OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



MARK SCHEME

C6.1 IMPROVING PROCESSES AND PRODUCTS

SCORE	PERCENTAGE
/331	%

STEMUP

These questions belong to OCR, not to us.

The examination questions, mark schemes and examiner comments in this pack were written and published by OCR. They are past assessment materials, reproduced here so that students can revise from them.

What we do not own

STEMUP is not affiliated with OCR and does not own, and makes no claim to own, any of the question, mark scheme or examiner report material in this pack. OCR has not endorsed, approved or been involved in the production of it. OCR and the qualification titles used here belong to their respective owners and appear for identification only.

Where to find the originals

OCR publishes its past papers, mark schemes and examiner reports. Always check the current specification at ocr.org.uk before you revise, because content and wording can change between series.

If you hold the rights to any material in this pack and would like it amended or removed, contact admin@stemup.co.uk and we will act on it.

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>a</td><td></td><td>Use a pipette filler (1)

Potassium hydroxide is caustic / potassium hydroxide can burn skin (1)</td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>When one drop makes the litmus change colour (1)

Correct colour change blue to red (1)</td><td>2</td><td>ALLOW use a pH probe = 1 mark

ALLOW gives a pH value of 7 when neutral = 1 mark</td></tr>
<tr><td></td><td>c</td><td>i</td><td>
<table>
<tr><th>Titration number</th><th>1</th><th>2</th><th>3</th></tr>
<tr><td>final reading in cm^3</td><td>17.8</td><td>37.5</td><td>32.1</td></tr>
<tr><td>initial reading in cm^3</td><td>0.0</td><td>20.4</td><td>15.0</td></tr>
<tr><td>titre (volume of acid added) in cm^3</td><td>17.8</td><td>17.1</td><td>17.1</td></tr>
</table>
</td><td>2</td><td>Correct burette readings = 1 mark

Correct titre = 1 mark

DO NOT ALLOW 0</td></tr>
<tr><td></td><td></td><td>ii</td><td>Yes

Titration 1 is a rough estimate / titration 1 is an outlier / titrations 2 and 3 are identical (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>7</td><td></td></tr>
<tr><td>2</td><td></td><td></td><td>Can be made into fibres / waterproof / insoluble in water / flexible / soft (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>3</td><td>a</td><td></td><td>Neutralisation (1)</td><td>1</td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>Slow evaporation of solution / heat solution over a steam bath (1)</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>4</td><td>a</td><td></td><td>….4…Fe(s) + $6H_2O(l)$ +…3… $O_2(g)$</td><td>2</td><td></td></tr>
<tr><td></td><td>b</td><td>i</td><td>((2 × 55.8) / 213.6) × 100 (1)
= 52.25% (1)</td><td>2</td><td></td></tr>
</table>

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	52.25% of rust is iron For a 1.0 kg Fe bar, total mass of rust produced = (1.0 (kg) / 52.25%) × 100% (1) = 1.914 kg (1) Therefore increase is 914 g which is greater than 800 g so student is incorrect (1)	3	
			Total	**7**	
5	a		Mean titre = 17.1 (1) Because titration 1 is a rough estimate / titration 1 is an outlier / titrations 2 and 3 are identical (1)	2	**IGNORE** anything in the titration table
	b		Moles of acid = 0.00171 (1) Concentration of KOH = 0.0684 (1)	2	**ALLOW ECF** from incorrect titre / 0.100 × titre × 10^{-3} **ALLOW ECF** from incorrect moles providing answer is to 3 sig figs / moles÷volume
	c		M_r of KOH = 56.1 (1) Concentration of KOH = 3.84 (1)	2	**ALLOW** correct answer without working **ALLOW** 3.837 **ALLOW ECF** from incorrect M_r and / or incorrect concentration from (b) / M_r × conc
			Total	**6**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
6	a		Endless supply of starting materials / no need to use solid raw materials to make fertilisers (1) Ammonia used to make fertilisers which increase crop yield (1)	2	**ALLOW** Haber Process used to convert atmospheric nitrogen into ammonia / Haber process involves the chemical fixation of ammonia (1)
	b	i	Titrate ammonia against sulfuric acid to obtain volumes needed for complete neutralisation (1) Add these volumes without the use of indicator (1) Slow evaporation of reaction mixture / heat reaction mixture over a steam bath (1) Burette and other chemical apparatus not suitable for using large quantities / very difficult to use a steam bath in the large scale (1)	4	**ALLOW** heat neutral mixture with carbon or charcoal and then filter off carbon **ALLOW** Slow evaporation of filtrate / heat filtrate over a steam bath if method involving carbon is used
		ii	34 (g or tonnes) of ammonia makes 132.1 (g or tonnes) of ammonium sulfate / 17 (g or tonnes) of ammonia makes 66 (g or tonnes) of ammonium sulfate (1) So 51 tonnes makes 198.1 tonnes of ammonium sulfate (1)	2	**ALLOW** one mark for correct calculation of M_r for ammonia **AND** ammonium sulfate **IGNORE** units for the first marking point **ALLOW** one mark for 2 moles of ammonia makes 1 mole of ammonium sulfate
			Total	**8**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
7	a		Leave for a longer period of time so that the results are more differentiated / keep at the same temperature because rate of reaction changes with temperature (1)	1	IGNORE references to same mass of metals ALLOW same surface area of metal strip because surface area affects rate of reaction
	b		ANY THREE FROM Water is needed for corrosion (of most metals) since no corrosion in dry air but there is corrosion in moist air (1) Most metals corrode faster in moist alkaline air since more corrosion than in moist air (1) Most metals corrode faster in moist acidic air since more corrosion than in moist air (1) The rate of corrosion is not related to the reactivity series with reference to either copper or aluminium (1)	3	
			Total	4	
8	a		Aluminium is above carbon in the reactivity series so cannot be obtained by reaction of oxide with carbon (1) Copper is below carbon in the reactivity series (1)	2	
	b	i	$Al^{3+} + 3e^- \rightarrow Al$ (1)	1	ALLOW any correct multiple **ALLOW** = instead of → DO NOT ALLOW & or and instead of +
		ii	Ions cannot move (1)	1	IGNORE electrons cannot move
			Total	4	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
9	a		…**4**…Fe(s) + …**6**…H_2O(l) +…**3**…O_2(g) ⟶ …**2**…**$Fe_2O_3.3H_2O$(s)**	2	Allow: **$2Fe(s) + 3H_2O + 1\ 1/2\ O_2(g) \longrightarrow (1)Fe_2O_3.3H_2O(s)$**✓
	b		Moles of iron = 1000.0 / 55.8 = 17.92 mol (1) Mole ratio (rust / iron) = 2/4 (1) Moles of rust = 17.92 × 2/4 = 8.96 mol (1) Mass of rust = 8.96 × 213.6 = 1914 g (1) Days to rust = 1914 / 60 days (1) = 32 days (1)	6	% of iron in rust = ((2 × 55.8) / 213.6) × 100 = 52.25% For a 1.0 kg Fe bar, total mass of rust produced = (1.0 (kg) / 52.25%) × 100% = 1.914 kg = 1914 g
			Total	**8**	

Question			Answer/Indicative content	Marks	Guidance
10	a	i	1500 (1)	1	units **not** needed **Examiner's Comments** Most candidates correctly interpreted the graph and scored the marks.
		ii	decreases / gets smaller / gets less (1)	1	**allow** goes up to start with and then goes down / AW (1) **Examiner's Comments** Most candidates correctly interpreted the graph and scored the marks.
	b		**any three from:** (UK decreases but) world is increasing (1) world uses more fertilisers than UK / AW (1) both UK and world use less phosphorus than nitrogen / ora (1) idea that 'blip' on graph for UK in 1997 not shown in the world / AW (1)	3	**allow** graph (a) for UK and graph (b) for world **Examiner's Comments** Good responses described that world use of fertilisers is increasing and that both the UK and the world use less phosphorus containing fertilisers than nitrogen containing fertilisers.
	c	i i i	 **?E** ?because idea that uses smallest amount of pesticides (1) idea that uses smallest amount of fertilisers (1)	2	**No marks for E, marks are for explanation** **allow** cannot tell because the figures give are mean values and so other countries may use lots of fertilisers and pesticides on **allow** other countries with correct justification **Examiner's Comments** Most candidates scored for correctly identifying that country **E** uses the smallest amount of fertilisers and pesticides.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	1.4×10^9 / 1 400 000 000 (1)	1	unit **not** needed **Examiner's Comments** Examiners saw a wide range of incorrect values calculated.
	d		nitrous oxide (1) largest source from farming (1)	2	N_2O (1) it is 88% is **not** sufficient but **allow** 88% from farming (1) **allow** fertilisers contain nitrogen and this gas contains nitrogen (1) **ignore** just quoting numbers **Examiner's Comments** Most candidates correctly chose nitrous oxide and explained their choice because it is the largest source from farming.
			Total	**10**	
11			sulfur (1)	1	**allow** S (1) **Examiner's Comments** Sulfur was usually correct.
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
12		i	34 - 36 (1)	1	units **not** needed **Examiner's Comments** This question assessed evaluation and analysis skills and was focused on the use of fertilisers. Most candidates could interpret the graph and give a value between 36 and 35 millions of tonnes.
		ii	Controls effective because gradient is less (than it would have been) after 1977 / controls effective since the use of fertilisers has grown at a much greater rate than the pollution / controls effective because of the sudden decrease at 1977 (1)	1	**allow** controls effective since concentration of nitrate less after 1977 **allow** figures quoted from graph to show decrease of nitrate concentration **allow** not (very) effective since little change in the gradient of graph before and after 1977 **Examiner's Comments** This question assessed evaluation and analysis skills and was focused on the use of fertilisers. Candidates usually referred to the decrease in the concentration of nitrate ions after 1977 although some did mention the difference in gradient of the line before and after 1977.
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
13	a	i	1 260 000 000 (1)	1	unit **not** needed **allow** 1.26×10^9 or 1.3×10^9 Examiner's Comments This question assessed evaluation and analysis skills and was focused on the use of fertilisers. candidates had to interpret a table of data. Many could calculate the mass of pesticides used in county **E**. Only a small number of candidates gave the answer in standard form which avoided writing so many zeros. A small proportion of candidates divided the number by 1000 instead of multiplying it by 1000
		ii	(percentage of) land available (for agriculture) is (much) less (1) so need to get very high crop yield from the land (1)	2	assume answers apply to country **B** but **allow** ora for **A** if specified **ignore** country small / 4% used for agriculture / 4% available unlike (another quoted value) **allow B** has lots of pests (1) Examiner's Comments This question assessed evaluation and analysis skills and was focused on the use of fertilisers. Candidates often appreciated that the land available for agriculture was much less than in country **A** but were less likely to link this to the need to improve crop yield. Some candidates referred to country **B** having a large number of pests and this was also given credit in the mark scheme.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b	i	nitrous oxide (1) largest source from farming (1)	2	N_2O it is 88% is **not** sufficient but **allow** 88% from farming **allow** fertilisers contain nitrogen and this gas contains nitrogen **ignore** just quoting numbers **Examiner's Comments** This question assessed evaluation and analysis skills and was focused on the use of fertilisers. Candidates had to interpret three pie charts. Candidates often chose nitrous oxide citing the evidence that it had the greatest percentage in the farming sector of the pie-chart. Some candidates in used an alternative approach stating that nitrous oxide contains nitrogen and many fertilisers contain nitrogen.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	**more** carbon dioxide produced by farming (1) **more** nitrous oxide produced by farming (1) **more** methane produced by farming (1)	3	**allow all** (three greenhouse) **gases** are in greater percentage from farming than from residential use (3) must compare data and **not** just quote the data **allow** farming is 147 and residential is 17 for one mark if no other mark awarded **Examiner's Comments** This question assessed evaluation and analysis skills and was focused on the use of fertilisers. The best answers noted that all three gases (carbon dioxide, methane and nitrous oxide) had a larger percentage coming from farming than residential. Other candidates just quoted the data from the pie-charts without making any comparison; this was not given any credit. Some candidates added all the percentage of each gas from the three pie charts but again most candidates using this approach did not make a comparison of the numbers they had calculated.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
14		i	air (1)	1	**allow** other ways of indicating answer e.g. tick or circle but the answer on the answer line takes precedence Examiner's Comments This question was about the manufacture of ammonia by the Haber process. Many candidates recognised that air was the source for nitrogen.
		ii	recycled (1)	1	**allow** sent round again / it is reacted together (again) Examiner's Comments This question was about the manufacture of ammonia by the Haber process. Some candidates thought that unreacted nitrogen and hydrogen was recycled but others stated it was vented into the air.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
15			[Level 3] All three metals are comprehensively evaluated AND metal A is chosen and justified. Quality of written communication does not impede communication of science at this level. (5–6 marks) [Level 2] An attempt is made to evaluate the strengths and weaknesses of at least two metals AND metal A or C is chosen with an attempt at a justification. Quality of written communication partly impedes communication of science at this level. (3–4 marks) [Level 1] An attempt is made to evaluate both the strengths or weaknesses of one metal. Quality of written communication impedes communication of science at this level. (1–2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A*. Indicative scientific points may include: • metal A has the lowest density and a high strength but is expensive • metal B has a high density, reasonable strength but is cheap • metal C has a high density but is cheap and is the strongest • metal A is the best choice • because it has the lowest density and good strength • metal A is expensive but not many aircraft will be made. • metal B has a low melting point as a disadvantage Use the L1, L2, L3 annotations in scoris. Do not use ticks. Examiner's Comments Candidates could often use the data in the table, but some candidates were confused over strengths and weaknesses — high density was often perceived as strength. Other candidates did not write about each of the metals but focused on the metal of their choice. C was the most common choice but some mixed choices for the wings and body were given.
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
16				3	**Use ticks in this question** **Mark scheme is hierarchical** – level 1 is required before level 2 can be awarded and levels 1 & 2 required before level 3 can be awarded
			Level 1 (1 mark) idea that fertiliser or nitrates increase the growth of water plants **or** that the outcome is that living organisms in the water die. idea that fertilisers cause water to become toxic limits mark to a maximum of 1		**allow** algal bloom for increased growth of water plants idea that **fertiliser** kills or poisons fish (0)
			Level 2 (2 marks) idea that (algal bloom) / plant growth blocks off sunlight (from other plants which then die).		**allow** idea that plants below surface cannot photosynthesis for level 2
			Level 3 (3 marks) idea that in addition to level 2, (aerobic) bacteria use up the oxygen in the water.		**allow** decomposers or microbes or micro organisms for bacteria **Examiner's Comments** Candidates often gave good answers to but failed to note that bacteria use the oxygen in the water, so were not awarded maximum marks for this question.
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
17			C because it is flexible, waterproof and breathable (2)	2	marks are for evaluation, not for the choice of C but for two marks properties must relate to correct choice of C for two marks **all three** properties must be listed **allow** one mark for choice of C with **two** properties listed **allow** one mark for E and because it is flexible and waterproof ignore reference to not breathable if E mentioned. **Examiner's Comments** The candidates were able to use and evaluate the data given about the five polymers and often obtained maximum marks for this question.
			Total	**2**	
18			**any two from:** cost of ethene (1) labour costs (1) equipment costs (1) cost of catalyst (1) research costs (1) cost of testing (1) rent or rates or taxes (1) pollution controls (1) storage (1)	2	**allow** extra qualification of costs (1) **allow** safety costs or safety equipment (1) **allow** maintenance costs (1) **ignore** references to energy costs / electricity / gas **ignore** packaging **ignore** transporting ethanol **ignore** marketing **Examiner's Comments** Most candidates scored 1 mark and a number both marks. Labour costs and the cost of ethene were common correct answers.
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
19			**Level 3 (5–6 marks)** Applies knowledge of properties to identify at least two correct properties **AND** analyses table of data to choose metal B and fully explains their choice to include references to lowest density. Quality of written communication does not impede communication of science at this level. **Level 2 (3–4 marks)** Applies knowledge of properties to identify at least two sensible properties **AND** metal B is identified or metal D identified based on greatest strength. Quality of written communication partly impedes communication of science at this level. **Level 1 (1–2 marks)** Applies knowledge of properties to identify one sensible property **OR** suggests metal B for making the wings and/or body. Quality of written communication impedes communication of science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to C.** **Relevant points include:** • metal needs to have a low density • metal needs to have high strength • metal must not corrode easily • melting point of metal must not be too low **ignore** references to thermal conductivity Metal **B** is best. This is because: • it has the lowest density or lightest metal • and a high strength • it has the highest melting point. **Examiner's Comments** This question was targeted at data interpretation and justifying a conclusion (Assessment Objectives 2 and 3). Candidates were required to identify the properties needed by a metal to be used to make the wings and body of an aircraft. Most candidates correctly quoted strength as an important property. Fewer recognised the importance of low density (others thought that high density was necessary). High melting point was also credited. Those candidates who quoted metal D based on strength scored Level 2. Those who quoted metal B with a justification based on low density scored Level 3.
			Total	**6**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
20			**benefits – any one from:** increased crop yield (1) crops grow faster (1) increased food supply (1) provides essential elements / provides nitrogen or phosphorus or potassium (1) **problem – any one from:** runs off into rivers and lakes (1) idea of algal bloom (1) causes death of water organisms (1) eutrophication (1)	2	**allow** bigger crops (1) **ignore** better crops **ignore** to help crops grow (healthy) **allow** blue baby syndrome (1) **ignore** just 'causes pollution' **allow** correct description of eutrophication (1) **Examiner's Comments** The words 'formula' and 'product' were both emboldened in the question. In spite of this there were a number of names rather than formulae given and only a minority of candidates understood what was meant by a product.
			Total	2	
21			**C** because it is flexible, waterproof and breathable (2)	2	marks are for evaluation, not for choice of **C** but for two marks properties must relate to correct choice of **C** for two marks **all three** properties must be listed **allow** one mark for **C** and **two** properties listed **allow** one mark for **E** and because it is flexible and waterproof ignore reference to not breathable if **E** mentioned. **Examiner's Comments** Most candidates scored 2 marks on this question, correctly interrogating the data to identify the best polymer for making a sports jacket.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
22	a		as a control / for comparison (1)	1	**allow** to see if the treatments have an effect (1) **allow** to see if the treatments made a difference (1) **allow** to see the difference between treating and not treating (1) **allow** to see if it would rust if there was no treatment (1) Examiner's Comments Most candidates recognised that the untreated iron would be used as a comparison or as a control. 'As a fair test' was a common unacceptable response.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b		Level 3 Identifies the correct order for the effectiveness of the methods of rust prevention AND explains their decision AND describes how painting protects iron from rusting to include the idea of a barrier to both water and oxygen or air. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) Level 2 Identifies the correct order for the effectiveness of the methods of rust prevention with one error or list is in reverse order AND attempts to explain their decision AND gives a simple reason why painting protects iron from rusting. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) Level 1 Identifies the least effective OR identifies most effective method of rust prevention OR gives a simple reason why painting protects iron from rusting. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) Level 0	6	This question is targeted at grades up to E. Indicative scientific points may include: correct order • iron mixed with chromium > iron coated in zinc > painted iron > iron covered in oil Explanation • idea that the longer the time before rusting appears the better the treatment How painting protects iron from rusting • provides a barrier • stops oxygen or air reaching the surface of the iron • stops water reaching the surface of the iron Use the L1, L2, L3 annotations in Scoris; do not use ticks. <u>Examiner's Comments</u> Rusting was well understood. Most candidates could rank the treatments in the correct order and explain how they had done it. Explanations about how painting protects iron were less precise. The idea of a barrier to both water and oxygen was required.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		
			Total	7	

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
23			Level 3 Analyses table to evaluate advantages AND disadvantages of all three types of treatment AND explains fully how attaching magnesium to iron helps to prevent rusting. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) Level 2 EITHER Analyses table to evaluate advantages AND disadvantages of all three types of treatment OR Analyses table to evaluate advantages AND disadvantages of two types of treatment AND attempts to explain how attaching magnesium to iron helps to prevent rusting. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) Level 1 EITHER Analyses table to evaluate an advantage AND a disadvantage of one type of treatment OR attempts to explain how attaching magnesium to iron helps to prevent rusting. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A/A*. Indicative scientific points may include: Evaluations • idea that painting is cheap but does not last long • idea that alloying is the best method of rust prevention but is the most expensive • idea that alloying is difficult to do • idea that attaching magnesium is expensive but lasts a long time How attaching magnesium to iron helps prevent rusting • idea that magnesium is a sacrificial metal • idea that magnesium is more reactive than iron and so reacts instead of the iron • magnesium loses electrons in preference to iron • magnesium is a better reducing agent • magnesium is easier to oxidise ignore reference to magnesium rusting Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments This question focused on rust prevention and partly assessed both evaluation and the quality of written communication. Candidates often achieved level 3 in this six-mark question. Candidates used the data provided to give disadvantages and advantages for each rust prevention treatment. Some candidates missed out how magnesium prevents rust. Other candidates just mentioned sacrificial protection without explaining how this works in terms of the magnesium being more reactive than iron. A common

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					misconception was that magnesium acted as a protective barrier. A significant proportion of candidates referred to magnesium rusting in their answers.
			Total	6	
24			C high(est) heat conductivity (1) high melting point (1)	2	no mark for choice **allow** a (very) good heat conductor **allow** will not melt when heated on a stove / does not melt easily **allow A** due to a (fairly) high melting point (1) **allow D** due to good heat conductivity (1) and either high melting point or low density / lightweight (1) ignore light **ignore** other properties **Examiner's Comments** Many candidates could evaluate the data in the table and suggest, with reasons, the letter of a metal that could be used to make the base of a saucepan. There were no marks for the choice of metal; all the marks were awarded for the explanation. Most candidates appreciated the importance of both a high thermal conductivity and a high melting point.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
25			Level 3 (5–6 marks) Discusses at least one advantage and at least one disadvantage of each process AND identifies the better process fully justifying their choice. Quality of written communication does not impede communication of the science at this level. Level 2 (3–4 marks) EITHER Discusses at least one advantage and at least one disadvantage of each process OR Gives two comments (either advantages or disadvantages) about each process AND identifies the better process and gives a reason for that choice Quality of written communication partly impedes communication of the science at this level. Level 1 (1–2 marks) Gives two comments (either advantages or disadvantages) about each process OR identifies the better process and gives a reason for that choice Quality of written communication impedes communication of the science at this level. Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit	6	This question is targeted at grades up to A/A* Indicative scientific points may include: Relevant points include for hydration process: advantages • making ethanol from ethene is a much quicker process • ethanol can be produced 24/7 from ethene • pure ethanol made so it does not need to be purified • making ethanol from ethene does not produce any waste products as the atom economy is 100% • UK has access to North sea oil. • made by a continuous process disadvantages • ethene has to be manufactured from crude oil • crude oil (ethene) is a non renewable source • uses a lot of energy. Relevant points include for fermentation process: advantages • making ethanol from sugar is greener as the raw sugar is renewable / can be grown • energy costs are cheaper because a lower atmospheric pressure and a lower temperature than hydration is used • catalyst used is not corrosive since it is an enzyme found in yeast disadvantages • ethanol has to be purified • takes a long time to make

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					• climate not suitable • uses large areas of arable land. • atom economy not 100% (if carbon dioxide not used) • made in a batch process Use the L1, L2, L3 annotations in Scoris; do not use ticks Examiner's Comments In this six mark question candidates often gave a comprehensive discussion of the advantages and disadvantages of hydration and fermentation. A significant proportion of the candidates needed to use additional pages to complete their answers. Sometimes candidates forgot to make a choice at the end of their answer which limited the mark to level 2 and four marks. Either choice of hydration or fermentation was accepted in themark scheme provided the answer was justified. The best organised answers put their information in a table of advantages and disadvantages.
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
26	a		LOOK FOR ANSWER FIRST OF ALL IF percentage = 27.4 (%) OR 27(%) AWARD 2 MARKS $\frac{19.2}{70} \times 100$ (1)	2	Examiner's Comments Candidates were often able to calculate the percentage as 27.4. In this question the value of 27 was also allowed in the mark scheme. A significant number of the candidates did not include the working out for this question.
	b	i	0.46 (g) (1)	1	**not** 0.5 Examiner's Comments Candidates were often able to calculate the mass as 0.46g. In this example the value of 0.5 was not allowed in the mark scheme since the answer had to be to two significant figures. A small proportion of the candidates did not answer this question.
		ii	idea that some of the sodium may have come from sources other than salt (1)	1	**allow** not all sodium is from sodium chloride / may be other sodium compounds present Examiner's Comments Many candidates referred to sodium being in other ingredients although they did not specifically state that sodium could come from other compounds or from ingredients other than salt. A common misconception was that the chloride ion had not been accounted for in the mass. A significant proportion of candidates did not answer this question.
			Total	4	
27			K (1)	1	**allow** potassium Examiner's Comments Most candidates could use the graph to link the melting point with the strength of metallic bonding, and as a result chose potassium.
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
28			Yes (no mark) solvent **A** will remove the blue paint and solvent **D** will remove the yellow paint (1) solvents **A** and **D** will not damage the clothes (1)	2	 **allow** solvent **A** removes blue paint and does not damage clothes (1) **allow** solvent **D** removes yellow paint and does not damage clothes (1) **Examiner's Comments** Better candidates answered this question well. They realised that both solvents **A** and **D** were required and that they did not damage clothes. Weaker candidates thought that they had to find one solvent that could remove both stains and said that this was not possible.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

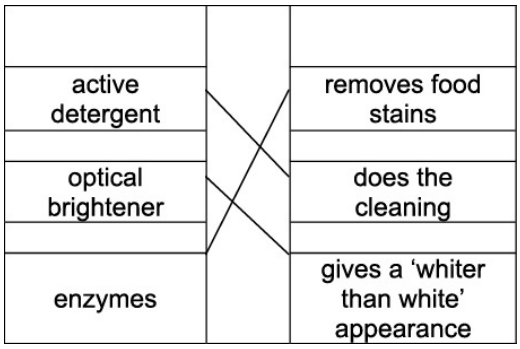
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
29	a		water (1) oxygen (1)	2	**allow** H_2O (1) **allow** O / O_2 / air (1) **allow** moist air or damp air (2) **ignore** iron **Examiner's Comments** Most candidates scored 2 marks on this question. A common incorrect substance was 'salt'.
	b		**any two from**: oil or grease (1) paint (1) galvanising (1) idea of sacrificial protection (1) alloying (1) tin plating (1) **then any one from**: oil or grease or paint or tin plating – act as a barrier (so they stop water and oxygen reaching the iron) (1) galvanising – coated with zinc / so acts as a barrier / zinc corrodes first (1) sacrificial protection uses a more reactive metal / magnesium reacts instead of iron / zinc reacts instead of iron (1)	3	 **allow** coat with zinc (1) **allow** put in contact with magnesium or zinc (1) **allow** coat in another metal (1) **allow** mix with another metal (1) **allow** use stainless steel (1) **allow** plastic coating (1) **allow** paint provides a protective layer (1) **Examiner's Comments** This question discriminated well across the ability range. Most candidates could state one or two methods of protecting iron from rusting. Painting, oiling and galvanising were common correct answers. Better candidates gave good explanations of how the methods worked. Weaker candidates suggested keeping the iron inside away from water.
			Total	**5**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
30			 **all three** correct (2) **but** **one** or **two** correct (1)	2	**Examiner's Comments** This question was well answered by the majority of candidates. Occasionally candidates thought that enzymes did the cleaning and lost a mark. 'Optical brightener' was almost always matched to 'gives a whiter than white appearance'.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
31			(copper because) good resistance to corrosion (1) **or** (aluminium because) good resistance to corrosion (1) low density (1) **or** (stainless steel because) good resistance to corrosion (1) strong (1) cheap(est) (1) **or** (titanium because) good resistance to corrosion (1) strong (1) low density (1)	3	**No mark for the metal – the mark is for the correct reason** **ignore** other properties **allow** copper does not rust (1) but **not** copper does not rust as easily **allow** aluminium does not rust (1) but **not** aluminium does not rust as easily **allow** lightweight (1), but **ignore** just light **allow** only £900 per tonne (1) **allow** titanium does not rust (1) but **not** titanium does not rust as easily **allow** lightweight (1), but **ignore** just light **Examiner's Comments** Most candidates were able to use the data in the question to suggest and explain which metal is the most suitable for making the bicycle. Candidates could gain full credit for justifying the choice of either stainless steel or titanium as the data presented suitable reasons for both.
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
32	a		**names of reactants:** (acid is) sulfuric acid (1) (alkali is) ammonia / ammonium hydroxide / ammonium carbonate / ammonium hydrogencarbonate (1) **AND** **any one from:** acid is titrated with alkali using an indicator / idea of controlled addition of acid to alkali with use of indicator (1) (heat to) evaporate water / leave solution to crystallise (1)	3	**allow** correct formulae or mix of formula and name H_2SO_4 $NH_3/NH_4OH/(NH_4)_2CO_3/NH_4HCO_3$ **not** ammonium / NH_4 / ammonia hydroxide **allow** acid is added to alkali (or vice versa) until a neutral solution is obtained (1) **allow** idea of controlled addition of acid to alkali with use of pH meter or test with indicator paper (1) **Examiner's Comments** Good responses to this question correctly stated that sulphuric acid and ammonia / ammonium hydroxide are needed to make ammonium sulphate and described how the acid and alkali are used to make a neutral solution. It was not necessary to describe a titration method to gain full credit, but candidates did need to suggest the controlled addition of acid to alkali rather than merely adding the acid to the alkali.
	b		**[Level 3]** **Answer describes advantages AND disadvantages of conditions used** **AND** **includes the balanced symbol equation for the reaction.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Answer describes an advantage AND a disadvantage of conditions used** **OR** **includes the balanced symbol equation for the reaction.** Quality of written communication partly	6	**This question is targeted at grades up to A*** **Indicative scientific points may include:** **Symbol equation** $NH_3 + 2O_2$? $HNO_3 + H_2O$ **allow** any correct multiple, including fractions **allow** = / ? instead of ? **not** and / & instead of '+' **Advantages of conditions listed** • high temperature or temperature of 900°C increases rate of reaction • (platinum) catalyst reduces costs • (platinum) catalyst increases rate of reaction

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer describes either an advantage or a disadvantage of conditions used OR includes the symbol equation for the reaction (may not be balanced). Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		• atmospheric pressure means lower energy costs • atmospheric pressure means lower plant costs Disadvantages of conditions listed • high temperature or temperature of 900°C increases energy use or expensive • high temperature reduces percentage yield • (platinum) catalyst is (initially) expensive • atmospheric pressure means slower rate of reaction allow answers in terms of position of equilibrium e.g. more moles on LHS so should use higher pressure e.g. if reaction is exothermic equilibrium is on LHS at higher temperature Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments This 6 mark question focused on the conditions used in the reaction to manufacture nitric acid and was targeted up to grade A*. At the simplest level, a candidate who described an advantage or a disadvantage of the conditions used, or who gave an unbalanced equation for the reaction, scored Level 1. To gain Level 2 candidates needed to give a correctly balanced symbol equation for the reaction. Alternatively candidates could describe an advantage and a disadvantage of the conditions used, although marks scored in this way were rarer. As in the other 6 mark questions on the paper, candidates had to address all aspects of the question to gain credit at level 3 (5-6 marks). Many candidates gained credit at Level 3 in this question.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			Total	9	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
33	a	i	transparent (1)	1	**allow** insoluble (in water) / waterproof / does not react with water (1) **allow** clear / see through / colourless (1) **allow** does not biodegrade / does not decompose / does not decay (1) **allow** does not photodegrade (1) **ignore** shatterproof / strong **Examiner's Comments** Most candidates suggested that glass for a car windscreen needs to be transparent.
		ii	(aluminium car body) will corrode less / does not corrode (1)	1	**assume unqualified answer refers to aluminium** **allow** (aluminium car body) will have a longer lifetime (1) **allow** aluminium does not rust (1) but **not** aluminium does not rust as easily (0) **allow** aluminium does not oxidise (in air) (1) **ignore** aluminium is less corrosive **allow** car will have better fuel economy (1) **allow** ora for steel **ignore** aluminium is easier to mould / is more flexible **not** stronger **Examiner's Comments** Good responses described that aluminium corrodes less than steel. Candidates who failed to gain credit often described that aluminium does not rust as easily as steel.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b		(PVC) has high flexibility / is flexible / aw (1) (PVC) has low (electrical) conductivity / is a poor (electrical) conductor / does not conduct (electricity) / aw (1)	2	**ignore** references to density **allow** is an (electrical) insulator (1) **Examiner's Comments** Good responses to this question used the data to explain that PVC is used for covering electrical wiring as it is flexible and a poor electrical conductor.
			Total	**4**	
34			**any one from:** idea that pharmaceutical drugs are usually required or made in smaller quantities (1) idea that pharmaceutical drugs are made as required (1) **any one from:** idea that fertilisers are made in large quantities (1) idea that fertilisers are made 24/7 (1)	2	must be **one** comment on pharmaceutical drugs and **one** on fertilisers for two marks **allow** idea that can control each batch for purity (1) **Examiner's Comments** Good responses to this question described that pharmaceutical drugs are made in small quantities or on demand whereas fertilisers are made in large quantities or 24/7. When candidates did not gain marks it was often because they gave more generic answers about batch and continuous processes, e.g. a continuous process can be automated.
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
35	a	i	4 (1)	1	
		ii	15 (1)	1	Examiner's Comments This question was about fertilisers. The number of different elements shown in the displayed formula was usually correct.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b		Level 3 (5–6 marks) Names both the reagents needed AND Describes a neutralisation experiment, including how both a neutral solution and solid ammonium sulfate is obtained. Quality of written communication does not impede communication of the science at this level. Level 2 (3–4 marks) Names both the reagents needed AND Attempts to describe a neutralisation experiment. Quality of written communication partly impedes communication of the science at this level. Level 1 (1–2 marks) Names one of the reagents needed OR Attempts to describe a neutralisation experiment. Quality of written communication impedes communication of the science at this level. Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.	6	This question is targeted at grades up to A*. Indicative scientific points may include: names of reagents • acid is sulfuric acid • alkali is (a solution of) ammonia or ammonium hydroxide or ammonium carbonate. method • sulfuric acid is added to ammonia solution until a neutral solution is formed • neutral solution obtained by use of pH meter / indicator solution / indicator paper / universal indicator solution • the neutral solution is evaporated until saturated • solution is allowed to stand and crystallise • crystals are filtered off and dried. **allow** idea of 'evaporation to dryness' as an alternative to crystallisation **N.B.** It is not necessary to describe a titration method to get Level 3. Use the L1, L2, L3 annotations in scoris; do not use ticks. Examiner's Comments This question was about fertilisers. The number of atoms in the formula was usually correct. Where candidates did not gain the mark it was often because they gave an answer of 132, being the relative formula mass of ammonium sulfate.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
36	a		(solvent) **D** (1) idea that removes more of the stain than **B**, without damaging the fabric / idea that removes majority of the stain, without damaging the fabric (1)	2	**Second marking point is dependent on correct choice of solvent D** **allow** idea that removes a high percentage of the stain, without damaging the fabric (1) **Examiner's Comments** Good responses to this question used the data to identify the most suitable solvent as D and explained that it removed the majority of the stain without damaging the fabric. When candidates did not gain full credit it was usually because they simply quoted data from the table, rather than using the data to compare the solvents.
	b		**any two from:** repeat the experiment (at each temperature) (1) carry out the experiment with a greater range of temperatures (1) do the experiment for a longer time (1) test on different types of stain (1) test on different types of cotton (1)	2	**allow** specific aspects related to a fair test (1) e.g. use same amount of solvent **ignore** test on different fabrics **Examiner's Comments** Good responses to this question suggested, for example, repeating the experiment for each temperature and using a greater range of temperatures or different types of stains. Candidates who suggested testing on different fabrics did not gain credit as the question was specifically about finding the most suitable solvent for removing stains from cotton.
			Total	**4**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
37			**any three from:** research and testing (1) energy costs / heat / electricity (1) labour costs (1) (raw) materials / (starting) materials (1) time taken for development / time taken to make the drug (1) marketing / packaging (1) plant costs / costs of the machines (1)	3	**allow** how much is made Examiner's Comments This question focused on the manufacture of a pharmaceutical drug in a batch process. Candidates often gave one factor but rarely were able to give three acceptable factors. Many candidates focused only on the factors related to research and testing. Other factors given included labour, energy and raw materials. Some candidates confused the terms raw materials and products.
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>38</td><td>a</td><td></td><td>(through their) roots (1)</td><td>1</td><td>not shoots / stems

ignore leaves

<u>Examiner's Comments</u>

This question focused on the fertiliser ammonium phosphate.

Most candidates could recall that plants absorb minerals through their roots.</td></tr>
<tr><td></td><td>b</td><td>i</td><td><table><tr><th>Atom</th><th>Number</th></tr><tr><td>N</td><td>3</td></tr><tr><td>H</td><td>12</td></tr><tr><td>P</td><td>1</td></tr><tr><td>O</td><td>4</td></tr></table>all four correct scores (2)
two or three correct scores (1)
one correct scores (0)</td><td>2</td><td><u>Examiner's Comments</u>

Some candidates could complete the table of information about the number of atoms in the formula. The most common errors involved the number of nitrogen and hydrogen atoms. A significant proportion of the candidates did not attempt. The names of the two essential elements in ammonium phosphate were given by some candidates</td></tr>
<tr><td></td><td></td><td>ii</td><td>nitrogen (1)

phosphorus (1)</td><td>2</td><td>allow N
not N_2

allow P

<u>Examiner's Comments</u>

Often phosphate or ammonium was given instead.</td></tr>
<tr><td></td><td>c</td><td></td><td>Level 3 (5 – 6 marks)
States the name of the acid and the alkali needed to make ammonium phosphate
AND
fully describes how an indicator can be used to check the pH of the solution made.
Quality of written communication does not impede communication of the science at this level.

Level 2 (3 – 4 marks)
EITHER
States the name of the acid and the alkali needed to make ammonium phosphate
OR
fully describes how an indicator can be</td><td>6</td><td>This question is targeted at grades up to C

Indicative scientific points may include:

• acid needed is phosphoric acid / H_3PO_4
• alkali needed is ammonia / ammonium hydroxide / NH_3 / NH_4OH

To check the pH of the solution

• add universal (indicator) / pH paper / full range indicator

ignore litmus / phenolphthalein / methyl orange</td></tr>
</table>

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			used to check the pH of the solution made. Quality of written communication partly impedes communication of the science at this level. Level 1 (1 – 2 marks) EITHER States the name of the acid needed to make ammonium phosphate OR states the name of the alkali needed to make ammonium phosphate OR attempts to describe how an indicator can be used to check the pH of the solution made. Quality of written communication impedes communication of the science at this level. Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.		• compare colour obtained against colour chart **allow** its colour tells you the pH **but** to see what colour it goes is **not** sufficient **allow** examples of colour matching with pH e.g. if it is green then it is pH 7 - the colour stated must match the pH, i.e. red, yellow, orange for a pH below 7 and blue-green, blue or purple for pH above 7 **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.** Examiner's Comments This question also assessed quality of written communication and involved aspects of the preparation of ammonium phosphate. Most candidates were not able to give the names of either the alkali or the acid needed. A common error was phosphorus acid. The use of the colours obtained when indicators are added to solutions of different pH values was well known although candidates did not always give the name of Universal Indicator. A significant proportion of the candidates did not attempt this question.
			Total	11	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
39			yes because none of the metals corrode in nitrogen / none of the metals corrode in the absence of oxygen or air (1) **all** of the metals show more change in acidic air (than moist clean air) (1)	2	If no then 0 marks for the question marks are for explanation rather than yes on its own **allow** for any given metal **allow** stays shiny instead of does not corrode **allow** no change instead of no corrosion **allow** for any given metal more corrosion is **not** sufficient for a mark Examiner's Comments This question was about the corrosion of metals. This question assessed the skill of evaluation. Candidates found this question demanding and rarely were awarded both marks for the question. Many candidates just repeated the conclusions and did not quote information from the table. The best answers appreciated that with nitrogen there was no corrosion and that with acidic air the metal was covered with more solid on the surface than with damp oxygen.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
40		i	strongest (1) **and any one from:** resistant to corrosion (1) easily shaped (1)	2	Examiner's Comments Many candidates could give two reasons but some did not include the importance of having the highest strength. Candidates often struggled to give a definition for the term alloy
		ii	a mixture containing a metal (1)	1	**allow** contains two metals / mixture containing a metal and a non-metal (1) **allow** a metal made from other metals (1) (limit of acceptability) **not** metals joined or metals combined or metals bonded **not** metal mixed with a compound Examiner's Comments Some candidates made reference to a material that does not corrode and others just a mixture of materials without referring to metals.
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
41	a		**any one from each additive and job:** Antioxidant (1) stops food reacting with oxygen (1) Preservative (1) stops food going off (1) Food colour (1) makes food more attractive / makes food more appealing (1) Sweeteners (1) to lower calorific value (1)	2	mark the additive first — the job must match the additive **allow** named additive e.g. salt as a preservative, sorbitol as an artificial sweetener or ester to provide a pleasant aroma (to the food) Examiner's Comments This question was about food additives. The most common food additive stated was a food colour however some candidates did not really explain why food colours were added to foods. Other candidates gave the names of specific food additives and where appropriate these answers were given credit. Those candidates that mentioned sweeteners rarely mentioned that this was a low calorie option. Candidates rarely stated preservatives or antioxidants. A significant proportion of the candidates did not attempt this question.
	b		**C** (1) **any two from:** not poisonous (1) no smell (1) cheapest (1)	3	**allow** one mark for **D** since it is not poisonous **not** any marks for answers when **A** and **B** are given if no letter given **allow** correct reasons cheap is **not** sufficient Examiner's Comments This question assessed the skill of evaluation and most candidates were able to choose emulsifier C and give two reasons for their choice of answer.
			Total	**5**	

Question			Answer/Indicative content	Marks	Guidance
42			**Level 3** **Defines biodegradable** **AND** **Evaluates the use of the polymer giving an advantage and a disadvantage** Quality of communication does not impede communication of science at this level. (5 – 6 marks) **Level 2** **EITHER** **Defines biodegradable AND evaluates the use of the polymer giving either an advantage or a disadvantage** **OR** **Evaluates the use of the polymer giving an advantage AND a disadvantage** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **Level 1** **EITHER** **Defines biodegradable** **OR** **Evaluates the use of the polymer giving either an advantage or a disadvantage** Quality of communication impedes communication of the science at this level. (1 – 2 marks) Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to C Indicative scientific points may include: **Definition of biodegradable** • does rot • does decay • does break down (naturally) • does break up (naturally) • is attacked by bacteria • will decompose **ignore** corrode / will not be around for ever **Evaluation** • advantage – when disposed of will not contribute to (long term) litter or pollution • advantage – no need to burn plastic in order to dispose of it / no need to use a disposal method that contributes to global warming • advantage – will not fill up land-fill sites • disadvantage – idea that it cannot have a long storage life • disadvantage – idea that it may start to degrade when still in use • disadvantage – not recyclable • disadvantage – polymer has a use by date **ignore** references to strength and flexibility Use the L1, L2, L3 annotations in Scoris, do not use ticks Examiner's Comments Many candidates did not understand the meaning of the term biodegradable and as a result found this six mark question quite challenging. Candidates often referred to biodegradable plastics being recyclable and not very strong. Some candidates gave disadvantages that were typical of

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					non-biodegradable plastics such as problems of disposal in land-fill sites or incineration. Only the very best answers appreciated the problems of using a biodegradable polymer in terms of it breaking down before the plastic bottle was thrown away. Other candidates stated there would be less pollution but did not attempt to explain why. Many candidates struggled with the correct use of chemical terminology.
			Total	6	
43			**any three from:** cost of starting materials (1) labour costs / wages (1) equipment (1) plant / cost of rent / cost of rates (1) cost of catalyst (1) transportation costs (1)	3	**allow** cost of nitrogen / hydrogen **allow** cost of high pressure container **allow** research costs **allow** environmental costs **Examiner's Comments** This part was fairly well answered.
			Total	3	
44			**any two from:** reduces problems of disposing of copper (1) uses less energy (1) idea that copper ore needs lots of processing to make copper (1)	2	**allow** saves digging up copper ore / malachite / copper carbonate **allow** to extract copper from its ore is difficult and takes a lot of time / lot of equipment required to extract copper from its ore **Examiner's Comments** Few candidates scored 2 marks because they concentrated on how expensive it is to dig the ore up but forgot that recycling copper requires less energy.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
45			Level 3 (5-6 marks) Candidates apply their knowledge and understanding of the link between properties and uses to suggest the important properties necessary for a metal to be used in construction of overhead power cables. AND Candidates analyse the data and explain why aluminium is the best choice of the metals. If copper is chosen as the metal with correct explanations a mark of 5 can be credited. Quality of written communication does not impede communication of the science at this level. Level 2 (3-4 marks) Candidates apply their knowledge and understanding of the link between properties and uses to suggest some properties necessary for a metal to be used in construction of overhead power cables AND choose a metal with a suitable reason for their choice. Quality of written communication partly impedes communication of the science at this level. Level 1 (1-2 marks) Candidates apply their knowledge and understanding of the link between properties and uses to suggest two properties a metal should have OR choose a metal with a suitable reason for their choice. Quality of written communication impedes communication of the science at this level Level 0 (0 marks) Insufficient or irrelevant science. Answer not worthy of credit.	6	This question is targeted at grades up to C. Indicative scientific points may include: general properties of metals needed for overhead power cable construction: • good electrical conductor • low density • strong • does not corrode • does not cost too much • flexible • able to be drawn into a wire / ductile. properties that make aluminium suitable from table: • good electrical conductor • low density • does not corrode. properties that make copper suitable: • good electrical conductor. properties that make iron suitable: • low cost • strong. Use the L1, L2, L3 annotations in scoris, do not use ticks. Examiner's Comments Credit was given to candidates who identified a metal then described and explained its properties although the question did ask for candidates to suggest what properties a metal should have to make overhead power lines before choosing an appropriate metal. This question was well answered.
			Total	6	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
46	a	i	4 (1)	1	**Examiner's Comments** A number of candidates correctly gave the number of different elements in the fertiliser as 4 but far fewer could give the number of atoms. A number of candidates totaled the atomic masses of the atoms.
		ii	15 (1)	1	
	b		sulfuric acid / H_2SO_4 (1)	1	**Examiner's Comments** Was reasonably well answered.
	c		**benefits** increases crop yield / increase food supply (1) **problems** cause death of aquatic animals (1)	2	to score **two** marks answer must have **one** benefit and **one** problem **allow** helps crops grow faster **allow** eutrophication / pollution of water supplies / contaminates water supplies / blue baby syndrome **ignore** damages soil **Examiner's Comments** Was reasonably well answered.
			Total	**5**	
47		i	**C** (1)	1	**Examiner's Comments** Was well answered.
		ii	all the solvents remove a higher percentage of the stain at 60°C / ora (1)	1	**allow** percentages go up at higher temperatures **Examiner's Comments** Was well answered.
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
48			polymer **B** (1) it is stiff (1) it is strong(er) (than polymers **A** or **C**) (1)	3	**allow** maximum useable temperature (above summer temperatures) / high melting point so it won't melt in the summer / AW **Examiner's Comments** The best answered question on the paper.
			Total	**3**	
49			Ti / V / Cr (1) have melting points above melting point of iron (1)	2	**allow** titanium / vanadium / chromium **allow** vanadium has the highest melting point (2) **Examiner's Comments** Both data interpretation questions were well answered by the majority of candidates.
			Total	**2**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

<table>
<tr><th colspan="3">Question</th><th>Answer/Indicative content</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>50</td><td>a</td><td></td><td>argument for:
(world) population is rising /
(so) need to produce more food (1)

argument against:
eutrophication or death of aquatic organisms (from excessive use of fertilisers) /
idea of pollution of water supplies (from excessive use of fertilisers) (1)</td><td>2</td><td>must have an argument for and an argument against the use of fertilisers for 2 marks

allow increasing population to feed (1)
allow fertilisers increase crop yield (1)
allow higher level answers
eg replace essential elements (used by a previous crop) (1)
ignore crops grow bigger or faster or idea of better crops

ignore cost

<u>Examiner's Comments</u>

Many good responses to this question were seen with candidates describing that fertilisers increase crop yield but cause eutrophication. Answers in terms of rising world population, resulting in the need to produce more food, were less common. When candidates did not gain credit it was usually because they described fertilisers as ‘adding nutrients’ or ‘making plants grow better’.</td></tr>
<tr><td></td><td>b</td><td>i</td><td><table><tr><th>Atom</th><th>Number</th></tr><tr><td>N</td><td>3</td></tr><tr><td>H</td><td>12</td></tr><tr><td>P</td><td>1</td></tr><tr><td>O</td><td>4</td></tr></table>all four correct scores (2)
two or three correct scores (1)
one correct scores (0)</td><td>2</td><td><u>Examiner's Comments</u>

Most candidates were successful in deducing the number of each type of atom in the formula $(NH_4)_3PO_4$.</td></tr>
</table>

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	Level 3 States the name of the acid and the alkali needed to make ammonium phosphate AND fully describes how ammonium phosphate can be made. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) Level 2 States the name of the acid and the alkali needed to make ammonium phosphate AND attempts to describe how ammonium phosphate can be made. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) Level 1 States the name of the acid and the alkali needed to make ammonium phosphate OR attempts to describe how ammonium phosphate can be made. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to A Indicative scientific points may include: **Acid** needed is phosphoric acid / H_3PO_4 **Alkali** needed is ammonia / ammonium hydroxide / NH_3 / NH_4OH **ignore** ammonia hydroxide To make ammonium phosphate: • titrate the acid with the alkali, using an indicator / add the acid to the alkali (or vice versa), using an indicator • repeat the titration until consistent results are obtained • use the titration result to add the correct amounts of acid and alkali together without the indicator / decolourise indicator with carbon • evaporate (most of) the solution • leave the remaining solution to crystallise **allow** add excess ammonia to phosphoric acid and then heat the mixture to drive off the excess ammonia Use the L1, L2, L3 annotations in Scoris. Do not use ticks. <u>Examiner's Comments</u> The 6 mark question focused on how ammonium phosphate can be made and was targeted up to grade A. At the simplest level, candidates who stated the name of the acid and the alkali needed to make ammonium phosphate, or who attempted to describe how ammonium phosphate can be made, scored Level 1. To gain Level 2 candidates needed to give the name of the acid and the alkali and attempt to describe

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					the method. A complete description of the method, including the names of the acid and the alkali, was required to gain credit at level 3 (5 - 6 marks). Common errors were naming the acid as 'phosphorus acid' and the alkali as 'ammonium'. A significant number of candidates did not mention repeating the titration to obtain consistent results, or repeating the titration without the indicator. Some candidates described the Haber process for the procedure.
			Total	10	
51			(no because) **hastelloy** is more resistant to corrosion at **high(er) concentrations** of acid (at 20°C) / ora (1) but (yes because) all (three) metals are more resistant to corrosion at **low(er) temperatures** / ora (1)	2	**marks are for explanations** Examiner's Comments Good responses to this question displayed an ability to interpret the data and appreciate that hastelloy is actually more resistant to corrosion at higher concentrations of acid, but all three metals are indeed more resistant to corrosion at lower concentrations of acid. When candidates did not gain credit it was often because they did not focus on the conclusions separately and tried to link the trend between both temperature and concentration, particularly when interpreting how concentration affected the resistance to corrosion. Many candidates also focused on individual metals rather than looking for overall trends.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
52		i	**any two from:** steel is strong (under tension) (1) steel is (more) flexible (1) steel stops the concrete stretching / cracking / breaking (1) concrete is hard (1) concrete is strong **under compression** (1)	2	**Assume unqualified answers refer to reinforced concrete** **allow** steel gives concrete (more) strength (1) **allow** concrete cracks (without steel reinforcing) (1) **allow** combines the strength and flexibility of steel with the hardness of concrete (2) **ignore** reinforced concrete is a composite material **if no other mark awarded, allow** reinforced concrete is stronger or reinforced concrete is more flexible (1) Examiner's Comments Good responses explained why reinforced concrete is a better construction material than non-reinforced concrete in terms of the combination of the hardness of concrete and the strength and the flexibility of steel. Candidates who simply compared reinforced and non-reinforced concrete, stating that reinforced concrete is stronger, gained only 1 mark.
		ii	(C because) **any two from:** strong**est** (1) (very good) resistance to corrosion (1) easily shaped (1) low density (1) other properties more important than high cost (1)	2	**marks are for explanation** **if A or B chosen scores 0** **allow** doesn't corrode (1) **ignore** light, but **allow** lightweight (1) Examiner's Comments Most candidates were able to interpret the data and correctly chose steel C, with two reasons to support their choice.
			Total	**4**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
53			Yes (no mark) because no metal has four 1's (1) idea that if a metal corrodes fast it is not suitable to store the chemical / to be used the container should corrode very slowly (1)	2	No mark for yes if answer is no 0 marks for question **allow** each metal has at least one 3 (1) **allow** can only use a metal if it is 1 **allow** each metal will corrode fast with at least one chemical / there is no metal that corrodes slowly with every chemical (2) **Examiner's Comments** This question assessed the evaluative skills of the candidates. Many candidates found it difficult to express their answer clearly and often just referred to each metal having different properties. The best answers appreciated that the conclusion was correct and illustrated their answer by quoting which metal would be best for each substance to be stored. Candidates did not often state clearly that the metals could not be used if they corroded rapidly.
			Total	2	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
54	a		nitrogen (1)	1	**allow** N **ignore** nitrate **Examiner's Comments** Many candidates recognised that the element nitrogen was present. The use of nitrate was not given a mark since it is not an element.
	b		sulfuric (acid) (1)	1	**allow** H_2SO_4 **Examiner's Comments** The acid needed to make ammonium sulfate was well known. Nitric acid and ammonia were two incorrect answers given by candidates. The most common misconception was to refer to sulfur acid rather than sulfuric acid.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		**any one benefit from:** idea of increasing food supply / bigger crop yield / produce bigger plants / plants grow faster (1) **and** **any one problem from:** harms or death of aquatic organisms / eutrophication / pollution of water supplies / produces an algal bloom (in rivers) (1)	2	**allow** replace essential elements / replace nitrogen / replace potassium / replace phosphorus / replace nutrients / replace minerals **allow** fertilisers contain nutrients / contain vital minerals **allow** to make more money **ignore** to make plants grow / to help plants grow / to produce better crops **ignore** makes plants healthier **not** kills weeds / kills pests **allow** contamination of water supplies effect organisms in river is **not** sufficient washed into rivers is **not** sufficient **Examiner's Comments** Many candidates were able to give a benefit and a disadvantage of using fertilisers. The idea that plants grow faster or give a greater crop yield was well known. Other candidates referred to the presence of extra plant nutrients. In terms of disadvantages candidates often used the term eutrophication or described some of the processes involved with eutrophication. It was not sufficient to describe that fertilisers could be washed away. A common misconception was that fertilisers kill other animals on the crop and act as pesticides.
	d		**[Level 3]** **Answer describes costs of making nitric acid AND includes the word equation for the reaction.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Answer describes costs of making nitric acid**	6	**This question is targeted at grades up to E** **Indicative scientific points may include:** **Word equation** ammonia + oxygen ? nitric acid + water **allow** correct formulae but equation does not need to balance e.g. $NH_3 + O_2$? $HNO_3 + H_2O$ **allow** mix of correct formulae and words **Costs**

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
			OR includes the word equation for the reaction and a cost of making nitric acid. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer describes a cost of making nitric acid OR includes the word equation for the reaction. Quality of written communication impedes communication of the science at this level. (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)		• energy / gas / electricity / heating / lighting / temperature / pressure • raw materials / starting materials / ammonia / oxygen / catalyst • labour / wages / salaries / staff / workers • equipment / plant / maintenance • marketing • taxes / rates / rent • safety / H&S • pollution control ignore R&D, distribution, transport, packaging, advertising , storage Use the L1, L2, L3 annotations in Scoris; do not use ticks. Examiner's Comments This question assessed the quality of written communication in the context of the cost of making nitric acid from ammonia. Answers were often well constructed and started with the word equation and then went on to describe different costs. Many candidates could construct the word equation but there were some errors in which water was also given as one of the reactants. The different costs of making chemicals were well known and sometimes candidates went beyond the mark scheme in terms of explaining how the process could be made cheaper. Typically the most common costs were that for maintaining the pressure and temperature, the raw materials, and labour costs. A small but significant proportion of the candidates did not attempt this question.
			Total	10	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
55	a		Level 3 Answer applies knowledge and understanding of the properties of a plastic and its use. Explanation as to why the plastic used to make the sandwich box needs to be nonbiodegradable and insoluble in water. One other property needed by the plastic explained. Quality of communication does not impede communication of science at this level. (5–6 marks) Level 2 Answer applies knowledge and understanding of the properties of a plastic and its use. Two properties of the plastic needed are explained. OR One property of the plastic needed is explained and one extra property is given. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) Level 1 Answer applies knowledge and understanding of the properties of a plastic and its use. One property of the plastic needed is explained. OR One extra property is given. Quality of communication impedes communication of the science at this level. (1 – 2 marks) Level 0 Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted at grades up to C Indicative scientific points may include: Explanations • Non-biodegradable so the plastic does not rot, decay, decompose or breakdown • Insoluble in water so it will not dissolve / so moist foods can be stored / idea that water cannot enter Extra properties • Non-toxic material (so it will not contaminate the food or make the food dangerous to eat) • Non-reactive (so will not react with chemicals in the food) • Ability to shape the plastic • Plastic must be air-tight to prevent entry by bacteria • Transparent / colourless / clear • Waterproof • Does not react with water • Cannot be crushed easily • Low density ignore references to can be coloured / is strong / is hard / tough / durable / melting point / boiling point / recycling ignore disadvantages Use the L1, L2, L3 annotations in Scoris, do not use ticks Examiner's Comments This question assessed quality of written communication in the context of the properties and uses of polymers. Candidates were often able to explain why the plastic was suitable for making the container for sandwiches. In terms of non-biodegradable candidates often referred to

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
					the plastic not rotting or decomposing. Candidates that referred to recycling were not given credit. Many candidates appreciated that if the polymer was insoluble in water then water could not enter or leave the container. Candidates could often explain an extra property the polymer would need but did not always identify the name of the property. For example candidates mentioned the sandwich box should not change shape easily without naming the actual property. Typical properties described were flexibility, permeability to air, and transparency.
	b		**any two from:** land-fill site (1) idea of recycling (1) incinerated / combusted / burned (1) cracked / broken down to form monomers (1)	2	**ignore** heated to make fossil fuels **Examiner's Comments** Most candidates were able to describe two ways of disposing polymers, typically recycling, land-fill or burning.
			Total	**8**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
56	a		any two from: to see if the perfume is toxic / poisonous (1) to see if the perfume irritates the skin (1) so the perfume can be approved by government (1)	2	to check for side effects is **not** sufficient **allow** whether the person is allergic (to perfume) **allow** harmful to the skin / gives a reaction with the skin **allow** to see if it is corrosive / too acidic **allow** is it harmful, is it dangerous or is it safe if no other mark has been awarded **ignore** references to the perfume having a pleasant smell **ignore** references to whether they wash away or dissolve in water Examiner's Comments Many candidates were able to give one reason often relating to either toxicity or irritation of the skin. A common misconception was to refer to the smell of the perfume when the question was asking about testing before the perfume could be permitted to be used.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b	i	**J** because it is insoluble in water / will not wash off (1) it has a low boiling point / it will evaporate easily / it is volatile (1)	2	**no mark** for the choice of perfume on its own. **allow** because it is insoluble in water / will not wash off **allow K** because it has a low boiling point / it will evaporate easily / it is volatile **ignore** references to other properties **Examiner's Comments** This question assessed the evaluation of data. There was not a mark for the choice of perfume; all the marks were awarded for the reasons given. Candidates were often able to explain their choice of perfume referring to the lack of solubility and the need for a low boiling point so the perfume would evaporate easily. A common misconception was that a perfume with a high volatility would have a high boiling point.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	**any one from:** does it have a nice smell / what is its smell / the smell / how long the smell lasts (1) does it react with water (1) does it irritate the skin (1) is the perfume toxic / poisonous / harmful / health and safety (1)	1	**ignore** is it volatile / does it evaporate easily / boiling point / does it dissolve in water **allow** does it react with other cosmetics **allow** what is the melting point **allow** are the raw materials available to make it **allow** consider the ethical nature of the process **allow** the constituents **allow** the energy needed in manufacture **allow** how long it takes to make **allow** the pH of the perfume **allow** is it flammable **Examiner's Comments** A wide range of answers were accepted for this question, either relating to the perfume itself or issues relating to the manufacture of the perfume. A small proportion of the candidates gave reasons given in the table and these answers were not given credit. The most common correct responses were the smell, the ingredients and safety issues.
			Total	**5**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
57			strong (1) low density / lightweight (1) does not corrode (1)	3	**mark first three points but ignore irrelevant reasons e.g. hardwearing or durable** **allow** stays rigid (1) **ignore** so it doesn't fall apart **ignore** light **allow** does not rust (1) **allow** a property (1) and a linked explanation (1) for example strong (1) so the frame will not buckle (1) **ignore** references to cost **Examiner's Comments** This question was well answered. Candidates could identify the necessary properties andmany offered explanations for why the property was needed e.g. ystrong to carry hisweight'.
			Total	3	
58			C ✓	1(AO 1.1)	Examiner's Comments Most candidates successfully identified the correct order for the stages in a life cycle.
			Total	1	
59			A ✓	1(AO 1.1)	Examiner's Comments While higher ability candidates often knew that air is the raw material for nitrogen, the majority chose natural gas.
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
60	a		Tube **A** (nail) will rust because water AND air/oxygen are present ✓ Tube **B** no rust/change as there is no air/oxygen present ✓ Tube **C** no rust/change as there is no water present ✓	3(AO 2.2)	**Observation AND explanation needed for each mark** **ALLOW** For Tube **A** idea of suitable colour change e.g. red / orange. **Allow** 'nothing happens' **ALLOW** 'because it's dry' as the reason **ALLOW** One mark for getting all three observations as a standalone mark <u>Examiner's Comments</u> Many candidates knew what would happen in the first and last tubes, and the higher ability remembered to explain their observations and so gained credit. The function of the oil above the boiled water was least well understood 'The oil can't get to the iron.' Some candidates misread the question and described what **should** be observed rather than what **would** be observed.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	b		(Oil) prevents water (reaching the iron) ✓ (Oil) prevents air / oxygen (reaching the iron) ✓	2(AO 1.1)	IGNORE other detail which doesn't contradict the answer 'lubricates the chain so it doesn't absorb water' Examiner's Comments Most candidates knew that the oil acted as a barrier, although often didn't say against what, as in **exemplar 1,** which was not creditworthy. Higher ability candidates did state that this barrier was against both oxygen and water. It was interesting to see a language change on going from the laboratory example of rusting to a real-life application. 'Water' often became 'moisture' or 'rain', and 'oxygen' often became 'air'. For some, this practical application became totally dissociated from the preceding part, and their answers focused on the lubricating properties of oil with minimal mention of corrosion prevention. 'It loosens the chain and makes it more flexible which prevents it from rusting'. Exemplar 1 Because it is like a protection layer due to being slippy and thick.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		(Iron has not rusted because) zinc is more reactive (than iron) / ora ✓ (so) zinc corrodes instead of iron / zinc acts as a sacrificial metal ✓	2(AO 1.1)	Marks are for explanation <u>Examiner's Comments</u> Almost all candidates knew and understood that the zinc plays an active role, and many recognised that it was the continuing presence of zinc that was responsible. 'There are still bits of zinc on the iron stopping it from rusting'. However, even the higher ability candidates had difficulty explaining this in terms of reactivity and sacrificial metals. A common misunderstanding was to state that zinc acts as a barrier, either without appreciating that the iron was no longer completely coated or accepting that the iron wasn't completely coated but not dealing with it as an issue, as in **exemplar 2** which was not creditworthy. Some suggested that the zinc was no longer needed because it had permanently altered the iron in some way, for example 'the zinc has covered the iron for so long that the iron isn't vulnerable anymore'. This was sometimes explicitly explained as the zinc continuing to have an effect even though it was no longer there, for example 'because the agents of the zinc are still with the iron, even if the physical zinc isn't'. Exemplar 2 Because no moisture can get to the iron So the reaction for rust can't happen. Most of the iron is still covered. [2]
			Total	7	

Question			Answer/Indicative content	Marks	Guidance
61	a	i	Carbon is more reactive (than zinc) ✓	1(AO 2.1)	**ALLOW** carbon displaces zinc from zinc oxide **ALLOW** carbon is higher (in the table) / above zinc **IGNORE** carbon is highly reactive Examiner's Comments The reactivity of carbon compared to zinc was well understood.
		ii	Idea that aluminium is more reactive (than carbon) ✓	1(AO 2.1)	**IGNORE** aluminium is reactive / quite reactive **ALLOW** aluminium is highly / too / very reactive **ALLOW** aluminium is higher (in the table) / above carbon Examiner's Comments The link between reactivity and the need for electrolysis was less well known than the previous part. Some candidates discussed other elements from the reactivity series rather than aluminium, giving answers such as 'because copper is less reactive' or 'magnesium is very reactive'.
	b		Zinc costs more than aluminium / ORA ✓ Amount of zinc in the Earth's crust is much less (than the amount of aluminium) / ORA ✓	2(AO 3.2a)	**'It' refers to zinc** **ALLOW** It's expensive **ALLOW** There's less of it **ALLOW** only a small amount of zinc (in Earth's crust) Examiner's Comments This question was very well attempted

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
	c		FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 2.85 (%) award 4 marks** 1.28 (g) + 43.70(g) = 44.98(g) ✓ $\frac{1.28}{44.98} \times 100$ ✓ = 2.8457 … ✓ = 2.85 (3 sig. figs) ✓	4(AO 3×2.2 1.2)	Candidates who divide by 43.70 instead of 44.98 are carrying out a very similar calculation, so can score the remaining three marks ie $\frac{1.28}{43.70} \times 100 = 2.92906$ = 2.93 (3 sig. figs) ✓✓✓ Allow the sig figs mark for any other incorrect calculation which leads to an answer that needs shortening. <u>Examiner's Comments</u> This question was well attempted. Most candidates had a good basic grasp of how to solve the problem, even if they made mistakes. Many candidates gained at least partial credit because they had shown their working. A common mistake was to divide 1.28 by 43.70 instead of 44.98. In such cases, the candidate could still gain three of the marks. Often marks were lost due to miscopying of numbers eg 43.70+1.24 instead of 1.28. Another problem occurred when candidates did not convert the number on their calculator screens from 2.8457 to 2.85. Again, these candidates could still gain the remaining three marks.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
62	a		Phosphorus ✓ Potassium ✓	2(AO 1.1)	**ALLOW** P, K **ALLOW** oxygen/O/sulfur/S **IGNORE** radicals eg sulfate/phosphate Examiner's Comments The most popular acceptable response was 'sulfur'. Incorrect responses of water, ammonia, carbon and hydrogen were also common.
	b		Heat the solution / to evaporate (most of the water) ✓ Dry in a warm oven / dry in air ✓	2(AO 2.2)	**IGNORE** allow to crystallise unless detail given (stem) **IGNORE** 'dry it'/ 'let it dry out' unless detail given Examiner's Comments Many candidates got a mark for heating the solution.
	c		**Explanation must match the description** **Any pair from:** Add **excess** / more sodium sulfate (rather than a few drops) ✓ (so) more reaction occurs / forms more calcium sulfate ✓ **OR** Filter the reaction mixture (rather than pouring off the liquid) ✓ (so) none / less of the calcium sulfate is lost ✓ **OR** Wash the calcium sulfate ✓ (so) the impurities are removed ✓ **OR** Put the calcium sulfate in an oven / warm place ✓ (so) the calcium sulfate is dry ✓	4(AO 4×3.3b)	**ALLOW** other suitable points **IGNORE** increase the calcium nitrate / both reactants **IGNORE** crystallisation **IGNORE** Idea of evaporation Examiner's Comments Candidates experienced great difficulty in applying their experience to this practical application. Few realised that the calcium nitrate was in excess. Tasks such as filtration were mentioned but lacked clarity of expression. Washing the precipitate was not mentioned at all and at the drying stage many wanted to evaporate the initial solution rather than the wash liquid.
			Total	8	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
63			**Any two from:** (Kevlar®) has a low(er) density / is (more) lightweight (than steel) ✓ so it is easier to wear or carry / more comfortable to wear ✓ **OR** (Kevlar®) is strong(er) ✓ so it is less likely to be penetrated (by a bullet) ✓ **OR** (Kevlar®) is (more) flexible ✓ so it is easier to wear / more comfortable to wear / idea that it allows movement more easily ✓ **OR** (Kevlar®) does not corrode / does not rust ✓ so it will last longer ✓	4(AO 3.2b)	**Explanation must be linked to description** **ALLOW** 'light / lighter' only if supported by comparative data **ALLOW** idea that person can move more easily or more quickly **ALLOW** idea that (Kevlar®) can withstand a greater impact / is less easily damaged / is more resistant to wear **IGNORE** just the idea that (Kevlar®) is better at keeping you safe **ALLOW** idea that the vest can be worn in all weathers Examiner's Comments The whole of this question is common with the Higher Tier paper. Part (a) was well answered.
			Total	**4**	
64			**C ✓**	1(AO 1.1)	
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

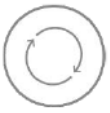
STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
65			**Any two from:** (Kevlar®) has a low(er) density / is (more) lightweight (than steel) ✓ so it is easier to wear or carry / more comfortable to wear ✓ **OR** (Kevlar®) is strong(er) ✓ so it is less likely to be penetrated (by a bullet) ✓ **OR** (Kevlar®) is (more) flexible ✓ so it is easier to wear / more comfortable to wear / idea that it allows movement more easily ✓ **OR** (Kevlar®) does not corrode / does not rust ✓ so it will last longer ✓	4(AO 3.2b)	**Explanation must be linked to description** **ALLOW** 'light / lighter' only if supported by comparative data **ALLOW** idea that person can move more easily or more quickly **ALLOW** idea that (Kevlar®) can withstand a greater impact / is less easily damaged / is more resistant to wear **IGNORE** just the idea that (Kevlar®) is better at keeping you safe **ALLOW** idea that the vest can be worn in all weathers Examiner's Comments This question required candidates to use the data to compare steel and Kevlar®. Candidates who did not gain full credit often simply repeated the stem of the question, ie Kevlar® is stronger than steel so is better at resisting bullets. Vague explanations, such as 'Kevlar® gives better protection', did not gain credit. ? **Misconception** Lower ability candidates still tend to confuse 'low density' with 'light'.
			Total	**4**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
66		i	Repeat the titration until concordant results are obtained ✓ Repeat the experiment without the indicator ✓	2(AO 3.3b)	ALLOW note how much sulfuric acid is needed to neutralise the ammonia ALLOW idea of using (activated) charcoal to remove the indicator BUT IGNORE idea of just removing indicator before crystallising ALLOW idea of doing a rough titration and then repeating without indicator for **2 marks** Examiner's Comments Good responses to this question described repeating the titration until concordant results are obtained and then repeating the experiment without the indicator. Lower ability candidates described using concentrated acid to give purer crystals, filtering the impure crystals or using distillation to remove the indicator.  AfL The idea of repeating the experiment to obtain **concordant titres** was only seen from higher ability candidates.

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	Volumes of solution are too large for titration method / large volumes of liquid need to be heated and then allowed to crystallise ✓	1(AO 1.1)	**ALLOW** idea that industrial method is on a much larger scale / ORA **ALLOW** titration is a batch process / not a continuous process **ALLOW** idea that industry wants the reaction to be continually occurring **IGNORE** idea that it takes too long to do on a large scale Examiner's Comments Misconception A common misconception that the process would be too slow in a laboratory.
			Total	3	
67			**C** ✓	1 (AO1.2)	
			Total	1	
68			**D** ✓	1 (AO1.1)	
			Total	1	
69			**D** ✓	1 (AO1.1)	
			Total	1	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
70	a		**Any three from:** (Metal wire is made of metal because) it is a good conductor (of electricity) ✓ it is flexible ✓ (Metal wire is coated with a polymer because) it is an insulator or poor conductor (of electricity) ✓ it is flexible ✓	3 (AO3.2a)	**IGNORE** references to other properties
	b		**Any one from:** Aluminium is higher in the reactivity series than carbon / aluminium is more reactive than carbon / ORA ✓ Carbon cannot displace aluminium (from bauxite) / bauxite cannot be reduced by carbon ✓	1 (AO2.2)	**Assume unqualified answers refer to aluminium** **IGNORE** aluminium is very reactive **Answers must be comparative** **ALLOW** bauxite does not react with carbon
	c	i	**Any two from:** Aluminium (metal) is sorted from other metals / materials ✓ Idea that aluminium / metal is shredded or crushed into smaller pieces ready for processing ✓ Idea that aluminium / metal is melted (by heating) ✓ Molten aluminium / metal is poured into moulds ✓	2 (AO1.1)	**DO NOT ALLOW** references to electrolysis **ALLOW** idea of cooling to form a solid (again)

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	**Any three from:** Idea that recycling aluminium saves energy (compared to extracting aluminium from bauxite) / ORA ✓ Idea that recycling makes more aluminium (than extraction from bauxite) ✓ Aluminium isn't wasted ✓ Use of data to back up either idea ✓ Idea of finite resource ✓ Idea of aluminium not being biodegradable, so recycling reduces landfill ✓ Idea that recycling aluminium produces less waste material (than extraction from bauxite) / ORA ✓ Idea that recycling aluminium produces less greenhouse gas emissions (than extraction from bauxite) / ORA ✓	3 (AO3.2b)	**IGNORE** just quoting numbers; answer must be comparative **IGNORE** references to cost **ALLOW** idea that recycling aluminium uses less raw materials
			Total	**9**	
71			Sulfur (for sulfur trioxide) ✓ Air (for nitrogen) ✓	2 (AO1.1)	**IGNORE** sulfur dioxide
			Total	**5**	
72			**C ✓**	1 (AO1.1)	
			Total	**1**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
73			**Any two from:** Fertilisers increase crop yields ✓ Idea that growing populations mean that farmers need to grow more crops ✓ Idea that fertilisers provide essential elements for crops ✓ Idea that the quality of crops will be reduced without fertilisers ✓ Idea that fertilisers allow farmers to use the same land over and over again ✓	2 (AO1.1)	**IGNORE** just references to good / increased / faster growth **ALLOW** specific examples of essential elements, ie nitrogen / potassium / phosphorus **IGNORE** references to providing nutrients / minerals **ALLOW** specific example of reduced crop quality eg poor (root or fruit) growth / discoloured or yellow leaves etc **IGNORE** idea of controlling pests
			Total	**5**	

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
74	a		**Any three from:** (Metal wire is made of metal because) it is a good conductor (of electricity) ✓ it is flexible ✓ (Metal wire is coated with a polymer because) it is an insulator or poor conductor (of electricity) ✓ it is flexible ✓	3 (AO3.2a)	**IGNORE** references to other properties
	b		**Any one from:** Aluminium is higher in the reactivity series than carbon / aluminium is more reactive than carbon / ORA ✓ Carbon cannot displace aluminium (from bauxite) / bauxite cannot be reduced by carbon ✓	1 (AO2.2)	**Assume unqualified answers refer to aluminium** **IGNORE** aluminium is very reactive **Answers must be comparative** **ALLOW** bauxite does not react with carbon
	c	i	**Any two from:** Aluminium (metal) is sorted from other metals / materials ✓ Idea that aluminium / metal is shredded or crushed into smaller pieces ready for processing ✓ Idea that aluminium / metal is melted (by heating) ✓ Molten aluminium / metal is poured into moulds ✓	2 (AO1.1)	**DO NOT ALLOW** references to electrolysis **ALLOW** idea of cooling to form a solid (again)

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
		ii	**Any three from:** Idea that recycling aluminium saves energy (compared to extracting aluminium from bauxite) / ORA ✓ Idea that recycling makes more aluminium (than extraction from bauxite) ✓ Aluminium isn't wasted ✓ Use of data to back up either idea ✓ Idea of finite resource ✓ Idea of aluminium not being biodegradable, so recycling reduces landfill ✓ Idea that recycling aluminium produces less waste material (than extraction from bauxite) / ORA ✓ Idea that recycling aluminium produces less greenhouse gas emissions (than extraction from bauxite) / ORA ✓	3 (AO3.2b)	**IGNORE** just quoting numbers; answer must be comparative **IGNORE** references to cost **ALLOW** idea that recycling aluminium uses less raw materials
			Total	9	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
75	a		**Any two from:** Fertilisers increase crop yields ✓ Idea that growing populations mean that farmers need to grow more crops ✓ Idea that fertilisers provide essential elements for crops ✓ Idea that the quality of crops will be reduced without fertilisers ✓ Idea that fertilisers allow farmers to use the same land over and over again ✓	2 (AO1.1)	**IGNORE** just references to good / increased / faster growth **ALLOW** specific examples of essential elements, ie nitrogen / potassium / phosphorus **IGNORE** references to providing nutrients / minerals **ALLOW** specific example of reduced crop quality eg poor (root or fruit) growth / discoloured or yellow leaves etc **IGNORE** idea of controlling pests
	b		Sulfur (for sulfur trioxide) ✓ Air (for nitrogen) ✓	2 (AO1.1)	**IGNORE** sulfur dioxide
			Total	**4**	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK

Question			Answer/Indicative content	Marks	Guidance
76		i	**Any two from:** (Bioleaching is) cheaper or uses less energy (than traditional mining) ✓ Idea that (bioleaching) allows copper to be extracted from low-grade ores ✓ Bacteria used occur naturally / bacteria do not need any special treatment ✓ (Bioleaching) does not release harmful sulfur dioxide (into the atmosphere) ✓ Idea that (bioleaching) does not lead to destruction of the landscape like mining ✓	2 (AO1.1)	**IGNORE** bioleaching is safer **IGNORE** less harmful to the environment, unless qualified
		ii	(Sulfuric acid) may escape into water supplies / (Sulfuric acid) may escape into the soil ✓	1 (AO1.1)	**ALLOW** an effect of acid escaping into soil eg changes pH of soil / makes soil acidic / stops plants growing / damage ecosystems **ALLOW** sulfuric acid can kill wildlife **IGNORE** references to acid rain
			Total	3	

© OCR 2022. You may photocopy this page.

Created in ExamBuilder

STEMUP.CO.UK