

Chemistry B J644

Gateway Science Suite

General Certificate of Secondary Education

Mark Scheme for the Units

January 2010

J644/MS/R/10J

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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)	any one from takes a long time to make (1) are used up faster than they are formed (1) cannot be made again (1)	[1]	ignore cannot be used again allow takes (many) years to make or thousands of years to make ignore takes hundreds of years to make allow once it's gone it's gone / can't be replaced
	(b)	crude oil (1)	[1]	
	(c)	(fractional) distillation (1)	[1]	not cracking not other forms of distillation e.g. filtering distillation
		Total	[3]	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	B (1)	[1]	allow ethane if answer line is blank allow correct answer circled, underlined or ticked
	(b)	D (1)	[1]	allow polythene or poly(ethene) if answer line is blank allow correct answer circled, underlined or ticked
	(c)	C (1)	[1]	allow ethene if answer line is blank allow correct answer circled, underlined or ticked
	(d)	3 / three(1)	[1]	
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	meat (1)	[1]	
	(b)	(i) any one from microwave / (conventional) oven / boiling / steaming / grilling / frying / fan assisted oven (1)	[1]	ignore BBQ
		(ii) any one from kills microbes (1) improve taste (1) improve texture (1) improve flavour (1) easier to digest (1)	[1]	allow kills bacteria allow idea of possible food poisoning or named food poisoning e.g. salmonella if food not cooked ignore kills germs or poisonous if raw allow description of the change eg becomes softer allow higher level answers eg ruptures cell wall allow food or protein denatured
		(iii) any one from new substance is formed (1) process cannot be reversed (1)	[1]	allow higher level answers e.g. bonds are broken and new bonds formed or its molecules rearrange allow correct references to proteins or enzymes denatured allow difficult to reverse
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	thermometer (1)	[1]	allow temperature probe
	(b)	(i) 30(°C) (1)	[1]	allow answer in table
		(ii) energy is released (into the surroundings) (1)	[1]	allow energy given out / temperature increase / heat released / surroundings gain energy
		Total	[3]	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	antioxidants (1)	[1]	
	(b)	help oil and water to mix / oil and water will not separate (1)	[1]	allow mix two liquids that don't normally mix 'mix the ingredients' or 'binds the ingredients together' is insufficient to score
	(c)	stop food from reacting with oxygen (1)	[1]	allow stops food oxidising allow stops food from reacting with air ignore keeps food fresh / stops food going off / stops oxygen getting in / helps preserve the food / so no oxygen gets in / to take out oxygen
		Total	[3]	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	does not decay / does not decompose (by bacterial or microbe action) (1)	[1]	allow does not rot /does not break up / does not break down / does not degrade / will stay the same for years ignore does not disintegrate / does not rust / does not erode / does not waste away / does not corrode
	(b)	any two from use of land fill sites/rubbish tips (1) burning (of waste plastic containers) (1) recycling (1)	[2]	allow 'dump' or bury in the ground
		Total	[3]	

Question		Expected Answers	Marks	Additional Guidance	
7	(a)	any two from dust (1) noise (1) lots of lorries (1) habitat lost for plants or animals (1)	[2]	allow extra qualification of answer eg lots of lorries (1) which will produce lots of greenhouse gases (1) destruction of landscape / aw (1) or lots of dust (1) which affects peoples' health (1) ignore just 'pollution' or quarries give off bad smells allow gives out greenhouse gases /causes global warming (1) carbon dioxide on its own does not score	
	(b)	break down of a compound or substance or chemical or molecule (when it is heated) / compound or substance or chemical makes two (or more) other compounds or substances or chemicals or molecule (when heated) / aw (1)	[1]	allow break up allow correct reference to specific reaction e.g. carbonates break down to give oxides and carbon dioxide	
	(c)	(i)	a gas is produced / carbon dioxide is given off (1)	[1]	allow some solid spits out from the test tube not wrong gas given off eg oxygen given off not references to evaporation
		(ii)	0.49 (1)	[1]	unit not needed not 49 but allow 049 or 0049
		Total		[5]	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	iron + sulfuric acid → iron sulfate + hydrogen (1)	[1]	allow $\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{FeSO}_4 + \text{H}_2$ allow mix of formulae and names allow = instead of arrow not and or + heat allow dilute sulfuric acid instead of sulfuric acid
	(b)	(i)		Idea of a comparison i.e. so she could check if the reaction went faster / as a control / to make it valid / aw (1)
		(ii)	[1]	(experiment) 5 (1) allow zinc (powder)
		(iii)	[2]	faster than experiment 1 / reaction took less time than experiment 1 (1) copper did not change (colour) / copper was still there at the end / copper did not change mass (1) allow just 'speeds up reaction' allow it only takes 20 seconds but ignore it takes 20 seconds allow implied comparison e.g. copper powder takes the shortest time ignore reaction time increased allow copper is not used up or it is not used up
Total			[5]	

Question		Expected Answers	Marks	Additional Guidance
9	(a)	oxygen (1) water (1)	[2]	allow H ₂ O (1) and O ₂ (1) allow air (1) allow moist air (2) allow damp air (2) allow (acid) rain (1)
	(b)	solder (1)	[1]	if answer line is blank allow correct answer circled, underlined or ticked
	(c)	any two from does not corrode (1) will not react with contents (1) non-toxic / not poisonous (1)	[2]	ignore hard / high melting point / electrical conductor / heat conductor / cost / light / ductile / non-corrosive allow strong / lightweight / low density / recyclable / waterproof / non-permeable / holds its shape / able to contain pressurised drinks / does not rust / unreactive / low reactivity / won't break easily
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	binder (1)	[1]	
	(b)	to give it colour / make it coloured / aw (1)	[1]	
	(c)	thins the paint / dissolves ingredients (1)	[1]	allow to make it easier to spread / makes paint go where you want it allow mix the paint together ignore references to paint drying or sticking paint to the walls
	(d)	<p>oil paint – a paint that has a pigment dispersed in oil phosphorescent – a paint that glows in the dark thermochromic paint – a paint that changes colour when heated all three correct (2) one or two correct (1)</p>	[2]	multiple lines from type of paint scores 0 for that paint
Total			[5]	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	any two from Li, Be, B, C, N, O, F and Ne OR any two from Na, Mg, Al, Si, P, S, Cl and Ar OR K and Ca OR H and He (1)	[1]	allow names of elements
	(b)	any two from Li, Na and K OR any two from Be, Mg and Ca OR any two from He, Ne and Ar OR B and Al / C and Si / N and P / O and S / F and Cl (1)	[1]	allow names of elements
	(c)	F / Cl (1)	[1]	allow fluorine / chlorine
		Total	[3]	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	any three from good heat conductors (1) good electrical conductors (1) sonorous/ring when hit (1) strong / high tensile strength (1) high density (1) high melting point (1) high boiling point (1) lustrous /shiny (1)	[3]	allow a good conductor (1) if heat and electricity not mentioned allow a correct property (1) and an explanation of the property (1) eg good electrical conductor (1) because it has delocalised electrons (1) ignore durable / easy to recycle /heavy allow hard / heavyweight / solid at room temperature allow chemical properties e.g. make basic oxides / react with acids / form positive ions
	(b)	(i)		
		copper nitrate – blue (1) iron(III) nitrate – orange / rusty / brown (1)	[2]	allow foxy-red / red-brown ignore red or yellow
		(ii)		
		copper nitrate / $\text{Cu}(\text{NO}_3)_2$ (1)	[1]	ignore CuNO_3
	(c)	copper carbonate and zinc carbonate (1)	[1]	both required for 1 mark order unimportant allow correct formulae allow zinc and copper carbonate / copper and zinc carbonate
		Total	[7]	

Question			Expected Answers	Marks	Additional Guidance
13	(a)	(i)	fluorine / astatine (1)	[1]	allow F / F ₂ / At / At ₂ not fluoride or astatide
		(ii)	increases / gets bigger / aw (1)	[1]	
	(b)		water treatment / kills microbes / making hydrochloric acid / making polymers (1)	[1]	allow in swimming pools / making PVC / keep water clean / sterilising babies' bottles / making bleach ignore to kill germs / sterilise wounds / sterilising medical equipment
	(c)		decreases / become less reactive / aw (1)	[1]	allow higher level answers e.g. electrons further away from nucleus so less easy to gain an electron
	(d)		same atomic number and different mass number / same number of protons and different number of neutrons (1)	[1]	allow same atomic number and different number of neutrons / same number of protons and different mass number allow same element but different numbers of neutrons ignore same atom but different numbers of neutrons ignore they have different numbers of neutrons
			Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
14	(a)	(i)	yellow / orange (1)	[1]	
		(ii)	lithium / Li (1)	[1]	allow strontium / Sr / calcium / Ca not compounds
	(b)		K ⁺ - has a positive charge (1)	[1]	both required for the mark
	(c)		burning splint (1) gives a squeaky pop (1)	[2]	result mark is dependent on correct test ignore use a glowing splint allow burn the hydrogen allow squeaky pop test for 1 mark max
			Total	[5]	

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

Question		Expected Answers	Marks	Additional Guidance
1	(a)	D (1)	[1]	allow polythene or poly(ethene) if answer line is blank allow correct answer circled, underlined or ticked
	(b)	C (1)	[1]	allow ethene if answer line is blank allow correct answer circled, underlined or ticked
	(c)	(the hydrogen and carbon atoms) share (1) an electron pair (1)	[2]	allow a diagram which shows a pair of electrons between a H atom and a C atom (2) allow share electrons scores (1) ignore references to complete outer shells
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	meat (1)	[1]	
	(b)	(i) any one from kills microbes (1) improve taste (1) improve texture (1) improve flavour (1) easier to digest (1)	[1]	allow kills bacteria allow idea of possible food poisoning or named food poisoning e.g. salmonella if food not cooked ignore kills germs or poisonous if raw allow description of the change e.g. becomes softer allow higher level answers e.g. ruptures cell wall allow food or protein denatured
		(ii) any one from new substance is formed (1) process cannot be reversed (1)	[1]	allow higher level answers e.g. bonds are broken and new bonds formed or its molecules rearrange allow correct references to proteins or enzymes denatured allow difficult to reverse
		Total	[3]	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	1575 J scores three marks but 25 X 4.2 X 15 (2) but temperature change = 15 (°C) (1)	[3]	allow 1 X 4.2 X 15 or 63 scores a maximum of (1)
		(ii)	1575 (1)	[1]	if answer is not 1575 allow ecf to part (i) e.g. if answer for part (i) is 63, 63 will score (1) for part (ii) if unit given it must be correct e.g. 1575 kJ scores (0) allow joules / J / j for unit if given
	(b)		energy is released (into the surroundings) (1)	[1]	allow energy given out / temperature increase / heat is released / surroundings gain energy
			Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	<p>burning makes toxic or poisonous gases / produces CO / produces CO₂ / produces carbon / produces greenhouse gases / contributes to global warming / AW (1)</p> <p>landfill sites get filled up / wastes land / waste of valuable resources / plastics last for a long time / plastics are non-biodegradable (1)</p>	[2]	<p>one mark associated with burning, the other mark associated with landfill sites allow produces soot ignore produces harmful or dangerous gases ignore produces smoke ignore references to pollution or ozone layer ignore sulfur dioxide / SO₂</p> <p>allow does not decompose / takes a long time to decompose ignore references to harming or killing wildlife</p>
	(b)	<p>any three from</p> <p>cross-links (between polymer chains) / (covalent) bonds between the polymer chains / intermolecular forces (1)</p> <p>the following 2 marks are dependent on scoring the first marking point:</p> <p>(bonds between polymer chains) are strong / difficult to break (1)</p> <p>therefore (polymer) chains do not stretch / do not slide over each other (1)</p>	[3]	<p>allow molecules for chains ignore references to bonds holding polymer / chains / molecules together if candidate also refers to intramolecular bonds it must be clear which bonds are responsible for preventing the polymer from stretching e.g. intermolecular and intramolecular bonds are strong and prevent the polymer from stretching scores (0)</p> <p>allow the cross-links stop the polymer chains from sliding over each other scores (2)</p>
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	cracking – a reaction which converts large alkane molecules into smaller alkane and alkene molecules fractional distillation – the separation of a mixture of hydrocarbons polymerisation – a reaction which makes large molecules from many smaller molecules all three correct (2) one or two correct (1)	[2]	
	(b)	alcohol + acid → ester + water (1)	[1]	allow mix of formulae and names e.g. $C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$ allow correct named alcohol or carboxylic acid allow = sign for arrow not and for +
		Total	[3]	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	break down of a compound or substance or chemical or molecule (when it is heated) / compound or substance or chemical makes two (or more) other compounds or substances or chemicals or molecule (when heated) / AW (1)	[1]	allow break up allow correct reference to specific reaction e.g. carbonates break down to give oxides and carbon dioxide
	(b)	$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$ (1)	[1]	allow any correct multiple allow = for arrow not + heat not and for +
	(c)	limestone is a sedimentary rock / limestone made of grains of rock cemented together / limestone made from sediments subjected to pressure (1) marble is a metamorphic rock / marble made when limestone subjected to heat and pressure (without melting) (1)	[2]	
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
7	(a)	iron + sulfuric acid → iron sulfate + hydrogen (1)	[1]	<p>allow $\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{FeSO}_4 + \text{H}_2$</p> <p>allow mix of formulae and names</p> <p>allow = instead of arrow</p> <p>not and or + heat</p> <p>allow dilute sulfuric acid instead of sulfuric acid</p>
	(b)	<p>faster than experiment 1 / reaction took less time than experiment 1 (1)</p> <p>copper did not change (colour) / copper was still there at the end / copper did not change mass (1)</p>	[2]	<p>allow just 'speeds up reaction'</p> <p>allow it only takes 20 seconds but ignore it takes 20 seconds</p> <p>allow implied comparison e.g. copper powder takes the shortest time</p> <p>ignore reaction time increased</p> <p>allow copper is not used up or it is not used up</p>
	(c)	<p>more surface area (1)</p> <p>more collisions per second / increased collision frequency (1)</p>	[2]	<p>answer must be comparison e.g. bigger surface area scores (1) but big surface area scores (0)</p> <p>allow collisions happen more often / greater chance of collision (1)</p> <p>allow more collisions (1) if no other mark has been awarded</p> <p>ignore successful</p> <p>ignore collide faster</p> <p>ignore more particles</p>
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	stronger / harder (1)	[1]	
	(b)	oxygen (1) hydrated iron(III) oxide (1)	[2]	allow hydrated iron oxide not hydrated iron(II) oxide ignore iron oxide / rust
	(c)	lead and tin (1)	[1]	both required for one mark answers can be in any order allow Pb and Sn if answer line is blank allow correct answer circled, underlined or ticked
	(d)	any two from does not corrode (1) will not react with contents (1) non-toxic / not poisonous (1)	[2]	ignore hard / high melting point / electrical conductor / heat conductor / cost / light / ductile / non-corrosive allow strong / lightweight / low density / recyclable / waterproof / non-permeable / holds its shape / able to contain pressurised drinks / does not rust / unreactive / low reactivity / won't break easily
		Total	[6]	

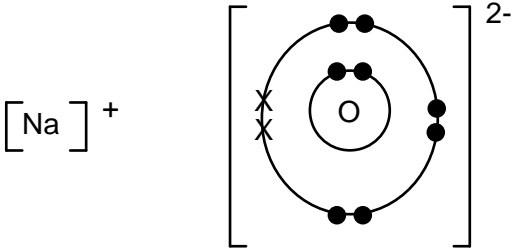
Question		Expected Answers	Marks	Additional Guidance
9	(a)	any two from gloss is oil based and emulsion is water based (1) gloss has more additives / ora (1) gloss has more binder / ora (1) gloss has less extender / ora (1) gloss has more pigment / ora (1) gloss has less solvent / ora (1)	[2]	answers must be comparative allow gloss has more colour (1)
	(b)	because (the particles) are too small / (particles) are very small (1)	[1]	allow (particles) are so small ignore references to density ignore (particles) are small / quite small
	(c)	oxidation / reaction with air / reaction with oxygen (1)	[1]	allow polymerisation
	(d)	phosphorescent pigments are not toxic / phosphorescent pigments do not release (ionising) radiation / phosphorescent pigments do not cause cancer / ora (1)	[1]	'it' = phosphorescent pigments allow radiation causes cancer / radiation poisoning / sickness (1) ignore phosphorescent pigments are safer / less harmful / less dangerous
		Total	[5]	

Question			Expected Answers	Marks	Additional Guidance
10	(a)		potassium / K (1)	[1]	
	(b)		F / Cl (1)	[1]	allow fluorine / chlorine
	(c)		O / S (1)	[1]	allow oxygen / sulfur allow O ²⁻ / S ²⁻
Total				[3]	

Question			Expected Answers	Marks	Additional Guidance
11	(a)	(i)	copper nitrate – blue (1) iron(III) nitrate – orange / rusty / brown (1)	[2]	allow foxy-red / red-brown ignore red or yellow
		(ii)	copper nitrate / Cu(NO ₃) ₂ (1)	[1]	ignore CuNO ₃
		(iii)	$\text{Cu}^{2+} + 2\text{OH}^- \rightarrow \text{Cu}(\text{OH})_2$ correct formulae (1) balancing (1)	[2]	allow any correct multiple allow 1 mark for correctly balanced equation with minor errors of case or subscripts allow = instead of arrow ignore state symbols not and for +
	(b)		copper oxide and carbon dioxide (1)	[1]	answers can be in any order allow CuO and CO ₂
Total				[6]	

Question			Expected Answers	Marks	Additional Guidance
12	(a)	(i)	any value between -120°C and -230°C (1)	[1]	ignore unit
	(a)	(ii)	any value between 148pm and 170pm (1)	[1]	ignore unit
	(b)		decreases / become less reactive / AW (1)	[1]	allow higher level answers e.g. electrons further away from nucleus so less easy to gain an electron
	(c)		potassium fluoride and iodine (1)	[1]	answers can be in any order allow KF and I ₂
	(d)		same atomic number and different mass number / same number of protons and different number of neutrons (1)	[1]	allow same atomic number and different number of neutrons / same number of protons and different mass number allow same element but different numbers of neutrons ignore same atom but different numbers of neutrons ignore they have different numbers of neutrons
Total				[5]	

Question		Expected Answers	Marks	Additional Guidance
13	(a)	<p>any three from</p> <p>using a (flame test) wire / splint / spill / nichrome wire / platinum wire / spray containing substance in solution (1)</p> <p>moisten flame test wire / moisten splint / moisten spill / moisten nichrome wire / moisten platinum wire (1)</p> <p>substance is put into flame / AW (1)</p> <p>colour of flame is observed (1)</p>	[3]	<p>if an incorrect experiment is described award 0 marks e.g. a metal being put in water or heating a compound in a beaker scores (0) all marks can be awarded from a labelled diagram ignore incorrect equipment / incorrectly named metal e.g. spatula, tongs, spoon, tweezers, copper wire an incorrectly named piece of equipment / wire can only score a maximum of (2)</p> <p>allow either water or hydrochloric acid as a moistening agent</p> <p>answers referring to metals being put in flame can only score a maximum of (2)</p>
	(b)	ions cannot move / ions locked into position / ions can only vibrate (1)	[1]	<p>allow no free ions ignore delocalised ions</p>

Question		Expected Answers	Marks	Additional Guidance
13	(c)	<p>sodium ion drawn with either a full outer shell or an empty one and charge of +1 (1) one oxide ion drawn with 8 electrons in outer shell and charge of -2 (1)</p> <p style="text-align: center;">  </p>	[2]	<p>alternatively mark as below to give the candidate the best mark (do not mix and match two mark schemes)</p> <p>allow correct electronic structure of sodium ion and oxide ion (1)</p> <p>allow correct charges on ions – this is independent of the electronic structures drawn (1)</p> <p>ignore inner shells</p> <p>not $[\text{Na}_2]^{2+}$ or $[\text{Na}]_2^{2+}$</p> <p>allow $2[\text{Na}]^+$</p> <p>allow electrons drawn as all dots / crosses</p> <p>if a covalently bonded structure is shown answer scores (0)</p>
		Total	[6]	

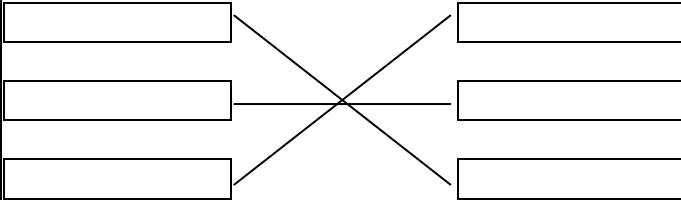
B642/01 Unit 2: Modules C4, C5 and C6 Foundation Tier

Question		Expected Answers	Marks	Additional Guidance
1	(a)	C ₆₀ (1)	[1]	allow answer ticked or circled but answer line takes precedence
	(b)	diamond / graphite (1)	[1]	
	(c)	(i) strong (1)	[1]	allow low density / lightweight
		(ii) electrical circuits / semiconductors / catalysts / drug delivery systems / supply drugs / deliver medicines (1)	[1]	allow fishing rods / microchips / to allow chemical reactions to take place inside the cage ignore use in electrical wiring / to conduct electricity
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	ammonium phosphate and potassium phosphate (1)	[1]	allow $(\text{NH}_4)_3\text{PO}_4$ and K_3PO_4 both needed for one mark
	(b)	potassium phosphate (1)	[1]	allow K_3PO_4 allow 55
	(c)	contains all three essential elements / contains nitrogen, phosphorus and potassium (1)	[1]	allow contains N, P and K allow contains more than 1 essential element / aw ignore contains more nutrients or minerals
	(d)	roots (1)	[1]	allow leaves
	(e)	nitric (acid) / HNO_3 (1)	[1]	ignore incorrect subscript if name correct
	(f)	60 (1)	[1]	
Total			[6]	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	liquid that can dissolve other substances (1)	[1]	allow a liquid that makes a solution with a solute
	(b)	(i) carbon dioxide + hydrogen → methanol	[1]	allow $\text{CO}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{OH}$ allow mix of formulae and names allow equilibrium sign / = not and / & instead of + ignore state symbols
		(ii) any three from: energy / heating / lighting / electricity / power / maintaining temperature / maintaining pressure / AW (1) raw materials / starting materials / hydrogen / carbon dioxide (1) catalyst (1) workers / labour / salary / wages (1) plant costs / equipment / maintenance / health and safety (1) research / development (1) pollution controls (1) rates / taxes / rent (1)	[3]	ignore transport / packaging / advertising / storage / insurance ignore cost of selling allow ingredients allow cost of the factory itself allow a correct cost (1) plus explanation (1)
	(c)	lower temperature / lower pressure / uses less energy (1)	[1]	allow use less temperature / use less pressure ignore method 2 uses only 1 substance as a catalyst but method 2 uses a mixture of 2 substances
	(d)	(i) one which runs all the time / operates 24-7 / AW (1)	[1]	ignore continuously being produced / process which operates continuously unless qualified
		(ii) ammonia / ethanol / sulfuric acid (1)	[1]	allow nitric acid / polymers / fractions from crude oil / products from cracking / aluminium / iron
Total			[8]	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	incomplete decomposition / was not heated for long enough / temperature not hot enough / some material may escape out of test tube (1)	[1]	
	(b)	increases (1)	[1]	
		Total	[2]	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	PbI ₂ (1)	[1]	allow PbI ₂ /PbI ² allow lead iodide
	(b)	chloride – white bromide – cream iodide – yellow all three correct (2) one or two correct (1)	[2]	
	(c)	(in solids) ions cannot move / ions are fixed (in solids) / ions can only vibrate (in solids) / no free ions (in a solid) (1) so no collisions (between ions) / ora (1)	[2]	allow ions move in a solution / free ions in a solution allow so collisions happen in a solution / more collisions in a solution
Total			[5]	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	pH – any value higher than 1 and less than 7 eg 1.1 (1) bubbles rapidly /bubbles very fast (1) to make carbon dioxide (1)	[3]	allow makes a (colourless) solution / it dissolves
	(b)	(i) hydrogen (1)	[1]	allow H / H ₂
		(ii) more ions (with hydrochloric acid) / greater concentration of ions (with hydrochloric acid) / ora (1)	[1]	assume answer refers to hydrochloric acid if acid not stated allow named ions eg more chloride ions or greater concentration of hydrogen ions allow formulae of ions eg more Cl ⁻ or greater concentration of H ⁺ allow stronger acid
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
7	(a)	gas given off / oxygen escapes (1)	[1]	allow it fizzes over the top ignore water evaporates not name of wrong gas escaping
	(b)	reactant runs out / hydrogen peroxide all used up (1)	[1]	not catalyst used up
	(c)	use of a gas syringe / burette / measuring cylinder (1) will it work – there must be no leaks or blockages (1)	[2]	allow name of piece of apparatus as a label or in text allow solid bungs
Total			[4]	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	10.0 cm ³ pipette (1)	[1]	allow tick or circled 10.0 cm ³ pipette but answer line takes precedence
	(b)	acid – colourless and alkali – pink (1)	[1]	both answers needed for 1 mark
	(c)	(i) litmus / methyl orange / universal indicator / screened methyl orange (1)	[1]	allow pH paper / any other acid-base indicator
	(d)	(i) 25.5 (1)	[1]	unit not needed
		(ii) 25.0/25 (1)	[1]	unit not needed
	(e)	because it is neutralised / alkali that is added has a pH above 7 / AW (1)	[1]	allow it reacts / hydroxide ions are being added / hydrogen ions are removed allow it has reached neutralisation point
		Total	[6]	

Question		Expected Answers	Marks	Additional Guidance
9	(a)	hydrogen (1)	[1]	allow H ₂ / H
	(b)	any one from sterilise water / to make solvents / make household bleach / to make plastics (1)	[1]	allow to kill microbes (in water) / to kill bacteria (in water) / make hydrochloric acid / make pesticides / used in water purification / make weedkillers ignore to kill germs ignore cleaning ignore used in swimming pools
Total			[2]	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	glucose (solution) (1)	[1]	allow sugar (solution) / other sugars / grape juice / fruit juice / $C_6H_{12}O_6$
	(b)	carbon dioxide (1)	[1]	allow CO_2 ignore CO_2/CO^2
	(c)	any two from absence of oxygen (1) 25-50 °C (1) presence of water (1)	[2]	allow enzymes allow absence of air allow room temperature ignore warm
	(d)	C_2H_5OH / C_2H_6O (1)	[1]	allow any order of atoms not C^2H^5OH / C^2H^6O / $C2H5OH$ / $C2H6O$
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	iron + oxygen + water → hydrated iron (III) oxide (1)	[1]	allow mix of formulae and names $\text{Fe} + \text{O}_2 + \text{H}_2\text{O} \rightarrow \text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ allow = sign for arrow not and / & for +
	(b)	redox (1)	[1]	allow answer ticked or circled but answer line takes precedence
	(c)	any two from oil / grease (1) paint (1) galvanising / coating with zinc / coating with chromium (1) sacrificial protection / attach magnesium to iron (1) alloying / make stainless steel (1) tin plate / tinning (1)	[2]	allow chrome plating allow 2 marks for method (1) and a correct explanation (1) eg oil and grease (1) prevent air or water getting to surface (1) ignore keep iron away from water or oxygen / keep it dry
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	hydrogen and oxygen (1)	[1]	both answers must be correct for mark allow H ₂ and O ₂ / H and O
	(b)	<p>produces electrical energy efficiently /</p> <p>less or no greenhouse gases / does not make carbon dioxide / does not give off any pollution /</p> <p>water is only waste product / gives off water which is not a pollutant / direct energy transfer / no moving parts (1)</p>	[1]	<p>allow less polluting ignore environmentally friendly / less damaging to environment / greener allow reduces carbon footprint / reduces carbon emissions</p> <p>allow fossil fuel running out / petrol is non- renewable / hydrogen and oxygen are renewable ignore so we stop burning fossil fuels / reduces amount of fossil fuels burnt</p>
		Total	[2]	

Question		Expected Answers	Marks	Additional Guidance
13	(a)	distilled water (1)	[1]	allow answer indicated in table if answer line is blank
	(b)	distilled water required less soap to form a lather than boiled tap water / boiled tap water must still have some hardness in it (1)	[1]	
	(c)	temporary hardness is destroyed (1)	[1]	
	(d)	calcium (1) magnesium (1)	[2]	allow correct responses ticked or underlined
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
14		any two from reduces pain (1) lowers body temperature (1) thins the blood (1) reduces risk of blood clots (1) reduces risk of heart attacks (1)	[2]	
		Total	[2]	

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

Question		Expected Answers	Marks	Additional Guidance
1	(a)	C ₆₀ (1)	[1]	allow answer ticked or circled but answer line takes precedence
	(b)	electrical circuits / semiconductors / catalysts / drug delivery systems / supply drugs / deliver medicines (1)	[1]	allow fishing rods / microchips / to allow chemical reactions to take place inside the cage ignore use in electrical wiring / to conduct electricity
	(c)	weak forces between layers (can easily be broken) (1) strong bonds between carbon atoms / has covalent bonds (1) which need lots of energy to overcome / which need lots of heat to be broken (1)	[3]	allow has van der Waals' forces between layers allow weak bonds between layers not weak covalent bonds between layers
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
2	(a)	provides nitrogen for making amino acids / provides nitrogen for making proteins (1) protein needed for growth (1)	[2]	Allow provides phosphorus for making DNA / RNA (1) DNA / RNA linked to protein synthesis (1)
	(b)	60 (1)	[1]	
	(c)	35%	[1]	
	(d)	to be able to be absorbed by roots / fertilisers enter plants as a solution	[1]	allow so the fertiliser can be sprayed
	(e)	nitric (acid) / HNO_3 (1)	[1]	ignore incorrect subscript if name correct
		Total	[6]	

Question		Expected Answers	Marks	Additional Guidance
3	(a)	working out to show that $124 = 80 + 44$ (1)	[1]	allow atoms are neither created nor destroyed / aw
	(b)	[actual mass/predicted mass] x 100 or [3.32/3.69] x 100 (1) 90 (1)	[2]	allow full marks for correct answer with no working out allow [am/pm] x 100 (1) allow 89.9 not 89 but this will score one mark if working out is given
	(c)	124 g makes 80g / 62 g makes 40 g (1) 4.0 / 4 (1)	[2]	allow full marks for correct answer with no working out allow 3.6g if the candidate has used 90% yield from (c)
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
4	(a)	carbon dioxide + hydrogen \rightarrow methanol	[1]	allow $\text{CO}_2 + \text{H}_2 \rightarrow \text{CH}_3\text{OH}$ allow mix of formulae and names allow equilibrium sign / = not and / & instead of + ignore state symbols
	(b)	reaction goes faster / need to heat for less time / need to use pressure for less time (1)	[1]	gives a fast reaction is not sufficient, needs to be a comparative answer allow can use a lower temperature / can use a lower pressure / uses less energy
	(c)	any two from lower temperature (1) lower pressure (1) uses less energy (1)	[2]	allow use less temperature / use less pressure ignore method 2 uses only 1 substance as a catalyst but method 2 uses a mixture of 2 substances
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	filter / pour the mixture through filter paper (1) wash residue with water / place residue in oven / leave residue in air to dry / aw (1)	[2]	allow filtration not sieve ignore evaporation unless it is clear it is the drying stage
	(b)	barium chloride + sodium sulfate → barium sulfate + sodium chloride (1)	[1]	allow any order of reactants and products allow $\text{BaCl}_2 + \text{Na}_2\text{SO}_4 \rightarrow \text{NaCl} + \text{BaSO}_4$ allow mix of formulae and names not and or & for +
	(c)	(in solids) ions cannot move / ions are fixed (in solids) / ions can only vibrate (in solids) / no free ions (in a solid) (1) so no collisions (between ions) / ora (1)	[2]	allow ions move in a solution / free ions in a solution allow so collisions happen in a solution / more collisions in a solution
		Total	[5]	

Question		Expected Answers	Marks	Additional Guidance
6	(a)	$\text{CH}_3\text{COOH} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}^+$ equation (1) reversible sign (1)	[2]	ignore state symbols reversible sign is independent of correct products but equation must start with CH_3COOH to be awarded the mark
	(b)	more crowded H^+ / greater concentration of H^+ (1) more collisions per second (1)	[2]	allow ora eg CH_3COOH has less crowded H^+ allow higher collision frequency / collisions more often (1) allow 1 mark for more collisions if no other mark awarded
	(c)	more ions (with hydrochloric acid) / greater concentration of ions (with hydrochloric acid) / ora (1)	[1]	assume answer refers to hydrochloric acid if acid not stated allow named ions e.g. more chloride ions or greater concentration of hydrogen ions allow formulae of ions e.g. more Cl^- or greater concentration of H^+ allow stronger acid
Total			[5]	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	0.003125 (1)	[1]	allow 0.0031 / 0.00312 / 0.00313 (1) not 0.003
		(ii)	0.060 (1)	[1]	allow 0.06 (1)
	(b)		use of a gas syringe / burette / measuring cylinder (1) will it work – there must be no leaks or blockages (1)	[2]	allow name of piece of apparatus as a label or in text allow solid bungs
Total				[4]	

Question		Expected Answers	Marks	Additional Guidance
8	(a)	they are the most reliable results / they are within 0.1 cm ³ / they are consistent results / they are most consistent / AW (1)	[1]	allow other results are anomalous / results are concordant / titres that are closest to one another / titres within 0.2 / titres will be more accurate
	(b)	moles of HCl = 0.002 (1) moles of KOH = 0.002 (1) average titre = 25.05 cm ³ / 0.02505 dm ³ (1) concentration of KOH = 0.08 / 0.07984 (1)	[4]	unit not needed allow ecf for moles of KOH / moles KOH = moles HCl unit not needed assume average titre is in cm ³ unless specified otherwise look for average titre in the expression for the concentration unit not needed allow ecf for concentration / concentration = moles of KOH ÷ 0.020 allow full marks for concentration of KOH = 0.08 if no working out given allow 3 marks for concentration of KOH = 0.08 if either volume used is not converted into dm ³ allow use of one of the titre values (rather than the average) to work out the concentration but this will have a maximum of three marks for the question
	(c)	because it is neutralised / alkali that is added has a pH above 7 / AW (1)	[1]	allow it reacts / hydroxide ions are being added / hydrogen ions are removed allow it has reached neutralisation point
		Total	[6]	

Question		Expected Answers	Marks	Additional Guidance
9		anode – chlorine (1) cathode – hydrogen (1)	[2]	allow correct formula: Cl ₂ allow correct formula: H ₂
		Total	[2]	

Question		Expected Answers	Marks	Additional Guidance
10	(a)	glucose (solution) (1)	[1]	allow sugar (solution) / other sugars / grape juice / fruit juice / $C_6H_{12}O_6$
	(b)	carbon dioxide (1)	[1]	allow CO_2 ignore CO_2 / CO^2
	(c)	<p>any one from if temperature too low yeast is inactive / if temperature is below $20^\circ C$ yeast inactive (1) if temperature too high enzyme (in yeast) denatured / if temperature too high yeast is killed (1)</p> <p>any one from absence of oxygen - prevents formation of ethanoic acid / prevents oxidation of the alcohol / allows anaerobic respiration (1)</p>	[2]	<p>optimum temperature is not sufficient</p> <p>allow enzyme molecule loses shape / at this temperature enzyme is most effective (1) allow enzyme is not denatured / enzyme is not inactive / yeast is not killed not enzyme is killed</p>
	(d)	C_2H_5OH / C_2H_6O (1)	[1]	allow any order of atoms not C^2H^5OH / C^2H^6O / $C2H5OH$ / $C2H6O$
Total			[5]	

Question		Expected Answers	Marks	Additional Guidance
11	(a)	iron + oxygen + water → hydrated iron (III) oxide (1)	[1]	allow mix of formulae and names $\text{Fe} + \text{O}_2 + \text{H}_2\text{O} \rightarrow \text{Fe}_2\text{O}_3 \cdot \text{H}_2\text{O}$ allow = sign for arrow not and / & for +
	(b)	redox (1)	[1]	allow answer ticked or circled but answer line takes precedence
		Total	[2]	

Question		Expected Answers	Marks	Additional Guidance
12	(a)	$2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ correct formulae (1) balancing (1)	[2]	balancing mark is conditional on correct formulae but allow one mark for a balanced equation with a minor error in the formulae eg failure to use subscript $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ allow = instead of arrow allow correct multiples including fractions not and or & instead of +
	(b)	any two from (produces electrical energy) more efficiently / fewer energy transfers gives off water (which is not a pollutant) / does not give off greenhouse gases (1) source of hydrogen should not run out / fossil fuels or oil are running out (1) simple design / no moving parts	[2]	ignore reference to cost / density allow hydrogen and/or oxygen are renewable / a sustainable resource ignore can be used for longer unless qualified
		Total	[4]	

Question		Expected Answers	Marks	Additional Guidance
13	(a)	distilled water required less soap to form a lather than boiled tap water / boiled tap water must still have some hardness in it (1)	[1]	
	(b)	limescale neutralised (1)	[1]	allow acid reacts with limescale / acid dissolves limescale
	(c)	calcium ions / Ca^{2+} / magnesium ions / Mg^{2+} / calcium and magnesium ions removed (1) replaced by sodium / Na^+ ions (1)	[2]	allow Ca^{2+} replaced by Na^+ (2)
Total			[4]	

Question		Expected Answers	Marks	Additional Guidance
14	(a)	any one from reduces cholesterol (1) reduces chance of developing heart disease (1) reduces furring of arteries / AW (1) provides essential fatty acids (1)	[1]	allow ora for saturated fat
	(b)	any two from bromine water is decolourised / changes from reddish brown to colourless (1) the bromine forms a compound (with the unsaturated fat) (1) the double bond breaks (1)	[2]	Ignore goes clear
		Total	[3]	

Grade Thresholds

General Certificate of Secondary Education
Chemistry B (Specification Code J644)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A*	A	B	C	D	E	F	G	U
B641/01	Raw	60	-	-	-	35	28	22	16	10	0
	UMS	69	-	-	-	60	50	40	30	20	0
B641/02	Raw	60	43	36	28	21	15	12	-	-	0
	UMS	100	90	80	70	60	50	45	-	-	0
B642/01	Raw	60	-	-	-	33	28	23	18	13	0
	UMS	69	-	-	-	60	50	40	30	20	0
B642/02	Raw	60	42	35	27	19	14	11	-	-	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	0.0	14.29	38.1	52.4	85.7	100.0	100.0	100.0	100.0	21

For a description of how UMS marks are calculated see:

<http://www.ocr.org.uk/learners/ums/index.html>

Statistics are correct at the time of publication.

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