

AQA, OCR, Edexcel

A Level

A Level Biology

**Biological Molecules and
Enzyme Answers**

Name:

M

M

E

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Total Marks:

M1.(a)	C.	1	
	(b) E.	1	
	(c) 1.	<u>Active site</u> (of enzyme) has (specific) shape / tertiary structure / <u>active site</u> complementary to substrate / maltose; <i>Reject active site on substrate.</i> <i>Must have idea of shape</i> <i>Assume "it" = maltase</i> <i>Accept (specific) 3D active site</i> <i>Reject has same shape</i>	
	2.	(Only) maltose can bind / fit; <i>Accept "substrate" for "maltose"</i>	
	3.	To form enzyme substrate complex. <i>Accept E-S complex</i>	3
			[5]
M2.	(a) (i)	Changes shape of antitrypsin; Reference to hydrogen/ionic/disulfide bonds; No longer attaches to/interacts/ reacts with trypsin; <i>Accept protease</i>	2
	(ii)	Higher the concentration of hydrogen peroxide, more amino acids/ proteins affected; More antitrypsin molecules change shape;	2
	(b)	(Longterm smokers) inhale a lot of hydrogen peroxide; Smokers have more active enzyme that damages lung tissue; Reducing gas exchange surface;	2 max
			[6]
M3.	(a) (i)	condensation;	1
	(b) (i)	D ;	1
	(ii)	C ;	1
	(iii)	A ;	1
	(c)	absence of a double bond; in the (hydrocarbon) chain; unable to accept more <u>hydrogen</u> / saturated with hydrogen;	2 max
			[6]

M4.(a) (i) Joins nucleotides (to form new strand).

Accept: joins sugar and phosphate / forms sugar-phosphate backbone

Reject: (DNA polymerase) forms base pairs / hydrogen bonds

1

(ii) (Prokaryotic DNA)

1. Circular / non-linear (DNA);

Accept converse for eukaryotic DNA

Ignore: references to nucleus, binary fission, strands and plasmids

2. Not (associated) with proteins / histones;

Accept does not form chromosomes / chromatin

3. No introns / no non-coding DNA.

Accept only exons

Q Neutral: *no 'junk' DNA*

2 max

(b) (i) 1. Have different genes;

Reject: different alleles

2. (Sobases / triplets) are in a different sequence / order;

Accept: base sequence that matters, not percentage

3. (So) different amino acid (sequence / coded for) / different protein / different polypeptide / different enzyme.

Unqualified 'different amino acids' does not gain a mark

Reject: references to different amino acids formed

Ignore: references to mutations / exons / non-coding / introns 2 max

(ii) (Virus DNA)

1. A does not equal T / G does not equal C;

Accept: similar for equal

Accept: virus has more C than G / has more A than T

2. (So) no base pairing;

3. (So) DNA is not double stranded / is single stranded. 2 max

[7]

M5.(a) 1. Maltose;

2. Salivary amylase breaks down starch. 2

(b) Maltase. 1

(c) (Mimics / reproduces) effect of stomach. 1

(d) 1. Add boiled saliva;
2. Everything same as experiment but salivary amylase denatured. 2

(e) 1. Some starch already digested when chewing / in mouth;
2. Faster digestion of chewed starch;
3. Same amount of digestion without chewing at end.

Accept use of values from Page 3 graph

3

[9]

- M6.(a)** 1. Add iodine / potassium iodide solution to the food sample;
1. Allow 'iodine'
2. Must be in the context of the correct reagent
2. Blue / black / purple indicates starch is present; 2
- (b) 1. Starch digested to maltose / by amylase;
Ignore 'hard to digest / easily digested'
2. Maltose digested to glucose / by maltase;
3. Digestion of sucrose is a single step / only one enzyme / sucrose;
3. Accept converse for starch
3. Do not accept digestion of sucrose is faster 3
- (c) 1. Smoking increases risk of CHD / introduces another variable; 1
- (d) (i) 1. No effect on risk with diet group 1 and 2 / lowest glycaemic load;
Simple statement of correlation is not enough for this mark
2. Above diet group 2 / in higher groups, risk increases as glycaemic load increases; 1 max
- (ii) 1. (Higher GL diets lead to) more (harmful) lipids (in blood), so greater risk of atheroma;
Ignore reference to lipids in diet
2. Atheroma leads to blockage of coronary artery / increased risk of blood clot in coronary artery;
Ignore references to myocardial infarction / heart attack 2
- M7.(a)** 1. Polymer of amino acids;
2. Joined by peptide bonds;
3. Formed by condensation;
4. Primary structure is order of amino acids;
5. Secondary structure is folding of polypeptide chain due to hydrogen bonding;
Accept alpha helix / pleated sheet
6. Tertiary structure is 3-D folding due to hydrogen bonding and ionic / disulfide bonds;
7. Quaternary structure is two or more polypeptide chains. 5 max
- (b) 1. Hydrolysis of peptide bonds;
2. Endopeptidases break polypeptides into smaller peptide chains;
3. Exopeptidases remove terminal amino acids;
4. Dipeptidases hydrolyse / break down dipeptides into amino acids.

4

- M8.(a)** Any **two** of the following:
Concentration of enzyme
Volume of substrate solution
pH.

Allow same concentration of substrate

1

- b) Ratio between 5.18:1 and 5.2:1
Initial rates incorrect but correctly used = 1 mark.

Allow 1 mark if rate at:

$$60^{\circ}\text{C} = 0.83\text{g dm}^{-3} \text{ s}^{-1} / 49.8\text{g dm}^{-3} \text{ minute}^{-1}$$

OR

$$37^{\circ}\text{C} = 0.16\text{g dm}^{-3} \text{ s}^{-1} / 9.6\text{g dm}^{-3} \text{ minute}^{-1}$$

2

- (c) At 60 °C:

1. More kinetic energy;
2. More E–S complexes formed.

Allow converse for 37 °C

2

- (d) Different times:

1. Higher temperature / 60 °C causes denaturation of all of enzyme;

Accept converse for 37 °C

2. Reaction stops (sooner) because shape of active site changed;

Reject if active site on substrate

Different concentrations of product (at 60 °C)

3. Substrate still available (when enzyme denatured);
4. But not converted to product.

4

[9]

- M9.(a)** 1. Starch formed from α -glucose but cellulose formed from β -glucose;
2. Position of hydrogen and hydroxyl groups on carbon atom 1 inverted. 2

- (b) 1. Insoluble;
2. Don't affect water potential;

OR

3. Helical;

Accept form spirals

4. Compact;

OR

5. Large molecule;
6. Cannot leave cell.

2

- c) 1. Long and straight chains;
2. Become linked together by many hydrogen bonds to form fibrils;
3. Provide strength (to cell wall). 3

[7]

- M10.** (a) (i) fructose; 1

- (ii) correctly drawn (OH group at bottom left); 1

- (b) hydrolysis;

- (c) (i) heat with Benedict's solution (*disqualify if HCl added*);
orange / brown / brick red / green / yellow colour or precipitate; 2
- (ii) biuret test / NaOH + CuSO₄;
purple / violet / lilac / mauve; 2

[7]

M11. (a) (i) Biuret / alkali + copper sulphate;
Lilac / purple / mauve / violet;
Do not give credit for blue or pink. Ignore references to heating.

2

(b) R group of phenylalanine copied accurately; 1

(c) (i) Bond shown linking carbon and nitrogen;
OH and H removed, =O and -H remaining; 2

(ii) Peptide bond; 1

(d) Addition of hydroxyl / OH group;
Candidate must distinguish clearly between hydroxylation and hydrolysis

1

[7]

M12. Standard deviation shows there is overlap of the 2 data sets;
Small sample of wild salmon so may not be representative of population;

[2]

- M13.**(a) 1. Crush / grind;
2. With ethanol / alcohol;
3. Then add water / then add to water;
2. Water must be added after ethanol for third mark.
4. Forms emulsion / goes white / cloudy;
4. Do not accept carry out emulsion test. 3

(b) (i) 4 / four; 1

- (ii) 1. Phosphate / PO₄;
"It" refers to phospholipid.
2. Instead of one of the fatty acids / and two fatty acids;
1. Accept minor errors in formula. Do not accept phosphorus / phosphorus group. 2

- (iii) 1. Double bonds (present) / some / two carbons with only one hydrogen /
(double bonds) between carbon atoms / not saturated with hydrogen;
Answer refers to unsaturated unless otherwise clearly indicated.
May be shown in appropriate diagram.

2. In (fatty acid) **C** / 3; 2 [8]

M14. (a) 1. Add Benedict's; Page 6

Hydrolyse with acid negates mp1

2. Heat;
Accept warm, but not an unqualified reference to water bath

3. Red / orange / yellow / green (shows reducing sugar present);
Accept brown

3

(b) (i) 1. Starch hydrolysed / broken down / glucose / maltose produced;
Neutral: Sugar produced

2. Lower water potential;

3. Water enters by osmosis; 3

(ii) Only 2 pHs studied / more pHs need to be tested;
Accept: different amylase may have a different optimum pH

1

[7]

M15.(a) Increase in the first 3 – 4 hours and then decrease;

1

(b) Little / no difference (at 8 hours);

Between all groups; 2

(c) Respiration (produce CO₂);

By cells / tissues; 2

(d) Clear differences between the lactose deficient and IBS / control group;

No overlap in SD;

Accept between all groups 2 [7]

M16.(a) Amino acid / amino acids ;
If anything else is given as well do not award mark. 1

(b) (i) 1. Affects one monomer / amino acid;
i.e. What is affected

2. Not found in all active sites;
i.e. Where it is found.
2. Must relate to active site. Enzyme is insufficient. 2

(ii) 1. **X**;

2. Enzyme in both pathways;
2. Award independently 2

(c) 1. Occupies / blocks / binds to Page 7 active site;

i.e. What it does in terms of the active site.

2. Substrate will not fit / does not bind / no longer complementary to / enzyme-substrate complex not formed;

1. Ignore references to change in shape and shape of aspirin molecule.

Ignore reference to competitive inhibitor i.e. Consequence required 2 [7]

- M17.(a)** 1. Inhibition;

Accept either competitive or non-competitive inhibition or a description of either.

2. Changes tertiary structure (of enzyme);

3. Changes shape of / blocks active site (of enzyme);

The active site must be in the context of the enzyme / cytochrome oxidase.

4. Enzyme cannot bind to its substrate / no enzyme-substrate complex formed.

Accept 'ES'. Accept 'substrate cannot attach to enzyme'.

3 max

- (b) (Antidote reacts with / binds to cyanide) so cyanide cannot bind to enzyme / cytochrome oxidase

OR

(Antidote reacts with / binds to cyanide) so causing cyanide to be released from the enzyme / cytochrome oxidase.

Key idea is how the antidote affects the cyanide.

1

- c) (i) 1. **A + C + E** / all liver (trials)
2. **B + D + F** / all kidney (trials)
3. **D + E** / all rat (trials);;

Accept a description of any trial letter.

All 3 groups correct = 2 marks.

Any 2 groups correct = 1 mark.

1 group / no groups correct = 0 mark.

2 max

- (ii) 1. Cyanide reduces oxygen use / rate of respiration in **A** and **B** / in both

OR

as concentration of cyanide increases, the use of oxygen decreases in both;

*Accept use of letters or description of the animal **and** organ*

Reference to 'both', in some way, is required.

2. Greater effect of cyanide (on oxygen use) on sheep kidney / **B** than on sheep liver / **A**;

Comparison required in the statement. The statement should not be inferred from MP3.

3. Appropriate calculations of mean oxygen use from the data
 E.g. 1 liver falls by 74% whereas kidney falls by 87%
 OR
 liver falls to 0.26 / to 26% whereas kidney falls to 0.13 / to 13%
 E.g. 2 liver falls by 2.0(au) whereas kidney falls by 12.2(au);
Check correct calculations using the data but a comparison must be shown. Accept other calculations using the data.

3

- (iii) 81(%)
Correct answer = 2 marks.
Allow 1 mark for either:
Showing 8.1 divided by 10 or answer of 19(%)
Ignore '+' or '-' in showing the difference. 2

[11]

- M18.(a)** (i) Repeating units / nucleotides / monomer / molecules;
Allow more than one, but reject two 1

- (ii) 1. C = hydrogen bonds;
 2. D = deoxyribose;
Ignore sugar
 3. E = phosphate;
Ignore phosphorus, Ignore molecule 3

(iii)

Name of base	Percentage
Thymine	34
Cytosine / Guanine	16
Adenine	34
Cytosine / Guanine	16

Spelling must be correct to gain MP1
First mark = names correct
Second mark = % correct, with adenine as 34%

2

- (b) (i) 153;

1

- (ii) Some regions of the gene are non-coding / introns / start / stop code / triplet / there are two DNA strands;
Allow addition mutation
Ignore unqualified reference to mutation
Accept reference to introns and exons if given together
Ignore 'junk' DNA / multiple repeats

[8]

- M19.(a)**
1. Cell wall not formed / production inhibited;
1. Q Accept: weakened cell wall, but do not accept 'cell wall is broken down'
 2. Lower water potential in bacterium;
2. Accept: converse
2. Must be clear that the lower water potential is in the bacterium
 3. Water enters and causes lysis / expansion / pressure;

2 max

- (b) Human cells lack enzyme (**B**) / have a different enzyme / produce different fatty acids / use different substrates;

Neutral: 'human cells do not have cell walls' as out of context

1

- (c)
1. Change in base sequence (of DNA / gene) leading to change in amino acid sequence / primary structure (of enzyme);
1. Accept: different amino acids coded for
1. Reject: different amino acids produced
 2. Change in hydrogen / ionic / disulphide bonds leading to change in the tertiary structure / active site (of enzyme);
2. Neutral: alters 3D structure / 3D shape
 3. Substrate not complementary / cannot bind (to enzyme / active site) / no enzyme-substrate complexes form;

3

[6]

M20.(a) Deoxyribose. 1

- (b)
1. Thymine 18 (%);
 2. Guanine 32 (%). 2

(c) DNA polymerase. 1

- (d)
1. (**Figure 1** shows) DNA has antiparallel strands / described;
 2. (**Figure 1** shows) shape of the nucleotides is different / nucleotides aligned differently;
 3. Enzymes have active sites with specific shape;
 4. Only substrates with complementary shape / only the 3' end can bind with active site of enzyme / active site of DNA polymerase.

4

[8]

M21.(a) 1. Separates / unwinds / unzips strands / helix / breaks H-bonds;

1. **Q Neutral:** strands / helix split
1. **Accept:** unzips bases
2. (So) nucleotides can attach / are attracted / strands can act as templates;
2. **Q Neutral:** bases can attach
2. **Neutral:** helix can act as a template

2

(b)

Sample	Type(s) of DNA molecule present in each tube		
	$^{15}\text{N}/^{15}\text{N}$	$^{15}\text{N}/^{14}\text{N}$	$^{14}\text{N}/^{14}\text{N}$
1	✓		
2		✓	
3		✓	✓

One mark for each correct row

3

- (c) (i) 1. Similar shape / structure (to cytosine) / added instead of cytosine / binds to guanine;
1. **Accept:** idea that only one group is different
1. **Reject:** same shape
2. Prevents (complementary) base pairing / prevents H-bonds forming / prevents formation of new strand / prevents strand elongation / inhibits / binds to (DNA) polymerase;
2. **Accept:** prevents cytosine binding
Neutral: 'prevents DNA replication' as given in the question stem
Neutral: 'competitive inhibitor' unqualified
Neutral: inhibits DNA helicase

2

- (ii) (Cancer cells / DNA) divide / replicate fast(er) / uncontrollably;
Accept: converse argument for healthy cells

1

[8]