Enzymes

Mark Scheme 9

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Enzymes
Sub Topic	Enzymes
Booklet	Theory
Paper Type	Mark Scheme 9

Time Allowed : **78 minutes**

Score : **/ 65**

Percentage : **/100**

Grade Boundaries:

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

CHEMISTRY ONLINE TUITION

1 **(a)** 1. only three colours (for positive reactions) / only a small range **;**
2. no measurement of actual concentration / no numerical value measured **;** [2]

(b) **(i)** peroxidase **;** [1]

(ii) 1. (catalyses breakdown of hydrogen peroxide) to produce oxygen **;**
2. chromogen, oxidised by / reacts with, (oxygen) **;**
3. produces range of colours **;**
4. more, peroxide / oxygen produced, = greater change / darker colour **;** [2 max]

(iii) 1. to keep out, proteins / enzymes / polymer / named large molecule **;**
R large molecules unqualified
2. to prevent interference (to reactions) **;**
3. to prevent loss of, enzyme / chromogen **;**
4. so still allowing reaction to occur **;** [2 max]

(c) **(i)** 1. **B** has diabetes and **A** does not **;**
2. **A**'s, values / peak, lower because he secretes insulin
or
B's, values / peak, higher because, no / little, insulin **;**
in A
3. (insulin affects), liver / muscle, cells **;**
4. increase in glucose uptake / increase in permeability of membranes (to glucose) **;**
5. increase in use of glucose in respiration **;**
6. (more) glucose converted to glycogen **;**
in B
7. because cells unresponsive to insulin **;** [4 max]
accept quoted values for lower and higher in mark point 2

(ii) (the concentration of blood glucose), above which some glucose appears in the urine / AW **;** [1]

(iii) 1. (at first), glucose reabsorbed by proximal convoluted tubule **;**
2. ref. co transported with Na^+ / facilitated diffusion / protein carrier **;**
3. above 180mg ($100cm^{-3}$ glucose in blood) no further reabsorption **;**
4. because carriers (in PCT) saturated / AW **;** [3 max]

[Total: 15]

CHEMISTRY ONLINE

2 **(a) (i)** β glucose ; [1]

(ii) glycosidic ; [1]

(b) many hydrogen bonds within the molecule ;
idea of parallel chains / AW ;
hydrogen bonds between cellulose molecules ;
to form microfibrils ;
held together by more hydrogen bonds to form fibres ; [2 max]

(c)

function	**letter from Fig. 5.1**
organelle that contains DNA	H
structure that transports cell wall material to the cell surface membrane	A
site of transcription	H
site of ribosome synthesis	J
site of photosynthesis	D

[4]

(d) polypeptide / protein, in (cisternae of) RER ;
to Golgi (apparatus / AW) ;
modification / glycosylation / packaging ;
vesicle(s) formed / transport in vesicle ; **A** vacuole
membrane of vesicle fuses with cell surface membrane ;
exocytosis / described ; [max 3]

[Total: 11]

CHEMISTRY ONLINE TUITION

3	**(a)**	**(i)**	so that, the bacteria were not killed / enzymes not denatured ;	[1]
		(ii)	1. bacteria put into (solution of) sodium alginate 2. place mixture in syringe 3. add drops of mixture to calcium chloride solution 4. calcium ions replace sodium ions (to form beads) 5. bacteria trapped in beads	[3 max]
	(b)	**(i)**	*note comparison between blue line and black line* *ignore references to red line - agar* 1. both increase up to, 18 / 24, hours 2. both similar, initially / up to 18 hours 3. biggest difference at 24 hours / rate of increase for immobilis cells greater than free cells between 18 and 24 hours ; 4. after 24 hours immobilised cells rate decreases while free cel rate continues to increase or after 39 hours free cells rate is greater than immobilised cells rate ; 5. free cells final concentration is still lower than highest val attained by immobilised cells ; 6. use of comparative figures	[4 max]
		(ii)	1. (could be) less surface area (t volume ratio) in cubes than beads ; 2. (could be) a greater diffusion distance to centre of cubes th beads ; 3. agar may be less permeable (to substrate) than alginate 4. something in agar may inhibit bacterial enzymes 5. some protease adsorb by agar ;	[2 max]

CHEMISTRY ONLINE TUITION

	(c)	**(i)**	82.14 / 82.1 / 82 (%) ; ; *allow one mark for suitable working if incorrect answer*	[2]
		(ii)	1. can use alginate (beads) many times 2. (reduces cost of), materials / energy / labour 3. fewer bacterial cultures needed / less time spent immobilisi bacteria ; 4. more protease produced (per hour) (using alginate) 5. can run fermentation for longer time 6. less time wasted between fermentations *answers must imply comparison*	[3 max]
				[Total:15]

CHEMISTRY ONLINE TUITION

4 **(a)** **(i)** tertiary (structure) ; **A** 3^o [1]

(ii) secondary (structure) ; **A** 2^o , alpha / α, helix [1]

(b) active site ; **A** catalytic site [1]

(c) **(i)**

mRNA	CGU	UGC / UGU	GAA ;
DNA	GCA	ACG / ACA	CTT ;

[3]

(ii) many / several / more than one, triplet for each amino acid ; **A** codon
an e.g. from Table 3.1 ;
degenerate code / description e.g. 64 possible triplets for 20 amino acids ; **A** codons
AVP ; e.g. may be an intron in this region, different nucleotides at the beginning (signal sequence) [2 max]

(d) **(i)** *reject references to time e.g. rapid, slowly*
as the concentration of, enzyme / lysozyme, increases the percentage of bacteria surviving decreases / AW ; **R** if only 1 named
steep, decline / decrease, 0 to 10 / first two concentrations, for *E. coli* ;
A large percentage difference in *E.coli* surviving at 0 to 10 / first two concentrations
less steep / more gradual, decline / decrease, from 10 to 150 for *E. coli* ;
decline / decrease, shallower / less steep from 0 – ,40 / 60 / 70 / 80, for *S. aureus* ;
A small percentage difference in *S. aureus* surviving from 0 – , 60 / 70 / 80
decline / decrease, more significant / steeper / more abrupt, from 60 / 70 / 80, up to 150 for *S. aureus* ; **A** large percentage difference *in S.aureus* surviving from 60 / 70 / 80, up to 150
always more *S. aureus* than *E. coli* ; ora
all bacteria survive with no lysozyme ;
lysozyme is more effective, at killing / against, *E. coli* / AW ; **A** ora
all *E. coli* killed, at 150 pmol dm^{-3} (of lysozyme) / at highest concentration ;
comparative data quote ; *both axes, both curves*
comparative data quote ; *penalise once for lack of units in both* [4 max]

(ii) different, polysaccharides / peptidoglycans, in cell walls ;

S. aure , does not have / has less, polysaccharides / peptidoglycans, in cell wall ;
ref to shape of active site ;
ref to shape of, polysaccharide / peptidoglycan (to fit into active site) ;
S. aure has a capsule / ora ; **A** protective lipids
AVP ; e.g. *S. aureus* produces inhibitor [2 max]

[Total: 14]

Question **Expected Answers** **Marks**

5 **(a)** *one mark per row*

statement	starch	glycogen	cellulose
glycosidic bonds between monomers	✓	✓	✓
monomer is β glucose	✗	✗	✓
stored within chloroplasts	✓	✗	✗
stored in muscle cells	✗	✓	✗
exists in two forms - branched and unbranched chain	✓	✗	✗

Do not penalise where <u>all</u> ✗ <u>or</u> ✓ s are omitted
Do penalise each row if a mixture of ✗ , ✓, and blanks

5

(b) take samples at <u>timed</u> intervals e.g. every minute;
test with iodine <u>solution</u> / potassium iodide <u>soln</u> / **or** Benedicts ;
determine the end point, eg continue until no blue / black (colour) / yellow / brown appears **or** continue until brick red / colourless ;
<u>time</u> taken to reach end point e.g. record the time;
ref to use of colorimeter (for precise results) (for both experiments) **or** standards / green -> yellow -> orange -> red;
plot amount of starch remaining **or** glucose / maltose / reducing sugar produced / transmission / absorption against time / sketch graph with labelled axes;
ref to initial rate / rate calculation (e.g. $^{1}/_{t}$ or gradient from graph);

max 4

[Total 9]