



Oxford Cambridge and RSA

# **Cambridge Technicals Applied Science**

## **Unit 1: Science Fundamentals**

Level 3 Cambridge Technical in Applied Science  
**05847 - 05849/05874/05879**

## **Mark Scheme for June 2019**

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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.

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Annotations available in RM Assessor

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

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

<b>Annotation</b>	<b>Meaning</b>
/	alternative and acceptable answers for the same marking point
<b>DO NOT ALLOW</b>	Answers which are not worthy of credit
<b>IGNORE</b>	Statements which are irrelevant
<b>ALLOW</b>	Answers that can be accepted
( )	Words which are not essential to gain credit
<u>—</u>	Underlined words must be present in answer to score a mark
<b>ECF</b>	Error carried forward
<b>AW</b>	Alternative wording
<b>ORA</b>	Or reverse argument

**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**.

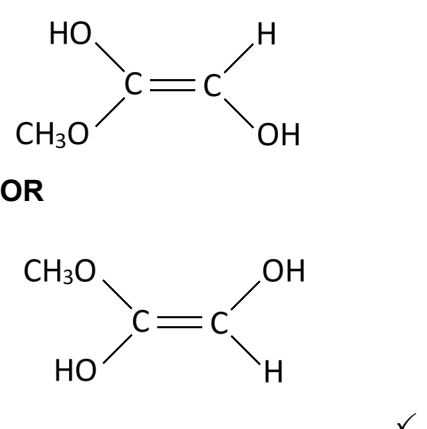
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question		Answer	Marks	Guidance
1	(a)	-1 ✓ proton <b>AND</b> 1 ✓ neutron <b>AND</b> 0 ✓	3	One mark for each correct row.
	(b) (i)	Mass number = 130 ✓ Atomic number = 52 ✓	2	
	(ii)	52 ✓ 6 ✓ shell / energy level ✓	3	<b>ALLOW</b> shells
	(iii)	ionic ✓	1	
	(iv)	K <sub>2</sub> Te 1 mark for using K and Te ✓ 1 mark for correct formula ✓	2	<b>ALLOW</b> 1 mark for both correct symbols <b>MUST</b> use correct case for symbols <b>ALLOW</b> TeK <sub>2</sub> = 1 max.
	(c) (i)	Iodine has more protons ✓ Outer electrons are in the same main shell/energy level ✓ Greater force of attraction between outer electrons and nucleus ✓	3	<b>ALLOW</b> iodine has a higher proton number/ atomic number (than antimony/Sb) <b>DO NOT ALLOW</b> iodine has a greater mass number
	(ii)	<b>weak</b> (nuclear) force	1	<b>DO NOT ALLOW</b> electromagnetic
<b>Total</b>			<b>15</b>	

Question			Answer	Marks	Guidance
2	(a)	(i)	Alloy ✓	1	<b>DO NOT ALLOW</b> composite
		(ii)	Carbon atoms, disrupt regular arrangement of / are between layers/gaps of, iron atoms ✓  Iron atoms cannot slide over each other ✓	2	<b>ALLOW</b> a correctly annotated diagram. <b>DO NOT ALLOW</b> molecules = atoms (apply to mp1 or mp2, not to both) <b>ALLOW</b> particles = atoms
	(b)	(i)	<b>Time</b> how long / how long it takes ✓  named <b>change</b> to occur e.g. volume of gas to be collected <b>OR</b> number of bubbles produced <b>OR</b> fizzing to stop <b>OR</b> nail to dissolve <b>OR</b> total mass to stop falling ✓	2	<b>ALLOW</b> any sensible method  <b>ALLOW</b> record values per unit time / determine gradient of curve generated ✓
		(ii)	surface area ✓  more frequent ✓  increases ✓	3	
		(iii)	Iron/Fe is oxidised ✓  H <sup>+</sup> is reduced ✓  Iron/Fe gives electrons to H <sup>+</sup> /hydrogen <b>ion</b> <b>OR</b> iron/Fe loses electrons and H <sup>+</sup> / hydrogen <b>ion</b> gains electrons ✓	3	<b>IGNORE</b> refs. to oxidation/reduction  <b>ALLOW</b> hydrogen = H <sup>+</sup>  <b>DO NOT ALLOW</b> iron ions

Question	Answer	Marks	Guidance
(c)	Fe <sup>2+</sup> ion is, in centre of /part of/ attached to, haemoglobin molecule / haem (group) ✓  Oxygen molecule binds/attracted to the Fe <sup>2+</sup> ✓	2	<b>ALLOW</b> iron = Fe <sup>2+</sup>  <b>IGNORE</b> ref. to red blood cells  <b>ALLOW</b> haemoglobin = Fe <sup>2+</sup> only if 1 mp is correct
<b>Total</b>		<b>13</b>	



Question	Answer	Marks	Guidance
3 (a)	Alcohol ✓	1	
(b) (i)	Addition ✓ 2 molecules/reactants have combined to form 1 molecule/product ✓	2	<b>ALLOW</b> correctly named molecules
(ii)	Substitution ✓ Cl has been replaced by OH in the molecule ✓	2	<b>DO NOT ALLOW</b> functional group = Cl
(iii)	<b>Radical</b> reaction ✓ The equation shows a radical chlorine atom / chlorine atom has an unpaired electron <b>OR</b> a radical species is produced / dot indicates radical ✓	2	
(c) (i)	There are four different groups attached to one carbon atom ✓	1	<b>FIRST</b> tick box = correct response
(ii)		1	

Question	Answer	Marks	Guidance
(d)	<p style="text-align: center;">OR</p> <p style="text-align: right;">✓</p>	1	<b>ALLOW</b> CH <sub>3</sub> as alternative methyl group
(e) (i)	CH ✓	1	<b>DO NOT ALLOW</b> multiples of CH eg. C <sub>8</sub> H <sub>8</sub> .
(ii)	<p style="text-align: center;">Colloidal foam component                      State of matter</p> <p style="text-align: right;">✓✓</p>	2	

Question	Answer	Marks	Guidance
(f)	<p><b>CARBON</b> Any three from:</p> <p>Carbon makes 4 (covalent) bonds ✓</p> <p>Carbon can form double and triple bonds with other carbon atoms ✓</p> <p>It means that it can break one of the bonds and add more atoms ✓</p> <p>It means that it can form long / continuous chains of carbon atoms (to form polymers) ✓</p> <p><b>OXYGEN/HYDROGEN</b></p> <p>Oxygen can only form 2 (covalent) bonds / hydrogen can only form 1 bond ✓</p> <p>Oxygen / hydrogen will only make small molecules with itself or other atoms ✓</p>	4	<b>DO NOT ALLOW</b> links = bonds
<b>Total</b>		<b>17</b>	

Question		Answer	Marks	Guidance												
4	(a) (i)	<p>Any two from:</p> <p>Nucleus ✓</p> <p>Vacuole ✓</p> <p>Mitochondria ✓</p> <p>Golgi apparatus ✓</p> <p>Endoplasmic reticulum / ER ✓</p> <p>Lysosome ✓</p> <p>Membrane-bound organelle ✓</p>	2	<b>ALLOW</b> chloroplast												
	(ii)	Protein ✓	1													
	(iii)	<table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>RNA usually has a single strand polynucleotide chain</td> <td>✓</td> <td></td> </tr> <tr> <td>RNA has a ribose sugar in its structure</td> <td>✓</td> <td></td> </tr> <tr> <td>The nitrogenous base in RNA is thymine</td> <td></td> <td>✓</td> </tr> </tbody> </table>	Statement	True	False	RNA usually has a single strand polynucleotide chain	✓		RNA has a ribose sugar in its structure	✓		The nitrogenous base in RNA is thymine		✓	3	
Statement	True	False														
RNA usually has a single strand polynucleotide chain	✓															
RNA has a ribose sugar in its structure	✓															
The nitrogenous base in RNA is thymine		✓														
	(b) (i)	Chloroplast ✓	1													
	(ii)	Photosynthesis ✓	1													
	(iii)	Manganese (ion) / $Mn^{2+}$ ✓	1	<b>ALLOW</b> Mn												

Question		Answer	Marks	Guidance
(c)	(i)	<p><b>Any three from:</b></p> <p>Controls/regulates the movement of substances in/out of the cell ✓</p> <p>Semi-permeable ✓</p> <p>Acts as an interface/barrier ✓</p> <p>Involved with cell-to-cell recognition ✓</p> <p>Cell signalling ✓</p> <p>Contains receptor molecules ✓</p> <p>Anchor cytoskeleton ✓</p>	3	<p><b>ALLOW</b> any correct description of plasma membrane function.</p> <p><b>IGNORE</b> details of proteins/phospholipids</p> <p><b>DO NOT ALLOW</b> monitors/allows</p> <p><b>ALLOW</b> any correctly named substance</p> <p><b>ALLOW</b> active transport/diffusion</p> <p><b>DO NOT ALLOW</b> holds cell together/keeps contents in place</p>
	(ii)	<p>A = phosphate ✓</p> <p>B = glycerol ✓</p> <p>C = fatty acid ✓</p>	3	

Question		Answer	Marks	Guidance												
	(d) (i)	support/protection/structure/shape (of the cell) ✓	1													
	(ii)	<table border="1"> <thead> <tr> <th>Statement</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>Cellulose is a polysaccharide.</td> <td>✓</td> <td></td> </tr> <tr> <td>Cellulose contains microfibrils which form cross-links.</td> <td>✓</td> <td></td> </tr> <tr> <td>The tightly-packed chains found in cellulose are easily separated.</td> <td></td> <td>✓</td> </tr> </tbody> </table> <p style="text-align: right;">✓✓</p>	Statement	True	False	Cellulose is a polysaccharide.	✓		Cellulose contains microfibrils which form cross-links.	✓		The tightly-packed chains found in cellulose are easily separated.		✓	2	3 correct responses = 2 marks 1 or 2 correct responses = 1 mark
Statement	True	False														
Cellulose is a polysaccharide.	✓															
Cellulose contains microfibrils which form cross-links.	✓															
The tightly-packed chains found in cellulose are easily separated.		✓														
<b>Total</b>			<b>18</b>													



Question			Answer	Marks	Guidance
		(ii)	B, (D), E, A, (F), C ✓✓✓✓	4	
<b>Total</b>				<b>12</b>	



Question	Answer	Marks	Guidance
6	<p><b>[Level 3]</b> Candidate has a high level of understanding of mechanical properties. Candidate also makes detailed comparisons <b>AND</b> calculates the Young's Modulus. <i>(5 - 6 marks)</i></p> <p><b>[Level 2]</b> Candidate shows a good understanding of mechanical properties. Candidate also makes both simple and detailed comparisons <b>AND/OR</b> calculates the Young's Modulus. <i>(3 - 4 marks)</i></p> <p><b>[Level 1]</b> Candidate has some understanding of mechanical properties. Candidate also makes simple comparisons with little evidence of a logical order <b>OR</b> calculates the Young's Modulus. <i>(1 - 2 marks)</i></p> <p><b>[Level 0]</b> Candidate includes <b>fewer than two</b> valid points. <i>(0 marks)</i></p>	6	<p><b>Valid points:</b></p> <p><b>Calculates Young's Modulus</b></p> <ul style="list-style-type: none"> <li>• <math>1.6 \times 10^8 \div 0.01 = 1.6 \times 10^{10} \text{ N/m}^2</math></li> </ul> <p><b>Detailed comparisons</b></p> <ul style="list-style-type: none"> <li>• steel has greatest elastic limit / strength / Young's Modulus</li> <li>• glass is brittle / has brittle failure</li> <li>• steel and plastic are ductile (linked to plastic behaviour)</li> <li>• steel stiffness/strength decreases after plastic deformation</li> <li>• all initially show elastic behaviour and will return to their original length if their elastic limit is not exceeded.</li> </ul> <p><b>Simple comparisons</b></p> <ul style="list-style-type: none"> <li>• steel is strongest/most stress</li> <li>• steel has least strain</li> <li>• glass has intermediate stress in relation to steel/plastic</li> <li>• glass has intermediate strain in relation to steel/plastic</li> <li>• plastic is weakest/lowest stress</li> <li>• plastic has most strain</li> </ul> <p><b>General description of graph</b></p> <ul style="list-style-type: none"> <li>• <b>ALLOW</b> stress = force, strain = stretching</li> <li>• increased stress - little strain (initially) in steel</li> <li>• followed by increase in strain for less stress in steel</li> <li>• increased stress - some strain (more than steel) initially in glass</li> <li>• followed by sudden decrease in stress for little change in strain in glass</li> <li>• increased stress linked to greatest increase in strain in plastic</li> <li>• followed by sudden decrease in stress for little change in plastic</li> </ul>
	<b>Total</b>	<b>6</b>	

Question			Answer	Marks	Guidance
7	(a)	(i)	<p><b>FIRST CHECK ANSWER ON THE ANSWER LINE</b>  <b>If answer = <math>3.7 \times 10^{-7} \text{ ms}^{-1}</math> award 4 marks</b></p> <p><math>v = I \div nAq</math> <b>OR</b> <math>5 \div (8.5 \times 10^{28} \times 1 \times 10^{-3} \times 1.6 \times 10^{-19})</math> ✓</p> <p>= <math>3.676\dots \times 10^{-7}</math> ✓</p> <p>= <math>3.7 \times 10^{-7}</math> (2 sf) ✓</p> <p>Units: <math>\text{ms}^{-1}</math> ✓</p>	4	<p><b>ALLOW</b> <math>5 \div 13600000</math></p> <p><b>ALLOW</b> <math>\text{m/s} = \text{ms}^{-1}</math></p>
		(ii)	<p><b>FIRST CHECK ANSWER ON THE ANSWER LINE</b>  <b>If answer = <math>1.72</math> (or <math>1.7</math>) <math>\times 10^{-4} \Omega</math> award 3 marks</b></p> <p><math>(R =) 8.6 \times 10^{-4} \div 5.0</math> ✓</p> <p>= <math>1.72 \times 10^{-4}</math> ✓</p> <p>Units: <math>\Omega</math> ✓</p>	3	<p><b>ALLOW</b> <math>1.7 \times 10^{-4}</math></p> <p><b>ALLOW</b> ohms = <math>\Omega</math> (must be correct spelling)</p>
	(b)		<p>density of <b>charge</b> carriers/particles/electrons is less <b>OR</b>  number of <b>charge</b> carriers/particles/electrons per unit volume is less ✓</p> <p>so current is less <b>AND</b> resistance is more ✓</p>	2	<p>OWTTE  <b>ALLOW</b> free electrons  <b>DO NOT ALLOW</b> unqualified electrons</p>
<b>Total</b>				<b>9</b>	

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