OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

January 2010

J644/MS/R/10J

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of pupils of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, OCR Nationals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by Examiners. It does not indicate the details of the discussions which took place at an Examiners' meeting before marking commenced.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

CONTENTS

GCSE Chemistry B (Gateway) J644

MARK SCHEMES FOR THE UNITS

Mark Scheme Guidance

Abbreviations, annotations and conventions used in the detailed Mark Scheme.

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

B641/01 Unit 1: Modules C1, C2 and C3 Foundation Tier

Question			Expected Answers	Marks	Additional Guidance
1	(a)		**any one from** takes a long time to make (1) are used up faster than they are formed (1) cannot be made again (1)	[1]	**ignore** cannot be used again **allow** takes (many) years to make or thousands of years to make **ignore** takes hundreds of years to make **allow** once it's gone it's gone / can't be replaced
	(b)		crude oil (1)	[1]	
	(c)		(fractional) distillation (1)	[1]	**not** cracking **not** other forms of distillation e.g. filtering distillation
			Total	[3]	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		B (1)	[1]	**allow** ethane if answer line is blank allow correct answer circled, underlined or ticked
	(b)		D (1)	[1]	**allow** polythene or poly(ethene) if answer line is blank allow correct answer circled, underlined or ticked
	(c)		C (1)	[1]	**allow** ethene if answer line is blank allow correct answer circled, underlined or ticked
	(d)		3 / three(1)	[1]	
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		meat (1)	[1]	
	(b)	(i)	**any one from** microwave / (conventional) oven / boiling / steaming / grilling / frying / fan assisted oven (1)	[1]	**ignore** BBQ
		(ii)	**any one from** kills microbes (1) improve taste (1) improve texture (1) improve flavour (1) easier to digest (1)	[1]	**allow** kills bacteria **allow** idea of possible food poisoning or named food poisoning e.g. salmonella if food not cooked **ignore** kills germs or poisonous if raw **allow** description of the change eg becomes softer **allow** higher level answers eg ruptures cell wall **allow** food or protein denatured
		(iii)	**any one from** new substance is formed (1) process cannot be reversed (1)	[1]	**allow** higher level answers e.g. bonds are broken and new bonds formed or its molecules rearrange **allow** correct references to proteins or enzymes denatured **allow** difficult to reverse
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
4	(a)		thermometer (1)	[1]	**allow** temperature probe
	(b)	(i)	30(^{o}C) (1)	[1]	**allow** answer in table
		(ii)	energy is released (into the surroundings) (1)	[1]	**allow** energy given out / temperature increase / heat released / surroundings gain energy
			Total	[3]	

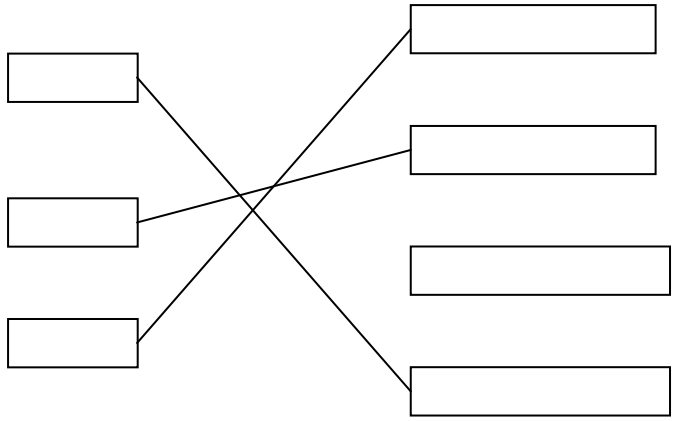
Question			Expected Answers	Marks	Additional Guidance
5	(a)		antioxidants (1)	[1]	
	(b)		help oil and water to mix / oil and water will not separate (1)	[1]	**allow** mix two liquids that don't normally mix 'mix the ingredients' or 'binds the ingredients together' is insufficient to score
	(c)		stop food from reacting with oxygen (1)	[1]	**allow** stops food oxidising **allow** stops food from reacting with air **ignore** keeps food fresh / stops food going off / stops oxygen getting in / helps preserve the food / so no oxygen gets in / to take out oxygen
			Total	[3]	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		does not decay / does not decompose (by bacterial or microbe action) (1)	[1]	**allow** does not rot /does not break up / does not break down / does not degrade / will stay the same for years **ignore** does not disintegrate / does not rust / does not erode / does not waste away / does not corrode
	(b)		**any two from** use of land fill sites/rubbish tips (1) burning (of waste plastic containers) (1) recycling (1)	[2]	**allow** 'dump' or bury in the ground
			Total	[3]	

Question			Expected Answers	Marks	Additional Guidance
7	(a)		**any two from** dust (1) noise (1) lots of lorries (1) habitat lost for plants or animals (1)	[2]	**allow** extra qualification of answer eg lots of lorries (1) which will produce lots of greenhouse gases (1) destruction of landscape / aw (1) or lots of dust (1) which affects peoples' health (1) **ignore** just 'pollution' or quarries give off bad smells **allow** gives out greenhouse gases /causes global warming (1) carbon dioxide on its own does not score
	(b)		break down of a compound or substance or chemical or molecule (when it is heated) / compound or substance or chemical makes two (or more) other compounds or substances or chemicals or molecule (when heated) / aw (1)	[1]	**allow** break up **allow** correct reference to specific reaction e.g. carbonates break down to give oxides and carbon dioxide
	(c)	(i)	a gas is produced / carbon dioxide is given off (1)	[1]	**allow** some solid spits out from the test tube **not** wrong gas given off eg oxygen given off **not** references to evaporation
		(ii)	0.49 (1)	[1]	unit not needed **not** 49 but allow 049 or 0049
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
8	(a)		iron + sulfuric acid → iron sulfate + hydrogen (1)	[1]	**allow** Fe + H_2SO_4 → $FeSO_4$ + H_2 **allow** mix of formulae and names **allow** = instead of arrow **not** and or + heat **allow** dilute sulfuric acid instead of sulfuric acid
	(b)	(i)	Idea of a comparison i.e. so she could check if the reaction went faster / as a control / to make it valid / aw (1)	[1]	**ignore** a fair test / make it more reliable / make it more accurate **allow** so she can compare the results / so she could see what the affect of the catalyst was / to see how much faster or slower the reaction would be without a catalyst / to see if there is a difference if she does not use a catalyst
		(ii)	(experiment) 5 (1)	[1]	**allow** zinc (powder)
		(iii)	faster than experiment 1 / reaction took less time than experiment 1 (1) copper did not change (colour) / copper was still there at the end / copper did not change mass (1)	[2]	**allow** just 'speeds up reaction' **allow** it **only** takes 20 seconds but **ignore** it takes 20 seconds **allow** implied comparison e.g. copper powder takes the shortest time **ignore** reaction time increased **allow** copper is not used up or it is not used up
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
9	(a)		oxygen (1) water (1)	[2]	**allow** H_2O (1) and O_2 (1) **allow** air (1) **allow** moist air (2) **allow** damp air (2) **allow** (acid) rain (1)
	(b)		solder (1)	[1]	if answer line is blank allow correct answer circled, underlined or ticked
	(c)		**any two from** does not corrode (1) will not react with contents (1) non-toxic / not poisonous (1)	[2]	**ignore** hard / high melting point / electrical conductor / heat conductor / cost / light /ductile / non-corrosive **allow** strong / lightweight / low density / recyclable / waterproof / non-permeable / holds its shape /able to contain pressurised drinks / does not rust / unreactive / low reactivity / won't break easily
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		binder (1)	[1]	
	(b)		to give it colour / make it coloured / aw (1)	[1]	
	(c)		thins the paint / dissolves ingredients (1)	[1]	**allow** to make it easier to spread / makes paint go where you want it **allow** mix the paint together **ignore** references to paint drying or sticking paint to the walls
	(d)		oil paint – a paint that has a pigment dispersed in oil phosphorescent – a paint that glows in the dark thermochromic paint – a paint that changes colour when heated all **three** correct (2) **one** or **two** correct (1) 	[2]	multiple lines from type of paint scores 0 for that paint
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
11	(a)		**any two from** Li, Be, B, C, N, O, F and Ne **OR** **any two from** Na, Mg, Al, Si, P, S, C*l* and Ar **OR** K and Ca **OR** H and He (1)	**[1]**	**allow** names of elements
	(b)		**any two from** Li, Na and K **OR** **any two from** Be, Mg and Ca **OR** **any two from** He, Ne and Ar **OR** B and Al / C and Si / N and P / O and S / F and C*l* (1)	**[1]**	**allow** names of elements
	(c)		F / C*l* (1)	**[1]**	**allow** fluorine / chlorine
			Total	**[3]**	

Question			Expected Answers	Marks	Additional Guidance
12	(a)		**any three from** good heat conductors (1) good electrical conductors (1) sonorous/ring when hit (1) strong / high tensile strength (1) high density (1) high melting point (1) high boiling point (1) lustrous /shiny (1)	[3]	**allow** a good conductor (1) if heat and electricity not mentioned **allow** a correct property (1) and an explanation of the property (1) eg good electrical conductor (1) because it has delocalised electrons (1) **ignore** durable / easy to recycle /heavy **allow** hard / heavyweight / solid at room temperature **allow** chemical properties e.g. make basic oxides / react with acids / form positive ions
	(b)	(i)	copper nitrate – blue (1) iron(III) nitrate – orange / rusty / brown (1)	[2]	 **allow** foxy-red / red-brown **ignore** red or yellow
		(ii)	copper nitrate / $Cu(NO_3)_2$ (1)	[1]	**ignore** $CuNO_3$
	(c)		copper carbonate and zinc carbonate (1)	[1]	both required for 1 mark order unimportant **allow** correct formulae **allow** zinc and copper carbonate / copper and zinc carbonate
			Total	[7]	

Question			Expected Answers	Marks	Additional Guidance
13	(a)	(i)	fluorine / astatine (1)	[1]	**allow** F / F_2 / At / At_2 **not** fluoride or astatide
		(ii)	increases / gets bigger / aw (1)	[1]	
	(b)		water treatment / kills microbes / making hydrochloric acid / making polymers (1)	[1]	**allow** in swimming pools / making PVC / keep water clean / sterilising babies' bottles / making bleach **ignore** to kill germs / sterilise wounds / sterilising medical equipment
	(c)		decreases / become less reactive / aw (1)	[1]	**allow** higher level answers e.g. electrons further away from nucleus so less easy to gain an electron
	(d)		same atomic number and different mass number / same number of protons and different number of neutrons (1)	[1]	**allow** same atomic number and different number of neutrons / same number of protons and different mass number **allow** same element but different numbers of neutrons **ignore** same atom but different numbers of neutrons **ignore** they have different numbers of neutrons
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
14	(a)	(i)	yellow / orange (1)	[1]	
		(ii)	lithium / Li (1)	[1]	**allow** strontium / Sr / calcium / Ca **not** compounds
	(b)		K^+ - has a positive charge (1)	[1]	both required for the mark
	(c)		burning splint (1) gives a squeaky pop (1)	[2]	result mark is dependent on correct test **ignore** use a glowing splint **allow** burn the hydrogen **allow** squeaky pop test for 1 mark max
			Total	[5]	

B641/02 Unit 1: Modules C1, C2 and C3 Higher Tier

Question			Expected Answers	Marks	Additional Guidance
1	(a)		D (1)	[1]	**allow** polythene or poly(ethene) if answer line is blank allow correct answer circled, underlined or ticked
	(b)		C (1)	[1]	**allow** ethene if answer line is blank allow correct answer circled, underlined or ticked
	(c)		(the hydrogen and carbon atoms) share (1) an electron pair (1)	[2]	**allow** a diagram which shows a pair of electrons between a H atom and a C atom (2) **allow** share electrons scores (1) **ignore** references to complete outer shells
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		meat (1)	[1]	
	(b)	(i)	**any one from** kills microbes (1) improve taste (1) improve texture (1) improve flavour (1) easier to digest (1)	[1]	**allow** kills bacteria **allow** idea of possible food poisoning or named food poisoning e.g. salmonella if food not cooked **ignore** kills germs or poisonous if raw **allow** description of the change e.g. becomes softer **allow** higher level answers e.g. ruptures cell wall **allow** food or protein denatured
		(ii)	**any one from** new substance is formed (1) process cannot be reversed (1)	[1]	**allow** higher level answers e.g. bonds are broken and new bonds formed or its molecules rearrange **allow** correct references to proteins or enzymes denatured **allow** difficult to reverse
			Total	[3]	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	1575 J scores three marks **but** 25 X 4.2 X 15 (2) **but** temperature change = 15 (°C) (1)	[3]	**allow** 1 X 4.2 X 15 or 63 scores a maximum of (1)
		(ii)	1575 (1)	[1]	if answer is not 1575 **allow** ecf to part (i) e.g. if answer for part (i) is 63, 63 will score (1) for part (ii) if unit given it must be correct e.g. 1575 kJ scores (0) **allow** joules / J / j for unit if given
	(b)		energy is released (into the surroundings) (1)	[1]	**allow** energy given out / temperature increase / heat is released / surroundings gain energy
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
4	(a)		**burning** makes toxic or poisonous gases / produces CO / produces CO_2 / produces carbon / produces greenhouse gases / contributes to global warming / AW (1) **landfill sites** get filled up / wastes land / waste of valuable resources / plastics last for a long time / plastics are non-biodegradable (1)	**[2]**	one mark associated with burning, the other mark associated with landfill sites **allow** produces soot **ignore** produces harmful or dangerous gases **ignore** produces smoke **ignore** references to pollution or ozone layer **ignore** sulfur dioxide / SO_2 **allow** does not decompose / takes a long time to decompose **ignore** references to harming or killing wildlife
	(b)		**any three from** cross-links (between polymer chains) / (covalent) bonds between the polymer chains / intermolecular forces (1) the following 2 marks are dependent on scoring the first marking point: (bonds between polymer chains) are strong / difficult to break (1) therefore (polymer) chains do not stretch / do not slide over each other (1)	**[3]**	**allow** molecules for chains **ignore** references to bonds holding polymer / chains / molecules together if candidate also refers to intramolecular bonds it must be clear which bonds are responsible for preventing the polymer from stretching e.g. intermolecular and intramolecular bonds are strong and prevent the polymer from stretching scores (0) **allow** the cross-links stop the polymer chains from sliding over each other scores (2)
			Total	**[5]**	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		cracking – a reaction which converts large alkane molecules into smaller alkane and alkene molecules fractional distillation – the separation of a mixture of hydrocarbons polymerisation – a reaction which makes large molecules from many smaller molecules all **three** correct (2) **one** or **two** correct (1)	**[2]**	
	(b)		alcohol + acid → ester + water (1)	**[1]**	**allow** mix of formulae and names e.g. $C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$ **allow** correct named alcohol or carboxylic acid **allow** = sign for arrow **not** and for +
			Total	**[3]**	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		break down of a compound or substance or chemical or molecule (when it is heated) / compound or substance or chemical makes two (or more) other compounds or substances or chemicals or molecule (when heated) / AW (1)	[1]	**allow** break up **allow** correct reference to specific reaction e.g. carbonates break down to give oxides and carbon dioxide
	(b)		$CaCO_3 \rightarrow CaO + CO_2$ (1)	[1]	**allow** any correct multiple **allow** = for arrow **not** + heat **not** and for +
	(c)		limestone is a sedimentary rock / limestone made of grains of rock cemented together / limestone made from sediments subjected to pressure (1) marble is a metamorphic rock / marble made when limestone subjected to heat and pressure (without melting) (1)	[2]	
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
7	(a)		iron + sulfuric acid → iron sulfate + hydrogen (1)	[1]	**allow** Fe + H_2SO_4 → $FeSO_4$ + H_2 **allow** mix of formulae and names **allow** = instead of arrow **not** and or + heat **allow** dilute sulfuric acid instead of sulfuric acid
	(b)		faster than experiment 1 / reaction took less time than experiment 1 (1) copper did not change (colour) / copper was still there at the end / copper did not change mass (1)	[2]	**allow** just 'speeds up reaction' **allow** it **only** takes 20 seconds but **ignore** it takes 20 seconds **allow** implied comparison e.g. copper powder takes the shortest time **ignore** reaction time increased **allow** copper is not used up or it is not used up
	(c)		more surface area (1) more collisions per second / increased collision frequency (1)	[2]	answer must be comparison e.g. bigger surface area scores (1) but big surface area scores (0) **allow** collisions happen more often / greater chance of collision (1) **allow** more collisions (1) if no other mark has been awarded **ignore** successful **ignore** collide faster **ignore** more particles
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
8	(a)		stronger / harder (1)	[1]	
	(b)		oxygen (1) hydrated iron(III) oxide (1)	[2]	**allow** hydrated iron oxide **not** hydrated iron(II) oxide **ignore** iron oxide / rust
	(c)		lead and tin (1)	[1]	**both** required for one mark answers can be in any order **allow** Pb and Sn if answer line is blank allow correct answer circled, underlined or ticked
	(d)		**any two from** does not corrode (1) will not react with contents (1) non-toxic / not poisonous (1)	[2]	**ignore** hard / high melting point / electrical conductor / heat conductor / cost / light /ductile / non-corrosive **allow** strong / lightweight / low density / recyclable / waterproof / non-permeable / holds its shape /able to contain pressurised drinks / does not rust / unreactive / low reactivity / won't break easily
			Total	[6]	

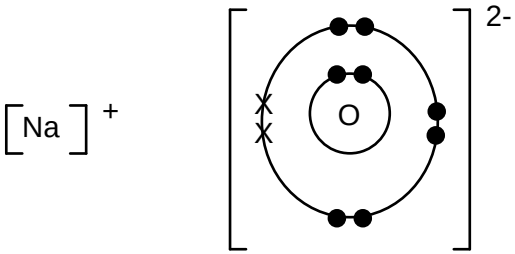
Question			Expected Answers	Marks	Additional Guidance
9	(a)		**any two from** gloss is oil based and emulsion is water based (1) gloss has more additives / ora (1) gloss has more binder / ora (1) gloss has less extender / ora (1) gloss has more pigment / ora (1) gloss has less solvent / ora (1)	[2]	answers must be comparative **allow** gloss has more colour (1)
	(b)		because (the particles) are too small / (particles) are very small (1)	[1]	**allow** (particles) are so small **ignore** references to density **ignore** (particles) are small / quite small
	(c)		oxidation / reaction with air / reaction with oxygen (1)	[1]	**allow** polymerisation
	(d)		phosphorescent pigments are not toxic / phosphorescent pigments do not release (ionising) radiation / phosphorescent pigments do not cause cancer / ora (1)	[1]	**'it'** = phosphorescent pigments **allow** radiation causes cancer / radiation poisoning / sickness (1) **ignore** phosphorescent pigments are safer / less harmful / less dangerous
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		potassium / K (1)	[1]	
	(b)		F / C*l* (1)	[1]	**allow** fluorine / chlorine
	(c)		O / S (1)	[1]	**allow** oxygen / sulfur **allow** O^{2-} / S^{2-}
			Total	[3]	

Question			Expected Answers	Marks	Additional Guidance
11	(a)	(i)	copper nitrate – blue (1) iron(III) nitrate – orange / rusty / brown (1)	[2]	 **allow** foxy-red / red-brown **ignore** red or yellow
		(ii)	copper nitrate / $Cu(NO_3)_2$ (1)	[1]	**ignore** $CuNO_3$
		(iii)	$Cu^{2+} + 2OH^- \rightarrow Cu(OH)_2$ correct formulae (1) balancing (1)	[2]	**allow** any correct multiple **allow** 1 mark for correctly balanced equation with minor errors of case or subscripts **allow** = instead of arrow **ignore** state symbols **not** and for +
	(b)		copper oxide and carbon dioxide (1)	[1]	answers can be in any order **allow** CuO and CO_2
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
12	(a)	(i)	any value between -120°C and -230°C (1)	[1]	**ignore** unit
	(a)	(ii)	any value between 148pm and 170pm (1)	[1]	**ignore** unit
	(b)		decreases / become less reactive / AW (1)	[1]	**allow** higher level answers e.g. electrons further away from nucleus so less easy to gain an electron
	(c)		potassium fluoride and iodine (1)	[1]	answers can be in any order **allow** KF and I_2
	(d)		same atomic number and different mass number / same number of protons and different number of neutrons (1)	[1]	**allow** same atomic number and different number of neutrons / same number of protons and different mass number **allow** same element but different numbers of neutrons **ignore** same atom but different numbers of neutrons **ignore** they have different numbers of neutrons
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
13	(a)		**any three from** using a (flame test) wire / splint / spill / nichrome wire / platinum wire / spray containing substance in solution (1) moisten flame test wire / moisten splint / moisten spill / moisten nichrome wire / moisten platinum wire (1) substance is put into flame / AW (1) colour of flame is observed (1)	**[3]**	if an incorrect experiment is described award 0 marks e.g. a metal being put in water or heating a compound in a beaker scores (0) **all** marks can be awarded from a **labelled** diagram **ignore** incorrect equipment / incorrectly named metal e.g. spatula, tongs, spoon, tweezers, copper wire an incorrectly named piece of equipment / wire can only score a maximum of (2) **allow** either water or hydrochloric acid as a moistening agent answers referring to metals being put in flame can only score a maximum of (2)
	(b)		ions cannot move / ions locked into position / ions can only vibrate (1)	**[1]**	**allow** no free ions **ignore** delocalised ions

Question			Expected Answers	Marks	Additional Guidance
13	(c)		sodium ion drawn with either a full outer shell or an empty one and charge of +1 (1) one oxide ion drawn with 8 electrons in outer shell and charge of -2 (1) 	[2]	alternatively mark as below to give the candidate the best mark (do not mix and match two mark schemes) **allow** correct electronic structure of sodium ion and oxide ion (1) **allow** correct charges on ions – this is independent of the electronic structures drawn (1) **ignore** inner shells **not** $[Na_2]^{2+}$ or $[Na]_2^{2+}$ **allow** $2[Na]^+$ **allow** electrons drawn as all dots / crosses if a covalently bonded structure is shown answer scores (0)
			Total	[6]	

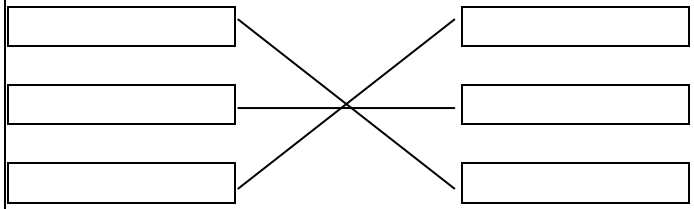
B642/01 Unit 2: Modules C4, C5 and C6 Foundation Tier

Question			Expected Answers	Marks	Additional Guidance
1	(a)		C_{60} (1)	[1]	**allow** answer ticked or circled but answer line takes precedence
	(b)		diamond / graphite (1)	[1]	
	(c)	(i)	strong (1)	[1]	**allow** low density / lightweight
		(ii)	electrical circuits / semiconductors / catalysts / drug delivery systems / supply drugs / deliver medicines (1)	[1]	**allow** fishing rods / microchips / to allow chemical reactions to take place inside the cage **ignore** use in electrical wiring / to conduct electricity
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		ammonium phosphate and potassium phosphate (1)	[1]	**allow** $(NH_4)_3PO_4$ and K_3PO_4 both needed for one mark
	(b)		potassium phosphate (1)	[1]	**allow** K_3PO_4 **allow** 55
	(c)		contains all three essential elements / contains nitrogen, phosphorus and potassium (1)	[1]	**allow** contains N, P and K **allow** contains more than 1 essential element / aw **ignore** contains more nutrients or minerals
	(d)		roots (1)	[1]	**allow** leaves
	(e)		nitric (acid) / HNO_3 (1)	[1]	**ignore** incorrect subscript if name correct
	(f)		60 (1)	[1]	
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		liquid that can dissolve other substances (1)	[1]	**allow** a liquid that makes a solution with a solute
	(b)	(i)	carbon dioxide + hydrogen → methanol	[1]	**allow** $CO_2 + H_2 \rightarrow CH_3OH$ **allow** mix of formulae and names **allow** equilibrium sign / = **not** and / & instead of + **ignore** state symbols
		(ii)	**any three from:** energy / heating / lighting / electricity / power / maintaining temperature / maintaining pressure / AW (1) raw materials / starting materials / hydrogen / carbon dioxide (1) catalyst (1) workers / labour / salary / wages (1) plant costs / equipment / maintenance / health and safety (1) research / development (1) pollution controls (1) rates / taxes / rent (1)	[3]	**ignore** transport / packaging / advertising / storage / insurance **ignore** cost of selling **allow** ingredients **allow** cost of the factory itself **allow** a correct cost (1) plus explanation (1)
	(c)		low**er** temperature / low**er** pressure / uses less energy (1)	[1]	**allow** use less temperature / use less pressure **ignore** method 2 uses only 1 substance as a catalyst but method 2 uses a mixture of 2 substances
	(d)	(i)	one which runs all the time / operates 24-7 / AW (1)	[1]	**ignore** continuously being produced / process which operates continuously unless qualified
		(ii)	ammonia / ethanol / sulfuric acid (1)	[1]	**allow** nitric acid / polymers / fractions from crude oil / products from cracking / aluminium / iron
			Total	[8]	

Question			Expected Answers	Marks	Additional Guidance
4	(a)		incomplete decomposition / was not heated for long enough / temperature not hot enough / some material may escape out of test tube (1)	[1]	
	(b)		increases (1)	[1]	
			Total	[2]	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		PbI_2 (1)	[1]	**allow** PbI2/Pbl^2 **allow** lead iodide
	(b)		chloride – white bromide – cream iodide – yellow all **three** correct (2) **one** or **two** correct (1)	[2]	
	(c)		(in solids) ions cannot move / ions are fixed (in solids) / ions can only vibrate (in solids) / no free ions (in a solid) (1) so no collisions (between ions) / ora (1)	[2]	**allow** ions move in a solution / free ions in a solution **allow** so collisions happen in a solution / more collisions in a solution
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		pH – any value higher than 1 and less than 7 eg 1.1 (1) bubbles **rapidly**/bubbles very fast (1) to make carbon dioxide (1)	**[3]**	**allow** makes a (colourless) solution / it dissolves
	(b)	(i)	hydrogen (1)	**[1]**	**allow** H / H_2
		(ii)	more ions (with hydrochloric acid) / greater concentration of ions (with hydrochloric acid) / ora (1)	**[1]**	assume answer refers to hydrochloric acid if acid not stated **allow** named ions eg more chloride ions or greater concentration of hydrogen ions **allow** formulae of ions eg more Cl^- or greater concentration of H^+ **allow** stronger acid
			Total	**[5]**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)		gas given off / oxygen escapes (1)	[1]	**allow** it fizzes over the top **ignore** water evaporates **not** name of wrong gas escaping
	(b)		reactant runs out / hydrogen peroxide all used up (1)	[1]	**not** catalyst used up
	(c)		use of a gas syringe / burette / measuring cylinder (1) will it work – there must be no leaks or blockages (1)	[2]	**allow** name of piece of apparatus as a label or in text **allow** solid bungs
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
8	(a)		10.0 cm^3 pipette (1)	[1]	**allow** tick or circled 10.0 cm^3 pipette but answer line takes precedence
	(b)		acid – colourless and alkali – pink (1)	[1]	**both answers** needed for 1 mark
	(c)	(i)	litmus / methyl orange / universal indicator / screened methyl orange (1)	[1]	**allow** pH paper / any other acid-base indicator
	(d)	(i)	25.5 (1)	[1]	unit **not** needed
		(ii)	25.0/25 (1)	[1]	unit **not** needed
	(e)		because it is neutralised / alkali that is added has a pH above 7 / AW (1)	[1]	**allow** it reacts / hydroxide ions are being added / hydrogen ions are removed **allow** it has reached neutralisation point
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
9	(a)		hydrogen (1)	[1]	**allow** H_2 / H
	(b)		**any one from** sterilise water / to make solvents / make household bleach / to make plastics (1)	[1]	**allow** to kill micobes (in water) / to kill bacteria (in water) / make hydrochloric acid / make pesticides / used in water purification / make weedkillers **ignore** to kill germs **ignore** cleaning **ignore** used in swimming pools
			Total	[2]	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		glucose (solution) (1)	[1]	**allow** sugar (solution) / other sugars / grape juice / fruit juice / $C_6H_{12}O_6$
	(b)		carbon dioxide (1)	[1]	**allow** CO_2 **ignore** CO2/CO^2
	(c)		**any two from** absence of oxygen (1) 25-50 ^oC (1) presence of water (1)	[2]	**allow** enzymes **allow** absence of air **allow** room temperature **ignore** warm
	(d)		C_2H_5OH / C_2H_6O (1)	[1]	**allow** any order of atoms **not** C^2H^5OH / C^2H^6O / C2H5OH / C2H6O
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
11	(a)		iron + oxygen + water → hydrated iron (III) oxide (1)	[1]	**allow** mix of formulae and names $Fe + O_2 + H_2O \rightarrow Fe_2O_3.H_2O$ **allow** = sign for arrow **not** and / & for +
	(b)		redox (1)	[1]	**allow** answer ticked or circled but answer line takes precedence
	(c)		**any two from** oil / grease (1) paint (1) galvanising / coating with zinc / coating with chromium (1) sacrificial protection / attach magnesium to iron (1) alloying / make stainless steel (1) tin plate / tinning (1)	[2]	**allow** chrome plating **allow** 2 marks for method (1) and a correct explanation (1) eg oil and grease (1) prevent air or water getting to surface (1) **ignore** keep iron away from water or oxygen / keep it dry
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
12	(a)		hydrogen and oxygen (1)	[1]	both answers must be correct for mark **allow** H_2 and O_2 / H and O
	(b)		produces electrical energy efficiently / less or no greenhouse gases / does not make carbon dioxide / does not give off any pollution / water is only waste product / gives off water which is not a pollutant / direct energy transfer / no moving parts (1)	[1]	 **allow** less polluting **ignore** environmentally friendly / less damaging to environment / greener **allow** reduces carbon footprint / reduces carbon emissions **allow** fossil fuel running out / petrol is non-renewable / hydrogen and oxygen are renewable **ignore** so we stop burning fossil fuels / reduces amount of fossil fuels burnt
			Total	[2]	

Question			Expected Answers	Marks	Additional Guidance
13	(a)		distilled water (1)	[1]	**allow** answer indicated in table if answer line is blank
	(b)		distilled water required less soap to form a lather than boiled tap water / boiled tap water must still have some hardness in it (1)	[1]	
	(c)		temporary hardness is destroyed (1)	[1]	
	(d)		calcium (1) magnesium (1)	[2]	**allow** correct responses ticked or underlined
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
14			**any two from** reduces pain (1) lowers body temperature (1) thins the blood (1) reduces risk of blood clots (1) reduces risk of heart attacks (1)	**[2]**	
			Total	**[2]**	

B642/02 Unit 2: Modules C4, C5 and C6 Higher Tier

Question			Expected Answers	Marks	Additional Guidance
1	(a)		C_{60} (1)	[1]	**allow** answer ticked or circled but answer line takes precedence
	(b)		electrical circuits / semiconductors / catalysts / drug delivery systems / supply drugs / deliver medicines (1)	[1]	**allow** fishing rods / microchips / to allow chemical reactions to take place inside the cage **ignore** use in electrical wiring / to conduct electricity
	(c)		weak forces between layers (can easily be broken) (1) strong bonds between carbon atoms / has covalent bonds (1) which need lots of energy to overcome / which need lots of heat to be broken (1)	[3]	**allow** has van der Waals' forces between layers **allow** weak bonds between layers **not** weak covalent bonds between layers
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		provides nitrogen for making amino acids / provides nitrogen for making proteins (1) protein needed for growth (1)	[2]	**Allow** provides phosphorus for making DNA / RNA (1) DNA / RNA linked to protein synthesis (1)
	(b)		60 (1)	[1]	
	(c)		35%	[1]	
	(d)		to be able to be absorbed by roots / fertilisers enter plants as a solution	[1]	**allow** so the fertiliser can be sprayed
	(e)		nitric (acid) / HNO_3 (1)	[1]	**ignore** incorrect subscript if name correct
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		working out to show that 124 = 80 + 44 (1)	[1]	**allow** atoms are neither created nor destroyed / aw
	(b)		[actual mass/predicted mass] x 100 or [3.32/3.69] x 100 (1) 90 (1)	[2]	**allow** full marks for correct answer with no working out **allow** [am/pm] x 100 (1) **allow** 89.9 **not** 89 but this will score one mark if working out is given
	(c)		124 g makes 80g / 62 g makes 40 g (1) 4.0 / 4 (1)	[2]	**allow** full marks for correct answer with no working out **allow** 3.6g if the candidate has used 90% yield from (c)
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
4	(a)		carbon dioxide + hydrogen → methanol	[1]	**allow** $CO_2 + H_2 \rightarrow CH_3OH$ **allow** mix of formulae and names **allow** equilibrium sign / = **not** and / & instead of + **ignore** state symbols
	(b)		reaction goes faster / need to heat for less time / need to use pressure for less time (1)	[1]	gives a fast reaction is not sufficient, needs to be a comparative answer **allow** can use a lower temperature / can use a lower pressure / uses less energy
	(c)		**any two from** low**er** temperature (1) low**er** pressure (1) uses less energy (1)	[2]	**allow** use less temperature / use less pressure **ignore** method 2 uses only 1 substance as a catalyst but method 2 uses a mixture of 2 substances
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		filter / pour the mixture through filter paper (1) wash residue with water / place residue in oven / leave residue in air to dry / aw (1)	[2]	**allow** filtration **not** sieve **ignore** evaporation unless it is clear it is the drying stage
	(b)		barium chloride + sodium sulfate → barium sulfate + sodium chloride (1)	[1]	**allow** any order of reactants and products **allow** $BaCl_2 + Na_2SO_4 \rightarrow NaCl + BaSO_4$ **allow** mix of formulae and names **not** and or & for +
	(c)		(in solids) ions cannot move / ions are fixed (in solids) / ions can only vibrate (in solids) / no free ions (in a solid) (1) so no collisions (between ions) / ora (1)	[2]	**allow** ions move in a solution / free ions in a solution **allow** so collisions happen in a solution / more collisions in a solution
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		$CH_3COOH \leftrightarrows CH_3COO^- + H^+$ equation (1) reversible sign (1)	[2]	**ignore** state symbols reversible sign is independent of correct products but equation must start with CH_3COOH to be awarded the mark
	(b)		more crowded H^+ / greater concentration of H^+ (1) more collisions per second (1)	[2]	**allow** ora eg CH_3COOH has less crowded H^+ **allow** higher collision frequency / collisions more often (1) **allow** 1 mark for more collisions if no other mark awarded
	(c)		more ions (with hydrochloric acid) / greater concentration of ions (with hydrochloric acid) / ora (1)	[1]	assume answer refers to hydrochloric acid if acid not stated **allow** named ions e.g. more chloride ions or greater concentration of hydrogen ions **allow** formulae of ions e.g. more Cl^- or greater concentration of H^+ **allow** stronger acid
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	0.003125 (1)	[1]	**allow** 0.0031 / 0.00312 / 0.00313 (1) **not** 0.003
		(ii)	0.060 (1)	[1]	**allow** 0.06 (1)
	(b)		use of a gas syringe / burette / measuring cylinder (1) will it work – there must be no leaks or blockages (1)	[2]	**allow** name of piece of apparatus as a label or in text **allow** solid bungs
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
8	(a)		they are the most reliable results / they are within 0.1 cm^3 / they are consistent results / they are most consistent / AW (1)	[1]	**allow** other results are anomalous / results are concordant / titres that are closest to one another / titres within 0.2 / titres will be more accurate
	(b)		moles of HCl = 0.002 (1) moles of KOH = 0.002 (1) average titre = 25.05 cm^3 / 0.02505 dm^3 (1) concentration of KOH = 0.08 / 0.07984 (1)	[4]	unit **not** needed **allow** ecf for moles of KOH / moles KOH = moles HCl unit **not** needed assume average titre is in cm^3 unless specified otherwise look for average titre in the expression for the concentration unit **not** needed **allow** ecf for concentration / concentration = moles of KOH÷0.020 **allow** full marks for concentration of KOH = 0.08 if no working out given **allow** 3 marks for concentration of KOH = 0.08 if either volume used is not converted into dm^3 **allow** use of one of the titre values (rather than the average) to work out the concentration but this will have a maximum of three marks for the question
	(c)		because it is neutralised / alkali that is added has a pH above 7 / AW (1)	[1]	**allow** it reacts / hydroxide ions are being added / hydrogen ions are removed **allow** it has reached neutralisation point
			Total	[6]	

Question			Expected Answers	Marks	Additional Guidance
9			anode – chlorine (1) cathode – hydrogen (1)	[2]	**allow** correct formula: Cl_2 **allow** correct formula: H_2
			Total	[2]	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		glucose (solution) (1)	[1]	**allow** sugar (solution) / other sugars / grape juice / fruit juice / $C_6H_{12}O_6$
	(b)		carbon dioxide (1)	[1]	**allow** CO_2 **ignore** CO2 / CO^2
	(c)		**any one from** if temperature too low yeast is inactive / if temperature is below 20^{o}C yeast inactive (1) if temperature too high enzyme (in yeast) denatured / if temperature too high yeast is killed (1) **any one from** absence of oxygen - prevents formation of ethanoic acid / prevents oxidation of the alcohol / allows anaerobic respiration (1)	[2]	optimum temperature is not sufficient **allow** enzyme molecule loses shape / at this temperature enzyme is most effective (1) **allow** enzyme is not denatured / enzyme is not inactive / yeast is not killed **not** enzyme is killed
	(d)		C_2H_5OH / C_2H_6O (1)	[1]	**allow** any order of atoms **not** C^2H^5OH / C^2H^6O / C2H5OH / C2H6O
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
11	(a)		iron + oxygen + water → hydrated iron (III) oxide (1)	[1]	**allow** mix of formulae and names $Fe + O_2 + H_2O \rightarrow Fe_2O_3.H_2O$ **allow** = sign for arrow **not** and / & for +
	(b)		redox (1)	[1]	**allow** answer ticked or circled but answer line takes precedence
			Total	[2]	

Question			Expected Answers	Marks	Additional Guidance
12	(a)		$2H_2 + O_2 \rightarrow 2H_2O$ correct formulae (1) balancing (1)	[2]	balancing mark is conditional on correct formulae but **allow** one mark for a balanced equation with a minor error in the formulae eg failure to use subscript 2H2 + O2 → 2H2O **allow** = instead of arrow **allow** correct multiples including fractions **not** and or & instead of +
	(b)		**any two from** (produces electrical energy) more efficiently / fewer energy transfers gives off water (which is not a pollutant) / does not give off greenhouse gases (1) source of hydrogen should not run out / fossil fuels or oil are running out (1) simple design / no moving parts	[2]	**ignore** reference to cost / density **allow** hydrogen and/or oxygen are renewable / a sustainable resource **ignore** can be used for longer unless qualified
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
13	(a)		distilled water required less soap to form a lather than boiled tap water / boiled tap water must still have some hardness in it (1)	[1]	
	(b)		limescale neutralised (1)	[1]	**allow** acid reacts with limescale / acid dissolves limescale
	(c)		calcium ions / Ca^{2+} / magnesium ions / Mg^{2+} / calcium and magnesium ions removed (1) replaced by sodium / Na^{+} ions (1)	[2]	**allow** Ca^{2+} replaced by Na^{+} (2)
			Total	[4]	

Question			Expected Answers	Marks	Additional Guidance
14	(a)		**any one from** reduces cholesterol (1) reduces chance of developing heart disease (1) reduces furring of arteries / AW (1) provides essential fatty acids (1)	[1]	**allow** ora for saturated fat
	(b)		**any two from** bromine water is decolourised / changes from reddish brown to colourless (1) the bromine forms a compound (with the unsaturated fat) (1) the double bond breaks (1)	[2]	**Ignore** goes clear
			Total	[3]	

Grade Thresholds

General Certificate of Secondary Education
Chemistry B (Specification Code J644)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B641/01	Raw	60	-	-	-	35	28	22	16	10	0
	UMS	69	-	-	-	60	50	40	30	20	0
B641/02	Raw	60	43	36	28	21	15	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B642/01	Raw	60	-	-	-	33	28	23	18	13	0
	UMS	69	-	-	-	60	50	40	30	20	0
B642/02	Raw	60	42	35	27	19	14	11	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A*	A	B	C	D	E	F	G	U
J644	300	270	240	210	180	150	120	90	60	0

The cumulative percentage of candidates awarded each grade was as follows:

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J644	0.0	14.29	38.1	52.4	85.7	100.0	100.0	100.0	100.0	21

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums/index.html

Statistics are correct at the time of publication.

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553