OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Schemes for the Units

June 2008

J644/MS/R/08

Oxford Cambridge and RSA Examinations

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GCSE Gateway Chemistry B 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		vegetable oil (1)	1	**allow** oil/vegetable
	b		preservative (1)	1	
	c		stops food from reacting with oxygen (1)	1	**allow** stops food oxidising **allow** air **not** keeps food fresh/stops food going off/stops oxygen getting in
	d		helps oil and water to mix / stops oil and water separating/bonds oil and water together (1)	1	**allow** keep oil and water together / keeps 2 substances mixed / prevents 2 liquids separating out.
			Total	**4**	

2	a		onions don't smell nice / AW (1)	1	**allow** onion can irritate the eyes / eyes water/tears/ AW **allow** roses smell nice / AW
	b		does not react with water (1) evaporates easily (1)	2	if **three** ticks given two correct and one wrong (1) if **three** ticks given one correct and two wrong (0) if **four** or **five** ticks given (0)
	c	i	insoluble (1)	1	
		ii	solvent (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	lubricating oils (1)	1	**allow** lubricating /lube oil **not** unspecified oil **ignore** numbers
		ii	gas(es) and petrol (1)	1	either order both answers required for 1 mark **ignore** numbers
	b		top left catalyst top right test tube bottom Bunsen burner all **three** correct (2) **one** or **two** correct (1)	2	 **allow** Bunsen
			Total	**4**	

4	a	i	water (1)	1	**allow** H_2O /hydrogen oxide / dihydrogen oxide **not** water vapour
		ii	limewater / calcium hydroxide / bicarbonate indicator (1)	1	**allow** $Ca(OH)_2$
	b		**any two from**: complete combustion does not produce carbon monoxide (1) carbon monoxide is toxic (1) incomplete combustion produces toxic / poisonous fumes (1) complete combustion gives more energy / is more efficient (1) complete combustion does not produce carbon / complete combustion does not make soot (1) presence of carbon or soot makes a dirtier flame ora (1)	2	assume answers with it refer to complete combustion e.g. it does not make poisonous carbon monoxide would score two marks **allow** incomplete combustion produces carbon monoxide (1) **allow** complete combustion does not produce poisonous / toxic gases / fumes **allow** incomplete combustion gives less energy (1) **allow** incomplete combustion produces carbon / incomplete combustion makes soot (1) **allow** heat for energy **ignore** references to flame colour /harmful /dangerous gases /pollution.
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
5	a	i	11 (1)	1	**allow** answer in table if not on line.
		ii	B (1)	1	**allow** ecf from wrong temperature change calculation
	b		joules (1)	1	**allow** J
			Total	**3**	

6	a		landscape destroyed / quarry must be filled in after use / increased dust / increased traffic /quarries take up valuable land / AW (1)	1	**allow** destroys ecosystems / habitat / harms or kills living things **allow** it is an eyesore / visual pollution **allow** damage to property by shock waves / blasting **ignore** references to pollution by machinery
	b		3 (1)	1	
	c		calcium carbonate → calcium oxide + carbon dioxide (1)	1	**allow** $CaCO_3 \rightarrow CaO + CO_2$ balanced or unbalanced **allow** mix of formulae and names **allow** = sign for arrow and heat above arrow **not** + heat or and for +
	d	i	70 (cm^3) (1)	1	**allow** 69 - 71 cm^3 unit **not** needed
		ii	60 - 90 (seconds) (1)	1	unit **not** needed
	e		clay (1)	1	
			Total	**6**	

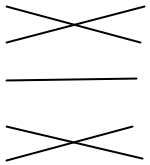
Question			Expected Answers	Marks	Additional Guidance
7	a		magma (1) lava (1) igneous (1)	3	
	b		to predict when future eruptions may happen / to find out about the structure of the Earth / AW (1)	1	**allow** give warning to people
			Total	**4**	

8	a		**any two from**: aluminium (1) chromium (1) copper (1) wood (1) leather (1) rubber (1) plastic (1) alloy (1)	2	**allow** foam / fibre / cloth **allow** named plastics e.g. polycarbonate **allow** two marks for two named plastics **not** stainless steel
	b		saves natural resources / reduces disposal problems / reduces number of dumped cars / saves energy / AW (1)	1	**ignore** references to time / safety references to the environment or pollution must be qualified **ignore** can be used again
	c		**any one from** salt (1) acid rain / acid in the water / sulfur dioxide / oxides of nitrogen (1) warm(er) / increase temperature / AW (1) wet(ter) / rain / moist / humid / water / AW (1)	1	**allow** hot **ignore** reference to catalyst
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
9	a		hydrogen (1)	1	**allow** H_2 / H
	b	i	2.0 (mol/dm^3)	1	**allow** 2 unit **not** needed
		ii	increases / goes higher (1)	1	**allow** becomes faster / speeds up **ignore** references to time but **not** time gets quicker
		iii	**any three from**: stir / shake (1) heat / change in temperature (1) so particles move faster / slower (1) use zinc powder (1) change the surface area (1) have more / less collisions between particles (1) add a catalyst (1)	3	 **ignore** pressure **allow** increase or decrease for change **allow** bigger or smaller lumps
			Total	**6**	

10	a		two or more atoms joined together (1)	1	**not** particles
	b		9 (1)	1	
	c		covalent (1)	1	
	d	i	a (horizontal) row (in the Periodic Table) (1)	1	**allow** have same number of (occupied) shells
		ii	have similar reactions / chemical properties (1)	1	**allow** same number of electrons in outer ring / **allow** same number of valence electrons / same number of outer shell electrons **ignore** same reactions **not** same outer shell **not** similar properties
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
11	a		alkali metals (1)	1	
	b	i	sodium + water → sodium hydroxide + hydrogen (1)	1	**allow** any order of reactants **allow** any order of products **allow** $2Na + 2H_2O \rightarrow 2NaOH + H_2$ **allow** unbalanced symbol equation **allow** mix of formulae and words **allow** hydrogen gas **allow** = instead of arrow **not** and instead of +
		ii	potassium hydroxide and hydrogen (1)	1	**allow** KOH and H_2 **allow** mix of names and formulae **ignore** wrong formula if name given **not** full equation unless products are clearly indicated
	c		sodium chloride (1)	1	**allow** NaCl
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
12	a		anion - negative ion anode - positive electrode cation - positive ion electrolyte - liquid that conducts all **four** correct (3) **three** or **two** correct (2) **one** correct (1)	3	the pattern is: 
	b		**any three from**: aluminium oxide / bauxite (1) cryolite (1) oxygen formed at anode / oxygen formed at positive electrode (1) aluminium formed at cathode / aluminium formed at the negative electrode (1) graphite anodes worn away / positive electrodes need replacing after a time (1) electrolyte is a hot liquid / electrolyte is molten (1)	3	**allow** presences of cryolite (1) reduces the temperature needed (1) **allow** carbon monoxide made at anode / carbon dioxide formed at anode (1) **allow** marks from equations $Al^{3+} + 3e^- \rightarrow Al$ (1) - aluminium at the cathode $2O^{2-} - 4e^- \rightarrow O_2$ / $2O^{2-} \rightarrow O_2 + 4e^-$ (1) - oxygen at the anode $2Al_2O_3 \rightarrow 4Al + 3O_2$ (or unbalanced) / aluminium oxide → aluminium + oxygen (1) - use of aluminium oxide **allow** contents are liquid / contents are molten (1)
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
13	a	i	iron (1)	1	**allow** Fe
		ii	copper (1)	1	**allow** Cu
	b		(good) conductor of heat (1)	1	**not** just a conductor / good conductor **ignore** references to electricity / high melting point
	c		superconductors (1)	1	
	d		aluminium (1)	1	**allow** Al
			Total	**5**	

			Section Total	**60**	

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

Question			Expected Answers	Marks	Additional Guidance
1	a		preservative (1)	1	
	b		no because no E number between 101 and 199 / AW (1)	1	no mark for just saying no **allow** E472 is an emulsifier **and** E953 is a sweetener
	c		water attracted to hydrophilic end / water attracted to head / water surrounds the hydrophilic end / water surrounds the head / AW (1) oil attracted to hydrophobic end / oil attracted to tail / oil around hydrophobic end / oil around the tail / AW (1)	2	**allow** marking points from a labelled diagram but check it does not contradict text **ignore** definitions of hydrophobic and hydrophilic e.g. head likes water (0) if answer refers to a single water molecule and/or a single oil molecule then answer loses that marking point – penalise use of single molecule only once
			Total	**4**	

2	a	i	does not <u>poison</u> wearer (1)	1	**ignore** so it will not harm / irritate / damage
		ii	does not wash off (1)	1	**allow** so it will not dissolve in perspiration / rain / AW
	b		weak attraction between molecules (of perfume) / weak intermolecular attraction / Van der Waals forces between molecules (1) so attraction is easily overcome / intermolecular force is easy to overcome / less energy required for evaporation / AW (1)	2	**not** weak forces between particles / weak attraction between particles **ignore** has weak bonds / weak covalent bonds / bonds are broken / weak forces **allow** weak bonds between molecules **allow** particles with lots of energy can escape **allow** easy to break intermolecular force / AW (1)
	c		solvent (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	lubricating oils (1)	1	**allow** lubricating / lube oil **not** unspecified oil **ignore** numbers
		ii	gas(es) **and** petrol (1)	1	**either** order **both** answers required for 1 mark **ignore** numbers
	b		cracking converts large hydrocarbon/chains/molecules into smaller ones (1) cracking converts fractions in excess to those in demand / AW (1)	2	**allow** cracking converts a named large hydrocarbon into a small one e.g. cracking changes heating oil into petrol (1) **ignore** references to fractional distillation **allow** converts (less useful) fractions into more useful fractions (1) some comparison needed to score mark e.g. converts fractions into useful fractions (0) but makes more useful fractions (1)
			Total	**4**	

4	a	i	water (1)	1	**allow** H_2O / hydrogen oxide / dihydrogen oxide **not** water vapour
		ii	limewater / calcium hydroxide / bicarbonate indicator (1)	1	**allow** $Ca(OH)_2$
	b		**any one from**: complete combustion does not produce carbon monoxide (1) carbon monoxide is toxic (1) incomplete combustion produces toxic (1) poisonous fumes (1) complete combustion gives more energy / is more efficient (1) presence of carbon or soot makes a dirtier flame ora (1)	1	assume answers with it refer to complete combustion e.g. it does not make poisonous carbon monoxide (1) **allow** incomplete combustion produces carbon monoxide **allow** incomplete combustion gives less energy / heat **allow** incomplete combustion has a dirty flame **ignore** references to flame colour / harmful gases / dangerous gases / pollution.
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
5	a		C (1)	1	
	b		more energy given out than taken in (1)	1	answer must be a comparison e.g. energy given out (0) **any** reference to bond breaking or bond making must be correct **ignore** references to number of bonds
	c		energy per gram = energy/mass of fuel OR 560/0.7 (1) =800 (1)	2	**allow** full marks for correct answer **ignore** units
			Total	**4**	

6	a		granite is an igneous rock (1) granite is harder than marble (1)	2	if one incorrect answer max (1) if two incorrect answers (0)
	b		calcium carbonate → calcium oxide + carbon dioxide (1)	1	**allow** $CaCO_3 \rightarrow CaO + CO_2$ balanced or unbalanced **allow** mix of formulae and names **allow** = **allow** heat above/below arrow **not** '+ heat' or 'and'
	c	i	60 - 90 (seconds) (1)	1	unit **not** needed
		ii	same shape of graph but steeper (1)	1	drawn line must start from origin and be above original line between 0-60 seconds **ignore** where it ends up **allow** a straight line graph with a gradient larger than that given
	d		clay (1)	1	
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
7	a		to predict when future eruptions may happen / to find out about the structure of the Earth / AW (1)	1	**allow** give warning to people
	b		composition of molten rock / viscosity of molten rock / whether gas is present in molten rock / temperature of molten rock / pressure exerted on molten rock / AW (1)	1	**allow** lava or magma for molten rock **allow** density of molten rock **allow** force exerted on molten rock
	c		continental plate and oceanic plate (1) oceanic plate more dense (than continental plate) / ora (1) oceanic plate forced underneath the continental plate / more dense plate forced under other plate (1)	3	penalise use of wrong plates / use of crust just once **allow** marks from a labelled diagram **allow** one plate forced underneath the other if not contradicted by reference to the wrong density
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
8	a	i	less raw resources used up / less scrapped cars dumped / less waste/litter / less use of landfill / AW (1)	1	**allow** named resource e.g. oil **allow** metals are easier to recycle than obtain new **ignore** references to cost or unqualified references to pollution
		ii	difficult/expensive to sort out all the materials / some materials are toxic / may make cars much more expensive / quality of recycled material not as good / AW (1)	1	**allow** uses a lot of energy **allow** labour intensive **allow** some materials are difficult to recycle
	b		**any two from**: salt (1) acid rain / acid in the water / sulfur dioxide / oxides of nitrogen (1) warm(er) / increase temperature / AW (1) wet(ter) / rain / moist / humid / water / AW (1)	2	**ignore** references to catalysts **allow** hot
			Total	**4**	

9	a		because a gas is given off / because hydrogen escapes / AW (1)	1	**not** wrong gas escapes **not** hydrogen or gas evaporates **ignore** water evaporates
	b	i	increases / goes higher / becomes faster (1)	1	**ignore** references to time **not** time gets quicker
		ii	139 (seconds) or less (1)	1	units **not** needed
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
10			**any two from**: photosynthesis changed carbon dioxide into oxygen / AW (1) carbon dioxide incorporated into rocks / carbon dioxide absorbed into oceans (1) water (vapour) condensed / cooled into oceans (1) ammonia converted into nitrogen (1) nitrogen very unreactive so built up in atmosphere (1)	2	**allow** plants changed carbon dioxide into oxygen **both** carbon dioxide **and** oxygen needed to score mark
			Total	**2**	

11	a		**any two from**: electrostatic (1) attraction between a positive ion and a negative ion (1) idea of electron transfer (1)	2	**allow** particle for ion **allow** oppositely charged ions / particles **not** swapping / sharing electrons
	b		both O-H bond pairs (1) rest of structure complete (1)	2	**ignore** inner shell electrons if drawn element labels not needed second mark can only be awarded if first mark is given
	c		no free electrons / does not contain ions / only has covalent bonds (1)	1	**allow** no free charge carriers
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
12	a	i	sodium + water → sodium hydroxide + hydrogen (1)	1	**allow** any order of reactants **allow** any order of products **allow** $2Na + 2H_2O \rightarrow 2NaOH + H_2$ **allow** unbalanced symbol equation **allow** mix of formulae and words **allow** hydrogen gas **allow** = **not** and
		ii	potassium hydroxide **and** hydrogen (1)	1	**both** answers required for 1 mark **allow** KOH and H_2 **allow** mix of names and formulae **ignore** wrong formula if name given **not** full equation unless products are clearly indicated
	b	i	same number of electrons in outer shell / all have one electron in their outer shell / all lose one electron (to get a stable electronic structure) (1)	1	
		ii	electrons further from nucleus / electrons easier to lose / needs less energy to remove an electron (1)	1	**allow** ionisation energy is less / more (shielding) shells **allow** weak(er) force of attraction **ignore** electrons can be lost faster
	c		$Na - e^- \rightarrow Na^+$ / $Na \rightarrow Na^+ + e^-$ (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
13	a		**any three from**: aluminium oxide / bauxite (1) cryolite (1) oxygen formed at anode / oxygen formed at positive electrode (1) aluminium formed at cathode / aluminium formed at the negative electrode (1) graphite anodes worn away / positive electrodes need replacing after a time (1) electrolyte is a hot liquid / electrolyte is molten (1)	3	**allow** presence of cryolite (1) reduces the temperature needed (1) **allow** carbon monoxide made at anode / carbon dioxide formed at anode (1) **allow** marks from equations $Al^{3+} + 3e^- \rightarrow Al$ (1) - aluminium at the cathode $2O^{2-} - 4e^- \rightarrow O_2$ / $2O^{2-} \rightarrow O_2 + 4e^-$ (1) - oxygen at the anode $2Al_2O_3 \rightarrow 4Al + 3O_2$ (or unbalanced) / aluminium oxide → aluminium + oxygen (1) - use of aluminium oxide **allow** contents are liquid / contents are molten (1)
	b		high cost of extraction / (high cost) of electricity / harder to extract (from its ore) (1)	1	**not** references to mining **allow** high cost of purifying ore
			Total	**4**	

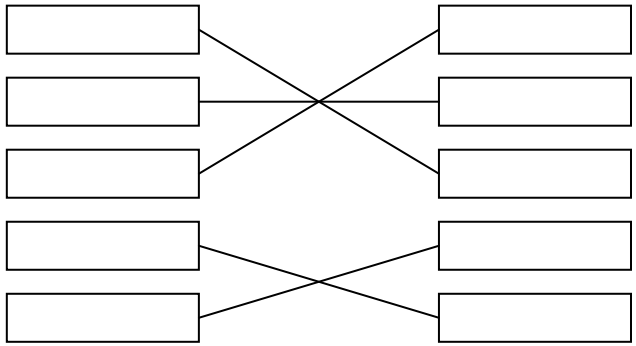
Question			Expected Answers	Marks	Additional Guidance
14	a		(good) conductor of heat (1)	1	**not** just a conductor / good conductor **ignore** references to electricity / high melting point
	b		low density / lightweight (1)	1	**ignore** light
	c		(delocalised) electrons (1) move (1)	2	**allow** mobile electrons (2) marks can be awarded from labelled diagram or text deduct 1 mark for each incorrect statement e.g. metals contain electrons that move freely but metallic centres labelled in diagram as atoms would only score (1)
	d		**any two from**: (virtually) no resistance (1) loss free power transmission / efficient power transmission / low energy loss (1) super fast circuits (1) powerful electromagnets (1)	2	 **ignore** faster electricity / current electromagnets on its own scores (0)
			Total	**6**	

			Section Total	**60**	

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

General Instructions

- All formulae must be totally correct e.g. CO_2 and not CO2 / CO^2 ; SO_4^{2-} and not SO42-, So_4^{2}-, $SO_4$2- (any subscripts must be at least marginally smaller than the atomic symbol and superscripts must be at least slightly above the symbol)
- Symbols must be as shown in the periodic table e.g. Ne and not NE / nE / ne
- In equations + heat or (+ heat) should be penalised but allow heat or other conditions above or below the arrow
- In equations no use of 'and' or '&'.
- Unless specified otherwise the answer on an answer line takes precedence
- In prompted recall questions allow other ways of indicating the answer e.g. ring around the answer, ticking the correct answer but any answer on the answer line must take precedence.

Question			Expected Answers	Marks	Additional Guidance
1			enzymes - helps to remove food stains in low temperature washes optical brightener - gives a whiter than white appearance water softener - softens hard water detergent - active cleaner all **four** correct (3) **two** or **three** correct (2) **one** correct (1)	3	
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
2	a		solid (1) (very) high (1)	2	**allow** any number above 1000°C
	b		diamond must be very hard (1) diamond must have a high melting point (1)	2	**allow** a good thermal conductor **allow** hardness (1) and melting point (1) **ignore** strong
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	ammonium nitrate / NH_4NO_3 (1)	1	
		ii	calcium phosphate / $Ca_3(PO_4)_2$ (1)	1	
	b	i	ammonia (1)	1	**allow** NH_3 / NH_4OH / ammonium hydroxide **not** ammonium
		ii	nitric (acid) (1)	1	**allow** HNO_3
			Total	**4**	

4	a		7 (1)	1	
	b		making fertilisers / battery acid / batteries / making detergents (1)	1	**allow** other suitable uses **not** unspecified cleaner
	c	i	any value between -1 and 6 (1)	1	
		ii	pH increases / pH goes up (1) sodium hydroxide has a pH above 7 / neutralisation occurs / less hydrogen ions present / more hydroxide ions present (1)	2	**allow** a change of pH that increases e.g. from 2 to 3 **not** pH goes green / pH goes neutral **allow** ecf from c(i) for starting pH if an actual numerical answer is given **allow** solution becomes neutral **allow** sodium hydroxide is alkaline
		iii	sodium sulfate (1)	1	**allow** sodium sulphate / Na_2SO_4 / sodium hydrogen sulfate / $NaHSO_4$
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
5	a		pesticide (1)	1	
	b		chlorination (1)	1	
	c		cheap / readily available / idea that it is used as a raw material for contact process / raw material for making ethanol / hydro-electric power / AW (1)	1	**allow** used on a large scale **allow** coolant **allow** solvent
			Total	**3**	

6	a		add water (1)	1	**ignore** any quantities given
	b		mol/dm^3 (1)	1	
	c		too concentrated / children need smaller doses / it is much safer / AW (1)	1	**allow** too strong
			Total	**3**	

7	a		reversible reaction / equilibrium / reaction goes backwards and forwards (1)	1	**allow** products can be changed back into reactants / reaction reaches equilibrium / sulfur trioxide can be changed back into sulfur dioxide
	b		air / the atmosphere (1)	1	
			Total	**2**	

Question			Expected Answers	Marks	Additional Guidance
8	a		blue / purple in alkali **and** red / pink in acid (1)	1	**both** needed **no** half marks **allow** red/orange but **not** orange
	b	i	21.2 (1)	1	unit not needed but must be correct if quoted
		ii	they are most consistent / first reading was a rough one / AW (1)	1	**allow** first reading was odd / first reading was anomalous / titres that are closest to one another / titres within 0.2 / titres will be more accurate
		iii	20.0 / 20 (1)	1	unit not needed but must be correct if quoted
			Total	**4**	

9	a		166 (1)	1	**ignore** units
	b		C_2H_2 (1) C_6H_6 (1)	2	
			Total	**3**	

10	a		carbon dioxide (1)	1	**allow** CO_2
	b	i	reactants run out / acid runs out / calcium carbonate runs out / AW (1)	1	**allow** no more acid left / no more acid particles / no more calcium carbonate particles / AW
		ii	use universal indicator / use pH paper (1) match the colour against a colour chart / AW (1)	2	**ignore** unspecified indicator **not** litmus **allow** use a colour chart the colour chart mark is not dependent on the correct indicator
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
11	a		H^+ / Cu^{2+} (1)	1	**not** H / Cu
	b		negative electrode gains mass (1) positive electrode loses mass (1)	2	the bottom two boxes mark incorrect answers first – max 1 if one incorrect, and award 0 if two incorrect
	c		ions cannot move / ions fixed in position (1)	1	**allow** no mobile charge carrier **ignore** reference to electrons
			Total	**4**	

12	a	i	A (1)	1	
		ii	B (1)	1	
	b		hydrogen + oxygen → water (1)	1	**allow** reactants in either order **allow** $2H_2 + O_2 \rightarrow 2H_2O$ **allow** mix of formulae and names **allow** unbalanced symbol equation **allow** (di)hydrogen oxide / hydrogen hydroxide
	c		electrical (1)	1	
	d		**any one from**: efficient (1) lighter (1) do not need recharging (1) no special fuel (1) produces water (1)	1	**allow** ora if specified e.g. a battery needs recharging **ignore** does not run out / references to cost **allow** no pollution / no problems if it leaks / no harmful products
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
13	a		oxygen / air (1) water (1)	2	**allow** either order **allow** moist air / damp air (2) **allow** moist oxygen / damp oxygen (2)
	b	i	prevents water from reaching (surface of) iron / stops oxygen from reaching (surface of) iron (1)	1	**allow** stops oxygen from reacting with iron / stops water from reaching it **allow** prevents air from reacting with iron paint acts as a barrier is not sufficient but **allow** acts as a barrier from oxygen
		ii	**any two from:** oiling / greasing / polishing (1) galvanising (1) sacrificial protection / description of sacrificial protection / AW (1) alloying (1) tinning / AW (1) keep dry (1) plastic coating (1)	2	**ignore** varnish
	c		redox (1)	1	
			Total	**6**	

14	a		solids (1) liquids (1)	2	
	b		two liquids (mixed) (1) one liquid is finely dispersed in the other / AW (1)	2	**allow** liquid dispersed in another (2)
	c		sodium hydroxide (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
15	a		painkiller (1)	1	
	b		paracetamol / ibuprofen (1)	1	**allow** trade names e.g. Calpol **allow** class A drugs e.g. heroin **not** aspirin
	c		$C_9H_8O_4$ (1)	1	
	d		**any one from**: faster acting (1) gets into the blood quicker (1) easier to take (1) AW (1)	1	**ignore** more effective **not** digested faster **ignore** you can drink it
			Total	**4**	

			Section Total	**60**	

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

General Instructions

- All formulae must be totally correct e.g. CO_2 and not CO2 / CO^2 ; SO_4^{2-} and not SO42-, So_4^{2}-, $SO_4$2- (any subscripts must be at least marginally smaller than the atomic symbol and superscripts must be at least slightly above the symbol)
- Symbols must be as shown in the periodic table e.g. Ne and not NE / nE / ne
- In equations + heat or (+ heat) should be penalised but allow heat or other conditions above or below the arrow
- In equations no use of 'and' or '&'.
- Unless specified otherwise the answer on an answer line takes precedence
- In prompted recall questions allow other ways of indicating the answer e.g. ring around the answer, ticking the correct answer but any answer on the answer line must take precedence.

Question			Expected Answers	Marks	Additional Guidance
1	a		diamond must be very hard (1) diamond must have a high melting point (1)	2	**allow** a good thermal conductor **allow** hardness (1) and melting point (1) **ignore** strong
	b	i	(many) strong bonds to be broken / (many) covalent bonds must be broken (1)	1	lots of energy needed because of strong bonds is not sufficient **not** strong intermolecular forces are broken
		ii	has delocalised electrons / free electrons / has electrons that can move / AW (1)	1	**allow** moving electron
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
2	a	i	ammonia (1)	1	**allow** NH_3 / NH_4OH / ammonium hydroxide **not** ammonium
		ii	nitric (acid) (1)	1	**allow** HNO_3
	b		$K_2CO_3 + 2HCl \rightarrow 2KCl + CO_2 + H_2O$ (1)	1	**allow** any correct multiples of this equation
	c	i	% yield = [actual yield/predicted yield] x100 / [0.596/1.49] x 100 (1) = 40 (1)	2	words/numbers in square brackets are needed for mark **allow** full marks for correct answer with no working out **no** ecf in this question
		ii	0.745 / 0.75 (1)	1	**allow** 0.298
	d		this is a **level of response** mark scheme any **two** of the bullet points in the Additional Guidance (1) **but** any **three** of the bullet points in the Additional Guidance with **one linking statement** (2) **but** any **four** of the bullet points in the Additional Guidance with at **least two linking statements** (3)	3	• idea of fertiliser run-off into rivers, ponds or lakes / fertiliser leached by rain water into rivers, ponds or lakes • presence of algal bloom / lots of algae grow • idea that the blocks off sunlight (from plants beneath the surface) • plants die • bacteria feed on the plants / microbes feed on plants / decomposers feed on plants • bacteria are aerobic / bacteria use up (all the) oxygen • aquatic life dies / animals die / fish die examples fertiliser in river cause an algal bloom (0) but get an algal bloom and fish die (1) but run-off of fertiliser into river causes an algal bloom. Lack of sunlight for plants below (2)
			Total	**9**	

Question			Expected Answers	Marks	Additional Guidance
3	a	i	sodium hydroxide has a pH above 7 / neutralisation occurs / less hydrogen ions present / more hydroxide ions present (1)	1	**allow** solution becomes neutral **allow** sodium hydroxide is alkaline
		ii	sodium sulfate (1)	1	**allow** sodium hydrogensulfate / sodium hydrogensulphate / $NaHSO_4$ / sodium sulphate / Na_2SO_4
	b		H^+ / H_3O^+ / hydrogen / oxonium / proton / hydroxonium (1)	1	**not** H / H_2 **ignore** OH^-
			Total	**3**	

4	a		insoluble material is removed / named insoluble material removed (1)	1	**allow** twigs removed / sand removed / dirt removed **ignore** large or small particles removed
	b		soluble salts are not removed by water purification / AW (1)	1	**allow** soluble (poisonous) pollutants still present / there are still dissolved substances present / fertilisers still present / nitrate present / pesticide (residues may still be) present **allow** aluminium ions present **ignore** lead compounds present but **allow** lead ions present
	c	i	distillation / evaporation and condensation (1)	1	**allow** reverse osmosis / desalination also look in part (ii) for answer
		ii	large energy requirement / need to boil lots of water / need lots of heat / need lots of electricity / AW (1)	1	**allow** needs lots of fossil fuels for heating but uses fossil fuels is not sufficient **ignore** references to other costs also look in part (i) for answer
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
5	a		there is a continuous colour change / no sudden change / no sharp end-point / AW (1)	1	**allow** has many colours **not** there is a slow colour change
	b		they are most consistent / first reading was a rough one / AW (1)	1	**allow** first reading was odd / first reading was anomalous / titres that are closest to one another / titres within 0.2 / titres will be more accurate
	c	i	$0.0025 / 2.5 \times 10^{-3}$ (1)	1	
		ii	$0.0025 / 2.5 \times 10^{-3}$ (1)	1	**allow** ecf from (i) - must be same answer as in part (i)
		iii	mean titre = 20 (cm^3) / 0.020 dm^3 (1) concentration = 0.125 (1)	2	**allow** ecf from part (ii) **allow** ecf from wrong titre being used if concentration of acid is correct but no response in parts c(i) and (c)(ii) then award all four marks for parts (c)(i), (c)(ii) and (c)(iii)
			Total	**6**	

6	a		107 (1)	1	
	b		C_2H_2 (1) C_6H_6 (1)	2	
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
7	a		negative electrode gains mass (1) positive electrode loses mass (1)	2	the bottom two boxes mark incorrect answers first – max 1 if one incorrect, and award 0 if two incorrect
	b		ions cannot move / ions fixed in position (1)	1	**allow** no mobile charge carrier / ions not free **ignore** reference to electrons
			Total	**3**	

8	a		acid runs out / AW (1)	1	**allow** no more acid left / no more acid particles / no more of the limiting reactant / one of the reactants has been used up / AW **not** no more calcium carbonate left
	b		correct apparatus to collect gas e.g. gas syringe / measuring cylinder / upturned burette (1) will it work - is it gas tight / is there water to be displaced (1)	2	**allow** all marks from a diagram **allow** apparatus if not labelled providing it has clear graduations or is obviously a gas syringe **allow** 'solid' bungs / 'solid' ends of tubes if gas is not collected e.g. lime-water test is shown award no marks
	c		0.72 / 720 cm^3 (1)	1	if unit missing then assume it is dm^3
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
9	a		**any four from**: **temperature** 450°C is a compromise temperature / an optimum temperature(1) it gives a fast rate of reaction without shifting position of equilibrium to the left (1) **atmospheric pressure** position of equilibrium already lies on the right (1) too high a pressure will increase costs (1) **catalyst** increases rate of reaction (1) without shifting position of equilibrium (1)	4	to score **maximum** marks at least one mark must refer to rate and at least one to the position of equilibrium answers must refer to position of equilibrium rather than yield **allow** high temperature gives a fast reaction but equilibrium on the left hand side / ora
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
10	a		hydrogen + oxygen → water (1)	1	**allow** reactants in either order **allow** $2H_2 + O_2 \rightarrow 2H_2O$ **allow** mix of formulae and names **allow** unbalanced symbol equation **allow** (di)hydrogen oxide / hydrogen hydroxide
	b		**any one from**: produces water (1) efficient (1) do not need recharging (1) lighter (1) no special fuel (1)	1	**allow** no pollution / no problems if it leaks / no harmful products **allow** ora if specified e.g. a battery needs recharging **ignore** does not run out / references to cost
	c		top box - reactant / hydrogen and oxygen (1) middle box- energy change / enthalpy change (1) bottom box- product / water (1)	3	
	d		exothermic (1)	1	
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
11	a		prevents water from reaching (surface of) iron / stops oxygen from reaching (surface of) iron (1)	1	**allow** stops oxygen from reacting with iron / stops water from reaching it **allow** prevents air from reacting with iron **allow** acts as a barrier from oxygen **but** paint acts as a barrier is not sufficient
	b		redox (1)	1	
	c		**any three from**: tin stops water from getting to the surface of iron / tin stops oxygen from getting to the surface of the iron (1) zinc stops water from getting to the surface of iron / zinc stops oxygen from getting to the surface of the iron (1) zinc also acts as a sacrificial protector / zinc will oxidise in preference to iron / zinc reacts with oxygen rather than iron / zinc reacts with water rather than iron / zinc releases electrons rather than iron (1) zinc will prevent rusting when scratched but tin will not / AW (1)	3	**allow** moisture / air answer can refer to galvanising rather than zinc this mark needs reference to a scratch or equivalent
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
12	a	i	fat / oil + sodium hydroxide → soap + glycerol (1)	1	**allow** NaOH
		ii	saponification (1)	1	
	b		immiscible (1)	1	
	c		oil is reacted with hydrogen / hydrogenation (1)	1	**allow** it is made (more) saturated **ignore** any incorrect catalyst
			Total	**4**	

13	a	i	$C_9H_8O_4$ (1)	1	
		ii	both have a 6 membered ring / both have a benzene ring (1)	1	**allow** both contain hydrogen / both contain oxygen / both contain carbon / both contain a carbonyl group / both contain an O-H bond / both contain C=O bond / both have carbon rings **ignore** both have double bonds
		iii	paracetamol contains nitrogen / paracetamol has an amide link / aspirin is an ester / aspirin is an acid (1)	1	**allow** any clear reference to a structural difference
	b	i	**any one from**: faster acting / gets into the blood quicker / easier to take / easier to swallow / AW (1)	1	**ignore** more effective / you can drink it **not** digested faster
		ii	replace top hydrogen with sodium ion / it is made into a salt / it is made into an ionic compound / it is made into an anion / made into a negative ion (1)	1	**allow** marks from the diagram
			Total	**5**	

			Section Total	**60**	

Grade Thresholds

General Certificate of Secondary Education
Chemistry B (Specification Code J644)
June 2008 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B641/01	Raw	60	-	-	-	35	29	23	18	13	0
	UMS	69	-	-	-	60	50	40	30	20	0
B641/02	Raw	60	45	37	29	22	17	14	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B642/01	Raw	60	-	-	-	35	29	23	17	11	0
	UMS	69	-	-	-	60	50	40	30	20	0
B642/02	Raw	60	45	37	29	31	17	15	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B645/01	Raw	60	53	49	44	40	35	30	25	20	0
	UMS	100	90	80	70	60	50	40	30	20	0
B646/01	Raw	60	52	47	41	36	30	24	18	12	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 2008. 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	24.8	55.0	78.9	92.6	97.4	99.2	99.7	99.9	100.0	8917

9001 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.

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