OCR
RECOGNISING ACHIEVEMENT

GCSE

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

January 2009

J644/MS/R/09J

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)		new substance is formed / difficult to reverse (1)	1	**allow** energy change takes place **allow** colour changes **allow** change in appearance / texture / protein denatures **allow** change in mass **not** change of state
	(b)	(i)	sodium hydrogencarbonate → sodium carbonate + carbon dioxide + water (1)	1	**allow** any order of the products **allow** correct formulae or mix of formulae and words; if words and formula given for a product mark the words and **ignore** formula **ignore** balancing if formulae used $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$ **not** hydrogencarbonate / sodium hydrocarbonate
		(ii)	to make the cake rise (1)	1	**allow** puts gas in the cake / puts carbon dioxide in the cake / puts CO_2 in the cake **allow** puts bubbles in the cake / cake expands **not** puts air in the cake
		(iii)	(pass gas through a solution of) calcium hydroxide / limewater (1) (which goes) cloudy (1)	2	**ignore** use of an indicator / litmus paper **allow** a white solid / precipitate / suspension is formed **allow** goes milky / white **ignore** references to blowing through straw **ignore** put out a lighted splint
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		insoluble (1) solvent (1)	2	answers must be in this order
	(b)		to ensure they are safe (1)	1	**allow** do not harm / do not poison / kill the person / do not damage the skin / do not irritate the skin / aw
			Total	**3**	

3	(a)		kerosene / heavy oil / aviation fuel / lubricating oil / diesel / paraffin / heating oil / fuel oil / naphtha (1)	1	**ignore** gasoline / tar / butane / propane / methane / oil
	(b)		boiling point (1)	1	**allow** molecular mass / weight **allow** different size molecule **not** different size / different weight / different mass / density
	(c)		ring round cracking (1)	1	**allow** underline / tick
	(d)		hydrogen (1)	1	**allow** a tick or underline in table

Question			Expected Answers	Marks	Additional Guidance
3	(e)		**any one from** idea of availability / is it easy to get hold of / how long will it last (1) idea of renewable (1) idea of ease of use (1) idea of storage (1) toxicity of fuel(1) idea of cost (1) idea of pollution products / does it have a clean flame / is it smelly / AW (1) idea of volatility (1) viscosity of fuel (1) state / is it solid, liquid or gas (1)	1	**allow** can it run out / is it nearby / global stocks / how much in reserves **allow** is it renewable / is it non-renewable / is it sustainable **allow** is it easy to use / is it difficult to use / is it safe **to use** **allow** idea of flammability / how well it burns / ease of burning / ease of ignition **allow** can it be stored / how much space to store it **allow** is it poisonous / must be non-poisonous / no harmful effects if in contact with people / will it irritate skin **ignore** is it safe / harmful / explosive / dangerous **ignore** environmentally friendly / effect on the environment **allow** how much waste is produced
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)		D (1)	1	
	(b)		C (1)	1	
	(c)		hydrogen **and** carbon	1	**allow** correct symbols H and C **allow** mix of symbol and name e.g. C and hydrogen must have both correct for 1 mark
			Total	**3**	

5	(a)		propene (1) poly(chloroethene) / polychloroethene (1)	2	**allow** pvc
	(b)		**any two from** (many) small molecules / monomers join together (1) conditions are **high** pressure (1) a catalyst / named catalyst (1)	2	use **ticks** in this question **allow** ethene molecules join together **allow** any pressure above 1 atm **not** just pressure **ignore** references to temperature
			Total	**4**	

6	(a)		crust (1) mantle (1) core (1)	3	answers must be in this order **allow** inner core / outer core
	(b)	(i)	magma (1)	1	**not** mantle
		(ii)	fertile soil / carry out research (1)	1	**allow** idea of power from geothermal vents / area attracts tourists / cultural or religious reasons / low risk from eruptions
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)		a mixture containing a metal (1)	1	**allow** contains two metals / mixture containing a metal and a non-metal **allow** a metal made from other metals (limit of acceptability) **not** metals joined / combined / bonded **not** metal mixed with a compound
	(b)		lead (1) tin (1)	2	either order **allow** Pb (1) Sn (1)
	(c)	(i)	(dental) fillings (1)	1	
		(ii)	taps / door knobs / (decorative) light switches / (musical) instruments / trophies / AW (1)	1	**allow** plugs / sockets **ignore** pipes / monuments / statues **ignore** properties of brass
			Total	**5**	

8	(a)		4 to 4.5 minutes (1)	1	**ignore** units **ignore** volume answers
	(b)		line steeper than original starting at origin / drawn further to the left but starting at origin (1) final volume is the same (1)	2	mark **independently**
	(c)		surface area increases / AW (1)	1	**allow** more collisions (per second) / increased collision frequency / more chance of collisions **ignore** smaller pieces
	(d)		increase temperature / hotter (acid) / increase concentration (1)	1	**allow** stir / shake **allow** heat **allow** use stronger acid / use less water **ignore** use more acid
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
9	(a)		**any two from:** protection (1) decoration / aw (1) stops water or oxygen getting through (1) to look good / add colour / AW (1)	2	If more than one line is drawn from a substance to a physical property then mark is lost
	(b)	(i)	phosphorescent (1)	1	
		(ii)	thermochromic (1)	1	
	(c)		thin (the oil or paint) / dissolve (the binding medium or pigment) (1)	1	**allow** helps the paint spread **ignore** to stick the paint to the surface
			Total	**5**	

10			carbon dioxide - colourless gas with a low mpt iron - a grey solid with a high mpt sodium chloride - white solid with a high mpt water - colourless liquid with a low mpt all **four** correct (3) **three** or **two** correct (2) **one** correct (1)	3	
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
11	(a)		fluorine / bromine / astatine / F / Br / At (1)	1	**allow** F_2 / Br_2 / At_2
	(b)		bromine / Br / Br_2 (1)	1	
	(c)		iodine / I / I_2 (1)	1	
	(d)		sodium chloride (1)	1	**allow** NaCl / 2NaCl **not** sodium chlorine **ignore** incorrect formula
	(e)		iodine + potassium chloride (1)	1	**allow** any order of products **allow** correct formulae or mix of formulae and words; if words and formula given for a product mark the words and **ignore** formula **allow** I_2 + KCl **not** iodide / potassium chlorine
			Total	**5**	

12	(a)	(i)	14 (1)	1	
		(ii)	negative (1)	1	**allow** minus / - **allow** correct answer ringed or underlined
	(b)	(i)	protons and neutrons (1)	1	**any order** both required for 1 mark
		(ii)	positive (1)	1	**allow** 14+ / +
	(c)		4 / IV / four (1)	1	
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
13	(a)		zinc (1)	1	**allow** Zn **allow** 7.1
	(b)		1.0 (1)	1	**allow** 1 / one
	(c)		highest electrical conductivity (1)	1	**allow** has a high electrical conductivity / is a good conductor of electricity **ignore** is a good / best conductor **ignore** flexible / ductile do **not** award marks if other physical properties are mentioned as positive attributes
			Total	**3**	

14	(a)		OH^- / SO_4^{2-} (1)	1	**allow** hydroxide / sulfate / sulphate / hydroxide and sulfate / hydroxide and sulphate **allow** other ways of indicating correct answers e.g. ring
	(b)		**any three from:** gas **X** is oxygen (1) test for hydrogen because it burns (1) with a sqeaky pop (1) test for oxygen because it relights (1) a glowing splint (1)	3	use **ticks** in this question **allow** O_2 / O **allow** test for hydrogen with a lighted splint (1) **allow** test for oxygen with a glowing splint (1) **allow** 1 mark for correct test and result for wrong gas as X e.g. X is carbon dioxide, limewater turns cloudy – 1 mark only
			Total	**4**	

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

Question			Expected Answers	Marks	Additional Guidance
1	(a)		sodium hydrogencarbonate → sodium carbonate + carbon dioxide + water (1)	1	**allow** any order of products **allow** correct formulae or mix of formulae and words; if words and formula given for a product mark the words and **ignore** formula **ignore** balancing if formulae used $2NaHCO_3 \rightarrow Na_2CO_3 + CO_2 + H_2O$ **not** hydrogencarbonate / sodium hydrocarbonate
	(b)		(pass gas through a solution of) calcium hydroxide / limewater (1) (which goes) cloudy (1)	2	**ignore** use of an indicator / litmus paper **allow** a white solid / precipitate / suspension is formed / goes milky / white **ignore** reference to blowing through straw **ignore** put out a lighted splint
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		strong intermolecular forces in water / strong intermolecular forces in nail varnish (1) weak intermolecular force between water and nail varnish (1)	2	use **ticks** in this question **allow** intermolecular forces in water **stronger** than that between water and nail varnish / intermolecular force in nail varnish **stronger** than between water and nail varnish scores (2) **allow** both marks from fully labelled diagram **allow** the following as alternatives to intermolecular force - force between molecules / attraction between molecules / bond between molecules **allow** particle instead of molecule **not** atoms to score any marks reference must be made to intermolecular forces or forces between molecules / particles e.g. weak forces between water and nail varnish scores (0)
	(b)		**advantage** animals reaction to cosmetic same as that of a human / no damage to humans (1) **disadvantage** animal may not behave in same way as human / animals have no choice / animals have rights AW / animals may be killed / animals may die / animals may be harmed / animals made to suffer (1)	2	must have **one advantage** and **one disadvantage** for 2 marks **allow** so humans do not die / humans are not killed **allow** so humans do not suffer allergic reactions **ignore** to make sure product is safe / make sure product is not harmful to humans / to see if will harm humans **ignore** references to cost / availability of animals
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	hydrogen releases most energy / only produces water (1)	1	**no mark** for name of fuel only **allow** other fuels with explanation e.g.biofuels - a renewable fuel source / releases similar amount of energy methane - is readily available / gives off more energy than petrol hydrogen - does not give off greenhouse gases / carbon dioxide
		(ii)	**any one from** idea of availability / is it easy to get hold of / how long will it last (1) idea of renewable (1) idea of ease of use (1) idea of storage (1) toxicity of fuel(1) idea of cost (1) idea of volatility (1) viscosity of fuel (1) state / is it a solid, liquid or gas (1)	1	 **allow** can it run out / is it nearby / global stocks / how much in reserves **allow** is it renewable / is it non-renewable / is it sustainable **allow** is it easy to use / is it difficult to use / is it safe **to use** **allow** idea of flammability / how well it burns / ease of burning / ease of ignition **allow** can it be stored / how much space to store it **allow** is it poisonous / must be non-poisonous / no harmful effects if in contact with people / will it irritate skin **ignore** is it safe / harmful / explosive / dangerous

Question			Expected Answers	Marks	Additional Guidance
	(b)		$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ formulae (1) balancing (1)	2	**allow** any multiples of this equation **allow** = instead of → **not** + heat or and balancing mark **dependent** on correct formulae
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	C (1)	1	
		(ii)	contains single bonds **only** (1)	1	**allow** have the general formula C_nH_{2n+2} / no C=C bonds **ignore** references to saturated
	(b)		bromine water is decolourised (1)	1	**allow** changes from orange / brown / red to colourless / goes colourless / loses it colour **ignore** discoloured / goes clear
	(c)		conditions are high pressure (1) a catalyst / named catalyst (1)	2	**not** just pressure **allow** any pressure above 1atm (1) **ignore** references to temperature
			Total	**5**	

5	(a)		4200(J) scores 2 **BUT** 100 x 4.2 x 10 (1)	2	**allow** one mark for 42
	(b)		bond breaking is endothermic / AW (1) more energy given out than taken in (1)	2	**allow** take in or uses heat or energy to break bonds (1) **ignore** reference to different numbers of bonds made or broken **allow** more energy is released / given out / transferred in bond making than is used to break the bonds (2) **allow** more energy transferred to make bonds than break bonds (1) **not** more energy needed to make bonds
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		sulfuric acid + zinc → zinc sulfate + hydrogen(1)	1	reactants **either** order products **either** order **allow** correct formulae or mix of formulae and words; if words and formula given for a reactant or product mark the words and **ignore** formula **allow** $H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$ - equation does not need to be balanced **allow** = instead of → **not** and
	(b)	**(i)**	4 to 4.5 minutes (1)	1	**ignore** units **ignore** volume answers
		(ii)	line steeper than original starting at origin / drawn further to the left starting at origin (1) final volume is the same (1)	2	mark **independently**
	(c)		surface area increases / AW (1)	1	**allow** more collisions (per second) / increased collision frequency / more chance of collisions (1) **ignore** smaller pieces
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	copper sulfate (solution) (1)	1	
		(ii)	anode - impure copper **and** cathode - copper (1)	1	**both** needed for one mark
		(iii)	anode – cooper goes into solution / copper loses electrons **and** cathode – copper forms / copper gains electrons (1)	1	**allow** at anode copper gets thinner / copper ions are formed / copper loses mass / copper dissolves / anode loses electrons (1) **allow** at cathode it gets thicker / copper ions are discharged / gains mass / cathode supplies electrons (1) **allow** correct ionic equations anode $Cu - 2e^- \rightarrow Cu^{2+}$ cathode $Cu^{2+} + 2e^- \rightarrow Cu$ **both** needed for one mark
	(b)		difficulty of separating different metals / AW (1)	1	**allow** references to large amounts of energy needed **allow** use of electricity / electrolysis **ignore** references to cost
	(c)		lead (1) tin (1)	2	**either** order **allow** correct symbols, Pb (1) and Sn (1)
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
8	(a)		nitrogen 77 - 79 (1) oxygen 20 - 22 (1)	2	
	(b)	(i)	reduced oxygen levels (1)	1	**allow** increasing carbon dioxide levels answers must refer to a change in composition e.g. lack of trees taking in carbon dioxide and giving out oxygen scores (0)
		(ii)	increased carbon dioxide levels (1)	1	**allow** reduced oxygen levels answers must refer to a change in composition e.g. burning fuels gives out carbon dioxide (0)
	(c)		**any three from:** idea of ammonia converted into nitrogen (1) so nitrogen increases (1) nitrogen is unreactive / AW (1) organisms/plants capable of photosynthesis/converting carbon dioxide (and water) into oxygen evolve / develop (1) conversion of carbon dioxide and water to oxygen (1) so oxygen increases (1) so carbon dioxide decreases (1)	3	use **ticks** in this question statements after **so** are linked and cannot be awarded as isolated marking points
			Total	**7**	

9			solvent (molecules) evaporate (1) oil (molecules) oxidise / AW (1)	2	**allow** causes cross linking **allow** oil (molecules) react with air **not** references to oil as solvent
			Total	**2**	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		strong attraction between **ions** / strong electrostatic attraction / strong ionic bond (1)	1	**allow** strong bond between ions (1) **allow** particles for ions **not** atoms **not** strong intermolecular forces
	(b)		at least one shared pair of electrons between carbon and each oxygen atoms (1) **but** correct structure (2)	2	**ignore** lack of inner shell electrons but do not award two marks if inner electrons are shown and they are wrong
	(c)		simple structure / simple molecule / simple molecular (1) weak intermolecular force / weak force between molecules (1)	2	**not** simple ionic **not** weak bonds / weak covalent bonds **not** atoms **allow** particles for molecules
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
11	(a)		bromine / Br_2 (1)	1	**allow** Br
	(b)		sodium chloride (1)	1	**allow** NaCl / 2NaCl **not** sodium chlorine **ignore** incorrect formula
	(c)		iodine + potassium chloride (1)	1	**allow** any order of products **allow** correct formulae or mix of formulae and words; if words and formula given for a product mark the words and **ignore** formula symbol equation does not need to be balanced I_2 + KCl (1) **not** iodide / potassium chlorine
	(d)		$2Na + At_2 \rightarrow 2NaAt$ correct formulae (1) balancing (1)	2	**allow** any correct multiple of equation including halves **allow** = instead of → **not** and balancing mark **dependent** on correct formulae
			Total	**5**	

12	(a)		protons and neutrons (1)	1	**any** order **both** required for 1 mark
	(b)		14 (1)	1	
	(c)	(i)	4 / IV / four (1)	1	
		(ii)	has three (occupied) shells (1)	1	**allow** this element is Si and Si is in period 3 **allow** three outer shells / three rings **allow** atomic number is 14 / atomic number between 11 and 18
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
13	(a)		highest electrical conductor (1)	1	**allow** has a high electrical conductivity / is a good conductor of electricity **ignore** it is a good conductor / best conductor do **not** award mark if other physical properties are mentioned as positive attributes **ignore** flexible / ductile
	(b)		chromium (1) hardest metal / highest melting point (1)	2	**allow** it is very hard second mark is **dependent** on correct first mark do **not** award mark if other physical properties are mentioned as positive attributes
	(c)		electron (1)	1	**allow** correct answer ringed, ticked or underlined
			Total	**4**	

14	(a)		hydrogen (1)	1	**allow** H_2 / H
	(b)		OH^- / hydroxide (1)	1	**allow** answer circled / underlined or ticked **any** answer on the **answer line** takes precedence
			Total	**2**	

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

Question			Expected Answers	Marks	Additional Guidance
1	(a)		detergent - active cleaner colouring agent - to make it look attractive water - thins out detergent water softener - softens hard water **all four** correct (3) **two** or **three** correct (2) **one** correct (1)	3	if **two lines** drawn from an ingredient then the use of that ingredient is **wrong**
	(b)	(i)	14 (cm) (1)	1	unit **not** needed
		(ii)	increases / more can be cleaned / gets higher / AW (1)	1	
			Total	**5**	

2	(a)		neutralisation (1)	1	**allow** other indications of correct answer if nothing written on the answer line
	(b)	(i)	2 / two (1)	1	
		(ii)	calcium hydroxide / $Ca(OH)_2$ (1)	1	
	(c)	(i)	water (1)	1	**allow** H_2O name takes precedence
		(ii)	copper nitrate (1)	1	**allow** $Cu(NO_3)_2$ name takes precedence
	(d)		carbon dioxide (1)	1	**allow** CO_2 name takes precedence
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		**any three from:** labour cost (1) often cannot be automated (1) so need more workers (1) energy cost / cost of heat / cost of electricity (1) equipment cost / cost of the factory to make it (1) raw materials (1) which may be rare (1) or involve expensive extraction from plants (1) time taken for development (1) because of government regulations (1) marketing (1)	3	**allow** factors or comments about the factors **allow** health and safety **ignore** manufacturing cost but allow a specific cost e.g. cost of energy **ignore** cost of selling
	(b)		continuous (1)	1	
			Total	**4**	

4	(a)		nitrogen / potassium / phosphorus (1)	1	**allow** N / P / K
	(b)		grow bigger plants / grow larger crops / grow crops faster / replace essential elements used by plants / increase crop yield (1)	1	**allow** to make more profit / to make more money **ignore** to grow crops - this must be qualified e.g. to grow bigger crops **ignore** better crops
	(c)		percentage yield = (actual yield÷predicted yield)×100 / = (4.92÷24.6)×100 (1) = 20 (1)	2	**allow** full marks for 20% with no working out **allow** full marks for 20% on answer line despite working out **allow** am for actual yield and pm for predicted yield
	(d)		it is an acid / it is acidic / it will neutralise an alkali / it can be neutralised by a base (1)	1	**allow** solution contains hydrogen ions
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	60 (1)	1	only **allow** 60 unit **not** needed
		(ii)	90 (1)	1	only **allow** 90 unit **not** needed
		(iii)	any value between 90 and 96 (1)	1	
	(b)	(i)	0.17 (1)	1	unit **not** needed
		(ii)	0.60 (1)	1	unit **not** needed
			Total	**5**	

6	(a)		sulfur + oxygen (1)	1	**allow** any order **allow** S + O_2 / mix of words and correct formulae
	(b)	(i)	reversible reaction (1)	1	**allow** an equilibrium **allow** reaction goes both ways / reaction goes backwards and forwards / reactants make products and products make reactants / AW
		(ii)	vanadium(V) oxide / vanadium pentoxide / V_2O_5 (1)	1	**ignore** vanadium oxide
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	bromine / lead (1)	1	**allow** Br_2 / Pb **ignore** Br
		(ii)	time (1)	1	**allow** how many seconds **allow** temperature / heat
	(b)		ions cannot move in solid / ions are fixed in solid / ions can only vibrate in solid (1) ions can move in liquid (1)	2	**allow** charge carrier instead of ions **not** electrons can move or are fixed but penalise just **once** in the question
			Total	**4**	

8	(a)		less than (1)	1	**allow** word circled or ticked mark answer on answer line first of all
	(b)		ethanoic acid (1)	1	**allow** word circled or ticked mark answer on answer line first of all
	(c)		hydrogen (1)	1	**allow** word circled or ticked mark answer on answer line first of all
	(d)		63 (1)	1	unit **not** needed
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
9	(a)		solid / precipitate (1)	1	
	(b)		solution / dissolved in water / aqueous (1)	1	**not** aqua
	(c)		**any two from** chloride ion will give a white (1) precipitate / solid (1) iodide ion will give a yellow (1) precipitate / solid (1)	2	**allow** chloride goes white (1) iodide goes yellow (1) **only** award solid / precipitate mark **once**
			Total	**4**	

10	(a)	(i)	lighted splint (1) gives a popping noise / AW (1)	2	**allow** the pop test which gives a pop (1) **allow** burns with popping noise (2)
		(ii)	damp litmus paper (1) bleaches (1)	2	**allow** universal indicator paper (1) **allow** loses colour / goes white (1) **allow** starch iodide paper (1) goes blue-black (1)
		(iii)	sodium hydroxide (1)	1	**allow** NaOH **allow** caustic soda
	(b)		making margarine (1)	1	**allow** fuel / making ammonia / fuel cells
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
11	(a)		fluorine (1)	1	**allow** F / F_2
	(b)		**any two from:** refrigerants (1) aerosol propellants (1) fire extinguishers (1) anaesthetic (1) foam insulation (1)	2	**ignore** deodorants
	(c)		**any two from:** sunburn (1) skin ageing (1) skin cancer (1) cataracts (1)	2	**not** just ageing **not** just cancer
			Total	**5**	

12	(a)		reduces pain (1) reduces temperature (1)	2	**either order** **allow** prevent strokes / prevent heart attacks (1) **ignore** suicide **not** to thin out blood
	(b)		willow (1)	1	
	(c)		pharmacist (1)	1	
			Total	**4**	

Question			Expected Answers	Marks	Additional Guidance
13	(a)	(i)	calcium hydrogencarbonate (1)	1	
		(ii)	calcium sulfate (1)	1	
	(b)		**any three from:** add soap to water sample (1) shake flask / AW (1) add further small portions of soap to the water sample until lather forms (1) record volume of soap used to make lather / note volume of soap to make a lather (1) same volume of water tested / idea of fair test (1)	3	
			Total	**5**	

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

Question			Expected Answers	Marks	Additional Guidance
1	(a)		**any two from** as temperature increases more plates can be cleaned / AW / ora (1) temperature has no effect on height of foam / temperature has little effect on height of foam (1) height of foam has no effect on number of plates that can be cleaned / height of foam has little effect on the number of plates that can be cleaned (1)	2	**allow** amount of foam rather than height of foam in all relevant marking points
	(b)		detergent molecule has a hydrophobic region and a hydrophilic region / detergent molecule has a polar head and a non-polar tail / AW (1) tail can form intermolecular forces with fat / non-polar region can form intermolecular forces with fat / hydrophobic region can attract fat molecules / AW (1) head can form intermolecular forces with water / polar region can form intermolecular forces with water / hydrophilic region can attract water molecules / AW (1)	3	**all marks** can be awarded from a **labelled diagram** intermolecular forces must be clearly used - alternatives to intermolecular include forces between molecules or attraction between fat molecules and detergent molecule **attaches** itself is **not** sufficient for idea of intermolecular forces if no marks awarded for intermolecular forces then a mark can be awarded for idea that fat is surrounded by tails and head by water (molecules)
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
2	(a)		calcium hydroxide / $Ca(OH)_2$ (1)	1	
	(b)	(i)	water (1)	1	**allow** H_2O name takes precedence
		(ii)	copper nitrate (1)	1	**allow** $Cu(NO_3)_2$ name takes precedence
	(c)		carbon dioxide (1)	1	**allow** CO_2 name takes precedence
	(d)		$H^+ + OH^- \rightarrow H_2O$ (1)	1	**allow** $H_3O^+ + OH^- \rightarrow H_2O$
			Total	**5**	

3			**any three from** raw materials may be rare (1) raw materials may have to be extracted from plants which could be difficult (1) may not be able to automate so labour intensive / AW (1) labour force needs to be highly trained / needs specialist workers / needs skilled workers (1) government legislation must be followed (1)	3	**allow** chemicals needed are expensive (1) **allow** reference to the cost of patent (1) **allow** have to pay the workers for a long time during testing (1) **ignore** marketing costs **ignore** testing is difficult / have to test lots of times
			Total	**3**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	ammonia / NH_3 (1)	1	**allow** ammonium hydroxide **not** ammonium / ammonia hydroxide
		(ii)	percentage yield = (actual yield÷predicted yield)×100 / = (4.92÷24.6)×100 (1) = 20 (1)	2	**allow** full marks for 20% with no working out **allow** full marks for 20% on answer line despite working out **allow** am for actual yield and pm for predicted yield
	(b)		M_r = 132 (1) % = 21.2 (1)	2	**allow** 21 **allow** full marks for correct answer on its own **allow** full marks for correct answer on answer line despite wrong working out **allow** ecf for percentage composition from wrong M_r
	(c)		Contain essential elements / contain nitrogen / contain potassium / contain phosphorus / replaces essential elements in the soil that have been used by plants / replaces named essential elements in the soil used by plants (1) essential elements used to make plant protein (for growth) / AW (1)	2	**allow** other specific use of essential elements by plants
			Total	**7**	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	46 (1)	1	unit **not** needed
		(ii)	any value between 90 and 96 (1)	1	unit **not** needed
	(b)	(i)	M_r = 44 (1) moles = 0.00386 / 3.86×10^{-3} (1)	2	**allow** ecf from wrong M_r **allow** 0.0039 / 3.9×10^{-3} / 0.0038 **allow** full marks for correct answer on its own
		(ii)	0.60 (1)	1	unit **not** needed
			Total	**5**	

6	(a)		ions cannot move in solid / ions are fixed in solid / ions can only vibrate in solid (1) ions can move in liquid (1)	2	**allow** charge carrier instead of ions **not** electrons can move or are fixed but penalise just **once** in the question
	(b)		$2Br^- - 2e^- \rightarrow Br_2$ / $2Br^- \rightarrow Br_2 + 2e^-$ correct formulae (1) balancing (1)	2	**allow** any correct multiple **allow** = instead of arrow balancing mark **dependent** on correct formulae
	(c)		current increases / current doubles (1) (but) time decreases / time halves (1)	2	**allow** coulombs = current x time (1) so same number of coulombs in both experiments (1)
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
7	(a)		sulfur + oxygen (1)	1	**allow** any order **allow** S + O_2 / mix of words and correct formulae
	(b)	(i)	vanadium(V) oxide / vanadium pentoxide / V_2O_5 (1)	1	**ignore** vanadium oxide
		(ii)	**catalyst** – increases rate of reaction / reaction is faster / AW (1) catalyst - does not change position of equilibrium (1) **450°C** – gives a sufficiently high rate of reaction / AW (1) and does not push position of equilibrium too much to the left / AW (1)	4	**allow** catalyst - lowers activation energy (1) **allow** if temperature is too low the reaction is too slow (1) **allow** if temperature is too high position of equilibrium is on left hand side (1) **but** optimum temperature that gives a fast rate of reaction without shifting position of equilibrium too much to the left scores two marks **allow** use of percentage yield rather than position of equilibrium e.g. so equilibrium does not shifts too far to the left is the same as percentage yield only decreases a little
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
8			hydrochloric acid is a strong acid and ethanoic acid is a weak acid (1) more (crowded) hydrogen ions with hydrochloric acid / greater concentration of hydrogen ions / ora (1) more collisions (involving hydrogen ions) per second with hydrochloric acid / greater collision frequency with hydrochloric acid / collisions more often with hydrochloric acid / ora (1)	3	**allow** just more collisions if no other mark awarded in this question
			Total	**3**	

9	**(a)**		sodium hydroxide (1)	1	**allow** NaOH / caustic soda
	(b)		$2H^+ + 2e^- \rightarrow H_2$ correct species (1) balancing (1)	2	**allow** correct multiples balancing mark dependent on correct species **allow** = instead of arrow
	(c)		oxygen (1)	1	**allow** O_2 **ignore** O
	(d)		subsidence (1)	1	**allow** buildings may collapse
			Total	**5**	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		one electron goes to each atom / even break to give unpaired electron (1)	1	**allow** $H_2 \rightarrow 2H$
	(b)		sets up chain reaction / AW (1)	1	**allow** chlorine radical not destroyed **allow** very reactive **allow** each chlorine radical can react with many ozone molecules
	(c)		remain in atmosphere (for a long time) (1)	1	**allow** unreactive / do not react with oxygen / do not react with water
	(d)		HFC s (1)	1	**allow** nitrogen / hydrocarbons / alkanes / HCFCs
			Total	**4**	

11	(a)	(i)	calcium hydrogen carbonate (1)	1	
		(ii)	calcium sulfate (1)	1	
	(b)		**any three from:** add soap to water sample (1) shake flask / AW (1) add further small portions of soap to the water sample until lather forms (1) record volume of soap used to make lather / note volume of soap to make a lather (1) same volume of water tested / idea of fair test (1)	3	
	(c)		(carbonate ions cause) calcium carbonate to precipitate out (1)	1	**allow** removes ions that cause hardness
			Total	**6**	

Question			Expected Answers	Marks	Additional Guidance
12	(a)		**any two from** bromine is brown (1) bromine is used up in the reaction (so colour goes) (1) bromine reacts with double bond (1) it is an addition reaction (1) it forms a dibromo compound (1)	2	**allow** bromine goes colourless
	(b)		hydrogen (1)	1	**allow** H_2
	(c)		saponification (1)	1	
	(d)		esters (1)	1	
			Total	**5**	

Grade Thresholds

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

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B641/01	Raw	60	-	-	-	36	30	24	18	12	0
	UMS	69	-	-	-	60	50	40	30	20	0
B641/02	Raw	60	40	33	26	19	15	13	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B642/01	Raw	60	-	-	-	31	26	21	17	13	0
	UMS	69	-	-	-	60	50	40	30	20	0
B642/02	Raw	60	45	37	29	21	16	13	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0

Specification Aggregation Results

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

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

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

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J644	44.2	84.6	90.4	96.2	98.1	100.0	100.0	100.0	100.0	52

82 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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