

Carbohydrates and Lipids

Mark Scheme 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biological Molecules
Sub Topic	Carbohydrates and Lipids
Booklet	Theory
Paper Type	Mark Scheme 1

Time Allowed : 42 minutes

Score : / 35

Percentage : /100

Grade Boundaries:

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

1 (a)

structural feature	triglyceride	phospholipid
phosphate (group)/contains phosphorus	✗	✓
nitrogen	✗	✓
charged / polar	✗	✓
(number of) fatty acids	3	2
number of ester bonds	3	2
number of phosphate ester bonds	0	
<i>award one mark for any of the following comparisons</i>		
number of double bonds (in hydrocarbon chain)	0	1
number of saturated fatty acids / ORA	3	1
presence of double bonds	✗	✓
presence of unsaturated fatty acids	✗	✓

These are alternatives – award on mark only

[max 2]

(b) *answer may be phrased in the context of amylase/trypsin ignore anything before Golgi, e.g. shuttle vesicles from RER*

- 1 vesicles, form from / 'pinch off', Golgi (apparatus / body / complex) ;
- 2 vesicles moves, through cytoplasm / to cell (surface) or plasma membrane ;
- 3 role of cytoskeleton / microtubules in movement of vesicles ;
- 4 energy / ATP, is required (movement of vesicles / fusion with membrane) ;
- 5 vesicle fuses with / AW, cell (surface) / plasma, membrane ;
I bind / attach A join / merge / becomes part of
- 6 exocytosis / vesicle 'opens up' so that enzyme molecules are released ;
- 7 ref to fluid nature of, membranes / phospholipid bilayer, that makes this possible ;

[max 4]

(c)

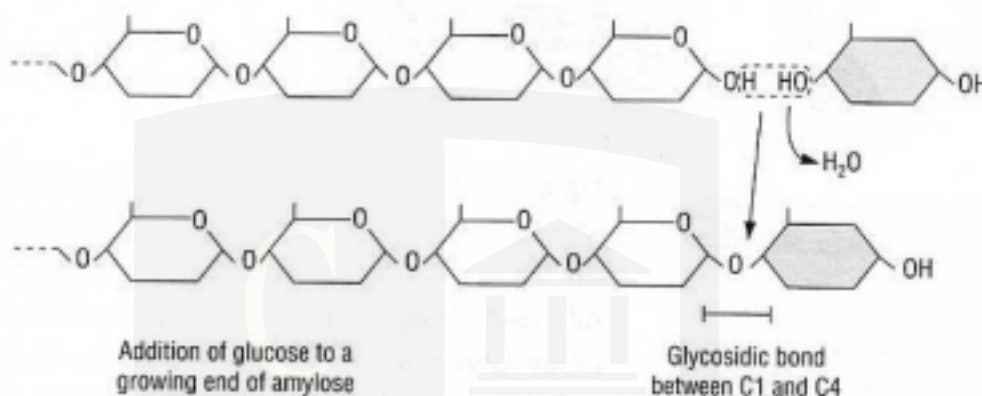
role of water	property of water
solvent for glucose and ions	dipolar / polar ; A description of polarity of water
transport in the xylem	hydrogen bonding ; I cohesion / adhesion
helps to decrease body temperature in humans	high latent heat of vapourisation / high specific heat (capacity) / high enthalpy heat of vapourisation / lots of energy required for evaporation ;

[3]

[Total: 9]

CHEMISTRY ONLINE
— TUITION —

- 2 (a) (i) $-H$ and $-OH$ indicated ; **A** $-OH$ on end of amylose and $-H$ on alpha glucose
 water eliminated / condensation ; **A** dehydration
 oxygen bridge / glycosidic bond, drawn between C1 and C4 ;



If the whole glucose molecule and/or the end of the amylose molecule has not been drawn, then only award mp3 if C1 and C4 are indicated in some way, e.g. by numbering them or putting in the hydrogens. [3]

- (ii) (1,4/1,6) glycosidic ; **A** glucosidic **A** phonetic spelling of glycosidic [1]

CHEMISTRY ONLINE
 — TUITION —

(b)

feature	a	glycogen	cellulose
type of glucose	α -glucose	α -glucose	β -glucose ;
branched or unbranched molecule	unbranched		unbranched / not branched ;
role in organisms	energy storage	energy storage	structural / (component of) cell walls / tensile strength / dietary fibre / roughage ; I support

[3]

(c) (i) *maltase and maltose must be correctly referenced
ignore references to reversible/irreversible*

(ascorbate) binds to / fits into / enters active site ;
complementary (shape) to active site ;
so substrate / maltose, cannot enter / cannot bind ;

A no / few, ES complex

A prevents formation of ES complexes

A ascorbate forms enzyme inhibitor complex

competes with substrate / competitive inhibition ;
slows the (rate of), digestion / hydrolysis / breakdown, of maltose ;

R 'stops the reaction'

R if in context of starch

alternative answer if candidates assume ascorbate is an enzyme:

ascorbate, breaks down / digests / hydrolyses, maltase ;

A ascorbate destroys the active site of maltase

so no enzymes to digest maltose ;

slows / stops, reaction / digestion / hydrolysis / breakdown, of maltose ;

[max 3]

(ii) inhibits / slows down / prevents, breakdown / (catalysing) hydrolysis / digestion, of maltose (to glucose) ;
I starch

less glucose is absorbed / passes across membranes / enters blood ;

[2]

[Total: 12]

3 (a) glycosidic ; **A** glucosidic [1]

(b) **A** = trehalose ;
B = maltose ;
C = cellobiose ;
D = sucrose ; [max 3]

(c) *idea of separation / barrier / AW, from surroundings / external environment ;*
2 regulates / controls / AW, entry / exit, substances / named substances ;
3 enables recognition of self (antigens) / cell recognition / avoids cell destruction / act as antigens / AW ;
4 allows binding of / receptors for, hormones / signal molecules / neurotransmitters / antigens ;
5 cell to cell adhesion ;
6 location for enzymes / multi-enzyme systems / enzyme pathways ;
7 AVP ; e.g. idea of flexibility (for some cells, ref. glycoproteins / glycolipids, form H bonds with water for stability [max 3]

(d) (i) 1 active site has, specific / particular, shape ;
2 complementary to substrate ; **A** substrate fits into active site
3 ref. to (some enzymes) induced fit mechanism ; **A** described
4 formation of enzyme-substrate complex ; AW
5 lowering, activation energy / E_a ; **A** detail of how activation energy lowered
e.g substrates held close together for bond formation
facilitates transfer of electrons
places strain on bond(s) to be broken [max 3]

(ii) 1 loss of tertiary structure / hydrogen bonds broken / ionic bonds broken ;
R if include disulfide or peptide bonds
2 changes shape / substrate unable to fit, active site; **A** enzyme changes shape so alters active site
3 loss of / AW, globular structure ;
4 hydrophobic groups to outside of molecule ;
5 hydrophilic groups no longer interact with water / AW ; [max 2]

(e) penalise once for no units

- 1 with no cryoprotectant, enzyme (remains), inactive / AW ;
A at 0 mmol of cryoprotectant, 0% (of maximum) activity
- 2 for both, increasing concentration increases % (enzyme) activity recovered ;
A comparative data quote with ref. to increase *need units*
- 3 trehalose, steeper curve / AW, up to 10 mmol (cryoprotectant) ; ora **R** rapid
- 4 at all concentrations (below 90 mmol), trehalose has higher percentage of (maximum enzyme) activity
- 5 comparative data quote to support either mps 3 or 4 ;
for mp 3 trehalose from 0 to 80% and glycerol from 0 to 10%
- 6 both cryoprotectants can produce, 100% / maximum, (enzyme, activity / recovery) ;
- 7 trehalose produces, 100% (enzyme) activity / full (enzyme) recovery at,
lower concentrations than glycerol / 30 mmol
compared to, 90-100 (mmol) ; *this is also mp 6*
- 8 trehalose more effective than glycerol (up to 90 – 95 mmol cryoprotectant) ;
A trehalose is a better cryoprotectant (than glycerol)

[max 4]

[Total: 16]

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— TUITION —

- 4 (a) *put ticks and crosses against the boxes*
1 – 4 and 7 – one letter only – if more than one letter mark as wrong
allow two or three correct letters for 5
allow two correct letters for 6

	statement	letter
1	contains peptide bonds	H
2	part of the molecule forms the hydrophobic part of cell membranes	L
3	contains 1-4 and 1-6 glycosidic bonds	K
4	forms the primary structure of a protein	H
5	used for energy storage in plants	K / M / H
6	forms a helical structure	M / H
7	the sub-unit molecule is β -glucose	J

[Total: 7]

CHEMISTRY ONLINE
 — TUITION —