

General comments

The overall performance of Chemistry paper 3 was generally poor. There were vast majority of candidates who struggled to respond correctly to various number of questions in the paper. Chemistry demands higher thinking skills in mathematical manipulation and application as well as scientific skills. Furthermore a large number of candidates also struggled to scientific skills such as plotting graphs even when the scale is already given on the grid, drawing smooth curve, deducing expected data from axes of graphs as well as sketching on the graphs if experiment is repeated at higher temperature

The questions which required learners to show their knowledge on exposure to experiments such as rate of reaction and planning an investigation were generally poorly answered. On the other hand candidates in few centres are becoming more familiar with the planning an investigation question. Candidates would be well advised to plan out their answers before writing them down, as this will avoid steps being out of sequence.

In addition, paper 3 is an alternative to practical paper, hence it has shown that most candidates are not sufficiently exposed to experimental and investigative skills and abilities (aspect) of the syllabus. These includes the suggested practical activities at the end of each topic as well as Annexure **A**.

Comments on specific questions**Question1**

- (a) While some excellent answers were seen, a large number of candidates struggled to express themselves clearly. Often these candidates concentrated on 'faster reaction' rather than to extract more amino acids and to increase surface area. Generally this question was poorly answered.
- (b) This part was well answered. The majority of candidates were able to correctly draw the measuring cylinder with the meniscus, however they could not level the bottom of the meniscus with a 200 cm³.
- (c) This part was well answered. Most candidates were able to correctly suggest a method in **step 4**, however they struggled to spell **filtration** correctly.
- (d) Most candidates were able to correctly identify apparatus labelled **A** and **B**. This question was well answered.
- (e) (i) This question was not well answered. Most candidates could not correctly identify the solvent front on the chromatogram. Teachers should make a clear distinction between solvent front and a solvent line.
- (ii) This part was poorly answered. Most candidates correctly stated amino acids contained in the sample, however they could not give a reason as required.
- (iii) Poorly answered. The vast majority of candidates do not know the use of a locating agent (Ninhydrin). Most candidates failed to mention "to make the spots visible" instead of mentioning to make samples of amino acids visible.
- (iv) This part was well answered. The majority of the candidates were able to correctly calculate R_f value, however they stated the unit.

Mark scheme

Question	Answer	Mark
1 (a)	Increase the surface area ✓ / smaller pieces react faster ✓ more amino acids extracted ✓	2
(b)	clearly shown perpendicular line of sight ✓ clearly shown bottom of meniscus at 200 cm ³ ✓	2
(c)	Filtration / decanting ✓	1

(d)	evaporating dish ✓ (Bunsen) burner ✓	2
(e) (i)	Clearly labelled solvent front at the top ✓	1
(e) (ii)	1 and 2, their spot position correspond with the spots in the sample/their spots are at the same height with the spots in the sample ✓	1
(e) (iii)	to show the position of spots / to make the spots visible/develop colour ✓	1
(e) (iv)	correct measurements of distance travelled by amino acid 3, AND correct measurements of distance travelled by solvent, AND correct substitution into equation 0.73 ✓✓	2

Question 2

- (a) This question was well answered. Most candidates plotted all points correctly. Candidates should be reminded that points should be marked clearly, ideally using x and lines drawn with sharp pencil. Many candidates did not correctly draw a smooth curve of best fit. A smooth curve of best fit does not simply join the points together with a wobbly line and must not be drawn with a ruler.
- (b) This question was poorly answered. Most candidates did not show clearly where they had read their answers from the grid.
- (c) This was generally answered correctly.
- (d) This question was poorly answered. The use of burette or pipette is not well known. Few good responses explained the use in terms of measuring volume more accurately compared to using a measuring cylinder.

Repeating the experiment alone does not improve the reliability of the results, nor does taking a mean or average.

- (e) This question was not well answered. Most candidates sketch lines above the original curve and lines that touched the top and /or the bottom of the original curve which were not acceptable.

Mark scheme

Question	Answer	Mark
2 (a)	all 5 points correctly plotted ✓✓ smooth curve ✓	3
(b)	vertical indication up to 0.075 on the x-axis ✓ horizontal indication up to y-axis ✓ value from graph matching horizontal indication ✓ (144-146)	3
(c)	same volume (of sodium thiosulfate / dilute sulfuric acid) ✓/same temperature	1
(d)	Two sources of error: <ul style="list-style-type: none"> • Use of measuring cylinder imprecise ✓ • Experiment done only once ✓ Two improvements: <ul style="list-style-type: none"> • use pipette / burette to measure volume ✓; • repeat experiment and average ✓ 	4
(e)	curve below original ✓ similar shape of curve with no intersection ✓	2

Question 3

- (a) (i) This question was fairly answered. A reasonable number of candidates made correct observation of solution A.
- (ii) This question was poorly answered. Only few candidates were able to state that there was no further change on adding excess sodium hydroxide. The majority of candidates reported incorrectly that there was a change in color.

(b)(i) (ii) These question was not well answered.

(c) This question was well answered. Most candidates provided correct test and results for chlorine gas

(d) This part was well answered. Most candidates identified solid B correctly

(e) This question was generally answered well.

Mark scheme

Question	Answer	Mark
3 (a) (i)	(red-) brown ppt ✓	1
(a) (ii)	(red-brown ppt) remains / no (colour) change ✓	1
(b) (i)	white precipitate ✓	1
(b) (ii)	(white precipitate) dissolves / colourless (solution forms) ✓	1
(c)	Damp (blue) litmus paper ✓ Bleaches ✓	2
(d)	barium ✓ carbonate ✓	2
(e)	avoid contact with skin/ wear protective gloves; ✓ avoid getting in eyes/ wear eye protection; ✓ avoid smelling/ drinking/ tasting ✓	1

Question 4

This question was poorly answered and proved to be the most challenging question in the whole question paper. A large number of candidates only managed to score in the range of 0-3 marks, scoring mostly from **MP1**, **MP2** and **MP3**.

The guidance is clear in the question paper and the reactants were provided and suitable laboratory apparatus. Surprisingly, candidates went to describe experiment with apparatus and reactants which are not provided such react water with Mg powder and heat the mixture. This has shown that most candidates lack knowledge and understanding of practicals.

A significant number of candidates did not attempt the question.

Mark scheme

Question	Answer	Mark
4	<ul style="list-style-type: none">● measure volume of hydrochloric acid ✓ MP1● measure initial temperature (temperature of acid before metal is added) ✓ MP2● measured mass of zinc powder / magnesium powder added ✓ MP3● measure final temperature of solution / temperature every 30s ✓ MP4● repeat with same mass of other metal and same volume of hydrochloric acid ✓ MP5● greater temperature change / higher final temperature is larger energy change ✓ MP6	6

POSITIVE SUGGESTIONS TO TEACHEACHERS

In general there is a need to put great emphasis on assessment objective C and also to make experiments parts of teaching and learning. There are suggested practicals at the end of each topic in the syllabus and it is important to expose learners to practical activities in order to reinforce practical skills and abilities.

Teachers are encouraged to use easily accessible and locally available materials to conduct practical activities in the classrooms. The large number of candidates demonstrated lack of exposure to practical activities in responding to questions in this paper.

In conclusion, teachers are also encouraged to emphasise strongly on drawing graphs. Learners should be reminded that points should be marked clearly, ideally using x and lines drawn with sharp pencil. A smooth curve of best fit does not simply join the points together with a wobbly line and must not be drawn with a ruler.