GCE AS MARKING SCHEME

SUMMER 2019

AS (NEW)
BIOLOGY - UNIT 1
2400U10-1

INTRODUCTION

This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

WJEC GCE AS BIOLOGY

UNIT 1 – BASIC BIOCHEMISTRY AND CELL ORGANISATION

SUMMER 2019 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (apart from the questions where a level of response mark scheme is applied).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement. Award the middle mark in the level if most of the content statements are given and the communication statement is partially met. Award the lower mark if only the content statements are matched.

Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only
ecf = error carried forward
bod = benefit of doubt

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
1	(a)	(i)		9		1		1		
		(ii)		The chromosomes have not paired up / Not (arranged) in homologous pairs/ Ignore homologous pairs unqualified Absence of bivalents/ Synapsis does not occur Ignore reference to chiasmata			1	1		
		(iii)		stains the {DNA/ nucleic acids/ histones}	1			1		1
	(b)	(i)		Anther/ ovary	1			1		1
		(ii)		C **BGEH** AFD		1		1		
		(iii)		Any **two** (x1) from • In E {chromosomes/ homologous pairs} are {segregating / being pulled to opposite poles} whereas in F the chromatids are being pulled to opposite poles (1) • In E the centromeres do not divide, in F they do divide (1) • Correct reference to the spindle (1) • E is diploid **and** F is haploid (1) Ignore reference to the production of cells at the end of meiosis I and meiosis II		2		2		
		(iv)		• {Chiasmata / chiasma formation / crossing over/ or description of} is taking place in {photomicrograph B/ prophase 1} (1) Ignore reference to photomicrograph G • {Independent assortment/random assortment/ or description of} is occurring in {photomicrograph G/ metaphase 1} (1) • Genetic variation allows {the species to adapt / some of the offspring to survive} (in changeable environments.) (1) Reject reference to {them/ offspring} {adapting}	1	2		3		
				Question 1 total	**3**	**6**	**1**	**10**	**0**	**2**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
2	(a)			A chloroplast B nucleus NOT nucleolus	1			1		1
	(b)	(i)		Any **four** (x1) from: A. (The cytoplasm of) the amoeba has a {lower/ more negative} water potential than the {surrounding water / external environment}/ ORA (1) B. Water will therefore move into the cell by osmosis. (1) If not credited here, can be given with reference to vacuole C. (By pumping ions into the vacuole) {it lowers the water potential of the vacuole / creates a water potential gradient between the cytoplasm and the vacuole} (1) D. Water will move from the {cytoplasm/ cell} to the vacuole (by osmosis) (1) E. (The water is then expelled from the cell) which prevents {osmotic lysis/ bursting} (1) Reject reference to turgidity		2	2	4		
		(ii)		Mitochondria (1) To provide the ATP for {active transport of ions / pumping of ions/ exocytosis}(1) Ribosomes(1) Produce proteins for {transport of ions/ carrier proteins}(1)		4		4		
	(c)			• (The cell wall is) {strong / resists tension/ generates pressure potential/ owtte} **and** prevents {osmotic lysis/ bursting} (1) • Beta glucose (1) • It is made of (long) straight chains / alternate molecules {inverted/ rotated 180^{o} }(1) • {hydrogen bonds / cross-links} between (parallel) chains/ to form microfibrils (1)	2	2		4		

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td></td><td>(d)</td><td></td><td></td><td><table>
<tr><th>Chlorella</th><th>Cyanophyceae</th></tr>
<tr><td>Membrane bound organelle/ named organelle present</td><td>No membrane bound organelles / named organelle</td></tr>
<tr><td>Linear DNA/ plasmid absent</td><td>{Loop of/ circular} DNA/ plasmid present</td></tr>
<tr><td>Larger/80s ribosomes</td><td>Smaller/70s ribosomes</td></tr>
<tr><td>Cellulose cell wall</td><td>Murein/peptidoglycan cell wall</td></tr>
<tr><td>Mesosome absent</td><td>Mesosome present</td></tr>
<tr><td>Flagellum absent</td><td>Flagellum present</td></tr>
<tr><td>Capsule absent</td><td>Capsule present</td></tr>
</table></td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td>Question 2 total</td><td>5</td><td>8</td><td>2</td><td>15</td><td>0</td><td>1</td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
3	(a)	(i)	I	{Maintain/ control/ prevent changes in} pH (1) keeping pH at optimum/ which would alter the {rate of reaction/ time taken}/ which could denature the enzymes/ prevents coagulation of milk (1)	1	1		2		2
			II	{Maintain/ control/ prevent changes in} temperature/ acclimatise to the same temperature (1) so that all of the enzymes and substrates had the same kinetic energy / if some test tubes were incubated at a higher temperature the enzymes (and substrates) would have more kinetic energy / ORA (1) Ignore references to denaturing/ optimum	1	1		2		2
		(ii)		91.2		1		1	1	1
		(iii)		Correct plots (2) ± ½ small square 5 correct = 2 marks 4 correct = 1 mark 0/1/2/3 = 0 marks Centre of plots joined with a ruler, no extrapolation/ line of best fit with ruler (allow extrapolation) (1) Range bars correct (1) ± ½ small square		4		4	4	4

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(b)	(i)		X = 1.6 - 1.8% and Y = 4.3 – 4.5% Take from candidates graph		1		1	1	1
		(ii)		Any **two** (x1) from: • Comparison of {range bars/ data} for {1%/2%/ X/ lower concentrations} (smaller)compared to {3%/4%/ 5%/ Y/ higher concentrations} (larger) (1) • Comparison of degree of overlap of the range bars e.g. at 3%, 4% and 5% all overlap and no overlap between 1 and 2% (1) • Correct reference to {reliability/ repeatability/ consistency} linked to {length of range bar/ spread of data} OR there would be less confidence in the trend for the overlapping results. (1) Reject reference to accuracy/ reproducibility			2	2		2
		(iii)		{Judging/ subjectivity of} {when the solution becomes transparent/ the end point } (1) As the milk powder forms a suspension, the powder may form sediment at the bottom off the test tube altering the time taken for the milk to clear / not mixed evenly/ not all transferred from one test tube to another (1)			2	2		2
				Question 3 total	**2**	**8**	**4**	**14**	**7**	**14**

<table>
<tr><th colspan="4" rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td></td><td>Two or more polypeptide chains {bonded/ joined} together (to form a functional protein)</td><td>1</td><td></td><td></td><td>1</td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td></td><td>438 (Accept 441/444)</td><td></td><td>1</td><td></td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td></td><td>A triplet code can produce 64 different combinations, which is enough to code for the 20 different amino acids/ 2 bases would only give 16 combinations which is not enough for 20 amino acids (1)
(As there are more than 20 codes) some amino acids are coded for by more than one mRNA codon. (1)</td><td>2</td><td></td><td></td><td>2</td><td></td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td></td><td>
<table>
<tr><td></td><td colspan="7">Codon position number</td></tr>
<tr><td></td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td colspan="2">8</td></tr>
<tr><td>DNA coding strand</td><td>GAC</td><td>TGA</td><td>GGA</td><td>CTC</td><td>CTC</td><td>TTC</td><td>TTT</td></tr>
<tr><td>mRNA codons</td><td>CUG</td><td>ACU</td><td>CCU</td><td>GAG</td><td>GAG</td><td>AAG</td><td>AAA</td></tr>
<tr><td>tRNA anticodons</td><td>GAC</td><td>UGA</td><td>GGA</td><td>CUC</td><td>CUC</td><td>UUC</td><td>UUU</td></tr>
<tr><td>Amino acid sequence</td><td>leucine</td><td>threonine</td><td>proline</td><td>Glutamic acid</td><td>Glutamic acid</td><td>lysine</td><td>lysine</td></tr>
</table>
Two marks for 6 correct cells in columns 3,4 and 5.
one mark for 4/5 correct cells (2)
One mark for correct amino acid sequence (1)
One mark for column 8 correct (1)</td><td></td><td>4</td><td></td><td>4</td><td></td><td></td></tr>
</table>

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Any **five** (x1) from: A. Translation (1) B. tRNA brings an amino acid to the ribosome (1) C. Each tRNA has a {specific/ particular} amino acid (1) D. Complementary base pairing occurs between the tRNA anticodon and the mRNA codon/ description of codon anticodon interaction (1) E. A second amino acid is brought to the ribosome / two tRNA molecules can attach to the mRNA (at the ribosome)/ reference to two binding sites. (1) F. A condensation reaction occurs/ a peptide bond forms between the amino acids. (1) G. The ribosome moves along the mRNA {by one codon/until a stop codon is reached.} (1)	5			5		
	(d)			{Thymine/ T} is replaced with {adenine/ A} / CAC. (1)		1		1		
	(e)	(i)		**Both** R groups circled	1			1		
		(ii)		Phenylalanine, leucine and valine are all non- polar **and** therefore are attracted to each other (1) Glutamic acid is polar **and** will therefore {be repelled from/ not attracted to} phenylalanine and leucine (1) any correct reference to hydrophobic/ hydrophilic (1)			3	3		
				Question 4 total	**9**	**6**	**3**	**18**	**1**	**0**

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
5	(a)	(i)		Addition of water (1) Galactose and glucose correctly drawn (OH below C^1 on galactose + CH_2OH at C^6 on glucose) (1)	1	1		2		
		(ii)		Hydrolysis (1)	1			1		
		(iii)		Add Benedict's reagent/solution and heat (1) NOT ref to HCl Change of colour <u>from blue</u> to {yellow/green/orange/brown/(brick) red} (1)	2			2		2
	(b)	(i)		Glucose oxidase has a <u>specific</u> <u>shaped</u> active site (1) Only glucose molecules have a complementary (shape) (1) (Therefore glucose fits) to form an enzyme-substrate complex (1)	1	2		3		
		(ii)		Any **two** (x1) from: • More glucose the more hydrogen peroxide is produced (1) • Equation shows a one to one relationship / is directly proportional (1) • Concentration of hydrogen peroxide is converted to an electrical signal/ detected by the electrode (1)			2	2		

Question				Marking details	Marks Available					
					AO1	AO2	AO3	Total	Maths	Prac
	(c)			Any **four** (x1) from: A. Arabinose has a similar {shape/ structure} to <u>glucose/</u> complementary to <u>active site</u> of glucose oxidase (1) Reject same shape B. So would act as a competitive inhibitor (of glucose oxidase)/ {competes for/ binds to} the active site (1) C. preventing the formation of enzyme-substrate complexes (1) D. Therefore, less hydrogen peroxide produced (1) E. The display would give a lower reading (1) Answer including description of non-competitive inhibition negates mark points A-C			4	4		
				Question 5 total	**5**	**3**	**6**	**14**	**0**	**2**

<table>
<tr><th rowspan="2">Question</th><th rowspan="2">Marking details</th><th colspan="6">Marks Available</th></tr>
<tr><th>AO1</th><th>AO2</th><th>AO3</th><th>Total</th><th>Maths</th><th>Prac</th></tr>
<tr><td>6</td><td>Indicative content
<u>Structure of water:</u>
Water has the chemical formula of H_2O.
Water consists of one oxygen atom joined to two hydrogen atoms by covalent bonds.
The molecule is a dipole.
The oxygen atom has a slight negative charge / δ-, the hydrogen atoms have a slightly positive charge δ+.

<table><tr><th><u>Properties of water</u></th><th><u>Essential to supporting life</u></th></tr><tr><td>Ice is less dense than water</td><td>Ice floats insulating the water below allowing organisms to survive.</td></tr><tr><td>Polar solvent</td><td>All chemical reactions occur in aqueous solutions.
Polar molecules and ions can dissolve and therefore be transported</td></tr><tr><td>Metabolite</td><td>Involved in chemical reactions</td></tr><tr><td>High specific heat capacity</td><td>Requires a lot of energy to cause water to heat up / cool down therefore creating thermostable environments</td></tr><tr><td>Cohesive / forms hydrogen bonds</td><td>Water molecules form hydrogen bonds allowing the movement of water</td></tr></table>
<u>Chemical elements:</u>
Phosphorous is required to synthesise phospholipids / nucleotides / ATP / DNA / RNA
Sulfur is required to synthesise some amino acids / methionine / cysteine / proteins.</td><td>4</td><td>5</td><td>0</td><td>9</td><td>0</td><td>0</td></tr>
</table>

				7-9 marks Indicative content of this level is detailed description of all three areas of content *The candidate constructs an articulate, integrated account, correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses scientific conventions and vocabulary appropriately and accurately.* **4-6 marks** Indicative content of this level is detailed description of two areas or less description of all three areas *The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate usually uses scientific conventions and vocabulary appropriately and accurately.* **1-3 marks** Indicative content of this level is any relevant indicative comment *The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate has limited use of scientific conventions and vocabulary.* **0 marks** *The candidate does not make any attempt or give a relevant answer worthy of credit.*						
				Question 6 total	**4**	**5**	**0**	**9**	**0**	**0**

UNIT 1: BASIC BIOCHEMISTRY AND CELL ORGANISATION

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

Question	AO1	AO2	AO3	TOTAL MARK	MATHS	PRAC
1	**3**	**6**	**1**	**10**	**0**	**2**
2	**5**	**8**	**2**	**15**	**0**	**1**
3	**2**	**8**	**4**	**14**	**7**	**14**
4	**9**	**6**	**3**	**18**	**1**	**0**
5	**5**	**3**	**6**	**14**	**0**	**2**
6	**4**	**5**	**0**	**9**	**0**	**0**
TOTAL	**28**	**36**	**16**	**80**	**8**	**19**