Cambridge Technicals

Applied Science

Unit 1: Science fundamentals

Level 3 Cambridge Technical in Applied Science

05847 - 05849, 05874 & 05879

Mark Scheme for June 2024

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

TRADITIONAL

Before the Standardisation meeting you must mark at least 10 scripts from several centres. For this preliminary marking you should use **pencil** and follow the **mark scheme**. Bring these **marked scripts** to the meeting.

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 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 or by email.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional lined pages 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 an annotation to confirm that the work has been seen.

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 anyway 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 isn't an attempt at the question

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

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

9. **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

10. **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

11. **Subject-specific Marking Instructions**

INTRODUCTION

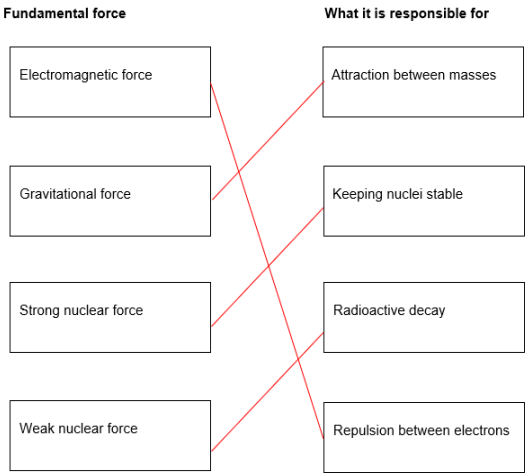
Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

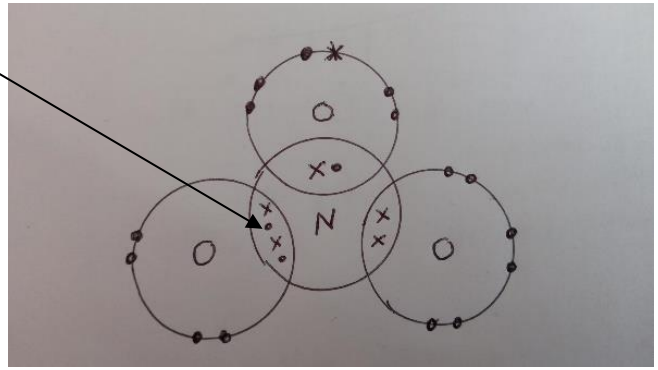
- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

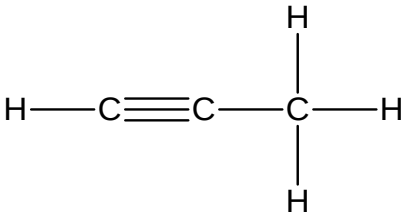
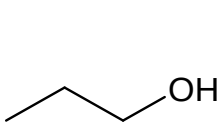
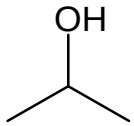
You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New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

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

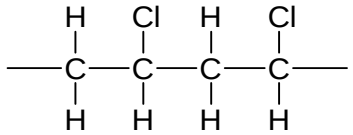
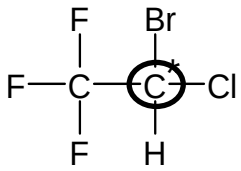
Question			Answer	Marks	Guidance
1	(a)		 ✓✓✓	3	4 correct lines = 3 marks 2 or 3 correct lines = 2 marks 1 correct line = 1 mark
	(b)	(i)	125 ✓	1	
		(ii)	84 ✓	1	
		(iii)	205 ✓ 82 ✓	2	**ALLOW** 82 205
		(iv)	4 ✓ 6 ✓	2	
	(c)	(i)	$Pb(NO_3)_2$ ✓ two **negative/1**$^-$ ions are needed to balance the **2**$^+$ charge (of the lead ion) ✓	2	Mark responses independently **ALLOW** $Pb^{2+}(NO_3^-)_2$

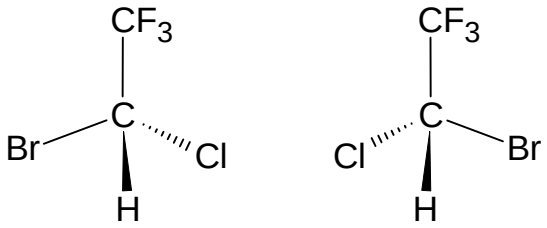
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)</td><td>Pb^{2+} (aq) + 2e$^-$ ✓ → Pb (s) ✓</td><td>2</td><td>DO NOT ALLOW e^{2-}</td></tr>
<tr><td></td><td></td><td>(iii)</td><td><table><tr><th>Type of reaction</th><th></th></tr><tr><td>Addition</td><td></td></tr><tr><td>Displacement</td><td>✓</td></tr><tr><td>Redox</td><td>✓</td></tr><tr><td>Substitution</td><td></td></tr></table>✓</td><td>1</td><td>ALLOW only 2 correct ticks = 1 mark</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>2 dots AND
2 crosses ✓
  </td><td>1</td><td>ALLOW any arrangement of two dots and two crosses if located within the overlap.</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Dative OR coordinate (covalent bond)✓</td><td>1</td><td>ALLOW phonetic spelling</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>16</td><td></td></tr>
</table>

<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></td><td>
<table>
<tr><th>Change</th><th>Decrease</th><th>No change</th><th>Increase</th></tr>
<tr><td>Activation Energy</td><td>✓</td><td></td><td></td></tr>
<tr><td>Rate of Reaction</td><td></td><td></td><td>✓</td></tr>
<tr><td>Yield of polyethene</td><td></td><td>✓</td><td></td></tr>
</table>
</td><td>3</td><td>ALLOW only 1 mark per correct row</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Aluminium✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any one from: ✓
• (Less) flexible / more rigid
• (Less) malleable
• Harder
• Tougher
• (More) durable</td><td>1</td><td>IGNORE references to strength / cost / corrosion / weight / brittleness</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any three from: ✓✓✓
• the nails have a greater surface area
• more particles / surface exposed (to the air/water)
• more collisions between particles
• increased rate of reaction</td><td>3</td><td>ALLOW only qualified references to “it” or “they”
ALLOW ORA throughout
OWTTE
ALLOW “speeds up” = rate</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
3	(a)	(i)	C_3H_8 ✓	1	
		(ii)	$CHCCH_3$ / $HCCCH_3$ / H_3CCCH / CH_3CCH **OR**  ✓✓	2	**ALLOW** 2 marks for $HC{\equiv}C\text{-}CH_3$ **ALLOW** 1 mark for **triple bond** / C≡C shown in the structure (as an independent marking point)
		(iii)	 **OR**  ✓✓	2	**ALLOW** 1 mark for **OH** group shown in the structure in any location (as an independent marking point) **ALLOW** inverse presentations
		(iv)	Propanone / acetone ✓	1	**ALLOW** Propan-2-one
	(b)	(i)	$C_3H_4O_2$ ✓	1	**DO NOT ALLOW** multiples even if correct **IGNORE** () *n*
		(ii)	Storage of molecules needed in respiration ✓	1	

Question			Answer	Marks	Guidance
		(iii)	**Any three from:** **glycogen** • produced / found in humans/animals/liver/muscles • stored (only) in cytoplasm • (more) branched / compact • smaller (than starch) • soluble **starch** • produced / found in plants • can be stored in chloroplasts • consists of amylose and amylopectin / two different polymers / contains a spiral or helix (component) • insoluble ✓✓✓	3	**ALLOW** stored ORA
		(iv)	**Any three from:** • condensation reaction • monomers combine / join together / form bonds • with the elimination of water • (original) monomers had (adjacent) O-H groups ✓✓✓	3	**ALLOW** water is produced / lost
			Total	**14**	

Question			Answer	Marks	Guidance
4	(a)		$-CH_2CHClCH_2CHCl-$ / $-CH_2-CHCl-CH_2-CHCl-$ **OR**  ✓✓	2	Two correct units shown = 2 marks **ALLOW** 1 mark **max.** for any of the following: • one correct unit shown • terminal hydrogens shown • no terminal bonds **ALLOW** Cl atoms pointing either up or down on chain **ALLOW** Cl atoms on carbons 1 and 3, or Cl atoms on carbons 2 and 3 **IGNORE** ()*n*
4	(b)	(i)	A chiral centre is a **carbon** (atom) with four **different** groups / atoms attached to it.	1	OWTTE
		(ii)	 ✓	1	

Question			Answer	Marks	Guidance
		(iii)	 ✓✓	2	4 correct components on **either** molecule (as shown in the adjacent example) = 1 mark **ALLOW** only if bond is draw to C of CF_3 Correct isomer /vertical mirror image for any combination of components = 1 mark
	(c)	(i)	ultraviolet / UV (light/radiation) ✓	**1**	**IGNORE** references to temperature
		(ii)	**X** = ClO• ✓ **Y** = $\underline{O_2}$ ✓	2	**ALLOW** •ClO / •OCl / OCl• **DO NOT ALLOW** oxygen
		(iii)	**Equation 2** show that a chlorine free radical / Cl• is produced/released (into the atmosphere) ✓ (The chlorine free radical / Cl•) can become a reactant in **Equation 1** again ✓	2	**ALLOW** chlorine free radical / Cl• is regenerated / acts as a catalyst OWTTE **ALLOW** 1 mark for: causes a chain reaction OWTTE
			Total	**11**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td>Plasmid ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Chloroplast ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>movement / locomotion ✓
sperm cell ✓</td><td>2</td><td>ALLOW swimming
IGNORE references to ciliated cells (e.g. tracheal / oviduct wall)</td></tr>
<tr><td></td><td></td><td>(iv)</td><td>Any one from:
• (DNA located in) nucleus of eukaryotic cells
• found freely in the cytoplasm of prokaryotic cells
• forms chromatin/chromosomes in eukaryotic cells
• forms a DNA loop / plasmids in prokaryotic cells
✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Phospholipid ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th>Region D</th><th>Region E</th><th></th></tr><tr><td>hydrophilic</td><td>hydrophilic</td><td></td></tr><tr><td>hydrophilic</td><td>hydrophobic</td><td>✓</td></tr><tr><td>hydrophobic</td><td>hydrophilic</td><td></td></tr><tr><td>hydrophobic</td><td>hydrophobic</td><td></td></tr></table>✓</td><td>1</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
		(iii)	**Any two from:** ✓✓ • receptor site / binding with other molecules • cross-linking / adhesion between cells • cell-to-cell / molecule recognition	2	**ALLOW** connection between plasma membranes
		(iv)	**A** = O_2 **B** = Na^+ **C** = $C_6H_{12}O_6$ ✓✓	2	3 correct responses = 2 marks 1 or 2 correct responses = 1 mark **ALLOW** oxygen, sodium or glucose
		(v)	**Any three from:** ✓✓✓ • Na^+ ions leave the cell • K^+ ions enter the cell • (Na^+ / K^+ ion) pump operates • ATP used to drive pump / channel • (net flow of) water enters the cell • (by) osmosis	3	**ALLOW** Na+ ion concentration (in the cell) would need to decrease **ALLOW** balance of water **IGNORE** references to diffusion
			Total	**14**	

Question			Answer	Marks	Guidance
6	(a)		bone ✓ muscle ✓ nerve ✓	3	**ALLOW** responses only in correct order
	(b)	(i)	Suspension ✓	1	
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer for mass of magnesium hydroxide = 1050 (mg) award 2 marks** • Mass magnesium hydroxide needed to neutralise 60 cm^3 acid = 5 x 84 mg = **420** (mg) ✓ • Mass needed to neutralise 150 cm^3 acid = $\frac{150}{60} \times 420$ $= 1050\ (\text{mg})$✓	2	**ALLOW** alternative method • Volume required = $\frac{150}{60}$ x 5 = **12.5** (cm^3) • Mass of $Mg(OH)_2$ in this volume = 84 x 12.5 = 1050 (mg)
		(iii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer for number of doses = 12 award 2 marks** $5.04g = 5040mg$ ✓ Number of doses = $\frac{5040}{420}$ = 12 ✓	2	**ALLOW** 5 x 84mg = 420mg **OR** ecf for 420(mg) equivalent from **b(ii)** for 1 mark **max.**

Question			Answer	Marks	Guidance
	(c)	**(i)**	Ca^{2+} ✓	1	
		(ii)	**Any one from:** ✓ • carbon dioxide is, not toxic/harmful / safe/harmless (to the human body) • carbon dioxide does **not** react (with the human body) / break down the (alginate) barrier	1	**ALLOW** carbon dioxide enters body naturally / is inhaled / released by cells
	(d)		$BaSO_4$ ✓ **AND** **Any one from:** ✓ • least soluble / lowest solubility value • barium ions will not be absorbed into the blood stream	2	**ALLOW** barium sulfate/sulphate **ALLOW** (compound with solubility of) 2.4×10^{-4} **ALLOW** 1 mark for correct explanation, even if incorrect compound given ORA **ALLOW** will not dissolve / will not react **IGNORE** references to toxicity
			Total	**12**	

Question			Answer	Marks	Guidance
7			**[Level 3]** Candidate shows a high level of understanding of the phase diagram including the significance of T_1/T_2 and point X **AND** explains the effect of increasing P **AND** explains why carbon dioxide sublimes. (5 – 6 marks) **[Level 2]** Candidate shows some understanding of the phase diagram including the significance of T_1/T_2 and point X **AND EITHER** explains the effect of increasing P **OR** explains why carbon dioxide sublimes. (3 – 4 marks) **[Level 1]** Candidate shows a basic understanding of the phase diagram including **EITHER** the significance of T_1/T_2 **OR** point X **OR** explains the effect of increasing P **OR** explains why carbon dioxide sublimes. (1 – 2 marks) **[Level 0]** Candidate includes fewer than two valid points. (0 marks)	6	Valid points include: **Significance of points on graph (ignore references to carbon dioxide)** • • T_1 is the melting point • at T_1 solid and liquid both present / in equilibrium • melting is solid to liquid • T_2 is the boiling/vaporisation point • at T_2 liquid and gas both present / in equilibrium • boiling/vaporisation is liquid to gas • at T_1 / T_2 bonds/forces broken • X is the triple point • triple point / X is where solid, liquid and gas are in equilibrium / all present **Effect of pressure of vaporisation point of Z O** • vaporisation/boiling is liquid to gas • the temperature at which **Z** vaporises/boils increases as P is increased • vaporisation occurs (at values of T and P) along the line separating liquid from gas • as P (or T) is increased, a higher T (or P) is needed for the line to be reached / vaporisation to occur • P increases at a faster rate than T along the line / gradient increases **Why carbon dioxide sublimes O** • triple point/X pressure is above 1atm • triple point/X temperature is below room temperature. • sublimation is solid to gas / does not pass through liquid phase
			Total	**6**	

Question			Answer	Marks	Guidance
8	(a)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer for P = 0.35 and unit = W award 2 marks** P = 2.5 x 0.14 = 0.35 ✓ W ✓	2	 **ALLOW** Watts
		(ii)	4.5 – 2.5 (= 2.0V) ✓	1	**ALLOW** alternative based on V=IR 0.14 x 10 = 1.4V
		(iii)	R= 2.5/0.14 = 17.857 ✓ R total = 17.857 **+ 10** = 27.857 (≈ 28Ω) ✓	2	 **ALLOW** ecf **+ 10** = 1 mark **max.**
		(iv)	I = 4.5/28 = 0.16 ✓	1	**ALLOW** 0.161 / 0.162
	(b)		**Any three from:** ✓✓✓ • calculated current is higher than measured (current) • (internal) resistance of supply • resistance of wires • resistance of connectors • increased resistance (of components) due to heating	3	 ORA **ALLOW** actual resistance of circuit is higher (than calculated) for 1 mark **max.**
			Total	**9**	

Need to get in touch?

If you ever have any questions about OCR qualifications or services (including administration, logistics and teaching) please feel free to get in touch with our customer support centre.

Call us on

01223 553998

Alternatively, you can email us on

support@ocr.org.uk

For more information visit

ocr.org.uk/qualifications/resource-finder

ocr.org.uk

Twitter/ocrexams

/ocrexams

/company/ocr

/ocrexams

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT

OCR is part of Cambridge University Press & Assessment, a department of the University of Cambridge.

OCR operates academic and vocational qualifications regulated by Ofqual, Qualifications Wales and CCEA as listed in their qualifications registers including A Levels, GCSEs, Cambridge Technicals and Cambridge Nationals.

OCR provides resources to help you deliver our qualifications. These resources do not represent any particular teaching method we expect you to use. We update our resources regularly and aim to make sure content is accurate but please check the OCR website so that you have the most up-to-date version. OCR cannot be held responsible for any errors or omissions in these resources.

Though we make every effort to check our resources, there may be contradictions between published support and the specification, so it is important that you always use information in the latest specification. We indicate any specification changes within the document itself, change the version number and provide a summary of the changes. If you do notice a discrepancy between the specification and a resource, please contact us.

Whether you already offer OCR qualifications, are new to OCR or are thinking about switching, you can request more information using our Expression of Interest form.

Please get in touch if you want to discuss the accessibility of resources we offer to support you in delivering our qualifications.