Cambridge Technicals

Applied Science

Unit 1: Science fundamentals

Level 3 Cambridge Technical in Applied Science

05847 - 05849, 05874 & 05879

Mark Scheme for June 2025

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training: OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor

3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 40% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. **Crossed-Out Responses**

Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. There is a NR (**No Response**) option. Award NR (No Response):

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g., 'can't do', 'don't know')
   - OR if there is a mark (e.g., a dash, a question mark) which is not an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:
To determine the level – start at the highest level and work down until you reach the level that matches the answer
To determine the mark within the level, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. **Annotations** available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

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

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
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

13. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

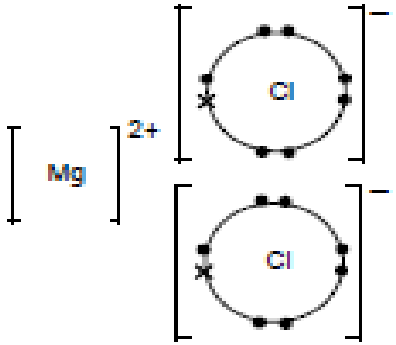
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>Electro magnetic force</th><th>Strong nuclear force</th><th>Weak nuclear force</th></tr>
<tr><td>Keeping nuclei stable</td><td></td><td>✓</td><td></td></tr>
<tr><td>Radioactive decay</td><td></td><td></td><td>✓</td></tr>
<tr><td>Repulsion between protons</td><td>✓</td><td></td><td></td></tr>
<tr><td>Binding protons and neutrons together</td><td></td><td>✓</td><td></td></tr>
</table>
</td><td>4</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>elements ✓
atomic number ✓
periods ✓
groups ✓</td><td>4</td><td></td></tr>
<tr><td></td><td>(c)</td><td></td><td>same number of shells / all have 3 shells / all in period 3 / same period ✓

more protons/ greater atomic number / increasing nuclear / positive charge ✓

greater attraction between nucleus and outer electrons/outer shell ✓</td><td>3</td><td>IGNORE references to number of electrons

ALLOW electromagnetic / electrostatic
ALLOW force / pull = attraction
OWTTE</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>(ionic bonding is the) electrostatic attraction between positive and negative <u>ions</u> ✓</td><td>1</td><td>ALLOW oppositely charged ions

IGNORE references to metals and non-metals
IGNORE references to electron (transfer)</td></tr>
</table>

Question			Answer	Marks	Guidance
		(ii)	Mg shown with either 8 or 0 outer electrons ✓ **Two** Cl shown with 8 electrons with 7 dots and 1 cross (or vice versa) ✓ **Correct charges** on both ions ✓ 	3	**ALLOW** $2[Cl]^-$ (brackets not required) Circles not required **IGNORE** inner electrons **IGNORE** arrows showing electron movement **DO NOT ALLOW** covalent bonding
				15	

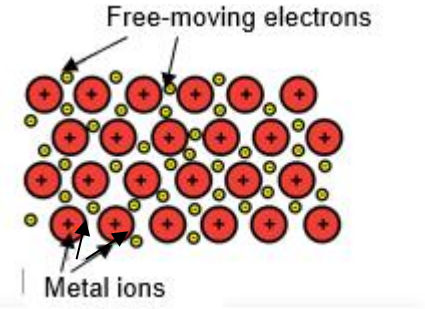
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td>tin > copper > gold ✓</td><td>1</td><td>ALLOW Sn > Cu > Au</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>3Cu + 2AuCl$_3$ → 3CuCl$_2$ + 2Au ✓✓</td><td>2</td><td>ALLOW 1 mark for any numbers which balance at least one of the elements

ALLOW other multiples of 3/2 e.g. 6/4</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>displacement ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iv)</td><td><table><tr><td>Decrease in pressure</td><td></td></tr><tr><td>Decrease in surface area of the metal</td><td></td></tr><tr><td>Increase in light intensity</td><td></td></tr><tr><td>Increase in temperature of the solution</td><td>✓</td></tr></table></td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><table><tr><td>Emulsion</td><td></td></tr><tr><td>Foam</td><td></td></tr><tr><td>Gel</td><td></td></tr><tr><td>Sol</td><td>✓</td></tr></table></td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>solution: (dispersed) particles/solute dissolved in the medium/solvent / smaller particles in a solution ✓

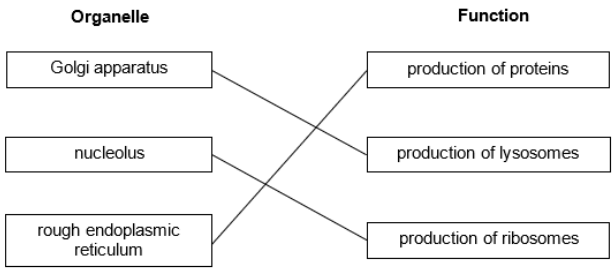
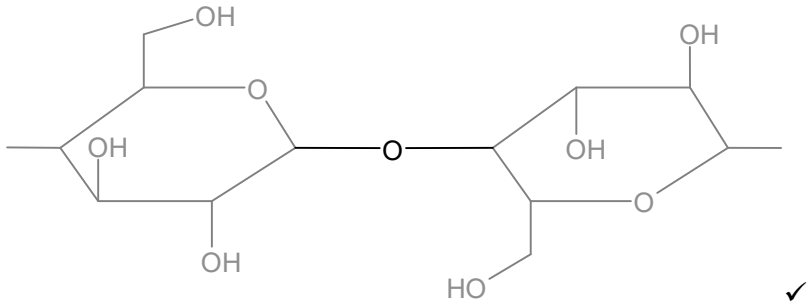
suspension: (dispersed) particles will settle out/separate from the medium / larger particles ✓</td><td>2</td><td>ORA
IGNORE references to solid

ORA

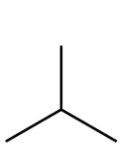
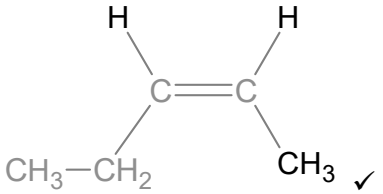
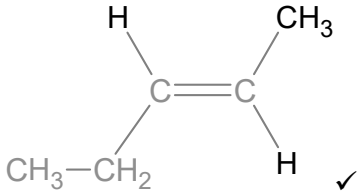
IGNORE descriptions of appearance</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)	(i)	bronze ✓	1	
		(ii)	mercury ✓	1	
		(iii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer for difference in mass of tin = 1.87(g) award 2 marks** **99.3 – 61.9** (= 37.4%) ✓ (37.4 x 5/100 =) 1.87(g) ✓	2	**ALLOW** 1.869… **ALLOW** alternative working **IGNORE** negative sign
	(d)	(i)	**positive** (metal) **ions** arranged in a regular way ✓ delocalised / free-moving electrons ✓	2	OWTTE e.g. rows / layers **ALLOW** a labelled diagram e.g.  **IGNORE** references to atoms / nuclei
		(ii)	disrupts (lattice) structure / different sized atoms in the alloy/solder A ✓ weakens bonding ✓	2	**ORA** throughout **ALLOW** correct reference to values from table in (c)(iii) **IGNORE** unqualified refs. to tin and copper **ALLOW** less energy required to break bonds
			Total	16	

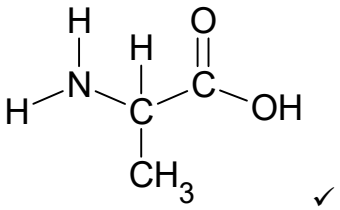
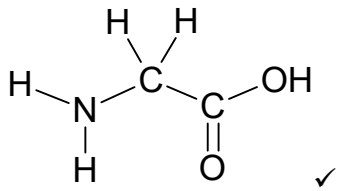
Question			Answer	Marks	Guidance
3	(a)		cofactor ✓	1	
	(b)	(i)	(the reaction is) reversible ✓	1	**ALLOW** e.g. reaction can go either way / equilibrium
		(ii)	oxidation ✓	1	
	(c)	(i)	hydrolase ✓	1	
		(ii)	NH_3 ✓ HCO_3^- ✓	2	**ALLOW** correct coefficients applied throughout **ALLOW** CO_3H^- OR O_3CH^- **DO NOT ALLOW** formula without - charge
	(d)		potassium ✓	1	
	(e)	(i)	**Any one from**: ✓ depression bipolar (affective disorder)	1	**ALLOW** hypertension / memory loss / Alzheimer's
		(ii)	**Any one from**: ✓ interferes with DNA replication/division/multiplication stops mitosis/cell division	1	**IGNORE** unqualified mutating / killing **ALLOW** stops cells growing
			Total	9	

Question			Answer	Marks	Guidance
4	(a)		 ✓✓	2	3 correct lines = 2 marks 1 or 2 correct lines = 1 mark
	(b)	(i)	chloroplast ✓	1	**DO NOT ALLOW** chlorophyll
		(ii)	**Any one from:** ✓ structure shape cell-to-cell adhesion cell protection	1	**ALLOW** support / strength / rigidity
		(iii)	cellulose ✓	1	
		(iv)	 ✓	1	**ALLOW** glycosidic link drawn as non-linear

	(c)	**(i)**	ribosome ✓	**1**	
		(ii)	nucleotide---gene ✓ gene---chromosome ✓	**2**	nucleotide ..... gene .....chromosome = 2 marks (smallest) (largest)
			Total	**9**	

Question			Answer	Marks	Guidance
5	(a)	(i)	butane ✓	1	
		(ii)	 ✓	1	
	(b)	(i)	 ✓  ✓	2	**ALLOW** ONE CH_3 in any one position on **both** isomers = 1 mark **max**. **DO NOT ALLOW** a bond drawn to H of CH_3 **ALLOW** bonds shown **within** CH_3 **ALLOW** completed structures in either order
		(ii)	geometric isomers have 2 different groups attached to each double bonded carbon ✓ pent-1-ene has the same groups / 2H atoms on one carbon of C=C ✓	2	**ALLOW** groups = atoms = functional groups throughout **IGNORE** references to rotation of C=C
	(c)	(i)	methyl propanoate ✓	1	**ALLOW** methyl propionate
		(ii)	**$CH_3CH_2CH_2COOH$** ☐ **$CH_3CH_2COOCH_3$** ✓ **$CH_3COOCH_2CH_3$** ☐ **$HCOOCH_2CH_2CH_3$** ☐	1	

Question			Answer	Marks	Guidance
	(d)		unbranched poly(ethene) ✓ **AND** straighter chain / rows / lines ✓ molecules pack close(r) together ✓	3	**ALLOW** no branches **ALLOW** atoms = particles = molecules throughout **ALLOW** marking points for correct explanation for "branched" = 2 **max**. **IGNORE** uniform arrangement **ALLOW** molecules are tightly packed / less space / more molecules per unit volume/area **IGNORE** references to bonding
			Total	11	

Question			Answer	Marks	Guidance
6	(a)	(i)	squamous ✓	1	
		(ii)	thin small diffusion ✓✓	2	**ALLOW** any clear indication of choice 3 correct responses = 2 marks 2 correct responses = 1 mark 1 or 0 correct responses = 0 marks
	(b)	(i)	elastin ✓ collagen ✓	2	**ALLOW** responses in either order **ALLOW** elastic = elastin **ALLOW** phonetic spelling throughout
		(ii)	 ✓  ✓	2	**ALLOW** structures with or without bonds shown eg $H_2NCH(CH_3)COOH$ H_2NCH_2COOH **ALLOW** completed structures in either order **ALLOW** correct but missing H (left) and OH (right) = 1 mark **max.**
		(iii)	**Any three from:** ✓✓✓ fibres/connective tissue unravel / become loose collagen concentration decreases/no longer maintained elastin concentration/elasticity decreases/no longer maintained epithelial tissue is no longer supported / sags wrinkles develop (in older skin)	3	 **ALLOW** broken / disorganised / weaker OWTTE **ALLOW** in contact with fewer fibres OWTTE **ALLOW** skin becomes loose/fragile OWTTE **IGNORE** references to bruising / injuries
	(c)	(i)	2+ ✓	1	

Question			Answer	Marks	Guidance
		(ii)	myoglobin ✓ muscle (tissue) ✓	2	**ALLOW** phonetic spelling **IGNORE** references to the type of muscle tissue **DO NOT ALLOW** muscle cells
		(iii)	copper ✓ invertebrates ✓	2	**ALLOW** invertebrates
			Total	**15**	

Question			Answer	Marks	Guidance
7			**[Level 3]** Candidate gives a **good** explanation of **stiffness** as a mechanical property of a diving board **AND** gives descriptions of the effects of **most factors** (F to w) on d **OR** an explanation of the effect of t **OR** L on d. ***(5 - 6 marks)*** **[Level 2]** Candidate gives a **basic** explanation of **stiffness** as a mechanical property of a diving board **AND** gives descriptions of the effects of **some factors** (F to w) on d. ***(3 – 4 marks)*** **[Level 1]** Candidate gives a **limited** explanation of **stiffness** as a mechanical property of a diving board **OR** gives simple descriptions of the effect of changing **some factors** (F to w) on d. ***(1 – 2 marks)*** **[Level 0]** Candidate response includes **fewer than two** valid points. ***(0 marks)***	6	Indicative scientific points may include: **Explanation of stiffness** ● resistance to bending e.g. how difficult it is to make the diving board change shape. ● resistance to stress/force without plastic/permanent deformation ● resistance to breaking e.g. how difficult it is to break. ● resistance to fatigue e.g. bounce / be loaded and unloaded many times without damage / last a long time ● allows the board to bounce (up and down) ● allows transfer of (potential) energy ● related to Young's modulus **Simple description of factors:** d/distance increases when ° F/force is increased ° L/length is increased d/distance decreases when ° S/stiffness is increased ° t/thickness is increased ° w/width is increased **Detailed explanation of factors:** ° t is cubed so small changes cause a large decrease in d ° L is cubed so small changes cause a large increase in d **NOTE** maximum **Level 2** if one or more errors in response
			Total	6	

Question			Answer	Marks	Guidance
8	(a)	(i)	R_t = (10 + 50 =) 60 (Ω) ✓	1	
		(ii)	$\frac{1}{R_t} = \frac{1}{60} + \frac{1}{120}$ ✓ (R_t = 40 (Ω))	1	**ALLOW** ecf using **(a)(i)**
	(b)	(i)	(p.d. = 40 x 0.3 =) 12 (V) ✓	1	
		(ii)	(P = 12 x 0.3 =) 3.6 (W) ✓	1	**ALLOW** ecf using **(b)(i)** x 0.3
		(iii)	(Q = 0.3 x 60 =) 18 (C) ✓	1	
		(iv)	**Branch 1** 0.2 (A) ✓ **Branch 2** 0.1 (A) ✓	2	**ALLOW** ecf using voltage in **(b)(i)** ÷ 60 **ALLOW** ecf using voltage in **(b)(i)** ÷ 120
	(c)		R_3 **lower/smaller** cross-sectional area ✓ R_3 has a **smaller** density of charge carriers ✓	2	**ORA** throughout **IGNORE** it is thinner OWTTE
			Total	9	

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