Enzymes

Mark Scheme 8

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Sub Topic	Enzymes
Booklet	Theory
Paper Type	Mark Scheme 8

Time Allowed : **70 minutes**

Score : **/ 58**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 (a (i) glycosidic ; [1]

(ii) hydrolysis / hydrolytic ; [1]

(iii) *assume that the answer refers to within the cell unless told otherwise*
accept any two relevant examples, e.g.
solvent / medium for reactions ;
transport medium ;
maintaining turgidity / keeping firm / prevents flaccidity / AW ;
(raw material / reactant for) photosynthesis / photolysis ;
expansion / elongation / growth ;
maintains, hydrostatic pressure / pressure potential ;
maintains water potential (gradient) ;
A maintains osmotic gradient / prevents plasmolysis
stomatal opening ;
hydrophilic interactions of membranes ;
(in vacuole) pushes chloroplast to edge of cell ;
R hydrogen bonding unqualified by ref. to membranes [2 max]

(b) spherical / ball-shaped / AW ;
has a tertiary structure ; **ignore** quaternary
hydrophilic / polar, groups on outside ;
water soluble ;
ignore 'more than one polypeptide' [2 max]

(c) (i) active site ; **ignore** binding / catalytic [1]

(ii) 1 (shape of) **U** / active site, gives specificity ; **A** *ecf* from **(i)**
2 substrate, fits into / binds with, active site / **U** ; **A** *ecf* from **(i)**
3 complementary (shape) / matching shape ;
A 'lock and key' / induced fit **R** 'same shape'
4 further detail of substrate binding to active site ;
5 forms, enzyme-substrate / E-S, complex ;
6 causes stress in substrate / AW ;
7 lowers activation energy / reactions occur at low(er) temperatures ;
8 not used up in reaction / remain unchanged / reusable ;
9 high turnover number / catalyse many reactions per unit time ; [4 max]

[Total: 11]

2 **(a (i)** **A** transcription ;
B tRNA / transfer RNA ;
C ribosome ; **A** subunit of ribosome / ribosomal subunit
treat 70S / 80S or small / large as neutral
D anticodon ; [4]

(ii) *similarities*

made of amino acids / amino acid monomers / polymer of amino acids **A** protein / polypeptides
have quaternary structure / have more than one polypeptide chain ;
four, sub-units / polypeptides ;
haem / porphyrin / prosthetic group(s) ; [2 max]

difference

(four) sub-units / polypeptides, are identical ;
or
haemoglobin has, two different, sub-units / polypeptides ;
or
haemoglobin has alpha and beta polypeptides ;

(catalase) has active site(s) ; **A** Hb has (oxygen) binding site [1 max]

(iii) each, sub-unit / polypeptide, has an active site ;
catalase has four, active sites / haem groups ; [1 max]

(b) iodine in potassium iodide solution / iodine in KI solution / I in KI solution ; **A** iodine solution **R** iodine

Benedict's, solution / reagent ; **A** Benedict's
A Fehling's solution / NaOH and $CuSO_4$ [2]

treat refs to colour changes as neutral

[Total: 10]

3 **(a** female *Anopheles* mosquito ;
either takes blood meal / AW, from infected person *or* parasites enter mosquito in blood meal from infected person ;

takes blood meal / AW, from uninfected person ;
parasite / pathogen / plasmodia, transferred in mosquito's, saliva / anticoagulant ;
ref. to transfusion malaria / congenital or mother-foetus malaria / needle sharing / needle stick injury for max 1 ; [3 max]

(b) (i) (protein is) antigen ;

following vaccination
(clonal) selection for, appropriate / corresponding / specific, B cell ;
clonal expansion / divide (by mitosis) (to form B cell clone) ;
memory cells ;

on infection by parasite
(B cells / plasma cells) secrete antibody ; **A** immunoglobulin / Ig
secondary response (qualified) / higher levels of antibody / rapid production of antibody ;
ref. to antigen-antibody specificity ;
antibody attaches to, surface protein / antigen, on parasite ;
prevents attachment to red blood cell ; **A** prevents entry into red blood cell [4 max]

(ii) genetic complexity of *Plasmodium* ; **A** ref to *Plasmodium*, being eukaryotic / having many genes
many antigens ;
many stages in life cycle (within human) ;
antigens change / antigenic variation, in different stages ;
Plasmodium / parasite, lives within cells ; **A** antigenic concealment
A only briefly free in the blood stream
antibodies cannot work against stages within cells ; [2 max]

(c) *use only one mark scheme as appropriate*

drug is either
competitive inhibitor / effect described in terms of competition ;
drug molecule has, same / similar / shape, as, substrate / surface protein ;
A complementary shape to active site
R same / similar, structure, as substrate
drug molecule fits into active site ;
blocks access to active site / prevents formation of ES complex ;

or
non-competitive inhibitor / described in terms of not competing ;
drug molecule fits into, another site (not the active site) / allosteric site ;
active site changes shape so cannot accept, substrate / surface protein ;
permanent (irreversible) / reversible ;

or
combines permanently with active site ;
e.g. by covalent bonding
blocks access to active site / prevents formation of ES complex ;
increasing, substrate / surface protein, has no effect ; [3 max]

[Total: 12]

4 **(a** *look at any labelling on the diagram*

cell contents / cytoplasm / not hollow ; **I** ref. to any organelles (not visible)
A xylem vessels are hollow
thin walls ;
A no, thickened walls / lignified walls / lignin
A xylem vessels have, thick walls / lignin
sieve plates / end walls / cross walls ;
A end walls not broken down
A xylem vessels have no end walls
R 'end' unqualified
I end plates / cell plates
no pits ; **A** xylem vessels have pits [max 2]
I *ref. to companion cells*

(b) dissolved in, water / sap ; **A** in solution
<u>mass flow</u> ;
down (hydrostatic) pressure gradient / moves from high(er) to low(er) pressure (potential) ;
A symbol – ψ_p
AVP ; e.g. from source to sink
loading by, <u>companion</u> / <u>transfer cells</u>, requires ATP / is active ;
I ATP required for mass flow [max 2]

(c) *answers may be general or in the context of phloem transport*

active site (with shape) complementary to substrate ;
A description in terms of lock and key (either way round)
I structure
induced fit / described ;
substrate binds to active site / enzyme-substrate complex forms / ESC forms ;
ref. to specificity of enzymes ;
activation energy of reaction is lowered ;
example of how activation energy lowered ;
e.g. reactants held close together for bond formation
transfer of electrons
strain on bonds
alternative pathway
holding the substrate in such a way that the bonds needed to be broken are exposed
product released from, enzyme / active site ;
A enzyme can be used again / enzyme unchanged at end of reaction [max 3]

[Total: 7]

5 dormancy ;

embryo ;

aleurone ;

endosperm ;

maltose ;

ATP / energy ;

transcription / expression ; [7]

[Total: 7]

6 **(a** cholera and TB ;
ignore *any other underlined diseases* [1]

(b) *must answer in context of antibiotics, not antibodies*
look for bacteria in answer if not clear in mp 1

1 (to ensure) all bacteria are, killed / removed / eliminated / destroyed / AW ;
R virus / bacteria and virus
ignore antigen or pathogen or disease
'all' *may be implied e.g. award if gain mp 2,3,4*
2 (so) no reservoir of infection remains / AW / ora ;
3 (disease) cannot be transmitted / cannot infect others / AW e.g. spread / ora ;
4 no recurrence / disease does not return ; *in context of same person*
5 to reduce chance of / AW, (antibiotic / drug) resistance developing ;
R *idea that human becomes resistant to antibiotics*
6 ref. to mutation in context of resistance ; [max 3]

(c) (i) binds with / fits into / AW, active site ; **R** collides with / reacts with
complementary shape to active site / similar shape to substrate ;
A same shape as substrate / same *or* similar structure as substrate
fewer, enzyme-substrate / E – S, complexes ;
A no ESC in context of one enzyme
A fewer successful collisions between enzyme and substrate
A prevents formation of E – S complexes
reduces rate of / slows (enzyme) reaction ;
A reduced enzyme activity / **A** less product formed [max 3]

(ii) *ideas that*
(humans) do not have the enzyme for cell wall synthesis ;
A penicillin only inhibits bacterial enzymes
penicillin will not inhibit any human enzyme ;
(human cells) do not have cell walls ; [max 1]

(iii) cell wall synthesis will stop / slow / be inhibited ;
A inhibit, murein / peptidoglycan, synthesis
ref. to uptake of water by osmosis ;
cell cannot withstand osmotic stress / cell cannot withstand turgor pressure / lysis / bursting / AW ;
A cell wall weakened
bacteria die / are killed / destroyed ;
stops bacteria dividing / reproducing / 'replicating' ;
AVP ; e.g. detail of action of penicillin (e.g. prevents cross-links forming),
(penicillin) only works on growing cells [max 3]

[Total: 11]