

2010 Sec 3 Biology EOY ANSWERS

1	B	4	D	7	A	10	B	13	C	16	C	19	D	22	C	25	A	28	B
2	D	5	C	8	A	11	C	14	D	17	A	20	C	23	A	26	D	29	A
3	D	6	A	9	A	12	C	15	B	18	B	21	D	24	A	27	B	30	D

- A1 (ai)** $36 \times 20 = 720\text{mg} = 0.72\text{g}$ [1]
(aia) That he has not eaten any other meal besides the brownies/ He has not consumed any other food or drink within that time; Assume that each brownie is identical in terms of content, recipe; [1]
(aiaii) maintain fluidity/integrity of cell membrane; used to synthesise hormones; used to synthesise vitamin D; used to synthesise bile; is a component of cell membrane; [1]
(bi) He should eat the brownies over several (5) days / Eat no more than 4 pieces per day / Eat 1 piece a day [should specify how many pieces a day; 5 pieces will exceed limit] [1]
(bii) This will keep him within the limit of the fat intake per day [since he eats other things in the same day]; High fat diet may lead to heart disease; [1]
[Concept: Fat is NOT the same as cholesterol]
(c) Mix brownie with water (and decant mixture into a fresh tube); [2]
 Add 2ml Benedict's solution to 2 ml sample (accept: equal vol of Benedict's solution to stated volume of sample);
 Heat in boiling water bath for (up to) 5 min;
(d) Diet with more protein content & sugar / diet with eggs, meat, rice; [3]
 Protein is needed for building muscles; and sugar is needed for energy;
 any other logical answer + rationale;
 [reject: protein for energy – as it is a last resort]

- A2 (a)** P: ingestion Q: egestion [2]
(b) (i) (1 mark for each correct comparison, i.e., across the row) [2]

Difference	Mechanical digestion	Chemical digestion
	X	✓
	X	✓

- (b) (ii)** Mechanical [1]

Description		
Digestive gland		
<u>liver</u>		
		<u>lipase.</u>
		<u>rennin. REJECT: RENIN (different enzyme)</u>
<u>intestinal gland</u>	<u>within</u>	

- A3 (a)** Diaphragm contracts and lowers; [4]
 Intercostal muscles contract and raise the ribs upwards and outwards;
 Both actions increase the volume of the thoracic cavity;
 Pressure inside the thoracic cavity falls lower than the atmospheric pressure;
(bi) Supports the trachea to ensure that it stays open / [1]
 Prevents the trachea from collapsing
(bii) Cilia of these cells beat continuously to create a wave-like motion to [1]
 sweep the dirt and dust particles trapped by the mucus towards the pharynx
(ci) Diffusion [1]
(cii) One-cell thick epithelium; [3]
 Surrounded by a network of blood capillaries;
 Large surface area to volume ratio;
 Thin film of moisture covers the internal surface; Max [3]

- A4 (a)** No; [2]
 Concentration of sulfate ions in the soil is lower than that in the roots of barley plants
(bi) With oxygen, at 100 min uptake of sulfate ions is 360 arbitrary units, while at 200 min it is 490 arbitrary units. Thus an increase (490 - 360) of 130 arbitrary units. [1]
 Thus with oxygen the rate of sulfate ion uptake is 1.3 arbitrary units per min. [1]
 Therefore it is greater by $(1.3 - 0.4) = 0.9$ arbitrary units
(bii) The cells in the barley roots use oxygen together with glucose for tissue respiration; [3]
 to generate ATP / energy;
 ATP / energy is required in active transport;
 to move sulfate ions from the soil i.e. a lower concentration into the root cells i.e. a higher concentration / against sulfate concentration/ against conc gradient; Max [3]
(biii) Active transport of sulfate ions to the root cells increases the osmotic concentration [3]
 of ions / lowers the water potential inside the root cells;
 Therefore the water potential of the soil becomes higher than that of the root cells;
 Thus water molecules move into the root cells;
 by osmosis hence assisting in the uptake of water through the roots;
- B5 (a)** catalyst is a chemical that speeds up the rate of reaction without itself being changed [1]
 at end of reaction;
 biological because it is organic in nature / it is a protein (or RNA) / it is made from a [1]
 living organism or cell;

(b)

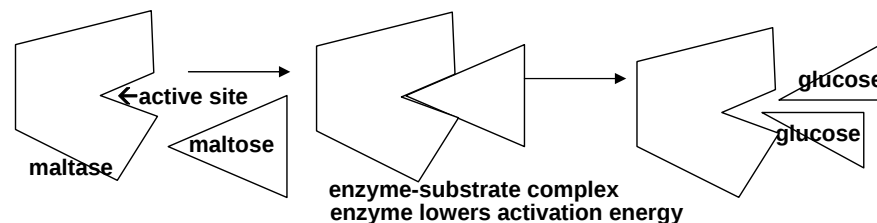


Diagram shows enzyme + substrate at beginning, with active site of enzyme labelled; [3]
 diagram shows enzyme-substrate complex, and labelled as such;
 diagram shows end products as glucose + glucose;
 diagram shows that enzyme is left unchanged at end of reaction;
 indicates by annotation that enzyme acts by lowering activation energy;
 bonus: diagram includes water molecule as part of initial reactants;

[any 3]

- (c)** Between $0 - 20^{\circ}\text{C}$ /close to 0°C , enzyme activity is low because enzymes are inactivated; [1]
 This is because enzymes and substrates have low kinetic energy/move slowly;
 Therefore rate of collision between enzyme & substrates is lower;
 As temp increases towards 36°C , rate of enzyme activity increases due to increased kinetic energy/ collisions between enzyme and substrate;
 At 36°C rate of reaction is highest because this is the optimum temp (range);

As temp increases from 36 to 50°C, rate of reaction drops because enzymes are denatured;

Bonus: high temperature causes disruption of bonds within enzyme molecule, causing disruption to 3D conformation, leading to enzyme becoming non-functional;
[any 5]

REJECT: student describes trend only – (not answering question)

B6

- (a) Title of graph: Graph showing the effect of light intensity on the rate of photosynthesis of dumbcane plants. [1] [5]
Size of graph: About ¾ of graph paper [1]
Both axes are labeled correctly [1]
Units on both axes are correct [1]
Best fit curve [1]

- (b) Describe and explain in detail, how a leaf is adapted for photosynthesis. [5]

Petiole holds the leaf in position to absorb maximum light;
Thin and flat lamina allows maximum absorption of light energy and allow carbon dioxide to reach inner cells rapidly;
Waxy cuticle to prevent excessive loss of water through evaporation from the leaf;
More stomata are present on the lower epidermis of the leaves to allow carbon dioxide to diffuse in and oxygen to diffuse out of the leaf;
Chloroplasts containing chlorophyll in all mesophyll cells absorb and transform light energy to chemical energy used in the reduction of carbon dioxide to glucose;
More chloroplasts are present in the palisade mesophyll cells to absorb more light energy;
Palisade mesophyll cells are closely arranged to increase the absorption of light energy;
Spongy mesophyll cells are loosely arranged with large intercellular spaces to allow rapid diffusion of carbon dioxide into the mesophyll cells;
A network of main vein and branch veins containing xylem and ps sugars away phloem. Xylem to transport water and mineral salts to the mesophyll cells while phloem transports sugars away from the leaf;
Max [5]

B7E

- (a) humidity; temperature; wind speed; light intensity/presence of light; [any 2] [2]
- (b) lignin in walls is a tough material to provide mechanical support for plant; [3]
lignin in walls prevents vessel from collapsing;
lignin is waterproof to prevent all water from leaving xylem as it moves up the stem;
no cross walls to provide continuous lumen for flow of water;
no protoplasm to obstruct passage of water up the stem;
- (c) plant is exposed to aphids, which insert their proboscis (accept mouthparts) into phloem; [5]
anaesthetise aphid with stream of CO₂;
cut off aphid with blade leaving the proboscis;
sap that exudes from this is tested;
Benedict's test is used to determine if reducing sugar is present;
green/ yellow/ orange/ brick red ppt indicates presence of reducing sugar;

if solution remains blue on heating, no reducing sugar is present;
repeat experiment 2 more times to ensure reliability of results or use exudate from 3 plants;

[Reject: colour change to Benedict's solution, without mention of precipitate]
[reject: precipitation]

Alternative answers:

Expose plant to 14-CO₂;
this will eventually be processed into sugar found in phloem;
(use aphids as above to extract phloem sap)
expose exudate to x-ray film to confirm that it is indeed sap;
(test for RS as above)

B7O

- (a) cause bacteria/foreign bodies to clump together/agglutinate; [2]
recruit phagocytes to engulf bacteria;
destroy bacterial cells directly (by causing rupture of surface membrane);
bind to virus, preventing them from entering host cell;
neutralise toxins produced by bacteria;
[concept: **viruses are NOT cells**]

- (b) type AB red blood cells have A and B antigens (on surface); [3]
type O blood has anti-A antibodies and anti-B antibodies in blood plasma (accept serum);
antibodies will bind to antigen (and donated blood is recognised as foreign to body);
thus causing agglutination of red blood cells;
(and also) causing haemolysis/destruction of red blood cells;

[writing precision: should mention antigens are on the **red blood cells**]

[reject: Antibodies *attack* antigens – they **attach to**...]

[reject: antibodies agglutinate antigens]

[Concept: **agglutination is NOT clotting**]

- (c) The levels of cholesterol are higher (167, 262) than normal range (130, 199); [5]
This leads to increased fatty deposits/formation of fatty plaques [REJECT: Plaque]
IN the walls of the arteries; [REJECT: on, under, above, around]
Over time, the lumen of the coronary artery becomes narrower;
Blood clots may become lodged at the narrowed part of artery;
Blood carrying oxygen and glucose to heart muscle is reduced/stopped; [REJECT: heart]
Without oxygen and glucose for respiration, heart muscle is unable to contract;
Death of heart muscle tissue /myocardial infarction occurs leading to heart attack;
[any 4]

[reject: "artery clogged up" (MM)]

Change in lifestyle: intake of cholesterol-lowering medicine; encourage Patient K to exercise more regularly; stop smoking; intake of omega fatty acids to reduce blood cholesterol levels; avoid food containing LDL; [any 1]

Reject: balloon angioplasty; stent; bypass surgery; heart transplant; [because these are if heart disease already diagnosed – but question only refers to *risk of*]