

GCSE

Science A

Session:	2010 June
Туре:	Mark scheme
Code:	J634
Units:	A321; A322; A323







Chemistry A

General Certificate of Secondary Education A321/01

Unit 1: Modules C1, C2, C3 (Foundation Tier)



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Guidance for Examiners

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- 1. Mark strictly to the mark scheme.
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- 3. Accept any clear, unambiguous response which is correct, e.g. mis-spellings if phonetically correct (but check additional guidance).
- 4. Abbreviations, annotations and conventions used in the detailed mark scheme:

/ (1)	 alternative and acceptable answers for the same marking point separates marking points
not/reject	= answers which are not worthy of credit
ignore	= statements which are irrelevant - applies to neutral answers
allow/accept	= answers that can be accepted
(words)	= words which are not essential to gain credit
words	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW/owtte	= alternative wording
ORA	= or reverse argument

E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1) work done = 0 marks work done lifting = 1 mark

change in potential energy = 0 marks gravitational potential energy = 1 mark

5. Annotations:

The following annotations are available on SCORIS.

- = correct response
- x = incorrect response
- bod = benefit of the doubt
- nbod = benefit of the doubt <u>**not**</u> given
- ECF = error carried forward
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- 6. If a candidate alters his/her response, examiners should accept the alteration.
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E.g.

For a one mark question, where ticks in boxes 3 and 4 are required for the mark:



8. The list principle:

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E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	~	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Qu	esti	on	Expected Answers	Marks	Additional Guidance
1	а	i	gases breathed out by animals	[1]	
			the burning of fuels (1)		
			the spreading of fertiliser		
		ii	oxygen (1) water (1)	[2]	
		iii	nitrogen dioxide (1) NO ₂ (1)	[2]	ias &
	b		There was a decrease	[2]	5
			More cars and power stations \checkmark (1)	1.2.4	
			There was an increase		lage
			More cars were fitted		
			More power stations were fitted \checkmark (1)		
			More people changed		
	С		people living near	[1]	
			people working in		
			the Government (1)		
			the companies supplying		
			Total	[8]	

Qu	Question		Expected Answers			Marks	Additional Guidance
2	a i any two from:			aalaulatad	[2]	do not allow it increases the reliability/accuracy of the results	
			it allows outliers	to be identified (a	and discarded).		and wit increases the reliability/accuracy of the best estimate
			it allows for diffe	rences in sample	s / it allows for		
			errors in equipm	ent / it allows for	errors in		
			technique / one	measurement ma	y be in error;	101	
		11	0.168 (2)			[2]	2 marks for correct answer
	h			-		[2]	
	D			\bigcirc		[2]	
				\bigcirc			
			\checkmark		(1)		les &
				\bigcirc			
				\bigcirc			
				\bigcirc	✓ (1)		
				$\bigcirc \bullet \bigcirc$			lage
				Total		[6]	

Qu	esti	on	Expected Answers	Marks	Additional Guidance
3	а	i	135 (1)	[1]	
		ii	134 to 137 (1)	[1]	allow 137 to 134 but do not allow 3 or 4
		iii	B higher than A	[1]	
			same value as the mean.		
			The mean near to the middle	1	
			narrow range. 🗹 (1)	١Ì	res &
		iv	many errors	[1]	
			small variations in structure. 🗹 (1)	-14	200
			different melting points.		age
	b	i	it has a lower melting point (1) and any one from: which will allow easier moulding; reduces energy needed/cost of heating; idea of increased productivity/time saving;	[2]	first mark requires comparison
		ii	strength do not bend too easily	[2]	all three correct = 2 marks two correct = 1 mark
			durability last a long time		two lines to or from one box negates that box from score
			stiffness not easy to break		
			Total	[8]	

Qu	esti	on	Expected Answers	Marks	Additional Guidance
4	а		valid choice of article (no marks)	[3]	if article choice is not valid = 0 marks
			material this article is now made from (1)		reject any mention of shoes
			valid advantage of new material (1)		advantage mark can only be scored if two different old and new
					materials valid for the article named are given
	b			[2]	three correct answers = 2 marks
			renewable		two correct answers = 1 mark
			more attractive appearance	1	
				. •	
			more expensive		AC X
			will rot		
				100	200
			used for longer		dye
			1		
	С		chomicals from crude oil	[1]	
			animal skins.		
			obtained without spoiling \checkmark (1)		
			hard wearing		
			Total	[6]	

Que	Question		Expected Answers				Marks	Additional Guidance
5	а		statement	type 1 diabetes	type 2 diabetes		[2]	three ticks in boxes as shown all three correct = 2 marks two correct = 1 mark
			diet and exercise young people its own insulin	• 	✓ ✓			
	b	i	contains a lot o contains a lot o Fat digeste Sugar is quickly a	f sugar. f fat. d into suga bsorbed	 ✓ (1 ar. ✓ (1)	[2]	es &
		ii	any two from: (they believe) it is cheat they do not have enoug make a more sensible they do not realise that comfort eating / better	aper to eat gh knowleo choice; t they have taste / hab	a poor diet; dge about fo a higher ris it;	; pod to sk;	[2]	accept arguments based around 'no choice'

Qu	iesti	on	Expected Answers	Marks	Additional Guidance
6	i a		amino acids (1) proteins (1)		
	b		plant legumes/beans/peas/clover / crop rotation (1) because bacteria in their roots fix nitrogen / because one crop puts back the nitrogen taken out by others (1)	[2]	do not allow idea of adding compost /dead plants/ dead animals/sewage to soil do not allow small scale ideas that apply to gardening but not farming
	С		any three (including at least one 'pests' answer and at least one 'weeds' answer) from: 'pests' idea of using natural predators of insect pests; pick off insects by hand; grow insect repelling plants amongst crops; use protective measures eg scarecrows, netting or bird scares; 'weeds' pull out weeds by hand; plant crops with little space between to deter	[3]	at least one pests answer at least one weeds answer other answer can be either all pests answer /all weeds answer = max 2 marks
			use mulch on surface of soil to deter weeds;	[4]	
			Total	[1] [8]	

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GCSE

Chemistry A

General Certificate of Secondary Education A321/02

Unit 1: Modules C1, C2, C3 (Higher Tier)



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AW/owtte ORA	 alternative wording or reverse argument

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Manchester	✓	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		~	
Score:	2	2	1	1	1	1	0	0	0	NR

Qu	esti	on	Expected Answers	Marks	Additional Guidance
1	а		There was a decrease	[2]	
			More cars and power stations \checkmark (1)		
			There was an increase		
			More cars were fitted		
			More power stations were fitted \checkmark (1)	i.	05 8.
			More people changed		ES OC
	b		as fuel burns it forms sulfur dioxide (1) sulfur dioxide reacts with oxygen (1)	[3]	do not allow answers based on formation of carbon dioxide or nitrogen oxides
			and water (in the air) (1)	11	do not allow sulfur is released into air and then reacts with
			I I CI		do not allow sulfur dioxide reacting with/dissolving in rain
					allow water vapour or moisture for water
	С		B and D not included in answer (1)	[3]	allow one mark for FBCE
			A F G C E (2)		allow one mark for three consecutive letters in correct order ie FGC or GCE even if other letter is B or D
	-		Total	[8]	

Qu	esti	on	Expected Answers		Marks	Additional Guidance	
2	а	i	any two from: it enables an ave it allows outliers	erage/mean to b to be identified (e calculated; (and discarded);	[2]	do not allow it increases the reliability/accuracy of the results allow it increases the reliability/accuracy of the best estimate
			it allows for differences in samples / it allows for errors in equipment / it allows for errors in technique / one measurement may be in error;				
		ii	0.168 (2)			[2]	2 marks for correct answer allow 1 mark for 0.174
	b				(1) ✓ (1)	[2]	res & age
				Total		[6]	

Qu	esti	on	Expected Answers	Marks	Additional Guidance
3	а		the only factor that is varied must be the one being investigated / only polymer type must be varied /	[2]	ignore references to fair test or fair testing or bias ignore reference to making errors
			so that the different polymer types can be		ignore references to getting different results each time unless
			compared (1)		qualified
			other factors than the one being investigated can		ignore references to accuracy or reliability
			affect the results / to make sure no other factors		
			affect the outcome / using different equipment		
			might produce different results / the results would		
			vary with sample size (1)	-	
	b	i	between the atoms	[2]	res &
			between the molecules (1)		
			bonded in different ways.	.1.4	
			Some atoms stronger forces		.age
			higher the forcemore energy \checkmark (1)		
		ii	increasing chain length (1)	[2]	each answer must refer to an increase to get the mark
			increasing crystallinity (1)		allow increase density as an alternative to crystallinity
					allow add cross-links / increase cross-linking
					do not allow cross links without idea of adding or increasing
					allow decrease branching
					do not allow make polymer branched / increase branching
					do not allow removal of plasticizer
					do not allow vulcanisation
			Total	[6]	

A321/02

Qu	esti	on	Expected Answers		Additional Guidance
4	а	i		[2]	three correct answers = 2 marks
			renewable		two correct answers = 1 mark
			more attractive appearance		
			more expensive		
			will rot	2410271	
			uses more energy	i.	105 8.
			used for longer		CS OC
		ii	Plastics have to be imported 🗸 (1)	[2]	
			It is easier		lage
			Leather is more durable		
			Leather can be made locally 🗹 (1)		
			Plastic shoes are not suitable		

Qu	Question		Expected Answers		Additional Guidance
4	b		last a lot longer 🗹 (1)	[3]	
			Manufacturing energy. 🗹 (1)		
			different small molecule		
			uses chemicals 🗹 (1)		
			will rot	i.	100 8.
			Making takes more energy		ES OC
			Total	[7]	



Qu	Question		Expected Answers			Marks	Additio	onal Guidance
5	а	i		l.	_	[2]	three ticks in boxes as show	n
			statement	type 1 type 2			all three correct = 2 marks	
			Clinit and averains	labetes diabetes	; 		two correct = 1 mark	
				•	_			
			its own insulin	· · ·	_			
		ii			-	[2]		
			Only a few food ite	ems		•	0	
			high blood suga	r level. 🗸] (1)		VAS X	
							5	
			Avoiding					
			Both types of diabe	etes]			
			serious sympton	ms 🗸] (1)		age	
				lis.			~~~~	
			liver stores the e	excess sugar.				
	h					[2]		
	U		Jason	✓ (1)		[4]		
			D .					
			Rosie					
			Steve					
			_					
			Emma	✓ (1)				
			То	otal		[6]		

Qu	lesti	on	Expected Answers	Marks	Additional Guidance
6	а		amino acids (1)	[2]	do not allow monomers
			proteins/polypeptides (1)		allow singulars instead of plurals
	b			[2]	
			Lightning \checkmark (1)		
			Plants absorb nitrogen gas		
			Ammonia is made		
			Nitrogen oxides dissolve (1)		ICC X.
			Plants use nitrogen gas		
				100	
	С		plant legumes/beans/peas/clover / crop rotation (1)	[2]	do not allow idea of adding compost/dead plants/dead
	-		because nodules/bacteria in their roots fix		animals/sewage to soil
			nitrogen / because one crop puts back the nitrogen		do not allow small scale ideas that apply to gardening but not
			taken out by others (1)		farming
	d		synthetic fertiliser is too expensive for farmers in	[3]	ignore references to organic farming and its supposed
			developing countries to buy / manure is free for		advantages
			farmers in developing countries (1)		
			developing countries do not have the technology to		
			make fertiliser / developing countries have to		
			import synthetic fertiliser / manure is readily		
1			available in developing countries (1)		
1			there is not enough manure in the UK to provide all		
1			of the fertiliser that farmers need / synthetic		
			tertilisers are used in UK to produce high yields (1)		
			Total	[9]	

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Chemistry A

General Certificate of Secondary Education A322/01

Unit 2: Modules C4, C5, C6



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1	а		dark grey to orange	[1]	
			orange to yellow		
			dark grey to purple (1)		
			green to brown		
	b		I ₂ (1)	[2]	105 8.
			(g) (1)		not (gas) or (G)
	С	i*	KF (1)	[1]	accept FK
		ii*	melting point rises / becomes less negative (1)	[3]	ignore references to atomic number or mass number
			boiling point rises (1) reactivity decreases (down the group) (1)	T	age
	d		non-metal	[2]	all three correct = 2 marks
			bigger less		one or two correct = 1 mark
			Total	[9]	

Qu	Question		Expected Answers		Additional Guidance
2	а		It starts to fizz.	[1]	
			It expands.		
			It catches fire.		
			It goes from shiny to dull. (1)		
	b		4 (1)	[1]	accept four
	С		more electrons than protons.	[1]	es &
			lower mass than a lithium atom.		
			more protons than neutrons.	rif	200
			ion by losing one electron (1)		age
	d	i	different number of lines / lines in different places / different amount of bars/ different pattern or arrangement idea (1)	[1]	ignore 'Different lines' ignore just "spectra is different/ different lengths/ different size sections" accept "lines do not match up"
		ii	sodium and potassium (1)	[1]	need both for 1 mark accept correct symbols i.e. Na and K
			Total	[5]	

Qu	esti	ion	Expected Answers		Marks	Additional Guidance
3	а		The ions become free to move. \checkmark	< (1)	[2]	
			The ions spread very far apart.			
			New bonds form between the ions.			
			The arrangement of ions	<u>(</u> 1)	2110207	
			a regular arrangement.		i\	105 8
	b	i	arrow to right (1)		[1]	accept arrows that are not horizontal, but are pointing towards the correct electrode any arrow in the wrong direction = 0 accept arrows above and below the container but between the electrodes in the correct direction
		ii	oxygen (1)		[1]	accept carbon dioxide/CO ₂
	С		good conductor of heat.]	[2]	
			less dense than other metals. \checkmark	_ (1)		
			lower melting point]		
			good electrical conductor.] (1)		
			softer]		
	d		metallic (1)		[1]	
			Total		[7]	

Qı	Question		Expected Answers		Marks	Additional Guidance
4*	а		SiO ₂ (1)		[2]	
			A <i>l</i> ₂ O ₃ (1)			
	b		less chlorine than sodium	✓ (1)	[2]	
			Chlorine is a gas.			
			occurs in other compounds	✓ (1)	•	
			shows only metals.		\mathbb{N}	les &
			small amount of chlorine			
-			Total		[4]	
						0061

5	а					[1]	azc
			increases	same	decreases		0
		carbon dioxide	\checkmark				
		oxygen			\checkmark		
	b	carbon dioxide co	ontains tw <mark>o</mark> e	lements	/ two types	[2]	assume "it" refers to carbon dioxide
		of atom / carbon	and oxygen	(1)			ignore "it is a mix of carbon and oxygen"
							allow "carbon dioxide has more / different elements" or "carbon
		Oxygen contains	only one ele	ment / c	only one type		dioxide has more than one element"
		of atom / only oxy	ygen <u>atoms</u> (1)		-	not just "pure element" for oxygen
							not "2 oxygen molecules"
			Total			[3]	

Qı	lesti	on	Expected Answers	Marks	Additional Guidance
6	a*		7 1	[1]	both correct for 1 mark must be in correct order
	b*		calcium nitrate (1)	[3]	
			carbon dioxide and CO_2 (1)		reject carbon monoxide
			water and H ₂ O (1)		accept hydrogen oxide
			Arch	۱i	numbers in formulae must be smaller than letters. e.g. accept CO ₂ or CO ₂ / H ₂ O or H ₂ O
					reject CO2 or CO ² / H2O or H ² O
			Hei	rit	maximum (2) marks If extra numbers are written in front of formulae e.g. 2CO ₂ etc
	С	i	lower concentration (of acid) (1)	[3]	allow "weaker concentration"
			lumps of calcium carbonate (1)		not just "pieces of calcium carbonate"
			lower temperature (1)		allow "less heat"
		ii	gas/carbon dioxide given off (1)	[1]	not "steam"
					Ignore "evaporates/ the liquid turns to gas" not "CaCO ₃ turns to a gas" but accept "CaCO ₃ produces a gas
			Total	[8]	

Qu	esti	on	Expected Answers	Marks	Additional Guidance
7	а		bubbles (of gas) given off / fizzing (1)	[2]	ignore just "gas given off"
			(1)		ignore "change of colour"
	b		C D B A (1)	[1]	fully correct order = 1 mark
	C		80% (1)	[1]	
	d			[2]	
	•		use more acid 🖌 (1)		
			heat the reaction		res oc
			use smaller pieces		
			use a catalyst	11	ade
			use more magnesium (1)		
			for a longer time		
			Total	[6]	

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GCSE

Chemistry A

General Certificate of Secondary Education A322/02

Unit 2: Modules C4, C5, C6



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Qu	esti	on	Expected Answers			Additional Guidance
1	а		FROM <u>dark grey</u> TO <u>purple</u> (1)		[1]	both colours required for 1 mark
						Order must be clear.
	b		l ₂ (aq) (1)		[1]	both required for 1 mark
						reject (ag)
	С	İ*	KF (1)		[1]	accept FK
		ii*	melting point rises / becomes less neg	gative (1)	[3]	ignore references to atomic number or mass number
			boiling point rises (1)			I'ES OL
			reactivity decreases (down the group)	(1)		
	d			-101	[3]	all five correct = 3 marks
			1	true false		four correct = 2 marks
			is a gas.	\checkmark		two or three correct = 1 mark
			has a lower melting point	\checkmark		one or none correct = 0 marks
			has one electron	\checkmark		
			forms an ion	\checkmark		
			reacts with iron more slowly	\checkmark		
			Total		[9]	

Qu	Question		Expected Answers	Marks	Additional Guidance
2	а	i	particle name of charge particle mass	[2]	charge on proton must have + sign
			$\begin{array}{c c c c c c c c c c c c c c c c c c c $		accept 'neutral/none/no charge' for charge on neutron and 'positive' for charge on proton. accept +1 for relative mass but reject -1
		II	3 electrons showing configuration 2,1 (1)	יז ווֹ רוֹו	2 X's anywhere in first shell, 1 X anywhere in second shell accept any other symbols for electrons e.g. e or o
	b		larger relative mass larger relative mass total charge more protons and electrons by gaining one electron. shells of electrons	[2]	all five correct = 2 marks four correct = 1 mark three or less correct = 0 marks
			Total	[5]	

Qu	Question		Expected Answers		Additional Guidance
3	а		(oxide ions / negative ions) move to positive electrode / move to the anode (1)	<u>e</u> [2]	ignore references to movement of metal ions / aluminium ions; allow attracted to for 'move'
			and then lose electrons / form oxygen molecules / fo oxygen gas / form O ₂ (1)	rm	accept 'form oxygen' alone ignore 'form oxygen <u>atoms'</u> ignore 'forms a gas' alone
	b	i	108 tonnes (1)	[1]	IAS &
		ii	ions give up electrons] [1]	
			More atoms of aluminium		
			same total number of electrons](1)	lage
			Aluminiumpositive electrode.]	0
			Total	[4]	

Qu	Question		Expected Answers		Additional Guidance
4*	а		SiO ₂ (1)	[2]	
			A <i>l</i> ₂ O ₃ (1)		
	b		less chlorine than sodium \checkmark (1)	[2]	
			Chlorine is a gas.		
			occurs in other compounds (1)	Ni.	10C 8.
			shows only metals.	11.	es or
			small amount of chlorine		
			Total	[4]	200
			1 IC		age



Qu	Question		Expected Answers		Additional Guidance
5	а		ammonium NH4 ⁺ nitrate NO3 ⁻ nitrite NO2 ⁻	[2]	ignore extra words in boxes unless more than one name or formula of a substance is given.
			Fully correct = (2) (1) mark for either All three names correct in correct places; All three formulae correct in correct places; Any 2 boxes fully correct;	i\	res &
	b	i	higher <u>percentage</u> mass of C / ORA (1) lower number of carbon <u>atoms</u> / more hydrogen <u>atoms</u> / 3 carbon <u>atoms</u> and 7 hydrogen <u>atoms</u> (1) hydrogen has a lower <u>atomic</u> mass / hydrogen <u>atoms</u> are lighter / carbon has a mass of 12 and hydrogen has a mass of 1 (1)	[3]	 ignore 'has 40% mass of carbon and/or 8% hydrogen' accept 'higher mass of carbon in the compound' or 'in the molecule' ignore 'higher mass of carbon' alone ignore 'There are <u>only</u> 3 carbon atoms'; If number of atoms are given, they must be correct. accept reverse arguments If atomic masses of atoms are given, they must be correct.

Qu	Question		Expected Answers			Additional Guidance
5	b	ii	Alanine has a low melting point.		[1]	
			Alanine is soluble in water.			
			carbon, hydrogen and oxygen.	✓ (1)		
			Alanine is non-toxic.			
			Total	Ma la	[6]	000



Qu	Question		Expected Answers		Additional Guidance
6	а		rate is faster (1) particles are closer together / more particles in the same volume (1) more <u>frequent</u> collisions / more collisions per unit time (1)	[3]	ignore Energy arguments / activation energy arguments; allow <u>faster</u> collisions/ more successful collisions
	b		catalyst is not used up / unchanged (1)	[1]	ignore can be re-used / recycled / does not react. ignore speeds up the reaction.
	С*		7 1	[1]	both correct for 1 mark must be in correct order
	d*		calcium nitrate (1) carbon dioxide and CO ₂ (1) water and H ₂ O (1)	[3]	 reject carbon monoxide accept hydrogen oxide numbers in formulae must be smaller than letters. e.g. accept CO₂ or CO₂ / H₂O or H₂O reject CO₂ or CO² / H₂O or H²O Maximum (2) marks If extra numbers are written in front of formulae e.g. 2CO₂ etc
			Total	[8]	

Qu	esti	on	Expected Answers		Additional Guidance
7	а	i	188 (1)	[1]	
		ii	1.26 g (2) For (1) mark 0.63 g (1)	[2]	allow 1.3 g for (2) allow 0.6 g for (1)
	b	i	Cu ²⁺ (1)	[1]	accept Cu^{+2} Charge must be superscripted. reject Cu2+ or Cu_{2^+} or $2Cu^{2^+}$ reject '2+' alone
		ii	sulfuric (acid) / H ₂ SO ₄ (1)	[1]	If formula given must be fully correct as shown. allow phonetic spellings of sulfuric e.g. 'sulffurik', but reject 'sulfur'.
		iii	LiNO ₃ / Li(NO ₃) (1)	[1]	allow NO ₃ Li reject capital I in Li, e.g. LINO ₃ Number 3 must be smaller or subscripted e.g. reject LiNO ³ or LiNO3 reject any numbers in front of formula e.g. $2LiNO_3$ reject Li ⁺ NO ₃ ⁻
			Total	[6]	

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Chemistry A

General Certificate of Secondary Education A323/01

Unit 3: Ideas in Context plus C7

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/ (1)	alternative and acceptable answers for the same marking pointseparates marking points
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ignore	= statements which are irrelevant - applies to neutral answers
allow/accept	= answers that can be accepted
(words)	= words which are not essential to gain credit
words	= underlined words must be present in answer to score a mark
ecf	= error carried forward
AW/owtte	= alternative wording
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E.g. mark scheme shows 'work done in lifting / (change in) gravitational potential energy' (1) work done = 0 marks work done lifting = 1 mark change in potential energy = 0 marks

gravitational potential energy = 1 mark

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For a one mark question, where ticks in boxes 3 and 4 are required for the mark:

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If a list of responses greater than the number requested is given, work through the list from the beginning. Award one mark for each correct response, ignore any neutral response, and deduct one mark for any incorrect response, e.g. one which has an error of science. If the number of incorrect responses is equal to or greater than the number of correct responses, no marks are awarded. A neutral response is correct but irrelevant to the question.

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E.g. If a question requires candidates to identify a city in England, then in the boxes

Edinburgh	
Manchester	
Paris	
Southampton	

the second and fourth boxes should have ticks (or other clear indication of choice) and the first and third <u>should be blank</u> (or have indication of choice crossed out).

Edinburgh			✓			✓	✓	✓	✓	
Manchester	✓	×	✓	✓	~				~	
Paris				✓	✓		✓	✓	✓	
Southampton	✓	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Q	uesti	ion	Expected Answer	Mark	Additional Guidance
1	а	i	more can be grown (1)	[1]	allow cotton can be planted again
		ii	any two from:	[2]	
			reference to using fertilisers;		
			reference to using pesticides;		
			cotton is bleached (using harmful chemicals);		
		iii	these polymers are made from crude oil (1)	[2]	
			(crude) oil/polymers are finite/will one day run out/is not		
			renewable (1)		
	b		they are easier to use/more convenient / they do not need to	[1]	allow more comfortable for baby / less likely to leak
			be washed / they are kinder to a baby's skin (1)	A	do not allow economy answers
	С	i	from getting the raw material used to make the product to	[1]	do not allow answers that start from making product
			the disposal of the product (1)		from raw material
		ii	any two from:	[2]	
			making materials;		
			making the products from the materials;		
			using the products;		
-			disposing of the products;		
	d	i	raw material production (1)	[2]	
			manufacture of components (1)		
		ii	(generation) of electricity used(1)	[2]	
			manufacture of detergent (1)		
			Total	[13]	

C	luest	ion	Expected Answer	Mark	Additional Guidance
2	а	i	alcohols (1)	[1]	
		ii	$C_2H_6O(1)$	[1]	accept C ₂ H ₅ OH
	b		liquid;	[3]	all four correct = 3 marks
			yes;		three correct = 2 marks
			yes no		two correct = 1 mark
	С	i	sugar/glucose (1)	[1]	
		ii	(high concentration of) ethanol kills yeast (1)	[1]	allow the ethanol denatures/destroys the yeast
					allow ethanol denatures enzymes but do not allow
			Arabiy		kills enzymes
		iii	distillation (1)	[3]	allow fractional distillation
			plus any two from:		allow explanation marks independent of name but do
			mixture is heated/evaporated/boiled;		not give marks for a method that does not separate
			vapour cooled to condense it;		eg reflux
			ethanol has lower boiling point (so boils off first);		
			Total	[10]	
				(* <u>?</u> -	
3	а	i	energy level of reactants is higher than that of products (1)	[2]	allow energy level at end is lower than at beginning /
			so energy/heat given out during the reaction (1)		energy level goes down / energy change is negative
		ii	methane + oxygen \rightarrow carbon dioxide + water (1)	[1]	Accept symbol equation if correct
	b		taken in/gained/endothermic	[1]	both required for the mark
			given out/released/exothermic		
	С		energy needed to start a reaction (1)	[2]	allow first mark for energy needed for a reaction to
					take place/begin / energy needed for successful
					collisions
			energy needed to break bonds (1)		ignore reference to catalysts
			Total	[6]	

C	luest	ion	Expected Answer	Mark	Additional Guidance
4	а		any three from: put spots of dyes (on origin); put end of paper in water;	[3]	
			in a beaker; leave; until water is nearly at the top of the paper;		allow other acceptable containers
			observe how far dyes have travelled;		S2=3
			QWC mark is for an answer that contains at least ten words with no more than one incorrect spelling in each ten words	[1]	2.
	b	i	maximum position of solvent travel (1)	[1]	
		ii	pen ink smudges/runs/dissolves in the water (1)	[1]	
	С	i	C (1)	[1]	
		ii	one spot from C travelled same distance up paper as the spot from the banned compound (1)	[1]	allow C has a spot at the same level as banned compound
		iii	distance travelled by solvent (1) distance travelled by (banned) dye (1)	[2]	C
			Total	[10]	
	T			1	
5	а	i	measure out 25.0 cm ³ of the stock solution (1) make up to 250 cm ³ with (distilled/deionised) water (1)	[2]	allow one mark for adding 1 part stock solution to 9 parts water ignore references to dilution to a tenth of stock concentration
		ii	g/dm ³ (1)	[1]	
	b	i	not accurate (1)	[1]	
		ii	pipette (1)	[1]	allow burette
		iii	to give a colour change (1) when the alkali has been neutralised / when the solution is neutral (1)	[2]	allow to determine the end point = 2 marks allow fully reacted
			Total	[7]	

C	Question		Expected Answer	Mark	Additional Guidance
6	а	i	a chemical that is made in large quantities (1)	[1]	
		ii	(to show that) the reaction is reversible / goes backwards and forwards (1)	[1]	allow to show that it is a (dynamic) equilibrium
	b		air makes the process (more) sustainable(1) because the supply of air is not limited / air is renewable(1) natural gas makes the process less/not sustainable(1) because it is finite/will one day run out/not renewable(1)	[4]	
	С		speed up the reaction (1)	[1]	accept provides an alternative route / lowers activation energy
	d		any two from: tanker vessel must be strong/pressurised/have thick walls; tanker vessel must be leak proof; tanker must carry a hazard warning sign; speed limits for heavy vehicles;	[2]	allow no naked flames
			Total	[9]	
	_		TICITU	ag	

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Manchester	\checkmark	×	✓	✓	✓				✓	
Paris				✓	✓		✓	✓	✓	
Southampton	\checkmark	×		✓		✓	✓		✓	
Score:	2	2	1	1	1	1	0	0	0	NR

Question		ion	Expected Answer	Mark	Additional Guidance
1	а		any two from:	[2]	
			reference to using pesticides (1)		
			cotton is bleached (using harmful chemicals) (1)		
	b		they are easier to use/more convenient / they do not need to	[1]	allow more comfortable for baby / less likely to leak
			be washed / they are kinder to a baby's skin (1)		do not allow economy answers
	С		from getting the raw material used to make the product to	[1]	do not allow answers that start from making product
			the disposal of the product (1)		from raw material
	d		description:	[2]	
			electricity/detergent used for washing (1)	ne	allow use of energy instead electricity
			explanation:		
			generating electricity causes pollution / detergent released	-	allow any reasonable explanation of how this causes
	_		Into rivers etc (1)	[0]	environmental impact
	е		hot everyone would collect used happies for recycling / may	႞ႄၪ	Intee aleas for marks.
			there are not enough recycling plants available / so many	20	
			nappies are used that this would be difficult (1)		demand for products
			there may not be enough demand for the materials		
			produced by recycling (1)		
	f	i	forces (of attraction) between polymer chains/molecules are	[2]	for the first mark candidates must write about forces
			low (1)		between chains/molecules not bonds
			so little energy is needed to separate the chains/molecules		for second mark allow reference to breaking bonds
			(1)		between chains/molecules as long as energy
					mentioned
					ignore references to short chains
		11	decrease chain length / decrease crystallisation / add	[2]	allow make branched polymer
			plasticizer / decrease density (1)		allow decreases number/strength of bonds between
			to decrease forces/attraction between chains/molecules (1)		
				_	ianore references to less energy needed
			Total	[13]	

Question		ion	Expected Answer	Mark	Additional Guidance
2	а		sodium + ethanol (slow) fizzing / dissolves / gets smaller / moves slowly across the surface (1) sodium + water (fast) fizzing / dissolves (quickly) / gets smaller (quickly) / shoots around on surface / melts / produces flame (1) sodium + hexane no reaction (1) answer shows that reaction with water is more vigorous than that with ethanol (1)	[4]	one mark each for a valid observation for each of the three demonstrations if a mixture of valid and non-valid observations are made this loses the mark for that box plus one additional mark for a correct comparison of the same observation with ethanol and with water allow bubbling=fizzing=hydrogen/gas given off
	b		similarity: ethanol and water have O-H group/same functional group/oxygen and so react in a similar way (1) difference: hexane has only carbon and hydrogen atoms/does not have an O-H group/does not have oxygen and so does not react (1)		allow water and ethanol have polar bonds allow hexane is a hydrocarbon/has unreactive C-C and C-H bonds and so does not react to score the answers must refer to the reactions not just to the structures
	С	i	(high concentration of) ethanol kills yeast (1)	[1]	allow the ethanol denatures/destroys the yeast allow ethanol denatures enzymes but do not allow kills enzymes
		ii	distillation (1) plus any two from: mixture is heated/evaporated/boiled (1) vapour cooled to condense it (1) ethanol has lower/different boiling point (so is collected on its own/separately) (1) Total	[3]	allow fractional distillation allow explanation marks independent of name but do not give marks for a method that does not separate eg reflux ignore ethanol has low boiling point

Question		ion	Expected Answer	Mark	Additional Guidance
3	а		energy level of reactants is higher than that of products (1)	[2]	allow energy level at end is lower than at beginning /
					energy level goes down / energy change is negative
			so energy/heat given out during the reaction (1)		
	b		energy needed to start a reaction (1)	[2]	allow first mark for energy needed for a reaction to
					take place/begin / energy needed for successful
					collisions
			energy needed to break bonds (1)		ignore reference to catalysts
	С	i	(2 x 805 =) 1610 (1)	[3]	allow 3 marks for 3466 without working (even if not on
			(4 x 464 =) 1856 (1)	00	answer line)
			energy released = 3466 (1)		ignore if go on to calculate 730 here
		ii	730 (1)	[1]	ignore sign (plus or minus)
					allow ecf from ci
					give mark for 730 without working
			Total	[8]	
			HOLIT	240 Y 61	
4	а	i	4.8 (1)	[2]	give 2 marks for correct answer without working
			divided by $7.0 = 0.69(1)$	- C	do not allow 4.9 or 0.7
					allow 0.68 or 0.685 or 0.686 (max 3 sf)
		ii	Rf value is always the same for each compound (1)	[2]	allow can be used to identify compound
			distance travelled by spot/solvent front may be different on		ignore reference to accuracy/precision
			different chromatograms (1)		
	h		stationary phase is paper and mobile phase is solvent /	[3]	
	D D		mobile phase moves up through stationary phase (1)	[0]	
			for each compound there is a dynamic equilibrium between		
			the two phases (1)		
			how far each compound moves depends on its distribution		for third mark allow compounds travel different
			between the two phases / if the compound is more soluble		distances because they have different solubility in
			in the mobile phase it will move further up the paper (1)		phases / dynamic equilibrium is more to one side /
					spend different amounts of time in the two phases
			Total	[7]	

Question		ion	Expected Answer	Mark	Additional Guidance
5	а		measure out 25.0 cm ³ of the stock solution (1) make up to 250 cm ³ with (distilled/deionised) water (1)	[2]	allow one mark for adding 1 part stock solution to 9 parts water ignore references to dilution to a tenth of stock concentration
	b	i	28.2 x 6.3/1000 = 0.178 (1)	[1]	be careful not to give this mark just for getting 0.178 the mark is for the correct method used to get 0.178 do not allow a mark for eg $28.2 \times 6.3/100 = 0.178$
		ii	$0.178 \times 40/63 (1)$ = 0.113 (1) 0.113 × 1000/25 = 4.52 (1)	[3] (es	allow any correct method for working eg 40 x 6.3/63 x 28.2/1000 allow 0.113 without working for 2 marks allow ecf from mass to concentration ie x40
		iii	uncertainty is low / value is reliable (1) because titration results show little variation/are very close/are within 0.2/have small range (1)	[2]	ignore references to accuracy ignore references to outliers
			Total	[8]	C

6	а	air makes the process (more) sustainable (1) because the supply of air is not limited / air is renewable (1) natural gas makes the process less/not sustainable (1) because it is finite/will one day run out/not renewable (1)	[4]	
	b	catalyst provides an alternative route (1) with a lower activation energy / less energy needed to begin the reaction / less energy needed to break bonds (1) QWC is for correct use of the term activation energy (1)	[2] [1]	do not allow marks for other explanations of how a catalyst works ignore references to collisions
	C	reactants/nitrogen and hydrogen that have not reacted are recycled (1) ammonia is removed so the system does not reach equilibrium/reverse reaction is not possible/pushes equilibrium to the right (1)	[2]	no mark simply for saying 85% recycled, must have idea that this gas has not reacted / goes back to react
		Total	[9]	

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