OCR
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 January 2019

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.

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

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

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:

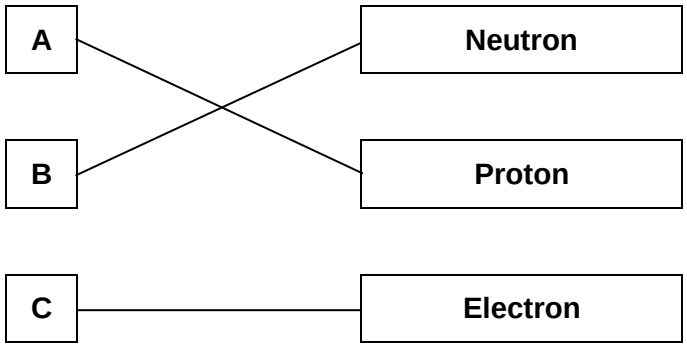
- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

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)		7✓	1	
	(b)		covalent ✓ shared electrons ✓	2	
	(c)	(i)	(nuclei contain) protons ✓ (protons) repel / repulsion ✓	2	**IGNORE** strong nuclear and nuclear forces
		(ii)	Nitrogen ✓	1	
	(d)	(i)	Magnesium ✓	1	
		(ii)	isotope ✓ (weighted) <u>average</u> mass / nucleon number ✓	2	**DO NOT ALLOW** weight = mass **IGNORE** mean/mode
	(e)	(i)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 23 award 3 marks** $(3.55 \times 10^{-15} \div 1.25 \times 10^{-15})^3$ **OR** $(3.55 \times 10^{-15})^3 \div (1.25 \times 10^{-15})^3$ **OR** $(3.55 \div 1.25)^3$ **OR** $(2.84)^3$ ✓ = 22.9 ✓ = 23 (nearest whole number) ✓	3	
		(ii)	e^- / e ✓	1	

Question			Answer	Marks	Guidance
	(f)	(i)	atomic radius decreases ✓	1	**ALLOW** gets less/smaller
		(ii)	(outer) electrons are in same shell / (outer) electrons experience similar or same shielding / same number of shells / same energy level ✓ greater nuclear attraction on (outer) electrons or shells / (Outer) electrons or shells are attracted more strongly to the nucleus ✓	2	
	(g)		 ✓ ✓ ✓	3	
			Total	19	

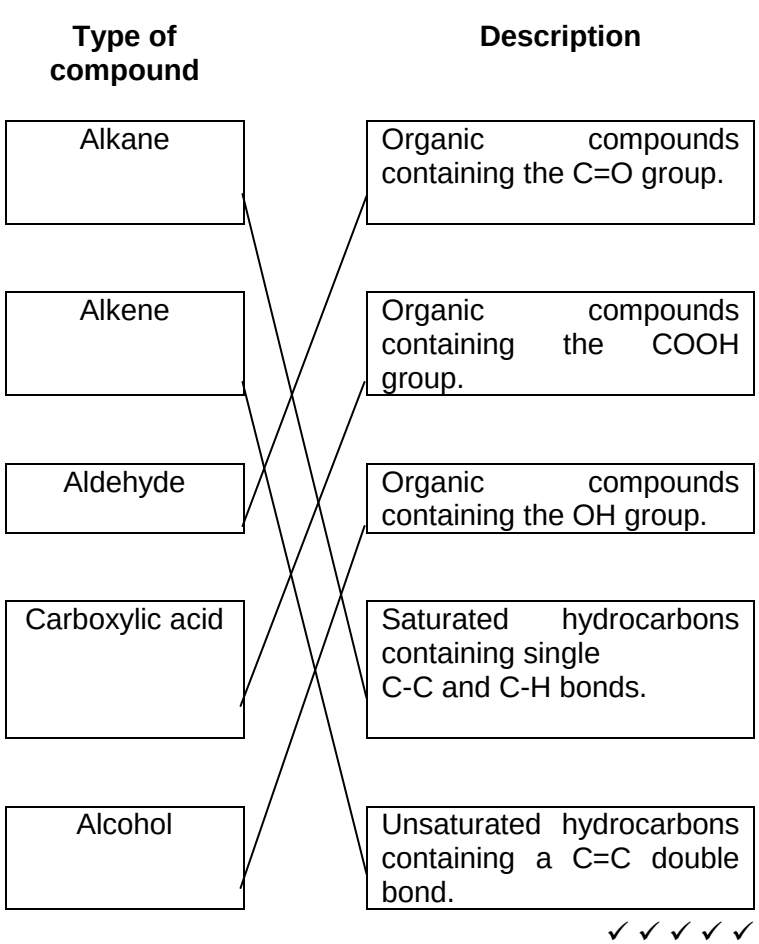
Question			Answer	Marks	Guidance
2	(a)		faster ✓ kinetic ✓ increases ✓	3	
	(b)	(i)	catalyst ✓	1	
		(ii)	**Any four from:** both curves/reactants start at same point / energy level ✓ both curves increase as the reaction progresses ✓ activation energy /peak is lower with enzyme / enzymes lower the activation energy ✓ peaks coincide ✓ both curves then decline ✓ energy level of the products (for both curves) the same ✓ product energy is less than reactant energy ✓	4	**IGNORE** explanations **ORA** **DO NOT ALLOW** products formed more quickly with enzyme
		(iii)	**Any two from:** number/concentration of reactants used up ✓ number/concentration of products generated ✓ measure the energy level of the reactants/products ✓	2	**ALLOW** named reactant or product **ONLY** if with qualified reaction e.g. respiration/photosynthesis
	(c)		2 4 **1** 5 3 ✓ ✓ ✓ ✓	4	One mark for each correct number in the sequence.
			Total	14	

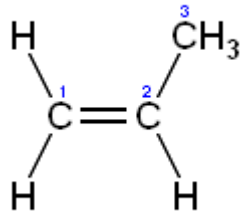
Question			Answer	Marks	Guidance
3	(a)	(i)	packaging/processing of material/proteins/lipids ✓	1	**DO NOT ALLOW** *production* of material/proteins/lipid
		(ii)	site of (aerobic) respiration/oxidation of acetyl CoA / release energy / production of ATP ✓	1	**IGNORE** powerhouse of cell **DO NOT ALLOW** creates energy / anaerobic respiration
	(b)		**Any one from:** only parts of some organelles/structures are visible ✓ chloroplast must have a circular/cup shape ✓ different parts of the chloroplast are sectioned ✓	1	OWTTE **ALLOW** any correct description for non-linear structure
	(c)		**Any two from:** **feature** - thylakoids/grana ✓ **function (any one from)** trap/absorb light ✓ light reactions of photosynthesis ✓ contain chlorophylls ✓ photolysis of water ✓ production of $NADPH_2$ / reduced NADP ✓ production of ATP ✓ **OR** **feature** - stroma/ground substance/matrix ✓ **function (any one from)** contains enzymes ✓ site of Calvin cycle / light-independent reactions ✓ **OR** **feature –** outer (double)-membrane/envelope ✓ **function (any one from)** freely permeable to carbon dioxide / oxygen / glucose ✓ allows light transmission ✓ acts as barrier to restrict reactions within the chloroplast/organelle / OWTTE ✓	2	One mark for the correct feature and the second mark for its related function.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(d)</td><td></td><td>lysosome ✓</td><td>1</td><td></td></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td>Any one from:
prokaryotic cells much smaller/size differential
quantified ✓
prokaryotic cells do not appear to have the organelles / correctly-named organelles visible in the eukaryotic cells ✓</td><td>1</td><td>IGNORE general references to cell shape/clarity</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any two from:
plasma membrane ✓
cytoplasm ✓
DNA ✓
ribosomes present ✓</td><td>2</td><td>ALLOW some eukaryotes (all prokaryotes) have a cell wall</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Any two from:
<table>
<tr><th>feature</th><th>prokaryotic</th><th>eukaryotic</th></tr>
<tr><td>nucleus</td><td>absent</td><td>present ✓</td></tr>
<tr><td>DNA</td><td>cytoplasm</td><td>nucleus/mitochondrion ✓</td></tr>
<tr><td>mitochondria</td><td>absent</td><td>present ✓</td></tr>
<tr><td>chromatin</td><td>absent</td><td>present✓</td></tr>
<tr><td>ribosomes</td><td>small</td><td>large (and small)</td></tr>
</table></td><td>2</td><td>ALLOW any other correctly-named distinguishing feature

ONLY need one correct reference for each feature

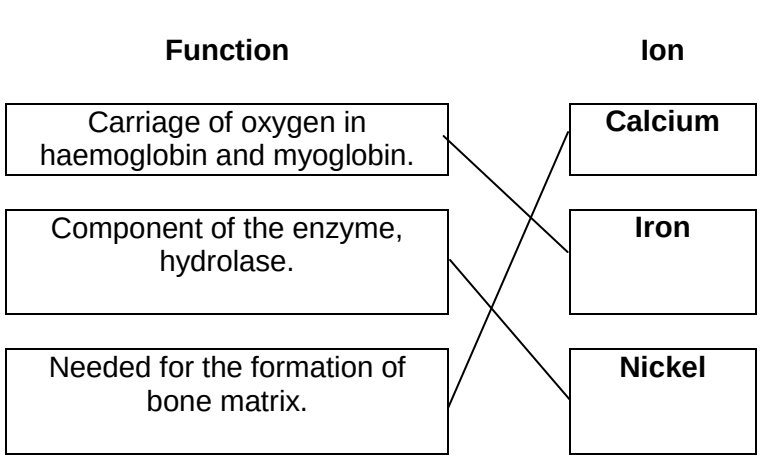
ALLOW correct reference to the size of each ribosome type – 70S/20nm (prokaryotic) vs 80S/25-30nm (eukaryotic)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>11</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
4	(a)	(i)	Nucleotides ✓	1	
		(ii)	Adenine ✓ Thymine ✓	2	
		(iii)	 ✓ ✓ ✓ ✓ ✓	5	One mark for each correct line.

Question			Answer	Marks	Guidance
	(b)		Double bond (between C^1 and C^2) ✓ Correct number of carbon and hydrogen atoms ✓ **OR** Correct structure ✓✓  	**2**	**ALLOW** correct molecular formula C_3H_6 = 1 mark max. **ALLOW** CH_3 at different rotation/corners
	(c)		**Any five from:** chromatin unwinds (separates from histones) to expose DNA ✓ DNA carries the coded message/sequence of bases for protein synthesis ✓ DNA is held in the (switchgrass) cell nucleus ✓ DNA forms a template (called mRNA) ✓ via process called transcription ✓ mRNA leaves the nucleus (via nuclear pore) ✓ mRNA codes for protein synthesis at ribosome ✓ tRNA brings amino acids to ribosome ✓ amino acids form the protein/polypeptide chain ✓ peptide bonds form between adjacent amino acids ✓ via process called translation ✓	**5**	**OWTTE** **IGNORE** references to the process of genetic modification
			Total	**15**	

<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></td><td>Any one from:
(Mn component of) oxidases ✓
(Mn component of) enzymes involved in structural components (of bone, cartilage) ✓
biosynthesis of choline / important for normal liver function/growth/repair ✓</td><td>1</td><td>ALLOW any other correct structural component</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>Liver ✓</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Pigs OR cattle ✓</td><td>1</td><td>ALLOW Pigs – based on lowest average conc. within an organ
ALLOW Cattle – based on lowest average conc. within animal</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th>Manganese compound</th><th>Oxidation state</th></tr><tr><td>(Mn_2O_3)</td><td>+3</td></tr><tr><td>(MnO_2)</td><td>+4</td></tr></table></td><td>2</td><td>One mark for each correct row</td></tr>
<tr><td></td><td>(d)</td><td></td><td>Electrons are lost ✓</td><td>1</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
	(e)		**[Level 3]** Candidate shows a high level of understanding of the data, describing trends for all regions of the body **AND** draws conclusions from the data. ***(5 – 6 marks)*** **[Level 2]** Candidate shows an understanding of the data, using some data, describing general trends **AND** draws conclusions from the data. ***(3 – 4 marks)*** **[Level 1]** Candidate describes basic trends **OR** makes limited conclusions from the data. ***(1 – 2 marks)*** **[Level 0]** Candidate includes **fewer than two** valid points. ***(0 marks)***	**6**	**Valid points:** **Description of data trends** • (prion proteins containing) Mn found in all three organs and the blood. • more Mn in brain stem, spinal cord and blood of BSE cattle (than in non-BSE). • less Mn in brain cortex of BSE cattle (than in non-BSE) • greatest conc. of Mn in brain stem. • lowest conc. of Mn in brain cortex. • > x2 amount of Mn in brain stem of BSE vs non-BSE. • correct reference to data values for one or more parts. • correct reference to % change in Mn for any region of body or between different regions. • relatively low levels of Mn in blood for both groups of cattle. **Conclusions** ○ high Mn may be cause of BSE. ○ link between Mn levels and the development of BSE for brain stem, spinal cord and blood. ○ BSE generally associated more with the brain stem than other nervous tissues/organs ○ low levels of Mn in blood but high levels in organs may indicate that the blood transports the Mn but Mn builds up within the organs.

Question			Answer	Marks	Guidance
	(f)		Lowest risk of arthritis with manganese intake of 2.09 – 3.00 ✓ Highest risk of arthritis with manganese intake of >3.00 ✓ Mid-risk of arthritis with manganese intake of <2.09 ✓ intake from food has no effect (on rheumatoid arthritis) ✓	**1**	OWTTE **ALLOW** any realistic interpretation of data in Table 5.4 including correct reference/assumption of diet
	(g)			**2**	3 correct lines = 2 marks 1 or 2 correct lines = 1 mark
			Total	**15**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><th>Feature</th><th>Form 1</th><th>Form 2</th></tr>
<tr><td>overall form</td><td>amorphous/non-crystalline</td><td>regular lattice/crystalline ✓</td></tr>
<tr><td>chain length</td><td>different / long and short</td><td>same / all long ✓</td></tr>
<tr><td>branched</td><td>yes</td><td>no ✓</td></tr>
<tr><td>packing</td><td>loose</td><td>close ✓</td></tr>
</table>
</td><td>2</td><td>OWTTE
ALLOW any realistic comparison based on the two forms in Fig. 6.1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>Feature</th><th>Form 1</th><th>Form 2</th></tr>
<tr><td>tensile strength</td><td>weaker</td><td>stronger ✓</td></tr>
<tr><td>hardness</td><td>softer</td><td>harder ✓</td></tr>
<tr><td>melting point</td><td>lower</td><td>higher ✓</td></tr>
</table>
</td><td>3</td><td>OWTTE
ALLOW a clear, correct statement for EITHER Form 1 or Form 2 for each feature</td></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th>Feature</th><th>Form 1</th><th>Form 2</th></tr>
<tr><td>tensile strength</td><td>less-close chains AND weaker intermolecular forces</td><td>closer chains AND greater intermolecular forces ✓</td></tr>
<tr><td>hardness</td><td>less packing - easier to scratch</td><td>greater packing - less easy to scratch ✓</td></tr>
<tr><td>melting point</td><td>less-close chains AND weaker intermolecular forces</td><td>closer chains AND greater intermolecular forces ✓</td></tr>
</table>
</td><td>3</td><td>OWTTE
ALLOW a clear, correct statement for EITHER Form 1 or Form 2 for each feature</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>8</td><td></td></tr>
</table>

Question			Answer	Marks	Guidance
7	(a)	(i)	emf = 12 × 2.3 = **28** (V) ✓	1	**ALLOW** 27.6
		(ii)	Internal resistance =12 x 0.5 = **6** (Ω) ✓	1	
	(b)	(i)	net emf = 100 – 28 = **72** (V)	1	**ALLOW** 72.4 [if 27.6 answer for (a)(i)] **ALLOW** ecf using 100 – **(a)(i)**
		(ii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 22 (Ω) award 5 marks** R = net emf ÷ I **OR** V ÷ I ✓ 72(V) ÷ 2.6(A) ✓ = 28 **OR** 27.7 **OR** 27.69 (Ω) ✓ resistance of X = 28 - r_B **OR** 28 – 6 ✓ = 22 (Ω) (2 sig. figs) ✓	5	**ALLOW** answer for (b)(i) ÷ 2.6(A) **ALLOW** 27.7/27.69 – 6
			Total	8	

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning
Telephone: 01223 553998
Facsimile: 01223 552627
Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553