

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

June 2009

J644/MS/R/09

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food reacting with oxygen (1)	1	allow air for oxygen allow to prevent oxidation ignore to stop food going bad / going out of date / get rid of oxygen / preserve food / stale / stop oxygen getting in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

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

Question			Expected Answers	Marks	Additional Guidance
3	a	i	acid + alcohol → ester + water (1)	1	allow correct formulae and mixture of words and formulae ignore balancing if formulae used eg $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$ allow = instead of → allow correct named reactants and products eg organic or carboxylic acid eg ethanoic acid + ethanol → ethyl ethanoate + water
		ii	synthetic (1)	1	
	b	i	evaporates (easily) (1)	1	allow (very) volatile ignore diffuses / diffusion
		ii	sense / sensory (1)	1	ignore nose or nasal or smell allow receptor or olfactory not scent or neurone
			Total	4	

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

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

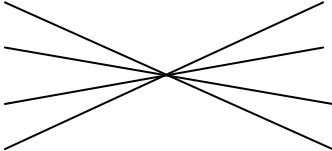
Question			Expected Answers	Marks	Additional Guidance
6	a		(fuel gases) have lowest boiling point (1)	1	allow are small molecules / low molecular mass / lower boiling point than petrol allow low boiling point
	b		contain (atoms of) hydrogen and carbon (1) only / AW (1)	2	not hydro not molecules of /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

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

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

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

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

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

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

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

Question			Expected Answers	Marks	Additional Guidance
14	a		lithium / potassium / rubidium / caesium / francium (1)	1	allow Li / K / Rb / Cs / Fr not sodium / Na as in stem if name correct and symbol wrong then do not award mark eg potassium, P but if name correct and a slip in symbol award mark eg potassium, k
	b		reactive metal / reacts with oxygen / to keep away from oxygen / stop it reacting with oxygen (1)	1	allow reacts with air / to keep away from air / to stop it reacting with air allow to stop it reacting with moist air / stop it reacting with moist oxygen allow to stop it corroding ignore reference to rusting / water
	c	i	hydrogen (1)	1	allow H ₂ not H
		ii	sodium hydroxide (1)	1	allow NaOH / caustic soda
			Total	4	

Question			Expected Answers	Marks	Additional Guidance
15	a		0.78 (1)	1	unit not needed look for answer under the results table as well as on the answer line if two different answers given use the one on the answer line
	b		goes milky / goes cloudy / goes white / white solid made / white precipitate (1)	1	ignore murky / foggy / misty
	c		breaks down / makes two substances / changed into simpler substances (1)	1	allow makes lots of substances allow makes smaller substances not elements break down
	d	i	manganese carbonate / manganese / Mn (1)	1	not magnesium (carbonate)
		ii	iron(III) carbonate / iron(III) / iron / Fe (1)	1	
			Total	5	
			Paper Total	60	

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

Question			Expected Answers	Marks	Additional Guidance
1	a		acid + alcohol → ester + water (1)	1	allow correct formulae and mixture of words and formulae ignore balancing if formulae used eg $\text{CH}_3\text{COOH} + \text{C}_2\text{H}_5\text{OH} \rightarrow \text{CH}_3\text{COOC}_2\text{H}_5 + \text{H}_2\text{O}$ allow = instead of → allow correct named reactants and products eg organic or carboxylic acid eg ethanoic acid + ethanol → ethyl ethanoate + water (1)
	b		evaporates (easily) (1)	1	allow (very) volatile ignore diffuses / diffusion
	c	i	attraction between water (particles) is stronger than attraction between water (particles) and (particles in) nail varnish / ora (1)	1	allow force or bond for attraction allow molecule for particle ignore water (particles) do not attract nail varnish (particles)
		ii	attraction between ester (particles) and nail varnish (particles) is stronger than attraction between (particles) in nail varnish / ora (1)	1	allow force or bond for attraction allow molecule for particle ignore ester (particles) attract nail varnish (particles) ignore ester is a solvent
			Total	4	

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

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

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

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

Question			Expected Answers	Marks	Additional Guidance
6	a	i	sand (1)	1	allow silicon dioxide
		ii	71 (%) (1)	1	
	b		calcium carbonate \rightarrow calcium oxide + carbon dioxide (1)	1	allow mix of correct symbols and words allow $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ ignore any balancing of symbol equation not + heat in equation not and allow = instead of \rightarrow allow heat written over arrow
	c		cement (1)	1	
	d	i	igneous (1)	1	
		ii	sedimentary (1)	1	
			Total	6	

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

Question			Expected Answers	Marks	Additional Guidance
8	a		any number from 340 to 500 and increased fuel consumption / higher population / greater awareness of impact has led to decrease / AW (1)	1	no mark for number on its own explanation must be consistent with given number allow less photosynthesis / deforestation / more industrialisation allow one mark if answer indicates how they arrived at this number eg based on a pattern of numbers
	b		internal combustion engine / (car) exhaust / car engine / lorry engines (1)	1	allow lightning / jet engines / reaction of nitrogen and oxygen at high temperature ignore from factories / fossil fuels burning / power plants
	c		$2\text{SO}_2 + \text{O}_2 + 2\text{H}_2\text{O} \rightarrow 2\text{H}_2\text{SO}_4$ (2) correct formulae of reactants and products (1) balancing (1)	2	allow any correct multiples including fractions balancing mark is dependent on correct formulae allow = in equation
			Total	4	

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

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

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

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

Question			Expected Answers	Marks	Additional Guidance
13	a	i	hydrogen (1)	1	allow H ₂ not H
		ii	sodium hydroxide (1)	1	allow NaOH / caustic soda
	b		<p>any one from the following observations colourless gas / fizzes / pops / makes a colourless solution / violent reaction / coloured flame / floats on the water / melts into a ball / explodes / reacts quickly / moves around (on the surface) (1)</p> <p>products are <u>hydrogen</u> and <u>francium hydroxide</u> (1)</p> <p>$2\text{Fr} + 2\text{H}_2\text{O} \rightarrow 2\text{FrOH} + \text{H}_2$ (1)</p>	3	<p>to get full marks there must be one correct observation, the names of the correct products and the correct equation</p> <p>allow any correct multiple including fractions allow = in equation</p>
			Total	5	

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

			Paper Total	60	
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B642/01 Unit 2: Modules C4, C5 and C6 Foundation Tier

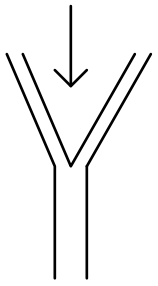
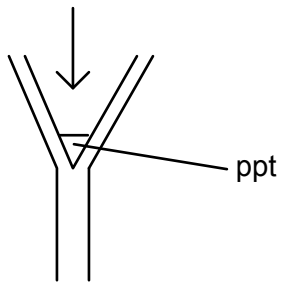
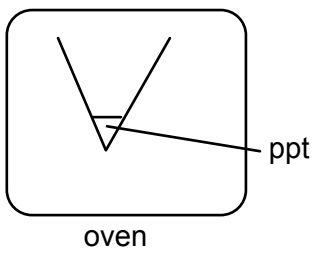
Question			Expected Answers	Marks	Additional Guidance
1	a		stays the same (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
	b	i	barium sulfate / sodium chloride (1)	1	allow BaSO ₄ / NaCl allow both correct answers, but not one correct and one incorrect ignore salt
		ii	white (1)	1	allow cloudy / milky ignore creamy
	c	i	barium sulfate and sodium sulfate (1)	1	allow BaSO ₄ and Na ₂ SO ₄
		ii	142 (1)	1	
			Total	5	

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

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

Question			Expected Answers	Marks	Additional Guidance
4	a	i	takes place all the time / works 24-7 / AW (1)	1	
		ii	make in (small) amounts and later on make some more / AW (1)	1	allow made in (small) amounts to order / made in (discrete) amounts when needed / AW ignore just made in batches / made in small amounts
	b		nitrogen + hydrogen \rightarrow ammonia (1) and any two conditions from high pressure (1) 450 °C (1) (iron) catalyst (1) idea of recycling nitrogen and hydrogen back into reaction container (1)	3	allow $\text{H}_2 + \text{N}_2 \rightarrow \text{NH}_3$ but ignore balancing allow equation with mix of correct formulae and words allow \rightleftharpoons or = instead of \rightarrow not and / & allow any pressure above 150 atmospheres not any pressure that is below 150 atmospheres allow any temperature between 250 and 500°C ignore heat / high temperature / hot / low temperature not incorrectly named catalyst if incorrect conditions quoted then max 1 mark for conditions
	c	i	urea / ammonium nitrate / ammonium sulfate (1)	1	allow $(\text{NH}_2)_2\text{CO}$ / NH_4NO_3 / $(\text{NH}_4)_2\text{SO}_4$ allow 'growmore' ignore NPK
		ii	phosphoric acid (1)	1	allow H_3PO_4 / phosphoric not phosphorus acid
			Total	7	

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

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

Question			Expected Answers	Marks	Additional Guidance
7	a		X is sulfur (1) Y is air (1)	2	allow X is S allow one mark if X is air and Y is sulfur allow correct answers written on flow chart if answer lines are blank
	b	i	reversible (reaction) / (reaction) goes both ways / (forms an) equilibrium (1)	1	allow (can go) either way
		ii	sulfur trioxide (1)	1	allow SO ₃ ignore sulphur oxide
			Total	4	

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

Question			Expected Answers	Marks	Additional Guidance
9	a		breakdown of a (liquid) substance using electricity / decomposition (of a liquid) using electricity (1)	1	allow break-up / splitting of a substance using electricity ignore making new substances
	b		hydrogen (1)	1	allow H ₂ ignore H allow correct answer ticked, circled or underlined in list if answer line is blank
	c	i	OH ⁻ / CH ₃ COO ⁻ (1)	1	allow both correct answers, but not one correct and one incorrect
		ii	CH ₃ COOH / H ₂ O (1)	1	allow both correct answers, but not one correct and one incorrect
			Total	4	

Question		Expected Answers	Marks	Additional Guidance
10	a	electrical (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
	b	hydrogen + oxygen → water (1)	1	allow = instead of → but not and / & allow hydrogen oxide or hydrogen hydroxide instead of water allow $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$ / word equation with mix of correct formulae and words and ignore balancing
	c	test burning / lighted splint (1) result (burns with a) squeaky pop (1)	2	mark the question as a whole when awarding marks allow idea of a flame not glowing splint allow it pops if incorrect test, result mark cannot be awarded
	d	any two from: fossil fuel running out / diesel or petrol is non-renewable / hydrogen and oxygen are renewable (1) less or no greenhouse gases / water is only waste product (1) fuel cell more efficient / fuel cell has direct energy transfer / ora for fossil fuel (1)	2	ignore more economic (cost in stem) allow fuel cell is a renewable energy source ignore so we stop burning fossil fuels / reduces amount of fossil fuel burnt allow less polluting ignore environmentally friendly / less damaging to environment / greener allow reduces carbon footprint / reduces carbon emissions
		Total	6	

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

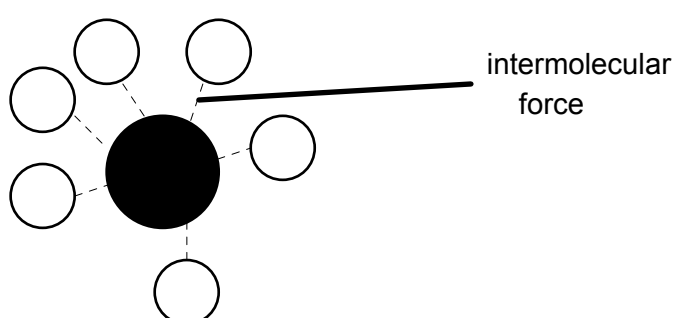
Question			Expected Answers	Marks	Additional Guidance
12	a		water / H ₂ O (1) air / oxygen / O ₂ (1)	2	allow moist air / damp oxygen (2) ignore O
	b	i	idea of stops oxygen reaching surface / stops water reaching the surface (1)	1	allow acts as a barrier to air / acts as a barrier to water / acts as a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

Question			Expected Answers	Marks	Additional Guidance
13	a		distillation (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
	b		any two from: (alcoholic) drinks (1) solvent (1) fuel (1)	2	allow named alcoholic drink allow methylated spirits / meths ignore used to make alcohol allow mouthwash / (making) perfume / disinfectants / sterile wipes ignore cleaner / vinegar
	c		$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ (1)	1	OH group in any correct position allow C – OH
	d		dehydration (1)	1	allow correct answer ticked, circled or underlined in list if answer line is blank
			Total	5	
			Paper Total	60	

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

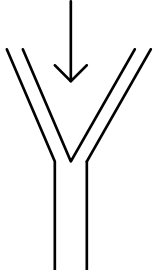
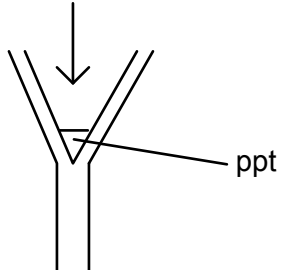
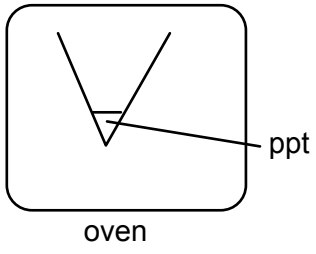
Question			Expected Answers	Marks	Additional Guidance
1	a		same number (of each type) of atoms on both sides of equation / same atoms on both sides of equation just arranged differently (1)	1	answer must refer to information from the equation allow atoms are not created or destroyed allow same amount of each element on both sides of equation ignore name same number of elements on both sides of equation allow calculation to show sum of M_r s on left equals sum of M_r s on right (M_r s must be correct)
	b		barium sulfate + ammonium chloride (1)	1	allow any order of products allow $\text{BaSO}_4 + \text{NH}_4\text{Cl}$ / mix of names and correct formula not ammonia chloride
	c	i	15 / fifteen (1)	1	
		ii	400 (1)	1	
			Total	4	

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

Question			Expected Answers	Marks	Additional Guidance
3	a		does not use water / AW (1)	1	allow stain does not dissolve in water allow uses an organic solvent not does not use a lot of water / uses steam
	b		any two from solvent molecules are non polar / solvent molecules are hydrophobic (1) solvent molecules form intermolecular forces with molecules of grease (1) solvent molecules surround molecules of grease / AW (1)	2	not reference to action of detergent eg use of hydrophobic tail and hydrophilic tail – scores zero allow solvent molecules attracted to grease / solvent bonded to grease molecules marks can be awarded from a labelled diagram <div style="text-align: center;"> <div style="display: inline-block; vertical-align: middle; text-align: center;"> ○ = non-polar = solvent molecule </div> <div style="display: inline-block; vertical-align: middle; text-align: center;"> ● = grease molecule </div> </div> <div style="text-align: center; margin-top: 20px;">  </div>
	c		no trace of solvent left on clothes / solvents can be poisonous / carbon dioxide will not damage clothes / carbon dioxide is not toxic (1)	1	allow solvents can be harmful / do not breathe in fumes from solvents / carbon dioxide can easily escape into atmosphere / carbon dioxide is not harmful
Total				4	

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

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

Question		Expected Answers	Marks	Additional Guidance
6	a	<p>filter / AW (1)</p> <p>wash residue (with water) / AW (1)</p> <p>put in oven to dry / leave in air to evaporate (1)</p>	3	<p>answers that do not include filtering will not score any marks</p> <p>allow centrifuging ignore sieving</p> <p>allow let it dry in air / leave to dry ignore dry it ignore heat it not use of a Bunsen burner to dry the residue</p> <p>allow all marks from a diagram</p> <div style="display: flex; justify-content: space-around; align-items: flex-end;"> <div style="text-align: center;">  <p>filtering (1)</p> </div> <div style="text-align: center;">  <p>washing (1)</p> </div> <div style="text-align: center;">  <p>drying (1)</p> </div> </div>
	b	<p>$2\text{KI} + \text{Pb}(\text{NO}_3)_2 \rightarrow \text{PbI}_2 + 2\text{KNO}_3$</p> <p>correct formula of reactants and products (1)</p> <p>balancing (1)</p>	2	<p>allow correct multiples of equation balancing mark dependent on correct formulae allow \rightleftharpoons or = instead of \rightarrow and not and / &</p>
		Total	5	

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

Question			Expected Answers	Marks	Additional Guidance
8	a		hydrogen (1)	1	allow H ₂ allow circle around hydrogen or tick by hydrogen but answer line takes precedence
	b		because hydrogen ions react there / hydrogen ions gain electrons / hydrogen ions move there (1)	1	allow H ⁺ instead of hydrogen ions / cation instead of hydrogen ion / positive ion instead of hydrogen ion allow hydrogen ions attracted to cathode
	c		HCl is a strong acid / ethanoic acid is a weak acid (1) greater number of ions with HCl / greater concentration of ions with HCl / ora with ethanoic acid (1)	2	allow HCl is a stronger acid / CH ₃ COOH is a weaker acid allow a strong acid has a greater number of ions / strong acid has a greater concentration of ions / ora with weak acid
			Total	4	

Question			Expected Answers	Marks	Additional Guidance
9			stage 1 S + O ₂ → SO ₂ (1) stage 3 SO ₃ + H ₂ O → H ₂ SO ₄ (1)	2	allow ⇌ or = instead of → and not and / & allow any correct multiple of equation allow any order of symbols in sulfuric acid eg SO ₄ H ₂
			Total	2	

Question			Expected Answers	Marks	Additional Guidance
10	a		hydrogen + oxygen → water (1)	1	allow = instead of → but not and / & allow hydrogen oxide or hydrogen hydroxide instead of water allow $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}$ / word equation with mix of correct formulae and words and ignore balancing
	b		any two from: fossil fuel running out / diesel or petrol is non-renewable / hydrogen and oxygen are renewable (1) less or no greenhouse gases / water is only waste product (1) fuel cell more efficient / fuel cell has direct energy transfer / ora for fossil fuel (1)	2	ignore more economic (cost in stem) allow fuel cell is a renewable energy source ignore so we stop burning fossil fuels / reduces amount of fossil fuel burnt allow less polluting ignore environmentally friendly / less damaging to environment / greener allow reduces carbon footprint / reduces carbon emissions
	c		$\text{H}_2 \rightarrow 2\text{H}^+ + 2\text{e}^-$ / $\text{H}_2 - 2\text{e}^- \rightarrow 2\text{H}^+$ correct formula of reactants and products (1) balancing (1)	2	allow any correct multiple allow = instead of → but not and / & balancing mark is dependent on correct formulae allow e for electron
	d		exothermic (1)	1	allow other ways of indicating answer but answer on answer line takes precedence
			Total	6	

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

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

Question			Expected Answers	Marks	Additional Guidance
13	a	i	high temperature denatures enzyme / changes shape of active site of enzyme (1)	1	allow yeast dies (1) ignore enzyme dies / yeast denatured
		ii	enzyme inactive / yeast inactive / yeast dormant (1)	1	allow particles collide infrequently / few collisions per second / collisions not sufficiently energetic
		iii	prevent reaction of oxygen with alcohol / stops vinegar being made / stops (ethanoic) acid being made (1)	1	allow prevents aerobic respiration / ora allow so there is only anaerobic respiration
	b		distillation (1)	1	allow other ways of indicating answer eg ringed but answer on answer line takes precedence
	c		$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ (1)	1	allow OH group in any correct position allow C – OH
	d		C ₅ H ₁₂ O (1)	1	allow C ₅ H ₁₁ OH
			Total	6	
			Paper Total	60	

Grade Thresholds

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

Unit Threshold Marks

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

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

Specification Aggregation Results

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

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

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

	A*	A	B	C	D	E	F	G	U	Total No. of Cands
J644	21.3	52.2	79.6	94.2	98.3	99.5	99.8	99.9	100.0	11531

11630 candidates were entered for aggregation this series

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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