6117
Paper 2

General Comments

The preparedness of the candidates in this examination was observed to have been at minimum levels. Few candidates seemed to have taken time to prepare and revise while the majority just did not. These candidates left so many questions in the paper unattempted. A significant number showed little knowledge of the basic facts and key concepts, and could hardly give scientific explanations and descriptions. It should be emphasised to candidates how important it is to always clearly communicate their responses. So many also lost marks because they could not spell terminologies correctly - even those that were listed for them.

Candidates need to be encouraged to learn standard definitions, laws and equations especially as given in the syllabus. Candidates should be advised to use the number of marks in a question as a guideline when answering. They should also be advised that giving two answers, when they are expected to give only one, leads to a loss of marks.

Correct use of symbols for formulae should be used. Many candidates seem not to be sure of whether to use uppercase or lowercase letters in the formulas. It is recommended that formulas are written in words to avoid such confusion.

Many candidates still seem to answer in pencil first and sometimes just leave the answers in pencil.

All in all, more still needs to be done by both teachers and learners to prove that the learner's understanding of the subject is enough to enable them to do further studies such as Advanced Subsidiary.

Comments on individual questions

1 Teachers are encouraged to emphasise to the learners that when terms are provided for them to select from, misspelling is penalized.

(a) Poorly answered.

The majority of candidates wrongly gave sulfide ion as the answer probably because its formed when the sulfur atom gains electrons. They failed to consider the fact that the question referred to electrolysis

(b) Very well answered.

(c) Fairly well answered.

A good number still could not spell the term correctly even though it was given to them

(d) – (e) Fairly well answered.

(f) Poorly answered

So many indicated methane, showing that they could not recall the correct names of shapes

Question	Model Answer	Additional guidance	Marks
1 (a)	Magnesium ion ✓	Penalise once on spelling on (a) to (f)	1
(b)	Condensation ✓		1
(c)	Buckministerfullerene ✓	Accept Buckminsterfullerene	1
(d)	Chlorine ✓		1
(e)	Nitrogen ✓		1
(f)	Carbon dioxide ✓		1
			[6]

2 (a) (i) Very well answered.

(ii) Fairly well answered.
Some seemed to have been guessing between solid, liquid and gas

(iii) Fairly well answered.

(b) (i) Very poorly answered.

Despite the description of metallic bonding, being in the syllabus (on page 14), the majority of learners failed to give it. A few however, were able to recall part of the definition – the sea of delocalized electrons. Nevertheless, it was a 2 marks or nothing question so many lost both marks.

Teachers are encouraged to train learners to learn definitions, laws, etc.

(ii) Poorly answered.

Most candidates seemed not to have understood this question. The fact that metal atom/ions are regularly arranged was not familiar with many. A few were able to score a mark by indicating that atoms slide over each other when a force is applied.

(c) (i) Fairly well answered.

A few were still misspelling the name of element magnesium.

(ii) Fairly well answered.

Even though ionic bonding is taught even in junior grades, a few learners still lost marks because of mixing up their explanations. A good number were able to indicate that magnesium loses two electrons but could not clearly describe how that two chlorine atoms each gains an electron.

(iii) Fairly well answered.

Many were able to give the correct state in which an ionic compound conducts electricity but the majority failed to give the particles that are present in an ionic compound to carry charge. They wrongly gave electrons instead of ions. Electrons are only present in elements such as metals or a non-metal, graphite.

Question	Model Answer	Additional guidance	Marks
2 (a) (i) **(ii)** **(iii)**	10 ✓ gas ✓ Ca^{2+} ✓		3
(b) (i)	Lattice of positive ions in (a sea of) delocalised electrons / free moving electrons ✓✓	2 or nothing	2
(ii)	Aluminium has a regular arrangement / lattice of positive ions/a layer of atoms or ions ✓ that slide over each other (without breaking) when a force is applied or when hammered. ✓		2
(c) (i)	Magnesium chloride ✓		1
(ii)	Magnesium atom transfer or loses two electrons. ✓ Two chlorine atoms <u>each</u> gains one electron. ✓	**Reject** chloride ions	2
(iii)	Molten/aqueous solution/ dissolved in water / liquid✓ Ions are free to move and ✓ Carry charges ✓	**Reject** electrons are free to move	3
			[13]

3 (a) Fairly well answered.

A good number of candidates were able to give the correct colour, red. However, a few lost marks because they gave two different colours indicating that they were not sure.
These type of questions can only be properly answered by learners who actually did the experiment. Teachers are encouraged not to neglect practical activities

(b) Well answered.

Many were able to give one of the correct observations especially, bubbles

(c) (i) Poorly answered.

A good number however, were able to get one mark either for the formula or for converting 20.0 cm^3 to dm^3

(ii) Poorly answered

Many failed to use mole ratios to obtain the number of moles in sodium carbonate

(iii) Fairly well answered.

A significant number of candidates recalled the formula of concentration and were able to use the number of moles in (ii) and divide it with the volume. Some forgot to convert 25.0 cm^3 to dm^3 and so lost a mark

(d) Fairly well answered.

Many recognized that the solution needed to be heated and then cooled, so it can form crystals. Some lost marks, however because they mixed up the explanations

(e) (i) Poorly answered.

The majority of the candidates failed to get the first part of this calculation and so lost marks. A few however recalled the formula of molar gas volumes and at least got awarded a mark.

(ii) Very poorly answered.

It appears many were not taught how to do calculations using the Avogadro's constant.

Question	Modal Answer	Additional guidance	Marks
3 (a)	Red ✓		1
(b)	Effervescence / bubbles/A gas is released / fizzing / sound ✓		1
(c) (i)	n = C × V (✓) 0.020 × 0.3 (✓✓) 0.006 or 6×10^{-3} ✓✓✓	0.02 seen (✓)	3
(ii)	n = 0.006 / 2 (✓) = 0.003 ✓✓	Accept **ecf** from **(c)(i)**	2
(iii)	C = n/V (✓) = 0.003mol / 0.025dm^3 (✓) = 0.12✓✓	Accept **ecf** from **(c)(ii)**	2
(d)	Heat the aqueous solution of sodium chloride / evaporate some water ✓ Leave the solution to crystallize ✓	**Ignore** cooling	2
(e) (i)	n = $\frac{m}{Mr} = \frac{265}{106}$ = 2.5 (✓) V = n × 24 ((✓) V = 2.5 × 24 (✓✓) = 60 ✓✓✓	2.5 seen ✓	3
(ii)	= 2.5 mol × 6.022 × 10^{23} (✓) =1.51 x 10^{24} ✓✓ OR 2.5 mol × 6.0 × 10^{23} (✓) =1.5 x 10^{24} ✓✓	Allow up to calculator answer 1.5055 × 10^{24} correctly rounded	2
			[16]

4 (a) Fairly well answered.

A good number of candidates recognized that it was a syringe, but many failed to spell it.

(b) Poorly answered.

Many failed to interpret the information in the table. They mistook surface area for particle size and so wrongly chose experiment 1 as the fastest one. A few however, were able to correctly answer it. The explanation, as to why experiment 3 was the fastest was unattainable by almost all the candidates. They just could not connect the collision theory to this whole explanation.

(c) Fairly well answered.

A good number of candidates managed to recall at least one of the other factors that affects the rate of a reaction

(d) (i) Well answered.

Even though many first answered in terms of oxygen before giving the answer in terms of electrons

(ii) Poorly answered.

This question was only available to advantaged candidates.

The candidates needed to first know the correct balanced chemical equation for the reaction between zinc and hydrochloric acid, determine the oxidation state of hydrogen ion (+1) and then that of hydrogen gas (0), and finally recognize that there was a decrease in the oxidation number, meaning, it accepted/gained an electron

Question	Modal Answer	Additional guidance	Marks
4 (a)	(Gas) syringe ✓		1
(b)	3 ✓ More particles exposed✓ More frequent collisions/more collisions (per second) ✓		3
(c)	Catalyst, concentration ✓✓	Accept pressure, light	2
(d) (i)	Loss of electron (s)✓		1
(ii)	Oxidation number decreases from (+)1 to 0 ✓ Because hydrogen ion gains an electron. ✓		2
			[9]

5 (a) (i) Fairly well answered.

(ii) Very well answered.

(b) Fairly well answered.

Candidates seemed to have been familiar with this content but lost marks because they couldn't clearly explain the concept and also clearly state what was diffusing (ammonia gas and hydrogen chloride gas, and not ammonium solution nor hydrochloric acid) even when it was given in the question.

(c) Fairly well answered.

The majority of candidates recalled the result but failed to give the proper test. Many could recall that a red litmus is what is used but didn't recall that it needed to be moist or damp. A good number of them lost the mark because they could not spell damp but wrote 'dump' instead.

Question	Modal Answer	Additional guidance	Marks
5 (a) (i)	NH_4C*l* ✓		1
(ii)	Diffusion ✓		1
(b)	At **Y** ✓ Ammonia molecules or particles have a smaller mass✓ So they move / diffuse faster ✓ OR At **Y** ✓ HC*l* molecules / particles have higher mass ✓ So they move / diffuse slower ✓	**Accept** ammonia is lighter Clear comparison	3
(c)	**Test**; Use damp red litmus paper✓ **Result** ;Turns blue +✓ (Dependent on the correct test)		1 +1
			[7]

6 (a) Fairly well answered.

Many however, failed to spell the term 'haematite'

(b) (i) Fairly well answered.

(ii) Fairly well answered.

Many recognised that the reaction that gives molten iron is that of the iron ore and carbon monoxide, they failed to realise, however that the question also required them to refer to the process by which this happens – reduction.

(c) (i) Poorly answered.

The majority of candidates didn't seem to be familiar with the basic oxygen steel making process. A few, were able to explain how the percentage of carbon is reduced i.e. When carbon reacts with the oxygen and then escapes as carbon dioxide.

(ii) Very well answered.

Since its common knowledge what stainless steel is used for.

(d) Poorly answered.

So many candidates were referring to galvanizing, which is not really what the question was demanding. They were supposed to explain how zinc protects iron, not to give a method.

Question	Modal Answer	Additional guidance	Marks
6 (a)	Haematite ✓		1
(b) (i)	Limestone / $CaCO_3$ / Calcium carbonate ✓		1
(ii)	Ore/haematite / iron(III) oxide is reduced✓ by carbon monoxide ✓	**Ignore** the initial steps of extraction	2
(c) (i)	Blow oxygen into molten iron ✓ Carbon escapes as carbon dioxide✓	**Accept ;** Blow oxygen in the furnace	2
(ii)	Cooking utensils /sinks ✓	**Allow** other appropriate uses	1
(d)	Zinc is more reactive ✓ Forms a stable layer/ prevents iron from oxidizing or reacting with air/ water✓	**Accept** Sacrificial protection ✓	2
			[9]

7 **(a)** Well answered.

(b) **(i)** Fairly well answered.
Although some were confusing it with that of alkanes while others wrongly wrote it as Cn + H2n

(ii) Fairly well answered.
The majority recognized that the double bond, is what makes alkenes react the way they do however they failed to mention how alkenes actually react- addition of simple molecules to the carbon chain

(c) Well answered.
Even though, a good number in trying to go further with their answer, gave wrong names to the isomers

(d) Fairly well answered.
The majority of candidates only managed to calculate up to the second step of dividing through the number of moles by the smallest answer from the first step. When they got to the third step, some just rounded off the decimal numbers instead of multiplying them by the same factor (2 in this case) to get whole numbers.

Question	Modal Answer	Additional guidance	Marks
7 (a)	Propanol ✓		1
(b) (i)	C_nH_{2n} ✓		1
(ii)	Alkene have (carbon - carbon) double bonds ✓ Simple molecules can add to the alkenes✓	**Accept ;** alkenes undergo addition reactions/ atoms or groups of atoms can add to alkenes	2
(c)	C and E ✓✓	Both must be correct (2 or nothing) **Letters only**	2
(d)	C: 48.76/12 = 4.063333333/2.70 H: 8.04/1 = 8.04/2.70 O: 43.20/16 = 2.70/ 2.70 C: 1.50 x 2 =3 H: 2.977777778 x 2 = 6 O: 1 x 2 = 2 $C_3H_6O_2$ ✓✓✓✓	M1: divide % by relative atomic mass (✓) M2: divide by 2.70 (✓✓) M3: scale up by factor of 2 (✓✓✓) M4: final formula ✓✓✓✓	4
			[10]

8 **(a)** **(i)** Well answered.

(ii) Poorly answered.

Many could not recall the term ‘oleum’. Some tried but misspelled it.

(b) Fairly well answered.

The formula of sulfur trioxide was a challenge for some learners

(c) Poorly answered.

Many recalled the conditions, but failed to write them sufficiently.
For example; some just wrote Vanadium oxide, leaving out the oxidation state, which is not sufficient for a mark. The

values of pressure were given but without units. They also lost marks because pressure can be measured in Pascal, kilopascals or atmospheres. So the correct unit must accompany the value.
Many seem to have confused the temperature range for the Haber process (300 °C- 500 °C) with the one for the contact process(400 °C- 500 °C)

(d) Fairly well answered.

(e) Fairly well answered.
This question was not answered as well as it was expected. More can be done by the teachers to help learners understand the impact of pollutant gases on the environment

(f) Well answered

The majority managed to recall a pollutant gas that is emitted from the exhaust pipe

Question	Modal Answer	Additional guidance	Marks
8 (a) (i)	Contact ✓		1
(ii)	Oleum ✓	Accept $H_2S_2O_7$	1
(b)	$2SO_2 + O_2 \rightleftharpoons 2SO_3$ ✓✓	✓ correct equation ✓ correct balancing	2
(c)	• Vanadium(V) oxide / V_2O_5 ✓ • (Pressure) of 100 - 500 kPa Or 1-5 atmospheres ✓ • (temperature) of 400-500ºC ✓	**Accept**; Vanadium pentoxide Vanadium oxide is **not** sufficient **Accept** high temp and low pressure ✓ Any two	2
(d)	• To make detergents ✓ • To make fertilizers ✓ • Used as battery acid ✓	Any one	1
(e)	Causes Acid rain / mixes or dissolves in rain water ✓ Damage building, damage plants, kill animals ✓	**Allow** other relevant impact	2
(f)	Carbon monoxide / unburned hydrocarbons/ nitrogen oxides ✓	**Accept**; carbon dioxide/lead compounds Any one	1
			[10]