

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Schemes for the Units

June 2008

J644/MS/R/08

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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 ₂ O /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 $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ 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	

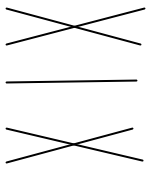
Question		Expected Answers	Marks	Additional Guidance
7	a	magma (1) lava (1) igneous (1)	3	
	b	to predict when future eruptions may happen / to find out about the structure of the Earth / AW (1)	1	allow give warning to people
		Total	4	

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	1	allow 2 unit not needed
		ii	1	allow becomes faster / speeds up ignore references to time but not time gets quicker
		iii	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	1	allow have same number of (occupied) shells
		ii	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 $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ 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 $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ (1) - aluminium at the cathode $2\text{O}^{2-} - 4\text{e}^- \rightarrow \text{O}_2$ / $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ (1) - oxygen at the anode $2\text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$ (or unbalanced) / aluminium oxide \rightarrow 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 ₂ O / 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 $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ 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	<p>any two from: photosynthesis changed carbon dioxide into oxygen / AW (1)</p> <p>carbon dioxide incorporated into rocks / carbon dioxide absorbed into oceans (1)</p> <p>water (vapour) condensed / cooled into oceans (1)</p> <p>ammonia converted into nitrogen (1)</p> <p>nitrogen very unreactive so built up in atmosphere (1)</p>	2	<p>allow plants changed carbon dioxide into oxygen both carbon dioxide and oxygen needed to score mark</p>
	Total	2	

11	a	<p>any two from: electrostatic (1) attraction between a positive ion and a negative ion (1)</p> <p>idea of electron transfer (1)</p>	2	<p>allow particle for ion allow oppositely charged ions / particles</p> <p>not swapping / sharing electrons</p>
	b	<p>both O-H bond pairs (1) rest of structure complete (1)</p>	2	<p>ignore inner shell electrons if drawn element labels not needed second mark can only be awarded if first mark is given</p>
	c	<p>no free electrons / does not contain ions / only has covalent bonds (1)</p>	1	<p>allow no free charge carriers</p>
	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 $2\text{Na} + 2\text{H}_2\text{O} \rightarrow 2\text{NaOH} + \text{H}_2$ 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		$\text{Na} - \text{e}^- \rightarrow \text{Na}^+ / \text{Na} \rightarrow \text{Na}^+ + \text{e}^-$ (1)	1	
			Total	5	

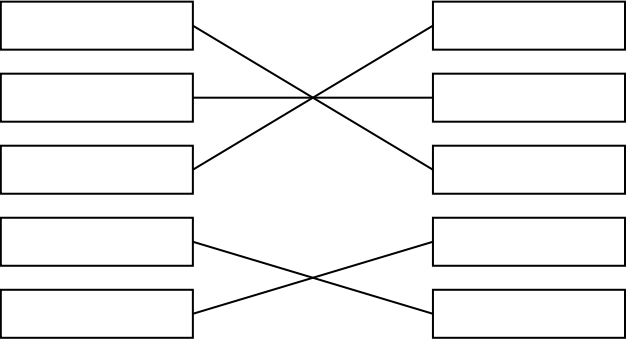
Question		Expected Answers	Marks	Additional Guidance
13	a	<p>any three from: aluminium oxide / bauxite (1)</p> <p>cryolite (1)</p> <p>oxygen formed at anode / oxygen formed at positive electrode (1)</p> <p>aluminium formed at cathode / aluminium formed at the negative electrode (1)</p> <p>graphite anodes worn away / positive electrodes need replacing after a time (1)</p> <p>electrolyte is a hot liquid / electrolyte is molten (1)</p>	3	<p>allow presence of cryolite (1) reduces the temperature needed (1)</p> <p>allow carbon monoxide made at anode / carbon dioxide formed at anode (1)</p> <p>allow marks from equations $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$ (1) - aluminium at the cathode $2\text{O}^{2-} - 4\text{e}^- \rightarrow \text{O}_2$ / $2\text{O}^{2-} \rightarrow \text{O}_2 + 4\text{e}^-$ (1) - oxygen at the anode $2\text{Al}_2\text{O}_3 \rightarrow 4\text{Al} + 3\text{O}_2$ (or unbalanced) / aluminium oxide \rightarrow aluminium + oxygen (1) - use of aluminium oxide</p> <p>allow contents are liquid / contents are molten (1)</p>
	b	high cost of extraction / (high cost) of electricity / harder to extract (from its ore) (1)	1	<p>not references to mining allow high cost of purifying ore</p>
		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. CO₂ and not CO2 / CO² ; SO₄²⁻ and not SO4²⁻, So₄²⁻, SO₄2⁻ (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 / $\text{Ca}_3(\text{PO}_4)_2$ (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 <u>alkaline</u>
		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)	unit not needed but must be correct if quoted
		ii	they are most consistent / first reading was a rough one / AW (1)	1
		iii	20.0 / 20 (1)	1
Total			4	

9	a	166 (1)	1	ignore units
	b	C ₂ H ₂ (1) C ₆ H 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 → 2H ₂ O 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	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	2	ignore varnish
		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)		
	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_42- (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 ₄ OH / ammonium hydroxide not ammonium
		ii	nitric (acid) (1)	1	allow HNO ₃
	b		K ₂ CO ₃ + 2HCl → 2KCl + CO ₂ + H ₂ O (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	<ul style="list-style-type: none"> • 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 <p>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)</p>
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 <u>alkaline</u>
		ii	sodium sulfate (1)	1	allow sodium hydrogensulfate / sodium hydrogensulphate / NaHSO ₄ / sodium sulphate / Na ₂ SO ₄
	b		H ⁺ / H ₃ O ⁺ / 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 / 2.5×10^{-3} (1)	1	
		ii	0.0025 / 2.5×10^{-3} (1)	1	allow ecf from (i) - must be same answer as in part (i)
		iii	mean titre = $20 \text{ (cm}^3\text{)} / 0.020 \text{ dm}^3$ (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 ₂ H ₂ (1) C ₆ H 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	<p>any four from:</p> <p>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)</p> <p>atmospheric pressure position of equilibrium already lies on the right (1) too high a pressure will increase costs (1)</p> <p>catalyst increases rate of reaction (1) without shifting position of equilibrium (1)</p>	4	<p>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</p> <p>allow high temperature gives a fast reaction but equilibrium on the left hand side / ora</p>
		Total	4	

Question		Expected Answers	Marks	Additional Guidance
10	a	hydrogen + oxygen → water (1)	1	allow reactants in either order allow $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ 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	
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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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