x test-tube holder
1 x safety goggles
1 x test-tube rack
1 x 150 cm^3 container containing solution H
1 x 150 cm^3 container containing solution G
1 x 150 cm^3 container containing solution P
1 x 100 cm^3 container containing solution Q
1X small plastic vial containing 2.00g of mixture of carbonates labelled R
1 x wash bottle containing deionised water
6 x test tubes
2 x wooden splint
1 x vial of red and blue litmus paper
2 x conical flask
1 x cleaning towel
2 x 50 cm^3 burette
1 x 25 cm^3 pipette
1 x pipette filler
1 x funnel
1 x white tile
1 x delivery tube
1 x spatula