OCR
RECOGNISING ACHIEVEMENT

SPECIMEN F

GENERAL CERTIFICATE OF SECONDARY EDUCATION

GATEWAY SCIENCE

B741/01

CHEMISTRY B

Unit B741: Chemistry modules C1, C2, C3 (Foundation Tier)

MARK SCHEME

Duration:1 hour 15 minutes

MAXIMUM MARK 75

This document consists of 16 pages

Guidance for Examiners

Additional Guidance within any mark scheme takes precedence over the following guidance.

1. Mark strictly to the mark scheme.
2. Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise.
3. Accept any clear, unambiguous response which is correct, eg mis-spellings if phonetically correct (but check additional guidance).
4. Abbreviations, annotations and conventions used in the detailed mark scheme:

   / = alternative and acceptable answers for the same marking point
   (1) = separates marking points
   not/reject = answers which are not worthy of credit
   ignore = statements which are irrelevant - applies to neutral answers
   allow/accept = answers that can be accepted
   (words) = words which are not essential to gain credit
   words = underlined words must be present in answer to score a mark
   ecf = error carried forward
   AW/owtte = alternative wording
   ora = or reverse argument

   eg mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1)
   work done = 0 marks
   work done lifting = 1 mark
   change in potential energy = 0 marks
   gravitational potential energy = 1 mark

5. If a candidate alters his/her response, examiners should accept the alteration.
6. Crossed out answers should be considered only if no other response has been made. When marking crossed out responses, accept correct answers which are clear and unambiguous.

Question			Expected answers	Marks	Additional guidance
1	(a)		propane (1)	1	**allow** C_3H_8
	(b)		11 (1)	1	
	(c)		hydrogen **and** carbon (1)	1	**not** 'hydro and carbon' **not** C and H
			Total	**3**	

Question			Expected answers	Marks	Additional guidance
2	(a)		carbon dioxide (1)	1	**allow** CO_2 **not** CO2 or CO^2 or Co_2 **not** carbon dioxide + heat
	(b)		idea that soot shows that incomplete combustion is happening (1) so poisonous carbon monoxide (may be being) formed / so less energy is being released (1)	2	**answers must be linked for 2 marks** eg poisonous carbon monoxide may be being formed because incomplete combustion is happening shown by soot being made (2) **allow** less heat is produced (1)
	(c)		fuel **C** is a sensible choice because it is cheaper than all the others (1) evidence of calculation of temperature differences to conclude that fuel **C** is not a sensible choice because fuel **B** gives the largest temperature rise / ora (1) **OR** evidence of calculation of temperature rise per penny to conclude that fuel **C** is not a sensible choice because fuel **A** has the highest temperature rise for 1 pence of fuel burned / ora (2)	3	**answers must link choice of fuel with evidence to gain credit** **allow** answers in terms of fuel **B** being a better choice if linked to evidence **allow** answers in terms of fuel **C** being a better choice if linked to evidence
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
3	(a)	(i)	water (1)	1	
		(ii)	ethyl ethanoate dissolves more of the colours (1)	1	**allow** ora
	(b)		**any two from:** idea that nail varnish remover could irritate skin or nails or hands (1) toxicity / AW (1) does not react with water / sweat / perspiration (1)	2	**allow** idea that could have harmful vapours (1)
			Total	**4**	

Question			Expected answers	Marks	Additional guidance
4	(a)		nitrogen / helium / neon / argon / krypton (1)	1	**allow** correct symbols **allow** radon
	(b)		sulfur dioxide causes acid rain (1) which kills plants / kills fish / attacks stonework / corrodes metals (1)	2	**allow** idea that sulfur dioxide aggravates asthma (1)
	(c)		plastics are non-biodegradable (1) so (plastics) do not rot / decay by bacterial action (1) this means that they need to be disposed of by burning / by landfill / by recycling (1)	3	**first and second marking points can be in either order** **allow** 'difficult to recycle because difficult to sort' as alternative to the third marking point (1)
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
5			**Level 3** Answer identifies both conditions needed for cracking and applies knowledge of cracking to explain that the decision should be based on both matching supply and demand and molecule size, with examples given from the table. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5-6 marks) **Level 2** Answer identifies at least one correct condition and applies limited knowledge of cracking to explain why at least one fraction from the table could be cracked. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3-4 marks) **Level 1** Answer includes one condition and some idea about using cracking to make more useful products. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1-2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**Relevant points include:** • cracking needs a high temperature / heating • cracking needs a catalyst / use of zeolite • cracking converts large hydrocarbon molecules into smaller ones • cracking converts less useful hydrocarbons into more useful hydrocarbons • cracking converts named fractions that are in excess into named fractions that are in short supply eg bitumen or paraffin into petrol or diesel • the table shows that petrol and diesel are in short supply • the table shows that bitumen and paraffin are in excess and that these are large molecules
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
6	(a)		iron (1)	1	
	(b)		aluminium (no mark) because density too high so wires would sag for copper, iron and/or silver / ora (1) because iron is too poor an electrical conductor / ora (1) because copper and/or silver are too expensive / ora (1)	3	**answers must support the candidates choice to gain credit** **if iron or silver max 1 mark** **allow** idea of wires are heavy **allow** reference to just one metal eg silver is expensive **ignore** any comments about corrosion
	(c)		musical instruments / coins / door decorations / horse brasses (1)	1	
			Total	**5**	

Question			Expected answers	Marks	Additional guidance
7	(a)		**Level 3** Detailed description of Earth structure, including all the main parts of the Earth, and the effects of plate movement. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5-6 marks) **Level 2** Limited description of Earth structure with some reference to the effects of plate movement. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3-4 marks) **Level 1** Identifies some parts of the Earth and recognises that tectonic plates move. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1-2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**Relevant points include:** • Earth is a sphere • Earth is made up of core, thin, rocky crust and mantle • core contains iron • beneath the surface there is molten rock called magma • tectonic plates move (very slowly or about 2.5cm per year) • tectonic plate movement causes volcanoes • tectonic plate movement causes earthquakes • idea of over millions of years movement results in the formation of continents **allow** tectonic plate movement causes mountain ranges to be formed **allow** higher level answers involving convection currents in the mantle, that crust is less dense than the mantle or a description of the lithosphere
7	(b)		theory explains the evidence (1) discussed and tested by a number of scientists (1)	2	**allow** idea of peer review or results published in scientific publications and conferences enables results to be checked (1) as alternative to second mark
			Total	**8**	

Question			Expected answers	Marks	Additional guidance
8	(a)	(i)	because nitrogen comes from the air (1)	1	**allow** higher level answers above target demand eg nitrogen does not need to be extracted from air at high cost
		(ii)	71.4% (1) because energy is needed to heat the reaction / maintain high pressure / AW (1)	2	**allow** 71% (1)
		(iii)	nitrogen **and** hydrogen (1)	1	both needed for mark **allow** N_2 and H_2
	(b)	(i)	yield decreases / AW (1)	1	
		(ii)	yield decreases / AW (1)	1	
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
9	(a)		KOH / H_2SO_4 (1)	1	
	(b)		sodium hydroxide + phosphoric acid → sodium phosphate + water (1)	1	
	(c)		benefits: fertilisers can increase food supply / AW (1) problems: fertilisers can kill aquatic organisms / eutrophication / can cause water pollution / AW (1)	2	**allow** idea of whether her use will be 'excessive' and therefore have negative impacts (1) **allow** idea of benefits and problems with no specific references for 1 mark
	(d)		ammonium sulfate contains only, one essential element / nitrogen, so the mixture is better because it contains **all three** essential elements / nitrogen, phosphorous **and** potassium (2) **OR** the mixture contains more essential elements than the ammonium sulfate / ora (1)	2	**answers must be a comparison in terms of specific numbers/names of essential elements in order to gain 2 marks**
			Total	**6**	

Question			Expected answers	Marks	Additional guidance
10	(a)		6 (minutes) (1)	1	**allow** range 6-6.4 minutes or 6 minutes-6 minutes 25 seconds
	(b)		hydrochloric acid runs out (1)	1	
	(c)		with 100 cm^3 of acid the volume of gas produced should be 125 cm^3 (1) the volume of gas produced will be greater than the volume of the gas syringe (1)	2	

Question			Expected answers	Marks	Additional guidance
10	(d)		**Level 3** Answer applies understanding of the reacting particle model and rates of reaction to explain comprehensively two ways of increasing the rate of reaction. All information in answer is relevant, clear, organised and presented in a structured and coherent format. Specialist terms are used appropriately. Few, if any, errors in grammar, punctuation and spelling. (5-6 marks) **Level 2** Answer applies limited understanding of the reacting particle model and rates of reaction to explain partially two ways of increasing the rate of reaction or explain comprehensively one way of increasing the rate of reaction. For the most part the information is relevant and presented in a structured and coherent format. Specialist terms are used for the most part appropriately. There are occasional errors in grammar, punctuation and spelling. (3-4 marks) **Level 1** Answer gives two ways in which the rate of reaction can be increased. Answer may be simplistic. There may be limited use of specialist terms. Errors of grammar, punctuation and spelling prevent communication of the science. (1-2 marks) **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**Relevant points include:** • more collisions between zinc and acid particles results in faster reaction • increase the temperature of acid increases rate of reaction • increase the concentration of acid increases the rate of acid • increase the surface area of the zinc increases the rate of reaction **temperature of hydrochloric acid** • idea that acid particles move faster / acid particles have more energy / more successful collisions between acid and zinc particles / collisions between acid particles and zinc particles are more energetic • idea of increased collisions (frequency) between acid particles and zinc **concentration of hydrochloric acid** • idea of more crowded acid particles / more acid particles in the same volume / more H^+ ions in the same volume • idea of increased collisions (frequency) **ignore** reference to 'more particles' **powdered zinc** • idea of increased surface area of zinc / more zinc particles exposed to the acid • idea of increased collision (frequency) between zinc and acid particles
10	(e)		slow reaction – rusting / corrosion (1) fast reaction – any explosion (1)	2	**allow** other very slow reactions **allow** reactions of alkali metals with water
			Total	**12**	

Question			Expected answers	Marks	Additional guidance
11	(a)		not all copper carbonate decomposes because not heated for long enough / not all copper carbonate decomposes because the temperature was not high enough (1)	1	
	(b)		0.22 g (2) **OR** idea that carbon dioxide made from 1.24g is 0.44g (1)	2	**allow** full marks for 0.22g with no working, correct working for 1 mark **allow** use of molecular masses and moles to calculate eg 0.62/124 = 0.005 moles (1)
	(c)	(i)	124 (1)	1	**allow** 123.5
		(ii)	64.51 % (2) **OR** if correct answer not given atom economy = $\frac{\text{M of desired products}}{\text{sum of M of all products}} \times 100$ / atom economy = $\frac{80}{124} \times 100$ (1)	2	**allow** full marks for the correct answer even if the equation for atom economy is not stated **allow** 65 / 64.5 / up to the calculator value **allow** ecf / 64.8 % if answer given for (i) is 123.5
		(iii)	because fewer atoms lost as waste so it is a greener process / because fewer atoms lost as waste so it is a more sustainable process (1)	1	
		(iv)	continuous – chemicals made all the time / chemicals made 24/7 (1) whereas in batch – chemicals made on demand (and not all the time) (1)	2	
			Total	**9**	

Question			Expected answers	Marks	Additional guidance
12	(a)		very high (1) does not conduct (1)	2	
	(b)		graphite is a good electrical conductor so will be able to transfer the electrical current without loss (from the wires to the electrolyte) (1) graphite has a high melting point / solid / insoluble / inert, so will not, dissolve / melt / react, during electrolysis (mixing with the electrolyte) (1)	2	**allow** higher level answers relating to the structure of graphite eg delocalised electrons allow current to flow (1)
			Total	**4**	