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BL02

Unit 2 Biological Systems and Disease

Mark scheme

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Question	Marking guidance	Mark	Comments
01.1	Ser, Arg, Leu, Tyr;	1	All amino acids needed in the correct order

Question	Marking guidance	Mark	Comments
01.2	1. Substitution of one base for another / described – eg 3rd triplet change from G → C; 2. Still codes for same amino acid / for Leu;	2	1. Ignore reference to codons 2. Reject same amino acid formed or produced.

Question	Marking guidance	Mark	Comments
01.3	1. Gly replaces Arg / change in amino acid (sequence)/primary structure; 2. Change in hydrogen/ionic bonds **OR** Change in tertiary structure; 3. Substrate cannot fit/enter/bind/attach to <u>active site</u> **OR** Substrate is no longer a complementary shape to the <u>active site</u>/no enzyme-substrate complexes form can form;	3	2. Reject peptide bonds

Question	Marking guidance	Mark	Comments
02.1	Tissue fluid;	1	Accept extracellular fluid/ECF/interstitial fluid

Question	Marking guidance	Mark	Comments
02.2	(Blood) plasma;	1	

Question	Marking guidance	Mark	Comments
02.3	To return tissue fluid/drain excess tissue fluid/named material(s) back to the circulatory system;	1	Suitable suggestions for materials e.g. proteins, fats, salts, urea, creatinine Accept other roles e.g. lipid absorption/described role in the immune response;

Question	Marking guidance	Mark	Comments
02.4	Any **two** from: 1. Single cell thick/thin walls **so** reduces diffusion distance **OR** Flattened (endothelial) cells **so** reduces diffusion distance **OR** Small diameter/narrow **so** reduces diffusion distance; 2. Fenestrations **so** can allow molecules through; 3. Narrow lumen **so** reduces flow rate giving more time for diffusion; **OR** Narrow lumen **so** red blood cells in contact with wall/gives a short diffusion distance;	2 max	1. Reject capillaries are one cell thick or reference to cell walls 1. For reduces diffusion distance allow rapid diffusion 2. Allow gaps between cells

Question	Marking guidance	Mark	Comments
02.5	1. Proteins can move into tissue fluid; 2. Water potential of tissue fluid decreases/becomes more negative **OR** Water potential of blood plasma increases/becomes less negative; 3. More <u>water</u> moves into tissue fluid via <u>osmosis</u> **OR** Less <u>water</u> moves/reabsorbed back into capillaries via <u>osmosis</u>;	3	2. For water potential allow WP or Ψ

Question	Marking guidance	Mark	Comments
03.1	1. (Releases) toxins; 2. Kills/damages cells/tissues;	2	

Question	Marking guidance	Mark	Comments
03.2	1. (Phagocyte engulfs pathogen) to form vacuole/vesicle/phagosome; 2. Lysosome fuses/joins with vacuole/vesicle/phagosome; 3. (Releasing) enzymes/lysozymes that digest/hydrolyse pathogen;	3	2. Accept formation of a phagolysosome 3. For digest/hydrolyse allow breakdown

Question	Marking guidance	Mark	Comments
03.3	1. (As antibody concentration increases) more antigen-antibody complexes form; 2. (Leads to) more agglutination (so phagocytosis becomes more efficient);	2	Need reference to more once only for 2 marks 1. Accept other descriptions for this 2. Accept 'clumping' for agglutination 2. Accept opsonisation/idea of labelling pathogen for phagocytes

Question	Marking guidance	Mark	Comments
03.4	1. Antigens/antibodies are a specific shape **OR** Antigens/antibodies have specific tertiary structure **OR** Antibodies have specific (shape) binding sites; 2. Antigens (on pathogen) fit/bind/are complementary to antibody **OR** Antibody-antigen complex forms;	2	Reject reference to active site once

Question	Marking guidance	Mark	Comments
04.1	1. Single/thin layer of cells/spread out cells **so** light passes through (making cells/nuclei/chromosomes visible); 2. Avoid rolling cells together **OR** Avoid displacing cells (to different distances from the tip) **OR** Avoid breaking/damaging chromosomes/cells;	2	1. Accept thin layer of tissue

Question	Marking guidance	Mark	Comments
04.2	To make chromosomes/chromatids/DNA/genetic material visible;	1	Ignore cells/organelles are more visible

Question	Marking guidance	Mark	Comments
04.3	Any **one** from the following: 1. (Toluidine blue) allows chromosomes to be seen more clearly; 2. (Toluidine blue) is less hazardous/is non-acidic/does not require heating;	1 max	Ignore reference to simpler / cheaper. 2. Accept acetic orcein may damage cells/tissues

Question	Marking guidance	Mark	Comments
04.4	14;	1	Only allow whole number

Question	Marking guidance	Mark	Comments
04.5	1. Overlap of standard deviations between 3 mm and 5 mm/between 5 mm and 7 mm; 2. So likely to be no significant difference (in the mean mitotic index between these distances); **OR** 3. No overlap of standard deviations between 1 mm and 3 mm; 4. So likely to be a significant difference in the mean mitotic index between these distances;	2	Mark in pairs 2. & 4. Reject reference to results being significant 2. & 4. Accept appropriate reference to chance If neither points are mentioned allow for one mark standard deviation as a measure of spread of data from the mean value

Question	Marking guidance	Mark	Comments
04.6	1. Distance of 1 mm/at the tip gives high(est) mitotic index; 2. (So) where (most) cell division/mitosis takes place;	2	2. Accept reference to root tip as location of meristem 2. Ignore reference to growth

Question	Marking guidance	Mark	Comments
04.7	Any **three** from the following: 1. The students could have moved the cells to a different distance from the tip e.g. when adding the coverslip; 2. Idea of error in counting e.g. the students could have miscounted the number of cells in the field of view/number of dividing cells; 3. (The magnification of the microscopes could be different so) there were more/less cells in a field of view (so that any errors had a smaller/larger effect on the mitotic index); 4. The fields of view at a particular distance could have been closer to the middle or nearer the outside edge of the root tip; 5. The students were unable to identify which end of the root was the tip so the distances were incorrect; 6. Genetic differences between root tissue/roots tissue samples from different species/varieties of onion/from different onions of the same species; 7. Different age of root tips/onion roots allowed to grow for different lengths of time; 8. Onions grown under different named conditions prior to the investigation e.g. light regime, intensity, temperature; 9. Quality of root tip sample leads to difficulty in observing chromosomes in cells; 10. Health of the onion tissue affecting root growth;	3 max	2. Accept error in the procedure qualified e.g. not enough stain added 2. Accept idea of students misidentifying cells that are dividing

Question	Marking guidance	Mark	Comments
05.1	Cholesterol/lipoprotein/protein/phospholipid;	1	Accept amino acids

Question	Marking guidance	Mark	Comments
05.2	(Healthy volunteers) 1. (So) results are not affected by medical conditions/medication **OR** (So) volunteers have similar lipid digestion/absorption; (Volunteers not eating any food for 12 hours before the start of the investigation) 2. Idea of no/low concentrations of lipid/triglycerides in the duodenum **OR** Idea that results are not likely to be affected by any lipids/triglycerides previously eaten;	2	

Question	Marking guidance	Mark	Comments
05.3	0.6 / 0.61;;	2	Award mark(s) if answer is recorded in **Table 4** One mark for 301.6/301.57/301.5656/301.7 OR Correct calculation of SA:V but using incorrect mean surface area value

Question	Marking guidance	Mark	Comments
05.4	Mean blood concentration of chylomicrons is higher (at each interval/throughout the investigation) with small lipid droplets;	1	Accept other suitable uses of data from **Figure 3** to illustrate this point.

Question	Marking guidance	Mark	Comments
05.5	1. (Collectively) small lipid droplets have greater total surface area for lipase **OR** (Individual) small droplets have larger SA:V for lipase; 2. (Leads to) faster/greater rate of digestion (of triglycerides) to fatty acids and glycerol/monoglycerides;	2	2. Accept small droplets absorb directly into lacteal/bloodstream

Question	Marking guidance	Mark	Comments
06.1	1. Capsid; 2. (Lipid) envelope;	2	 2. Allow plasma/(phospho)lipid membrane/envelope

Question	Marking guidance	Mark	Comments
06.2	1. (After 8 years) there is a low number of helper T-cells / only 130 to 140 helper T-cells (per mm^3); 2. (So fewer) helper T-cells available to activate B cells/plasma cell/memory cells; 3. Reduced/no antibody production;	3	 2. Accept reference to cytotoxic T-cells

Question	Marking guidance	Mark	Comments
06.3	263;	2	One mark for: 460/459.7/262.7/262.6

Question	Marking guidance	Mark	Comments
06.4	1. Reverse transcriptase; 2. Prevents formation of HIV DNA from RNA strands; 3. Role of DNA in coding for new HIV structures / enzymes to break out of the cell; **OR** 4. Protease; 5. Prevents modification of proteins; 6. Proteins used for making new HIV / as enzymes to break out of the cell;	3	Mark as mp1-3 or mp4-6 3. Prevents formation of viral proteins / viral mRNA

Question	Marking guidance	Mark	Comments
07.1	Any **three** from: Factors related to the plants 1. Same species/variety/type of plant; 2. Same/similar age of plant; 3. Growing conditions during/before the start of the investigation; 4. Time/method of inoculation of plants with BYDV; Factors related to aphids 5. Age of aphids; 6. Length of time infective aphids have been carrying BYDV; 7. Conditions aphids were kept in during/before the start of the investigation; Factors related to setup of choice chamber 8. Leaf surface area (in the choice chamber) for each type of plant; 9. Distance between leaves in the choice chamber;	3	3. Accept suitable suggestions e.g. volume of water, soil pH, type/concentration of fertiliser 7. Accept suitable suggestions e.g. air humidity in the choice chamber

Question	Marking guidance	Mark	Comments
07.2	1. Stylets inserted/punctured into phloem vessels; 2. Sap in phloem under (high) pressure (so is forced into the aphid's gut);	2	1. Accept description of stylets e.g. piercing mouthpart

Question	Marking guidance	Mark	Comments
07.3	To see if the observed numbers (of infective aphids and non-infective aphids on the BYDV-infected/non-infected plants) are (significantly) different from the expected **OR** The data is in categories and is counted;	1	Accept frequencies or proportions for number

Question	Marking guidance	Mark	Comments
07.4	1. The **probability** that the difference (between the expected and observed numbers of aphids) is due to **chance** is less than 5%; 2. So the differences are <u>significant</u>; **OR** 3. The **probability** that the difference (between the expected and observed numbers of aphids) is due to **chance** is less than 0.01%; 4. So the differences are (highly) <u>significant</u>;	2	Mark as pairs 2. and 4. Allow P <0.05 so reject the null hypothesis

Question	Marking guidance	Mark	Comments
07.5	**Support** 1. Non-infective aphids prefer to feed on BYDV-infected plants **so** more aphids become infective/more aphids carry BYDV; 2. Infective aphids prefer to feed on non-infected plants **so** (increased) transmission/spread of BYDV; 3. Large sample size 12 replicates (of 50 aphids)/600 aphids **so** results are representative/valid; 4. Statistical test demonstrates differences are significant; **Against** 5. No error bars shown; 6. Investigation in laboratory conditions/aphid behaviour could be different in agricultural/natural conditions; 7. Investigation only used one species of aphid/the behaviour of other aphid species may not be the same **OR** Investigation only used one viral pathogen/BYDV other viral pathogens may not affect aphid behaviour in the same way **OR** Investigation only used one species of plant;	4 max	For full marks must have at least one point from each of support and against 6. Accept other valid reasons e.g. relating to differences in **named** environmental factors e.g. temperature, humidity

Question	Marking guidance	Mark	Comments
08.1	1. Atrium has higher pressure than ventricle (due to filling/contraction) causing atrioventricular valves to open; 2. Ventricle has higher pressure than atrium (due to filling/contraction) causing atrioventricular valves to close; 3. Ventricle has higher pressure than aorta causing semilunar valve to open; 4. Higher pressure in aorta than ventricle (as heart relaxes) causing semilunar valve to close; *5.* (Muscle/atrial/ventricular) contraction causes increase in pressure;	5	1. Accept bicuspid, reject tricuspid 3 & 4. Allow aortic valve Start anywhere in sequence, but points must be in the correct order. MP1, 2, 3 and 4 penalise once if not comparative

Question	Marking guidance	Mark	Comments
08.2	1. Atheroma is fatty material/cholesterol/plaque/LDL in the wall of an artery; 2. (Higher risk of) thrombus formation/blood clot; 3. Blocks <u>coronary</u> artery; 4. Less oxygen/glucose to heart muscle/cells/tissue; 5. Reduces/prevents respiration (so causes myocardial infarction);	5	3. Accepts narrows/restricts blood flow in the coronary arteries