NANYANG GIRLS' HIGH SCHOOL

End-of-Year Examination 2012

Secondary Three

BIOLOGY

Paper 1

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

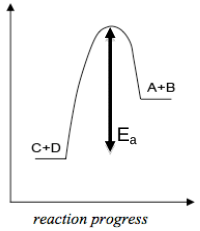
Paper 2 - Section A

Qn	Answers	Marks
A1a	Controls movement of substances into and out of a cell / partially permeable membrane / selectively permeable membrane (reject: semi-permeable)	1
A1b(i)	Cell-cell recognition; protein channels for transport of substances; enzymatic activity / protein transporters ; signal transduction; attachment of cytoskeleton and extracellular matrix; act as receptors; aid in facilitated diffusion; aid in active transport; allows diffusion of polar substances; (any 1)	1
A1b(ii)	Protein markers from mouse and human were mixed in the hybrid / markers' distributions were not separated / showed mosaic pattern / various proteins embedded in the structure; Lateral movement of proteins occurred / proteins were mobile / proteins could move within the membrane / positions of the proteins are not fixed / ability of two separate cells to fuse into a bigger cell;	2
A1c(i)	Higher temperature results in increased amount of cholesterol / Lower temperature results in decreased amount of cholesterol;	1
A1c(ii)	Membranes becomes more fluid at warmer temperatures; Cholesterol maintains stability of membrane / maintains integrity of membrane / prevents deformation / prevents disintegration ; Cholesterol helps to make the membrane less fluid at higher temperatures; Restrains movement of phospholipds / Less movement of phospholids; (any 2)	2

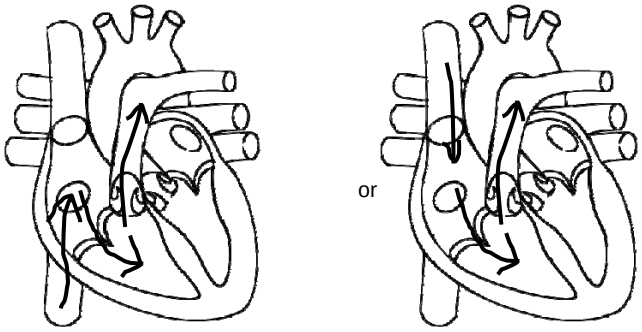
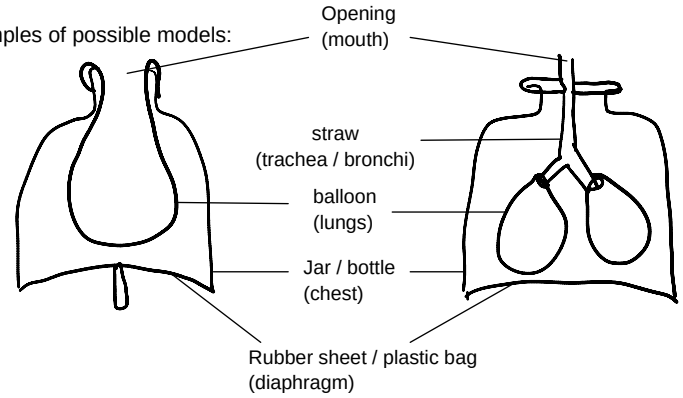
Qn	Answers	Marks
A1d		2

Diffusion	Facilitated diffusion
Transport proteins / carrier proteins are not involved	Transport proteins / carrier proteins are involved
Mainly for the transport of hydrophobic substances	Mainly for the transport of hydrophilic substances
Non-specific	Specific due to carrier proteins
Mainly for transport of non-polar substances	Mainly for transport of polar substances
May occur with or without membrane	Occurs across a membrane

(any 2)

A1e	Contractile vacuole would be less active / will not function [OWTTE]; (must have) Less water absorption in isotonic environment; hence less water is required to be pumped out by the contractile vacuole; Water potential gradient is less steep in isotonic environment; Water potential is same; No net movement of water molecules; (any 1)	2
A2a(i)		1
A2a(ii)	Adding an enzyme speeds up the reaction/increases the rate; AND as less energy is required for the reaction to progress / complete; addition of enzyme lowers activation energy; *Reject: catalysing the reaction*	2
A2b(i)	Boiled ginger juice did not curdle/coagulate / curdle slower the milk while raw ginger did; *Reject: clumping/clotting of milk, raw ginger milk will curdle better*	1
A2b(ii)	Protease / rennin in the ginger juice is denatured when boiled; The active sites of the protease / enzyme (ECF) can no longer bind to the milk proteins / The 3-D conformation of the protease has changed; *Reject: kill protease / protease died*	2

Qn	Answers	Marks
A3a	Chloroplast is <u>compartmentalized</u> for <u>more efficient</u> running of light dependent and light independent stages [OWTTE]; Enzymes for <u>light dependent stage / light stage / photolysis of water</u> are located in <u>thylakoid / grana</u>; <u>Chlorophyll</u> is located in grana to <u>absorb light</u> for photosynthesis/photolysis; Enzymes for <u>light independent stage</u> / <u>dark stage / reduction of carbon dioxide into glucose</u> are located in <u>stroma</u>; Water transport channels in membranes of chloroplast allow water to enter the organelle for photosynthesis; Double membrane allows transport of glucose out of the chloroplast; Thylakoid membrane / grana has high SA:VR to absorb more light; [any 3] *Reject: Chloroplast is round and flat to increase SA:VR, allow <u>substances</u> to diffuse in and out of the chloroplast*	3
A3b(i)	It is the same lamp / in the same position for all experiments ; We are not investigating light intensity in this experiment; It is a constant variable; Does not change the temperature *significantly*;	1 [any 1]
A3b(ii)	Remove Bunsen burner – do not heat directly; Do not add ice-cubes directly into beaker/ use ice pack; Use a water bath to regulate temperature ; Repeat the experiment 3 times / have 3 replicates ; Have a control with no plant ; Use sodium bicarbonate to provide carbon dioxide, not calcium hydroxide; Use (inverted funnel with) inverted measuring cylinder to measure oxygen volume; Do not use thermometer as a stirrer; Use a datalogger; Narrow the intervals from 10degrees to 5 degrees C [must state #]; Cover beaker to prevent evaporation and concentration of solution; Have same mass of elodea plant for each setup; Allow 5-10 min for elodea to adjust to new temperature before counting;	4 [any 4]
A3c	Thin cuticle indicates that water loss is not an issue (as it is submerged); / allows gases/water to diffuse in and out easily; / allows light to pass through easily Chloroplasts in epidermis (no mesophyll layers) indicate that it must absorb max / more sunlight in a place that receives less light; Undeveloped xylem/ few xylem seen as water transport system reduced to minimum / cells possibly receive water direct from environment; / does not require mechanical support in water; No stomata seen – because plant does not need to release gas as it does not come into contact with any; No intercellular air space as it is fully submerged and air is less dense / it does not require gaseous exchange; Only 2 layers of cells to allow rapid diffusion of gases / water; Thin epidermis to allow rapid diffusion of gases; [any 3]	3 max

Qn	Answers	Marks
A4a		1
A4b(i)	X: Red blood cell / Erythrocyte; Z: Platelet / Thrombocyte	1
A4b(ii)	Entry of bacteria/pathogens/disease-causing microorganisms into the body / infections; Tissue rejection due to incompatibility; Y (White blood cell / phagocyte) protects the body by phagocytosis / engulfing and ingesting the foreign substances / production of antibodies; Transplant of bone marrow; White blood cells are produced; [any 2]	2
A5a(i)	1m – logical model drawn is workable; 1m – diagram shows chest wall + lungs + diaphragm; 1m – At least 3 labels to show what each structure represents in the human system • glass jar / plastic bottle = chest • plastic bag (cut) / rubber sheet = lungs • straw = trachea / bronchi • opening to bottle = mouth / trachea Reject: if glass jar / bottle has an opening that is not sealed Reject: if glass jar / bottle is completely sealed Reject: if straws have gap into chest cavity Examples of possible models:  	3

Qn	Answers	Marks

A5b(ii)

	Your model	Human respiratory system
Similarity	Lungs expand as diaphragm / sheet is lowered; 2 lungs are represented (if model shows it); Trachea and bronchi are represented (if model shows it); Mouth is represented (if model shows it); [max 1]	
Difference	Diaphragm is flat; Intercostal muscles are not shown; Ribs / sternum not shown; Alveoli are not shown; Glass jar does not expand; [max 1] [statements must be in full sentences, and comparing the same things]	Diaphragm is curved at rest; Intercostal muscles are present; Ribs / sternum are present; Alveoli are present; Chest wall can expand / Sternum ;moves up and down / rib cage can move;

2

A5c Mr Tan you are feeling tired because you are taking in less oxygen due to shortness of breath; 3
Oxygen is required for <u>respiration</u> (which generates energy) / <u>oxidation</u> of food substances;
Your cells thus have insufficient energy (for biochemical processes), thus your feeling of fatigue;
Any other logical explanation;
[any 3]

Paper 2 - Section B

Qn	Answers	Marks

B6a Large, complex and insoluble molecules must be broken down <u>into small / simple / diffusible / soluble products;</u> 2
before they can pass through the <u>partially permeable membrane;</u>
of the <u>microvilli</u> in the ileum / before they can be <u>absorbed</u>;
[any 2]

B6b(i) Without stomach, a person will be unable to digest <u>protein</u> into polypeptides as efficiently as a normal person / proteins digestion will be less efficient; 4
The person will need to change his diet by consuming food with <u>less protein;</u>
No pepsin / rennin present;
Soluble caseinogen cannot be converted into insoluble casein;
Lack of physical / mechanical digestion / churning;
The person will need to take more frequent meal and lesser amount of food per meal;

The person need to take in liquid food;
The person will <u>be more prone to infection of the gut</u> as bacteria are not killed by stomach;
Person may take in amino acids supplements;
Food preparation needs to be sanitary;
Vitamin B12 cannot be absorbed;
Take vitamin B12 supplements that can be absorbed easily;

B6b(ii) Use of antibiotics; to treat the bacterial infection / kill the bacteria; 4
Vaccination against the bacteria; / Injecting antibodies against the bacteria; / kill the bacteria;
instead of using only alkali;
to neutralize the stomach acids; / reduce acid production in the stomach;
Prescribe medicine or recommend food which strengthens the immune system; / increase the amount of white blood cells in the body;
instead of asking patients to avoid spicy food and cope with stress;
Reject: Introduce white blood cells into the body / Inject white blood / Transfuse white blood cells

B7a(i) [(7.2 – 4.5)/4.5] x 100% 1
= 60% 1

B7a(ii) Increase in amount of red blood cells / Increase in amount of haemoglobin; 2
Increase in lung capacity ; Strengthen heart muscles;
More oxygen transported to <u>muscle cells</u>; [any
For efficient aerobic respiration to release energy; 2]
Adaptations do not adjust back to normal levels immediately;
Later onset of anaerobic respiration produces less lactic acid;
Increase affinity of Hb to oxygen ensures higher oxygen capacity in blood;
Decrease affinity of Hb to oxygen ensures more supply of oxygen to muscle tissues;

B7b(i) Adaptation: 2
Larger lungs / 14.3 g kg^{-1} body mass in bar-headed compared to 11.5 g kg^{-1} body mass in pink-footed and barnacle;
Explanation:
Total vital capacity / lung capacity increases / increase amount of oxygen transported in blood;
Increase in surface area of alveoli;
Greater gaseous exchange;
Increase in oxygen diffusion capacity; [any 1]

Adaptation:
Higher capillary density in left ventricles / approximately 2700 mm^{-2} in bar-headed compared to approximately 2000 mm^{-2} and 2250 mm^{-2} in pink-footed and barnacle; 2
Explanation:
Increase transport of oxygen to heart muscles;
Higher surface area for diffusion of oxygen to heart muscles / Faster diffusion of

oxygen to heart muscles; [any 1]

Adaptation:
Smaller heart / 8.8 g kg^{-1} body mass in bar-headed compared to 10.4 g kg^{-1} and 9.9 g kg^{-1} body mass in pink-footed and barnacle ;
Explanation:
Overall mass decrease and lowers energy required for flight;

B7b(ii) Higher mitochondria content in bar-headed geese / More mitochondria in bar-headed geese; Increase infolding of cristae; 2
Higher rates of aerobic respiration to release more energy in muscles for strenuous flight; Higher rates of oxidation of glucose / Krebs cycle / electron transport chain;

B8Either

a Companion cells next to sieve tube cell to keep sieve tube cell alive; 2
Sieve tube cells have degenerate protoplasm to allow sap to flow through easily;
Sieve tube cells have sieve plates / are joined end-to-end at sieve plates to allow continuous stream of sap / food substances;
Companion cells provide energy for sieve tube cells to transport food substances; [Any 2]
Reject: *phloem* has companion cells / sieve plates [concept error] – must specify STC

b Suggestion: 1
He should water the plant regularly;

Explanations: 7
Water given to soil will be absorbed by roots via osmosis;
At root xylem, mineral salts are actively pumped in, causing the water potential to become more negative;
Water moves into xylem via osmosis;
A water potential gradient is set up and a constant influx of water into xylem causes a pressure which pushes water up the xylem;
Water increases turgor pressure in cells, allowing stems and leaves to become firm;
Water will allow the plant to photosynthesise;
Glucose produced from photosynthesis is used in respiration (or any other post-photosynthetic use of glucose);
Water allows opening of stomata which allows carbon dioxide to enter leaves for photosynthesis;
Place plant in sunlight to open stomata, increase transpiration rate, to induce transpiration pull to draw water up to leaves;
Place plant in chamber of high humidity to reduce transpiration rate;
Place plant in low light intensity to reduce transpiration rate;
Place plant in still air to reduce transpiration rate;
Place plant in cooler area to reduce evaporation, thus transpiration rate; [any 7]

Bonus(Other) suggestions:
Remove brown leaves, as they are dead/are unable to photosynthesise;
Place brown leaves in soil to allow recycling of nutrients;

B8Or

a *Description of trends* 6
All graphs increase from 0 to max CO_2 levels in ~300s;
Holding breath for 60s increases CO_2 levels to ~ 76000ppm, as compared to 30s at 65000ppm, and normal at 48000ppm / Holding breath for 60s increases CO_2 levels by 28000ppm / Holding breath for 30s increases CO_2 levels by 17000ppm [OWTTE];

Explanation of trends
Increase from 0 to max CO_2 levels because sensor needs time to detect CO_2 in chamber / CO_2 molecules move randomly in chamber before being detected by sensor;
At same time, respiration produces CO_2, (which enters blood);
Elaboration: CO_2 is carried to lungs as bicarbonate / dissolved CO_2/ bound to Hb;
Blood CO_2 conc increases;
greater conc gradient of CO_2 between blood and alveolar space;
so more CO_2 diffuses into alveolar space;
CO_2 conc in breath/lungs increases as it is not expelled over 30/60sec;
Decline in CO_2 conc as there are less CO_2 molecules in the chamber;
Reject: When holding breath person goes into anaerobic respiration [concept]

b Prediction: 1
Similar trend but graph hits higher maximum value than the original for 60s;

Explanation: 3
Aerobic respiration of muscles produces more carbon dioxide than normal;
As oxygen supply becomes insufficient, muscles switch to anaerobic respiration instead;
Glucose is used to produce lactic acid;
After running, lactic acid is removed from muscle and oxidised into carbon dioxide;
Thus blood carbon dioxide levels increased;
[any 3]
Reject: During anaerobic respiration, carbon dioxide is produced (directly) [concept – lactic acid is produced only]