

General Comments

It appeared as if most of the candidates were not exposed to enough, if any, practicals throughout the year. Many candidates seemed to have “cooked” the data for the experiments, especially for the titration, as they gave exact values for the titre that was not realistic if compared to the initial and final volumes.

Many candidates seemed to not be familiar at all with the chemistry practical notes that are provided in the question paper. They did not consult the notes when giving their observations.

Recording of data in tables was not up to standard, in many cases data was not recorded in the required table format, but simply noted somewhere on the page. When data was recorded, was done incorrectly

Candidates were unsure of the number of significant figures to use and many rounded incorrectly.

Comments on specific questions

Question 1

The majority of the candidates appeared to have not been able to reach the end-point of the titration. There was a very wide range amongst the candidates for the final titres and concentration calculated. This could be due to teachers not correctly preparing the solutions, or candidates not titrating until they reached the end-point. It appeared as if most candidates were not familiar with a redox titration.

(a) Fairly well answered.

- Majority of candidates had initial and final burette readings
- Headings were incomplete, for example, they would just use “Volume of L” instead of “Volume of L added/used”
- Units were omitted or used incorrectly. Some candidates indicated units, but they were not correctly separated from the quantity using either the solidus, /, or brackets, (), as recommended in the syllabus
- A significant number of candidates did not record their burette readings to the nearest 0.05 for accurate titrations. They gave their readings to either 1 decimal place or simply as a whole number
- Some candidates subtracted incorrectly to calculate the final titre. They used initial volume – final volume, and therefore ended up with a negative answer, or they did not subtract it at all.
- Learners were not able to identify the end-point accurately and therefore had a large spread of values for their final titres. Learners who seemed to have an idea of what was expected for the final titres seemed to have “cooked” their data by giving exact values that are either not corresponding to their initial and final volumes or that are unrealistic. It appears they have done this in order to have values that fall within the ideal spread. **Teachers are advised to consult the Syllabus page 36-50 (Annexe A – Assessment criteria for paper 3) for the layout of a titration table as well as the rules for end-point values and the spread for accurate titres.**

Mark scheme

Question	Expected Answer	Marks	Skill
1(a)	I Initial and final burette readings and volume of L added recorded for at least 2 accurate titrations	1	PDO
	II all headings and units correct for accurate titrations – - initial / final (burette) reading / volume OR reading / volume at start / finish - titre OR volume L added / used - (cm ³) OR / cm ³ OR in cm ³ by every entry ALLOW in top left cell only.	1	PDO
	III all accurate burette readings are recorded to the nearest 0.05 cm ³ . 16.7 – only acceptable for the rough titration 16.60 – necessary for all accurate titres 16.65 – necessary for all accurate titres	1	PDO
	IV final titre within 0.10 cm ³ of any previous accurate titre and subtractions are correct to give titre values	1	PDO
	V, VI and VII - award V, VI and VII for spread ≤ 0.20 cm ³ - award V and VI for 0.20 cm ³ < spread ≤ 0.30 cm ³ - award V for 0.30 cm ³ < spread ≤ 0.50 cm ³	3	MMO

- (b) Fairly well answered. The majority of learners correctly calculated the mean titre, however there were a few candidates who included the rough titre in the mean as well, which is incorrect. The mean titre is also a reading and should therefore be given to two decimal places.

Question	Expected Answer	Marks	Skill
(b)	Mean titre correctly calculated from clearly selected values: • Candidates must average two (or more) titres where the total spread is ≤ 0.20 cm ³ (if this is not available, ALLOW this mark for choosing the best two or more titres.) • Working must be shown or ticks must be put next to the two (or more) accurate readings selected • The mean should be quoted to 2 d.p rounded to the nearest 0.01	1	ACE

- (i) Fairly well answered. There were a few learners that either did not read the instruction for the number of significant figures or completely ignored it.

(ii) – (iv) Fairly well answered.

- The majority of learners were able to complete the calculations correctly. There were a few learners who failed to use their previous answers in the next calculations. Learners should use the answers that they wrote on the answer line in the next calculation and not any other value.
- Some learners were not able to round their answers correctly or gave their answers to an incorrect number of significant figures and therefore lost marks.

Question	Expected Answer	Marks	Skill
1(c)	(i) all final answers to 3 or 4 sig. fig. (minimum two parts attempted)	1 1 1 1	ACE
	(ii) correctly calculates $\frac{0.0057 \times (b)}{1000}$		ACE
	(iii) correctly uses (ii) × 5/2		ACE
	(iv) correctly uses or x40 or $\frac{(iii) \times 1000}{25}$		ACE

(d) Poorly answered.

- This question clearly shows that learners did not consult the given practical notes, as they simply had to copy the test from the practical notes given in the question paper.
- Learners are encouraged to use appropriate action terms, such as mix, add and drop, when adding chemicals to each other, and not the word “react”.

Question	Expected Answer	Marks	Skill
1(d)	add/mix/drops aqueous/dilute ammonia / NH ₃ / sodium hydroxide / NaOH It forms an off-white or white or pink ppt.	1	ACE
		1	

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Question 2

The majority of candidates seemed to have managed to carry out the experiment as per instructions, but failed to record their results as instructed.

(a) Poorly answered.

- All quantities that were expected to be in the table, were clearly stated in the instructions.
- A large number of candidates were once again not able to correctly use units in the table.
- Majority of candidates gave the balance readings to the same number of decimal places, as it was expected from them.
- A large number of candidates appeared to not understand the aim of the experiment and were unable to use their results correctly in further calculations. It is of utmost importance that candidates thoroughly read all instructions before starting the experiment.

Question	Expected Answer	Marks	Skill
2(a)	I Table of data Must show all of the following: <ul style="list-style-type: none"> • Mass of crucible (+ lid) • Mass of crucible (+ lid) + N • Mass of crucible (+ lid) + residue • Mass of N • Mass of residue • Mass of water lost 	1	PDO
	II Recording of data <ul style="list-style-type: none"> • Unit / g, (g) or in grams for all data recorded • All three balance readings recorded to same number of dp 		
	III Correctly calculates <ul style="list-style-type: none"> • Mass of N, • Mass of residue, • Mass of water lost 	1	PDO
	Examiner checks supervisor's subtraction for mass of N and mass of residue and calculates the ratio mass of N ÷ mass residue. Examiner compares candidate's value with that of supervisor. IV - Award IV and V if $\delta \leq 0.10$ V - Award V if $\delta \leq 0.20$	1	PDO PDO

(b) Fairly well answered.

- (i)-(iii) Majority of candidates knew which formulae to use, but a small number used the wrong values in the calculations.
- The value of **z** was expected to be given as a whole number, and a few candidates gave it as a decimal. There were also a notable number of candidates who were not sure on how to calculate the value of **z**.

Question	Expected Answer	Marks	Skill
2(b) (i)	$n = \text{mass of residue} / 208.3$	1	PDO
2(b) (ii)	$n = \text{mass of water lost} / 18$	1	PDO
2(b) (iii)	Correctly calculates (ii) ÷ (i) and z as an integer.	1	PDO

(c) Very poorly answered.

The majority of the candidates appeared to not understand the questions and their answers were the exact opposite of what was expected. It seemed that most candidates were simply guessing.

Question	Expected Answer	Marks	Skill
2(c) (i)	Greater mass lost / smaller mass of residue / fewer moles of residue / greater mass of water (appears to be / is) lost so z would be greater	1 1	ACE
2(c) (ii)	Heat to constant mass OWTTE / cooling in a desiccator	1	ACE
2(c) (iii)	Stop it from absorbing water (from the atmosphere)	1	ACE

[12]

Question 3

Well answered. The majority of candidates were able to carry out the experiment as per instructions and give the correct observations as per the given practical notes. However, some candidates lost marks for their descriptions of the colour changes seen. Candidates should use the descriptions when testing for ions as given in the practical notes.

(a) (ii) Many candidates observed the water droplets, but described it incorrectly as vapour. Water vapour is a colourless gas, which cannot be observed. (iii) – (b) (iii) When reagents are mixed and no change in colour takes place, candidates are discouraged to describe it as “no reaction”, because some reactions take place without showing any change in colour. It should rather be described as “no observation”.

(c) Some candidates gave the name of the compounds or the ion that was tested for. They were able to correctly identify the ion present in the compound, but could not give the correct formula. Candidates should take note whether a question requires the name of a compound, or the formula.

(d) The candidates understood the question and correctly gave safety precautions. However, candidates misspelled “gloves” as “glooves” as well as “goggles” as “googles”. Teachers should make candidates aware of this misspelling and make an effort on correcting it.

Question	Expected Answer	Marks	Skill	
3(a)	(ii) Q turns white / off white droplets of liquid / condensation / water	[1] [1]	2	MMO
	(iii) Q gives a light blue ppt	[1] [1]		MMO MMO
	(v) Q gives a white ppt. no change / insoluble with HNO₃	[1] [1]	2	MMO MMO
	(vi) No ppt formed / no change / no observation IGNORE “no reaction”	[1] [1]	2	MMO MMO
			1	
3(b)	(i) R gives effervescence / bubbling / fizzing / gas given off	[1]	1	MMO
	(ii) R gives a white ppt (not “off white”) insoluble in excess reagent / NaOH	[1] [1]	1	MMO MMO
	IGNORE “solution turns milky”		1	
	(iii) No ppt formed or very slight white ppt or no change IGNORE “nothing happens” “no colour change” “no reaction”	[1]	1	
3(c)	Q – CuSO ₄	[1]	1	ACE
	R – CaCO ₃ IGNORE words, mark formulae only	[1]	1	ACE
3(d)	wearing of safety goggles or gloves or not holding (test tubes) with hands while heating / using tongs or direct mouth of tube away from people IGNORE lab coats, references to tasting or smelling[1]		1	ACE

[14]