OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

June 2009

J644/MS/R/09

Oxford Cambridge and RSA Examinations

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, GCSEs, OCR Nationals, 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 syllabuses 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 Gateway Chemistry B J644

MARK SCHEMES FOR THE UNITS

Unit/Content		Page
Mark Scheme Guidance		1
B641/01	Unit 1: Modules C1, C2 and C3 Foundation Tier	2
B641/02	Unit 1: Modules C1, C2 and C3 Higher Tier	15
B642/01	Unit 2: Modules C4, C5 and C6 Foundation Tier	26
B642/02	Unit 2: Modules C4, C5 and C6 Higher Tier	39
Grade Thresholds		51

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		E120 (1)	1	**allow** food colouring **not** 120
	b		flavour enhancer and / or emulsifiers (1)	1	
	c		stop food reacting with oxygen (1)	1	**allow** air for oxygen **allow** to prevent oxidation **ignore** to stop food going bad / going out of date / get rid of oxygen / preserve food /stale / stop oxygen getting in
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
2	a		oxygen (1)	1	**allow** O_2 **not** O
	b		carbon monoxide (1)	1	**allow** CO
			Total	**2**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	acid + alcohol → ester + water (1)	1	**allow** correct formulae and mixture of words and formulae **ignore** balancing if formulae used eg $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$ **allow** = instead of → **allow** correct named reactants and products eg organic or carboxylic acid eg ethanoic acid + ethanol → ethyl ethanoate + water
		ii	synthetic (1)	1	
	b	i	evaporates (easily) (1)	1	**allow** (very) volatile **ignore** diffuses / diffusion
		ii	sense / sensory (1)	1	**ignore** nose or nasal or smell **allow** receptor or olfactory **not** scent or neurone
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	methane or oxygen (1)	1	**allow** mark if both reactants given **allow** correct formulae CH_4 and/or O_2
		ii	5 (1)	1	
		iii	2 (1)	1	
	b		released (to) / transferred (to) (1)	1	**allow** given off / given out / lost / given (to) used to heat
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
5	a		to keep dry (1)	1	**allow** keep rain off / stop water going through / so the person does not get wet / protect clothes from getting wet **ignore** any reference to warmth
	b		allows sweat to escape / perspiration can escape (1)	1	**allow** person does not get sweaty / moisture can escape / does not trap sweat in **not** stops person perspiring / stops person sweating / water escaping **ignore** any reference to warmth
	c		tough / lightweight / keeps UV out (1)	1	**allow** strong / does not tear / flexible / windproof / durable / hardwearing **allow** does not weigh a lot / is not heavy **ignore** light on its own **ignore** keeps you warm / permeable
			Total	**3**	

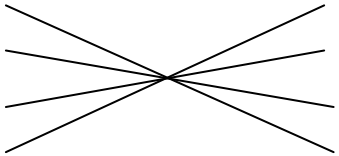
Question			Expected Answers	Marks	Additional Guidance
6	a		(fuel gases) have lowest boiling point (1)	1	**allow** are small molecules / low molecular mass / lower boiling point than petrol **allow** low boiling point
	b		contain (atoms of) hydrogen and carbon (1) only / AW (1)	2	**not** hydro **not** molecules of / mixture of hydrogen and carbon **allow** H and C
	c		as a fuel (1)	1	**allow** (to power) cars / transport / anything powered/fuelled by petrol
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
7	a		**any two from** wood (1) aluminium (1) iron / steel (1) zinc (1) copper (1) lead (1) plastic / named plastic eg polystyrene or poly(chloroethene) (1) sand / gravel (1) brick (1) breeze blocks (1) tiles (1) plaster (1) fibreglass / foam (insulation) (1) granite (1) limestone (1) marble (1) slate (1) sandstone (1)	2	**allow** any other construction material not listed **allow** metal (1) providing marks have not been awarded for a named metal **ignore** cement / mortar / concrete **allow** clay (1) if brick or tile not listed **allow** rock / stone (1) providing marks have not been awarded for a named rock or stone **allow** water (1)
	b	i	sand (1)	1	
		ii	add iron rods / add steel rods / add metal rods (1)	1	**allow** bars / mesh / wire / gauze / beams as alternatives to rod **allow** put in a metal stick **ignore** copper rods **not** contains metals i.e. without reference to a rod **not** pipes
	c	i	sand (1)	1	**allow** silicon dioxide
		ii	71(%) (1)	1	
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
8	a		oxygen (1) water (1)	2	**allow** air for oxygen **allow** moist or damp air (2) **not** distilled water / salt water / rain water
	b		salt / salty water / sea water (1)	1	**allow** acid / NaCl
	c		**any two from** protective coating (1) (aluminium) oxide layer (1) stops oxygen / air / water getting to it (1) non permeable layer (1) non flaky layer (1)	2	**ignore** rusting eg protective layer of aluminium oxide scores (2)
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
9	a	i	increases / goes up (1)	1	**allow** changes by 17 (ppm) (concentration gets) stronger **ignore** incorrect use of numbers
		ii	any number from 340 to 500 **and** increased fuel consumption / higher population / greater awareness of impact has led to decrease / AW (1)	1	**no** mark for number on its own explanation must be consistent with given number **allow** less photosynthesis / deforestation / more industrialisation **allow** one mark if answer indicates how they arrived at this number eg based on a pattern of numbers
	b		internal combustion engine / (car) exhaust / car engine / lorry engines (1)	1	**allow** lightning / jet engines / reaction of nitrogen and oxygen at high temperature **ignore** from factories / fossil fuels burning / power plants
	c		acid rain / global warming / climate change (1)	1	**allow** greenhouse effect **allow** (makes) sulfurous acid / (makes) sulfuric acid / kills plant / damages plants or parts of plants / kills aquatic life / corrodes metals / erodes or damages buildings or statues **allow** smog / breathing difficulties **ignore** kills animals
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
10	a	i	80 (1)	1	**ignore** units
		ii	40 (1)	1	**ignore** units
		iii	40 steeper line /gradient bigger / more gas made in first two minutes / AW (1)	1	**no** mark for identifying line, mark is for **reason** only
	b		hydrochloric acid runs out / no more calcium carbonate / reactant(s) runs out (1)	1	**allow** acid all used up / no more hydrochloric **ignore** nothing left to react
	c		**any one from** stir / shake (1) increase concentration / pressure (1) decrease particle size / use a powder / increase surface area (1)	1	**allow** add a catalyst/enzymes / have more collisions between particles **ignore** add more chemical
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
11			chlorine – making pesticides and plastics copper - electrical wires iodine - sterilise cuts and wounds iron – bridges all four correct (3) two or three correct (2) one correct (1)	3	two lines coming from an element is a wrong answer if two lines going to a use penalise the use that is wrong 
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
12	a		one other transition element from the Periodic Table - either symbol or name (1)	1	**allow** name with small slip with symbol eg nickel NI and cobalt CO **allow** name and symbol of a different transition element with or without a slip eg nickel and CO if any symbol or name of an element that is **not** a transition element is included do **not** award mark **ignore** Cu or Fe as in question stem
	b		**any three from** (good) conductors of heat / (good) thermal conductors (1) (good) electrical conductors (1) (often) have a high density / dense (1) (often) have a high melting point (1) (often) have a high boiling point (1) shiny / lustrous (1) malleable / can be worked into shape easily (1) ductile / can be drawn into wires (1) flexible (1) sonorous / make a noise when hit (1)	3	**allow** one mark for good conductor if no other conductor mark has been awarded **ignore** heavy / strong / hard / durable / hardwearing / don't break easily / brittle **allow** solid at room temperature only if answer has not referred to high melting point or high boiling point **not** magnetic
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
13	a		5 / five (1)	1	
	b		11 / eleven (1)	1	
	c	i	3 / three / III (1)	1	
		ii	2 / two (1)	1	
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
14	a		lithium / potassium / rubidium / caesium / francium (1)	1	**allow** Li / K / Rb / Cs / Fr **not** sodium / Na as in stem if name correct and symbol **wrong** then do **not** award mark eg potassium, P but if name correct and a **slip** in symbol **award** mark eg potassium, k
	b		reactive metal / reacts with oxygen / to keep away from oxygen / stop it reacting with oxygen (1)	1	**allow** reacts with air / to keep away from air / to stop it reacting with air **allow** to stop it reacting with moist air / stop it reacting with moist oxygen **allow** to stop it corroding **ignore** reference to rusting / water
	c	i	hydrogen (1)	1	**allow** H_2 **not** H
		ii	sodium hydroxide (1)	1	**allow** NaOH / caustic soda
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
15	a		0.78 (1)	1	unit **not** needed look for answer under the results table as well as on the answer line if two different answers given use the one on the answer line
	b		goes milky / goes cloudy / goes white / white solid made / white precipitate (1)	1	**ignore** murky / foggy / misty
	c		breaks down / makes two substances / changed into simpler substances (1)	1	**allow** makes lots of substances **allow** makes smaller substances **not** elements break down
	d	i	manganese carbonate / manganese / Mn (1)	1	**not** magnesium (carbonate)
		ii	iron(III) carbonate / iron(III) / iron / Fe (1)	1	
			Total	**5**	

			Paper Total	**60**	

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

Question			Expected Answers	Marks	Additional Guidance
1	a		acid + alcohol → ester + water (1)	1	**allow** correct formulae and mixture of words and formulae **ignore** balancing if formulae used eg $CH_3COOH + C_2H_5OH \rightarrow CH_3COOC_2H_5 + H_2O$ **allow** = instead of → **allow** correct named reactants and products eg organic or carboxylic acid eg ethanoic acid + ethanol → ethyl ethanoate + water (1)
	b		evaporates (easily) (1)	1	**allow** (very) volatile **ignore** diffuses / diffusion
	c	i	attraction between water (particles) is stronger than attraction between water (particles) and (particles in) nail varnish / ora (1)	1	**allow** force or bond for attraction **allow** molecule for particle **ignore** water (particles) do not attract nail varnish (particles)
		ii	attraction between ester (particles) and nail varnish (particles) is stronger than attraction between (particles) in nail varnish / ora (1)	1	**allow** force or bond for attraction **allow** molecule for particle **ignore** ester (particles) attract nail varnish (particles) **ignore** ester is a solvent
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
2	a		**any two from** **more** energy released (1) carbon monoxide not produced (1) soot not produced / less soot produced (1)	2	**allow more** heat produced / **more** efficient **ignore** does not waste fuel / does not waste energy **allow** CO not produced (1) **allow** poisonous / toxic gas not produced (1) **allow** answers that qualify harmful eg a harmful gas which might kill you (1) **ignore** it is safer / it is harmful if unqualified **ignore** references to pollution
	b		released (to) / transferred (to) (1) endothermic (1)	2	**allow** given off / given out / lost / given (to) / used to heat
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
3	a		tough / lightweight / keeps UV out (1)	1	**allow** strong / does not tear / flexible / windproof / durable / hardwearing **allow** does not weigh a lot / is not heavy **ignore** light on its own **ignore** keeps you warm / permeable
	b		idea of coping with perspiration wetness / sweat (1)	1	**allow** the person's skin does not stay wet **allow** body water evaporates / perspiration evaporates /sweat evaporates / lets out sweat / lets out water vapour **ignore** lets the person sweat freely **not** she does not sweat **not** lets out body vapour / lets out body heat
	c		polymer or membrane has holes too small for water (droplets) to pass through (1) but big enough for water vapour to pass through (1)	2	answer must include reference to size of holes / AW to score any marks **allow** marks from a clearly labelled diagram **allow** perspiration vapour / sweat vapour for water vapour
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
4	a		(fuel gases) have lowest boiling point (1)	1	**allow** are small molecules / low molecular mass / lower boiling point than petrol **allow** low boiling point
	b		**any two from** larger molecules / longer chain hydrocarbons have higher boiling points / ora (1) intermolecular forces between larger molecules / longer chain hydrocarbons are stronger / ora (1) forces between larger molecules / longer chain hydrocarbons are more difficult to break or overcome / AW / ora (1)	2	answer must have at least one statement that is a comparison to score full marks **allow** large molecules / long chain hydrocarbons have high boiling points **allow** forces / attraction / bonds between molecules for intermolecular forces **allow** large molecules / long chain hydrocarbons have strong forces between molecules **ignore** references to number of intermolecular bonds
	c		contain (atoms of) hydrogen and carbon (1) only / AW (1)	2	**not** hydro **not** molecules of / mixture of hydrogen and carbon **allow** H and C
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
5	a		B (1)	1	allow any indication of correct answer in table mark answer line first
	b		correct substitution i.e. 100 x 4.2 x 30 (1) 12600 (1)	2	correct answer line on answer line gets **two** marks correct answer with no working out gets **two** marks **allow** 2 x 4.2 x 30 or 252 (1)
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
6	a	i	sand (1)	1	**allow** silicon dioxide
		ii	71 (%) (1)	1	
	b		calcium carbonate → calcium oxide + carbon dioxide (1)	1	**allow** mix of correct symbols and words **allow** $CaCO_3 \rightarrow CaO + CO_2$ **ignore** any balancing of symbol equation **not** + heat in equation **not** and **allow** = instead of → **allow** heat written over arrow
	c		cement (1)	1	
	d	i	igneous (1)	1	
		ii	sedimentary (1)	1	
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
7	a		**any two from** protective coating (1) (aluminium) oxide layer (1) stops oxygen / air / water getting to it (1) non permeable layer (1) non flaky layer (1)	2	**ignore** rusting eg protective layer of aluminium oxide scores (2)
	b	**i**	lower density / car body is lighter (1)	1	**allow** better fuel economy / does not corrode / does not rust **ignore** it is lighter / weighs less / is lightweight
		ii	not as strong (1)	1	**allow** more expensive **ignore** it is not strong / not very strong
	c		**any one from** less metal ore needed / AW (1) less waste / AW (1)	1	 **allow** saves natural resources **ignore** references to (fossil) fuels **allow** reduces disposal problems eg less use of landfill (1) **ignore** less energy **ignore** references to pollution / global warming / environment **ignore** references to cost
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
8	a		any number from 340 to 500 **and** increased fuel consumption / higher population / greater awareness of impact has led to decrease / AW (1)	1	**no** mark for number on its own explanation must be consistent with given number **allow** less photosynthesis / deforestation / more industrialisation **allow** one mark if answer indicates how they arrived at this number eg based on a pattern of numbers
	b		internal combustion engine / (car) exhaust / car engine / lorry engines (1)	1	**allow** lightning / jet engines / reaction of nitrogen and oxygen at high temperature **ignore** from factories / fossil fuels burning / power plants
	c		$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$ (2) correct formulae of reactants and products (1) balancing (1)	2	**allow** any correct multiples including fractions balancing mark is **dependent** on correct formulae **allow** = in equation
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
9	a		correct volume ÷ correct chosen time (1) rate between 2.4 and 2.6 (1)	2	**allow** two marks for correct rate with no working out look for evidence on the graph
	b		**any three from** particles have more energy / particles collide with more energy / move more quickly (1) greater frequency of collision / more collisions per second (1) more successful collisions / collisions have more energy / more energetic collisions / more effective collisions (1) idea of activation energy (1)	3	 **not** particles vibrate faster **allow** collisions more often / more collisions in a given time / more chance of collisions **ignore** faster collisions **allow** collisions happen with more energy **allow** (for successful collisions) particles need to collide with enough energy
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
10	a	i	loss of electron(s) (1)	1	**allow** electron(s) are removed / electron(s) are taken away / by oxidation / electron transferred to chlorine / electron transferred to another atom **ignore** has a different number of electrons
		ii	ions cannot move (in a solid) (1)	1	**allow** ions locked (in a lattice) / ions can only vibrate **allow** use of the term charge carrier instead of ion **allow** ions are not free **ignore** references to particles **not** reference to electrons
		iii	ions can move (in a solution) (1)	1	**allow** use of the term charge carrier instead of ion **allow** ions are free **not** reference to electrons
	b		magnesium is 2.8 and oxygen is 2.8 (1) Mg^{2+} and O^{2-} (1)	2	two correct electronic structures without identification scores maximum (1) if a covalent structure is drawn then the answer scores (0) electronic structures can be drawn or written **not** Mg^{+2} and O^{-2} **allow** magnesium is 2.8 and Mg^{2+} (1) **allow** oxygen is 2.8 and O^{2-} (1)
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
11	a		X since it is colourless / X because only compounds of transition elements are coloured (1)	1	**allow** X because a coloured compound / solid / precipitate was not made **ignore** X because nothing happens / it did not react / did not change colour **no** marks for X on its own **no** marks if any letter other than X is chosen
	b		Cu^{2+} / copper / copper(II) (1)	1	**ignore** Cu
	c		$Fe^{3+} + 3OH^- \rightarrow Fe(OH)_3$ (1)	1	look for balancing on the printed examination as well as the answer line
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
12	a		5 / five (1)	1	
	b		11 / eleven (1)	1	
	c	i	3 / three / III (1)	1	
		ii	2 / two (1)	1	
	d		diagram with 5 protons (open circles) and any number of neutrons (black circles) except 6 (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
13	a	i	hydrogen (1)	1	**allow** H_2 **not** H
		ii	sodium hydroxide (1)	1	**allow** NaOH / caustic soda
	b		**any one from the following observations** colourless gas / fizzes / pops / makes a colourless solution / violent reaction / coloured flame / floats on the water / melts into a ball / explodes / reacts quickly / moves around (on the surface) (1) products are <u>hydrogen</u> **and** <u>francium hydroxide</u> (1) $2Fr + 2H_2O \rightarrow 2FrOH + H_2$ (1)	3	to get full marks there must be one correct observation, the names of the correct products and the correct equation **allow** any correct multiple including fractions **allow** = in equation
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
14			aluminium / Al (1) oxygen / O_2 (1)	2	**allow** O
			Total	**2**	

			Paper Total	**60**	

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

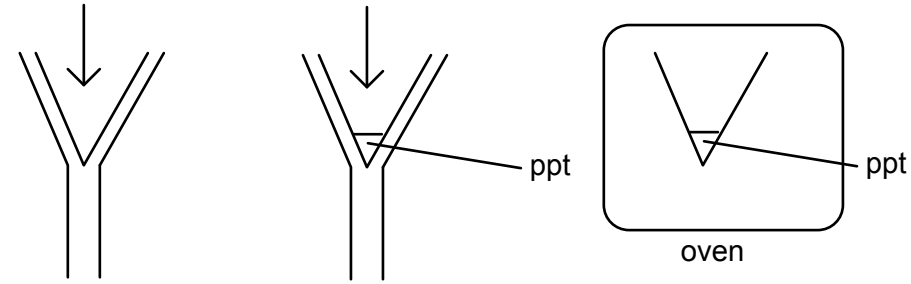
Question			Expected Answers	Marks	Additional Guidance
1	a		stays the same (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
	b	i	barium sulfate / sodium chloride (1)	1	**allow** $BaSO_4$ / NaCl **allow** both correct answers, but not one correct and one incorrect **ignore** salt
		ii	white (1)	1	**allow** cloudy / milky **ignore** creamy
	c	i	barium sulfate **and** sodium sulfate (1)	1	**allow** $BaSO_4$ **and** Na_2SO_4
		ii	142 (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
2	a		carbon (1)	1	**not** C **allow** carbon 60
	b		black solid (1)	1	if two or more answers given then do not award a mark
	c		joined together / AW (1)	1	**ignore** react together **ignore** put them together
	d		semiconductors / reinforce graphite / tennis rackets / fishing rods / microchips / supply drugs / deliver medicines / allow chemical reactions to take place inside the cage (1)	1	**ignore** reference to catalysts **ignore** used in electrical wiring / to conduct electricity
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
3	a		B (1)	1	
	b		D (1)	1	
	c		D (1)	1	
	d		does not use water / AW (1)	1	**allow** stain does not dissolve in water **allow** uses an organic solvent **not** does not use a lot of water / uses steam
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
4	a	i	takes place all the time / works 24-7 / AW (1)	1	
		ii	make in (small) amounts and later on make some more / AW (1)	1	**allow** made in (small) amounts to order / made in (discrete) amounts when needed / AW **ignore** just made in batches / made in small amounts
	b		nitrogen + hydrogen→ ammonia (1) **and any two conditions from** high pressure (1) 450 ^{o}C (1) (iron) catalyst (1) idea of recycling nitrogen and hydrogen back into reaction container (1)	3	**allow** H_2 + N_2 → NH_3 but **ignore** balancing **allow** equation with mix of correct formulae and words **allow** ⇆ or = instead of → **not** and / & **allow** any pressure above 150 atmospheres **not** any pressure that is below 150 atmospheres **allow** any temperature between 250 and 500^{o}C **ignore** heat / high temperature / hot / low temperature **not** incorrectly named catalyst if incorrect conditions quoted then max 1 mark for conditions
	c	i	urea / ammonium nitrate / ammonium sulfate (1)	1	**allow** $(NH_2)_2CO$ / NH_4NO_3 / $(NH_4)_2SO_4$ **allow** 'growmore' **ignore** NPK
		ii	phosphoric acid (1)	1	**allow** H_3PO_4 / phosphoric **not** phosphorus acid
			Total	**7**	

Question			Expected Answers	Marks	Additional Guidance
5	a		niacin (1)	1	**allow** 13.2
	b		23.7 (1)	1	unit **not** needed answer on answer line takes precedence
	c		200 (1)	1	unit **not** needed
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
6	a		yellow (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
	b		filter / AW (1) wash residue (with water) / AW (1) put in oven to dry / leave in air to evaporate (1)	3	answers that do not include filtering will not score any marks **ignore** sieving **allow** let it dry in air **ignore** dry it / let it dry **ignore** heat it **not** use of a Bunsen burner to dry the residue **allow** all marks from a diagram reaction mixture water  filtering (1) washing (1) drying (1)
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
7	a		**X** is sulfur (1) **Y** is air (1)	2	**allow X** is S **allow** one mark if **X** is air and **Y** is sulfur **allow** correct answers written on flow chart if answer lines are blank
	b	i	reversible (reaction) / (reaction) goes both ways / (forms an) equilibrium (1)	1	**allow** (can go) either way
		ii	sulfur trioxide (1)	1	**allow** SO_3 **ignore** sulphur oxide
			Total	**4**	

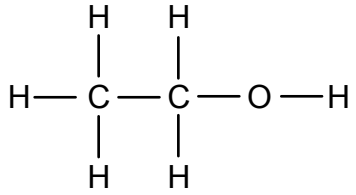
Question			Expected Answers	Marks	Additional Guidance
8	a		burette (1)	1	
	b	i	increases / AW (1)	1	**allow** increases slowly then increases rapidly and finally slowly levels off **not** it goes neutral / neutralises **ignore** the graph goes up
		ii	1.3 to 1.4 (1)	1	
		iii	30 (1)	1	unit **not** needed
	c		universal indicator (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
9	a		breakdown of a (liquid) substance using electricity / decomposition (of a liquid) using electricity (1)	1	**allow** break-up / splitting of a substance using electricity **ignore** making new substances
	b		hydrogen (1)	1	**allow** H_2 **ignore** H **allow** correct answer ticked, circled or underlined in list if answer line is blank
	c	i	OH^- / CH_3COO^- (1)	1	**allow** both correct answers, but not one correct and one incorrect
		ii	CH_3COOH / H_2O (1)	1	**allow** both correct answers, but not one correct and one incorrect
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
10	a		electrical (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
	b		hydrogen + oxygen → water (1)	1	**allow** = instead of→ but **not** and / & **allow** hydrogen oxide or hydrogen hydroxide instead of water **allow** $H_2 + O_2 \rightarrow H_2O$ / word equation with mix of correct formulae and words and **ignore** balancing
	c		test burning / lighted splint (1) result (burns with a) squeaky pop (1)	2	**mark the question as a whole when awarding marks** **allow** idea of a flame **not** glowing splint **allow** it pops if incorrect test, result mark cannot be awarded
	d		**any two from:** fossil fuel running out / diesel or petrol is non-renewable / hydrogen and oxygen are renewable (1) less or no greenhouse gases / water is only waste product (1) fuel cell more efficient / fuel cell has direct energy transfer / ora for fossil fuel (1)	2	**ignore** more economic (cost in stem) **allow** fuel cell is a renewable energy source **ignore** so we stop burning fossil fuels / reduces amount of fossil fuel burnt **allow** less polluting **ignore** environmentally friendly / less damaging to environment / greener **allow** reduces carbon footprint / reduces carbon emissions
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
11	a	i	water that doesn't lather easily with soap (1)	1	**allow** water containing Ca^{2+} ions / water containing Mg^{2+} ions / water containing dissolved calcium (compounds) / water containing dissolved magnesium (compounds) (1) **ignore** water containing limescale / water containing calcium carbonate
		ii	5 (1)	1	
	b		acids (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
	c		ion exchange / washing soda / boiling / remove Ca^{2+} (1)	1	**ignore** add water softener **not** caustic soda / sodium hydroxide
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
12	a		water / H_2O (1) air / oxygen / O_2 (1)	2	**allow** moist air / damp oxygen (2) **ignore** O
	b	i	idea of stops oxygen reaching surface / stops water reaching the surface (1)	1	**allow** acts as a barrier to air / acts as a barrier to water / acts as a barrier to oxygen acts as a barrier is **not** sufficient
		ii	**any one from:** paint (1) galvanising / coating with zinc / coating with chromium (1) sacrificial protection / attach magnesium to iron (1) alloying / make stainless steel (1) tinning (1)	1	 **allow** coating the iron in plastic **allow** chrome plating **ignore** keep it away from water or oxygen / keep it dry
	c		magnesium zinc iron tin (1)	1	all 4 metals must be correct for one mark **ignore** list of metal salts
			Total	**5**	

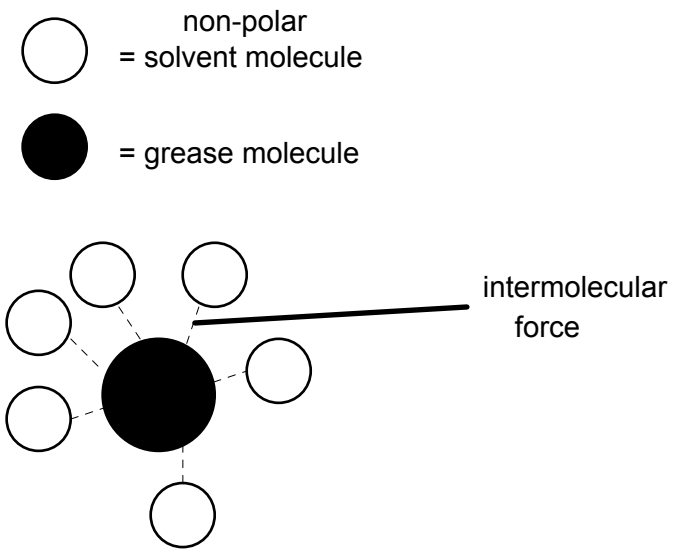
Question			Expected Answers	Marks	Additional Guidance
13	a		distillation (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
	b		**any two from:** (alcoholic) drinks (1) solvent (1) fuel (1)	2	**allow** named alcoholic drink **allow** methylated spirits / meths **ignore** used to make alcohol **allow** mouthwash / (making) perfume / disinfectants / sterile wipes **ignore** cleaner / vinegar
	c		 (1)	1	OH group in any correct position **allow** C ─ OH
	d		dehydration (1)	1	**allow** correct answer ticked, circled or underlined in list if answer line is blank
			Total	**5**	

			Paper Total	**60**	

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

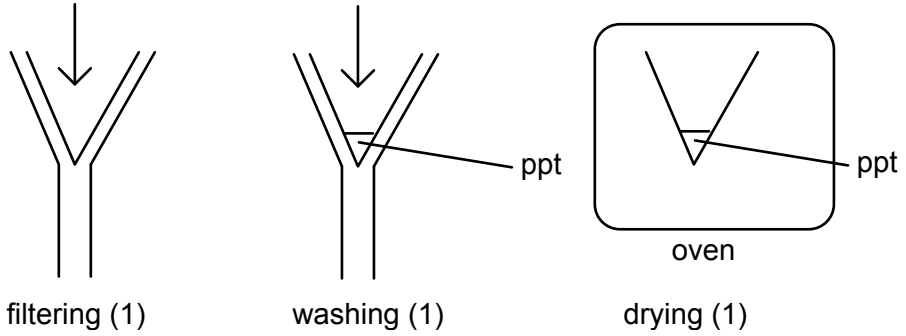
Question			Expected Answers	Marks	Additional Guidance
1	a		same number (of each type) of atoms on both sides of equation / same atoms on both sides of equation just arranged differently (1)	1	**answer must refer to information from the equation** **allow** atoms are not created or destroyed **allow** same amount of each element on both sides of equation **ignore** name same number of elements on both sides of equation **allow** calculation to show sum of M_rs on left equals sum of M_rs on right (M_rs must be correct)
	b		barium sulfate + ammonium chloride (1)	1	**allow** any order of products **allow** $BaSO_4$ + NH_4Cl / mix of names and correct formula **not** ammonia chloride
	c	i	15 / fifteen (1)	1	
		ii	400 (1)	1	
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	C_{60} (1)	1	**allow** C60 / C^{60} **allow** multiples of C_{60} eg C_{120} **allow** C_{72}
		ii	supply drugs / allow chemical reactions to take place inside the cage (1)	1	**allow** to act as catalysts **allow** to deliver medicines
	b	i	**any two from:** nanotubes have a large surface area (1) catalyst can be attached to the nanotube (1) reacting molecules cannot escape (1)	2	**allow** can cage molecules / enables more collisions to happen between particles
		ii	semiconductors / reinforce graphite / tennis rackets / fishing rods / microchips / supply drugs / deliver medicines (1)	1	**ignore** reference to catalysts **ignore** used in electrical wiring / to conduct electricity **ignore** chemical reactions to take place inside the cage
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
3	a		does not use water / AW (1)	1	**allow** stain does not dissolve in water **allow** uses an organic solvent **not** does not use a lot of water / uses steam
	b		**any two from** solvent molecules are non polar / solvent molecules are hydrophobic (1) solvent molecules form intermolecular forces with molecules of grease (1) solvent molecules surround molecules of grease / AW (1)	2	**not** reference to action of detergent eg use of hydrophobic tail and hydrophilic tail – scores zero **allow** solvent molecules attracted to grease / solvent bonded to grease molecules marks can be awarded from a labelled diagram 
	c		no trace of solvent left on clothes / solvents can be poisonous / carbon dioxide will not damage clothes / carbon dioxide is not toxic (1)	1	**allow** solvents can be harmful / do not breathe in fumes from solvents / carbon dioxide can easily escape into atmosphere / carbon dioxide is not harmful
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
4	a		idea of a large demand for ammonia / idea of a consistent demand for ammonia (1)	1	**allow** there is always a need for ammonia / made on a large scale
	b		nitrogen + hydrogen→ ammonia (1) **and any two conditions from** high pressure (1) 450 ^{o}C (1) (iron) catalyst (1) idea of recycling nitrogen and hydrogen back into reaction container (1)	3	**allow** H_2 + N_2 → NH_3 but **ignore** balancing **allow** equation with mix of correct formulae and words **allow** ⇆ or = instead of → and **not** and / & **allow** any pressure above 150 atmospheres **not** any pressure that is below 150 atmospheres **allow** any temperature between 250 and 500^{o}C **ignore** heat / high temperature / hot / low temperature **not** incorrectly named catalyst if any incorrect conditions quoted then max 1 mark for conditions
	c		phosphoric acid (1)	1	**allow** H_3PO_4 / phosphoric **not** phosphorus acid
	d		provides nitrogen (1) nitrogen or N used to make plant protein / nitrates used to make plant protein / ammonium compounds used to make plant protein / ammonia used to make plant protein (1)	2	**allow** provides potassium / provides phosphorus / contains NPK **ignore** reference to nitrates or phosphates
			Total	**7**	

Question			Expected Answers	Marks	Additional Guidance
5	a		200	1	unit **not** needed
	b	i	30 (%) (1)	1	
		ii	**use of %** % Na in NaCl is 39.3 / 39% (1) and working to show that 0.7 is 39% of 1.8 / working to show that 39.3% of 1.8 is 0.7 (1) **or** use of moles moles of sodium chloride = 1.8/58.5 (1) so mass of sodium = (1.8/58.5) X 23 = 0.7 (1) **or** ratios Na Cl NaCl 23 35.5 58.5 1 35.5/23 58.5/23 (1) 0.7 (35.5/23) X 0.7 = 1.1 (58.5/23) X 0.7 = 1.8 (1)	2	There are three main ways in which candidates may express their answer use of % of sodium use of moles of sodium use of ratios
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
6	a		filter / AW (1) wash residue (with water) / AW (1) put in oven to dry / leave in air to evaporate (1)	3	answers that do not include filtering will not score any marks **allow** centrifuging **ignore** sieving **allow** let it dry in air / leave to dry **ignore** dry it **ignore** heat it **not** use of a Bunsen burner to dry the residue **allow** all marks from a diagram reaction mixture water  filtering (1) washing (1) drying (1)
	b		$2KI + Pb(NO_3)_2 \rightarrow PbI_2 + 2KNO_3$ correct formula of reactants and products (1) balancing (1)	2	**allow** correct multiples of equation balancing mark **dependent** on correct formulae **allow** ⇆ or = instead of → and **not** and / &
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
7	a	i	1.3 - 1.4 (1)	1	
		ii	30 (1)	1	unit not needed
	b		moles of NaOH = $20.0 \times 10^{-3} \times 0.100 / 0.002$ (1) moles of HCl = moles of NaOH / 0.002 (1) concentration of HCl = 0.08 (1)	3	**allow** $0.002 / 2 \times 10^{-3}$ **allow** $0.002 / 2 \times 10^{-3}$ / ecf from moles of NaOH (1) **allow** 0.08 / ecf from moles of HCl (1) unit for concentration **not** needed **allow** all three marks for correct concentration even if working out appears to be incorrect
			Total	**5**	

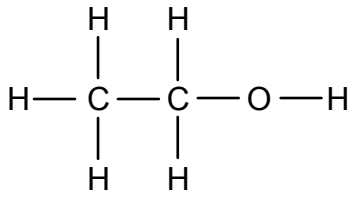
Question			Expected Answers	Marks	Additional Guidance
8	a		hydrogen (1)	1	**allow** H_2 **allow** circle around hydrogen or tick by hydrogen but answer line takes precedence
	b		because hydrogen ions react there / hydrogen ions gain electrons / hydrogen ions move there (1)	1	**allow** H^+ instead of hydrogen ions / cation instead of hydrogen ion / positive ion instead of hydrogen ion **allow** hydrogen ions attracted to cathode
	c		HCl is a strong acid / ethanoic acid is a weak acid (1) greater number of ions with HCl / greater concentration of ions with HCl / ora with ethanoic acid (1)	2	**allow** HCl is a stronger acid / CH_3COOH is a weaker acid **allow** a strong acid has a greater number of ions / strong acid has a greater concentration of ions / ora with weak acid
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
9			stage **1** $S + O_2 \rightarrow SO_2$ (1) stage **3** $SO_3 + H_2O \rightarrow H_2SO_4$ (1)	2	**allow** ⇆ or = instead of → and **not** and / & **allow** any correct multiple of equation **allow** any order of symbols in sulfuric acid eg SO_4H_2
			Total	**2**	

Question			Expected Answers	Marks	Additional Guidance
10	a		hydrogen + oxygen → water (1)	1	**allow** = instead of→ but **not** and / & **allow** hydrogen oxide or hydrogen hydroxide instead of water **allow** $H_2 + O_2 \rightarrow H_2O$ / word equation with mix of correct formulae and words and **ignore** balancing
	b		**any two from:** fossil fuel running out / diesel or petrol is non-renewable / hydrogen and oxygen are renewable (1) less or no greenhouse gases / water is only waste product (1) fuel cell more efficient / fuel cell has direct energy transfer / ora for fossil fuel (1)	2	**ignore** more economic (cost in stem) **allow** fuel cell is a renewable energy source **ignore** so we stop burning fossil fuels / reduces amount of fossil fuel burnt **allow** less polluting **ignore** environmentally friendly / less damaging to environment / greener **allow** reduces carbon footprint / reduces carbon emissions
	c		$H_2 \rightarrow 2H^+ + 2e^-$ / $H_2 - 2e^- \rightarrow 2H^+$ correct formula of reactants and products (1) balancing (1)	2	**allow** any correct multiple **allow** = instead of→ but **not** and / & balancing mark is **dependent** on correct formulae **allow** e for electron
	d		exothermic (1)	1	**allow** other ways of indicating answer but answer on answer line takes precedence
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
11	a	i	idea of stops oxygen reaching surface / stops water reaching the surface (1)	1	**allow** acts as a barrier to air ***/*** acts as a barrier to water / acts as a barrier to oxygen acts as a barrier is **not** sufficient
		ii	**any two from** forms a barrier to prevent water reaching iron / barrier to oxygen / barrier to air (1) sacrificial protection / zinc reacts instead of iron (1) zinc is more reactive (than iron) / ora (1) zinc loses electrons more easily (than iron) / ora (1)	2	**ignore** zinc rusting
	b		oxidation (1)	1	**allow** other ways of indicating answer eg ringing word but answer on answer line takes precedence.
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
12	a		$C_8H_9NO_2$ (2)	2	**allow** any order of symbols if there is an error in counting atoms allow one mark if one error and no marks if two errors eg $C_8H_8O_2N$ (1), $C_8H_9O_2$ (1) but $C_8H_8O_2$ (0) if a molecular formula is not written allow one mark if all the atom counting is correct eg C_8H_9ONO (1) and C_8H_8NOOH (1) If a counting atoms and molecular formula error then 0 marks eg C_8H_8ONO (1)
	b		aspirin may cause stomach bleeds / hospitalisation / death (1)	1	**allow** vomiting / asthma attacks / stomach ulcers **ignore** thinning of the blood
	c		easier to take / easier to swallow / faster acting (1)	1	**allow** gets into blood faster **ignore** digests faster / more effective / you can drink it gets into body quickly needs an extra qualification
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
13	a	i	high temperature denatures enzyme / changes shape of active site of enzyme (1)	1	**allow** yeast dies (1) **ignore** enzyme dies / yeast denatured
		ii	enzyme inactive / yeast inactive / yeast dormant (1)	1	**allow** particles collide infrequently / few collisions per second / collisions not sufficiently energetic
		iii	prevent reaction of oxygen with alcohol / stops vinegar being made / stops (ethanoic) acid being made (1)	1	**allow** prevents aerobic respiration / ora **allow** so there is only anaerobic respiration
	b		distillation (1)	1	**allow** other ways of indicating answer eg ringed but answer on answer line takes precedence
	c		 (1)	1	**allow** OH group in any correct position **allow** C ─ OH
	d		$C_5H_{12}O$ (1)	1	**allow** $C_5H_{11}OH$
			Total	**6**	

			Paper Total	**60**	

Grade Thresholds

General Certificate of Secondary Education
Chemistry B (Specification Code J644)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B641/01	Raw	60	-	-	-	37	30	24	18	12	0
	UMS	69	-	-	-	60	50	40	30	20	0
B641/02	Raw	60	44	36	27	19	14	11	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B642/01	Raw	60	-	-	-	29	23	17	12	7	0
	UMS	69	-	-	-	60	50	40	30	20	0
B642/02	Raw	60	42	34	26	18	14	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B645/01	Raw	60	55	51	46	42	37	32	27	22	0
	UMS	100	90	80	70	60	50	40	30	20	0
B646/01	Raw	60	54	49	43	38	32	26	20	14	0
	UMS	100	90	80	70	60	50	40	30	20	0

B645 & B646 - The grade thresholds have been decided on the basis of the work that was presented for award in June 2009. The threshold marks will not necessarily be the same in subsequent awards.

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	21.3	52.2	79.6	94.2	98.3	99.5	99.8	99.9	100.0	11531

11630 candidates were entered for aggregation this series

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