OCR
Oxford Cambridge and RSA

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/09**: Chemistry

General Certificate of Secondary Education

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	Ignore

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
I	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	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

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science A.

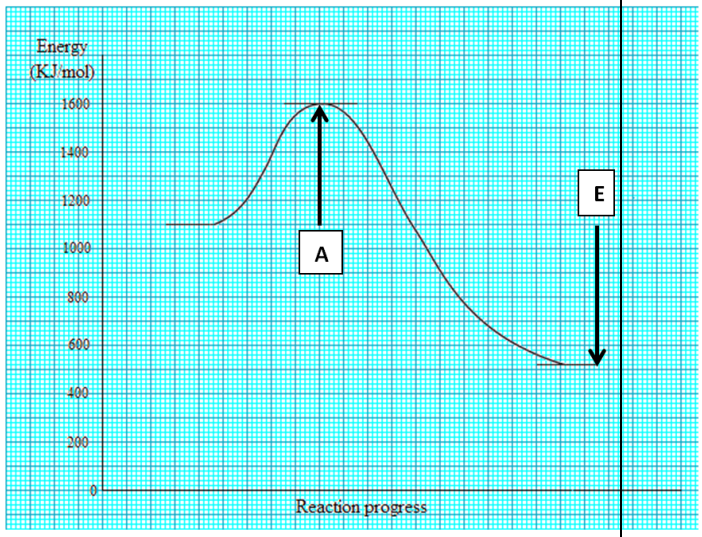
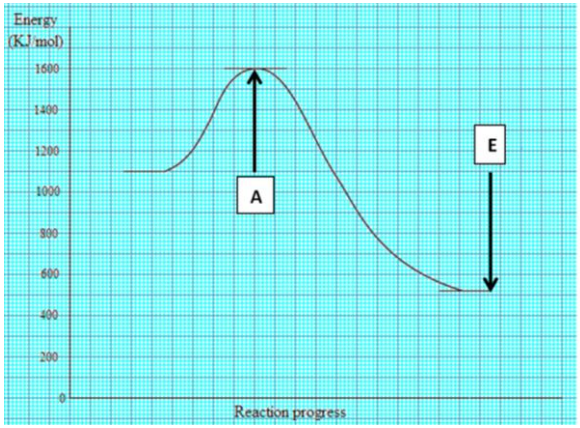
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.**
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	**Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.**
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question			Answer	Marks	AO element	Guidance
SECTION A						
1			C ✓	**1**	1.1	
2			B ✓	**1**	2.1	
3			D ✓	**1**	1.1	
4			C ✓	**1**	1.1	
5			C ✓	**1**	1.1	
6			D ✓	**1**	2.1	
7			D ✓	**1**	1.2	
8			B ✓	**1**	1.1	
9			A ✓	**1**	1.1	
10			C ✓	**1**	2.2	

SECTION B						
Question			Answer	Marks	AO element	Guidance
11	(a)		Covalent bonds identified in tubes✓ Idea that **bonds** are (very) strong / there are many bonds / bonds take lots of energy to break ✓	**2**	2 x 1.1	**DO NOT ALLOW either mark for** reference to intermolecular forces or ionic bonding Covalent bonds are strong(er) = 2 Giant covalent structures = 2
	(b)		(nanotubes contain) delocalised / free **electrons** ✓ (electrons) move ✓	**2**	2 x 1.1	**IGNORE** 'conduct electricity' as this is in the stem. **IGNORE** references to moving ions
	(c)	**(i)**	**FIRST CHECK THE ANSWER ON THE ANSWER LINE** **If answer = 4.9 award 2 marks** 7.9÷1.6 ✓ = 4.9 ✓	**2**	2 x 2.2	 **ALLOW** 5 / 4.94 /4.938 / 4.9375 Check for incorrect rounding e.g. 4.93 would not score 2 marks
		(ii)	**Any one from:** Atoms are packed clos**er** together (in metals) / **ORA** ✓ Carbon nanotubes have hollow spaces / holes **ORA** ✓ RAM of iron much bigg**er** than RAM of C ✓	**1**	2.1	Assume 'it' refers to iron unless qualified. Beware of repeats of stem – 'iron is more dense than carbon' **ALLOW** (iron) layers are clos**er** together
		(iii)	(Covalent) **bonds** are strong**er** (than metallic bonds) / more energy needed to break (covalent) bonds / **ORA** ✓	**1**	3.2a	**DO NOT ALLOW** Intermolecular forces references Assume 'they' relates to carbon

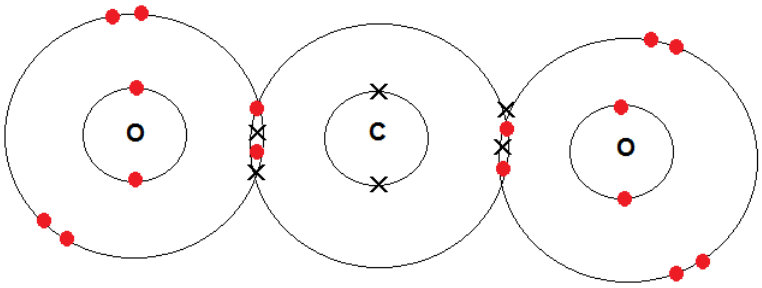
Question			Answer	Marks	AO element	Guidance
12	(a)		Al_2O_3 ✓	1	2.1	**ALLOW** O_3Al_2 **DO NOT ALLOW** Al^2O^3
	(b)		Teacher is wrong / student is right (no mark) **Any one from:** Formula should be $Mg(NO_3)_2$ ✓ Idea that charges do not balance as Mg ion is 2+ and NO_3 is 1- ✓ The ratio of ions is 1:2 ($Mg:NO_3$) ✓	1	3.1b	**Mark is for explanation –** Who is right or wrong can be implied in response. **ALLOW** $MgNO_3$ would be charged (+)
	(c)	(i)	Al_2S_3 + **6**HCl → **2**$AlCl_3$ + **3**H_2S ✓	1	2.1	**ALLOW** correct multiples
		(ii)	(H_2S) is a gas ✓	1	2.1	**ALLOW 'g'**

Question			Answer	Marks	AO element	Guidance
13	(a)	(i)	Labelled arrow (activation energy /A) from 1100 to 1600 ✓ 	1	2.1	**ALLOW** +/- 1 small square **ALLOW** label of E_A for activation energy
		(ii)	Labelled arrow (energy change /E) from 1100 to 520 ✓ 	1	2.1	**ALLOW** +/- 1 small square

Question			Answer	Marks	AO element	Guidance
13	(b)		Bond breaking is endothermic / takes in energy **AND** bond making is exothermic / gives out energy. ✓ More energy is given out (in bond making) than is taken in (in bond breaking) ✓	**2**	2 x 1.1	**ALLOW** bond breaking absorbs energy or heat **ALLOW** bond making releases energy or heat **IGNORE** references to different numbers of bonds, e.g. more bonds made than broken **DO NOT ALLOW** references to intermolecular bonds **ALLOW** exothermic reactions give out energy or heat / temperature rises / reactants have more energy than products ✓ **if no other mark awarded**
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = - 486 KJ/mol award 3 marks** (2 x 436) + 498 = 1370 ✓ 4 x 464 = 1856 ✓ 1370 – 1856 = - 486 KJ/mol ✓	**3**	3 x 2.2	**ALLOW** (2 x 436) + 498 – (4 x 464) for 2 marks

Question			Answer	Marks	AO element	Guidance
14	(a)		Salt **AND** water **AND** carbon dioxide ✓	**1**	1.1	**ALLOW** in any order
	(b)		To measure pH / to tell when the acid is neutralised ✓	**1**	1.2	**ALLOW** to see if it is acid or alkaline
	(c)		1×10^{-1}/ 0.1 (mol/dm^3) ✓	**1**	2.2	
	(d)	(i)	3.7 ✓	**1**	2.2	**ALLOW** 8.9 to 12.6 – must state both lowest and highest value **ALLOW** 1.6 if anomaly is missed out of the range / 11.0 to 12.6
	(d)	(ii)	**Any two from:** Identifies result **6** as anomalous for one or both acids ✓ Identifies result **2** as anomalous to a **lesser extent** for one or both acids ✓ Idea that the majority of the results (1,3,4 and 5) are repeatable ✓	**2**	2 x 3.1b	**IGNORE** suggested improvements to the method

Question			Answer	Marks	AO element	Guidance
15*			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Correctly analyses the information to choose C for the storage box and explains all relevant properties linked to this polymer. **AND** Applies knowledge and understanding by relating the relative flexibility of polymer A **AND** B/C to their structure. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Correctly analyses the information to choose C for the storage box and explains more than one reason for the choice of polymer based on properties. **AND** Applies knowledge and understanding by relating the relative flexibility of either polymer A **OR** B/C to its structure. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Correctly analyses the information to choose polymer B or C for the storage box and justifies choice based on property. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	**6**	2 x2.1 2 x 3.2a 2 x 3.2b	**AO2.1 Applies of knowledge and understanding of polymer structure.** • A is flexible because it has weak intermolecular forces between polymer chains, so the polymer chains can slide over each other • B and C are rigid because they have strong covalent bonds / crosslinks between the polymer chains which require a large amount of energy to break **AO3.2a / AO3.2b** **Analyses of information about polymers to make judgements and draw conclusions about which polymer is best for the storage box.** Indicative scientific points may include: Polymer C is used for making storage boxes because: • it has a relatively low density, o so isn't heavy to lift / lightweight • it is strong, o so will not break easily / can carry heavy loads • it is rigid, o so will not bend / cannot be squashed **Level 1 only** Polymer B could be used for making storage boxes because: • it is rigid.

Question			Answer	Marks	AO element	Guidance
16	(a)		Weak intermolecular forces / weak forces **between** molecules ✓ Idea that only need a small amount of energy to break these forces ✓	**2**	2 x2.1	**DO NOT ALLOW** reference to covalent bonds in incorrect context or references to ions
	(b)		2 shared pairs of electrons between carbon and one oxygen atom ✓ Rest of structure correct ✓	**2**	2 x2.1	Inner electrons not required but must be correct if shown. **ALLOW** all dot, all crosses or mixture of dots and crosses. 
	(c)		**Any two from:** Transfer of electrons from metals to non-metals ✓ Metals form positive ions and non-metals form negative ions ✓ Electrostatic forces / attraction between oppositely charged ions✓	**2**	2 x1.1	

Question			Answer	Marks	AO element	Guidance
17	(a)		**Any four from:** Idea that most particles went straight through without being deflected ✓ Most of the atom is empty space ✓ Idea that a few particles were (slightly) deflected ✓ The nucleus (deflected the alpha particles because it) is positive ✓ Idea that **very** few particles were (greatly) deflected back towards the source✓ Most of the mass is found in the small nucleus. ✓	**4**	4 x1.2	**ALLOW** 'some' as AW for 'few' in this marking point only
	(b)		**Any two from:** can evaluate ideas / check results / can compare results ✓ can share ideas / have different views ✓ so that further evidence can be collected ✓ Idea that scientists provide information to other scientists or public or other organisations ✓ so they can get recognition for their work ✓	**2**	2 x1.1	

Question			Answer	Marks	AO element	Guidance
17	(c)		Electrons shells / electrons orbit /electrons have definite amounts of energy ✓	1	1.1	
18			**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 6.4(g) award 2 marks** 3.84 ÷ 96 = 0.04 moles ✓ 0.04 x 160 = 6.4g ✓ **OR** 96g (of $(NH_4)_2CO_3$) makes 160g (of NH_4NO_3) ✓ 3.84g (of $(NH_4)_2CO_3$) makes 6.4g (of NH_4NO_3) ✓	2	2 x2.2	**ALLOW** 3.84/96 x 80 = 3.2 for 1 mark as this is only 1 mistake i.e. not used stoichiometry in equation.
19			Any **two advantages** from: **A and/or C** shows number and type of atoms ✓ **A and/or C** shows type of bonds ✓ **B and/or C** shows how the atoms are connected in 3D (tetrahedral) ✓ **B** shows the comparative size of the atoms ✓ Any **two disadvantages** from: **A** only 2D ✓ **A and/or C** no indication of size of atoms ✓ **B** does not show number and type of atoms ✓ **B** does not show type of bonds ✓	4	2 x 3.1a 2 x 3.1b	

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