Mark Scheme (Results)

Summer 2023

Pearson Edexcel International GCSE In Human Biology (4HB1) Paper 02R

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1 (a) (i)	<table><tr><th rowspan="2">cell structure</th><th colspan="3">Function</th></tr><tr><th>makes proteins</th><th>contains DNA</th><th>allows substances in and out of cells</th></tr><tr><td>nucleus</td><td></td><td>✓</td><td></td></tr><tr><td>ribosomes</td><td>✓</td><td></td><td></td></tr><tr><td>cell membrane</td><td></td><td></td><td>✓</td></tr></table>	One mark for each correct row	3
(ii)	cell membrane/cell wall/cytoplasm/plasmid/DNA/ribosomes/flagellum;		1
(b) (i)	Part W phosphate (group); Part X sugar/ deoxyribose sugar;		2
(ii)	• complementary base pairing; • A-T, G-C; • hydrogen bonds between bases;		3
(c)	153 ÷ 3; 51;	Full marks for correct final answer Ecf allow correct final answer to calculation for 1 mark	2

Total for Question 1 = 11 Marks

Question number	Answer	Notes	Marks
2 (a) (i)	In the following order: • proteases; • protein Q; • amino acids;	Reject protein P	3
(ii)	stomach/ small intestine/ pancreas/ duodenum/ ileum;		1
(iii)	DNA / mRNA / messenger RNA;		1
(b) (i)	• as pH increases activity increases; • to pH2/peaks at pH2/to optimum; • decreases from pH2;	Allow increases and then decreases for one mark	3 exp
(ii)	Any two from: • enzyme is denatured (at pH2); • change in shape of active sites; • no enzyme-substrate complexes formed/no binding with substrate;		2 exp
(iii)	• repeat; • calculate a mean/average/remove anomalous result		2 grad
(iv)	Any one from: • temperature; • substrate concentration/volume; • enzyme concentration/volume;		1 grad

Total for Question 2 = 13 Marks

Question number	Answer	Notes	Marks
3 (a)	• contains particular features / characteristics/ adaptations; • to perform a specific function;		2
(b) (i)	• 84 ÷ 0.006; • 14000x	Allow correct final answer from a calculation that includes 84 and 0.006, max 1 mark	2
(ii)	half the amount/haploid/23 chromosomes;		1
(iii)	• to provide energy; • for swimming/movement/travelling;		2
(iv)	• 180 ÷ 0.070; • 2571; • (÷ 60) 42.85;	Allow any figure that rounds to 43 Allow ecf for third mark – an incorrect value for a calculation carried out for mps1 and 2, divided by 60 **and** a correct answer to that calculation	3 exp
(c)	Any two from: • greater magnification; • higher resolution/can see objects more clearly/in more detail; • can see a greater number of structures;		2 exp

Total Question 3 = 12 marks

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 (a) (i)</td><td><table><tr><th>Activity</th><th>Pulse rate
in beats per minute</th></tr><tr><td>walking</td><td></td></tr><tr><td>jogging</td><td></td></tr><tr><td>running</td><td></td></tr></table></td><td>1 mark for valid table
1 mark for labels;
1 mark for units;</td><td>3</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Activity</th><th>Pulse rate
in beats per minute</th></tr><tr><td>walking</td><td>94</td></tr><tr><td>jogging</td><td>116</td></tr><tr><td>running</td><td>133.5</td></tr></table></td><td>2 marks for all readings correct.
1 mark for 1 or 2 readings correct.

tolerance +/- ½ square</td><td>2</td></tr>
<tr><td>(iii)</td><td>Any four from five

• take resting pulse;
• method for measuring pulse rate e.g. finger on wrist/neck/electronic device;
• carry out an activity/exercise (for a set period of time/given time);
• measure pulse rate after activity;
• repeat (for each activity);</td><td></td><td>4</td></tr>
<tr><td>(b)</td><td>Any four from

• faster/more/greater muscle contraction during running;
• more energy/ATP required;
• faster rate of respiration;
• more oxygen/ glucose required/more CO_2 removed;
• increase blood flow/faster blood flow/more blood (to muscles);</td><td>ORA for all marking points</td><td>4</td></tr>
</table>

Total for Question 4 = 13 marks

Question number	Answer	Notes	Marks
5 (a) (i)	Any two from: • chemical; • diffused from one neurone to another; • allows neurones to communicate / reference to communication between presynaptic and post synaptic neurones;		2
(ii)	• neurotransmitter/dopamine/ diffuses/travels across synapse; • binds with receptor (on postsynaptic membrane)		2
(iii)	Any two from: • increased movement; • increased heart rate/blood pressure; • more energy; • sleeping difficulties; • anxiety/stress; • hallucinations;		2
(b) (i)	Any two from • tremors/random muscular movement / involuntary movement; • slower movement; • speech/writing changes; • impaired posture/balance; • sleeping problems; • rigidity/stiffness; • anxiety/depression/mental health/memory problems;		2
(ii)	• (145 000 ÷ 100) (x 18) = 26 100; • (26 100 + 145 000) = 171 100;	Allow ecf for mp2 – if mp1 has an incorrect value but this value is added to 145 000 to arrive at the correct answer for the calculation award 1 mark Full marks for correct final answer	2

Total for question 5 = 10 marks

Question number	Answer	Notes	Marks
6 (a)	• fertilisation; • egg and sperm fuse/gametes/join;		2
(b)	Any four from • mitosis; • DNA is replicated; • chromosomes move to the centre of the cell; • chromosomes are separated to opposite poles; • cell divides;	Allow one mark for prophase, metaphase, anaphase, telophase in the correct order Allow zygote/embyro divides	4
(c)	**D;** (the cells are able to differentiate into any type of body cell)		1
(d)	• (corpus luteum) produces progesterone; • to maintain uterus lining;		2
(e)	Any two from: • umbilical cord established; • transports nutrients/named nutrients/oxygen (to fetus/embryo); • removes waste products/named waste product (from fetus/embryo);		2
(f)	development of male sexual characteristics/genitalia;		1
(g)	**C;** (release of oxytocin from the pituitary gland)		1

Total for Question 6 = 13 marks

Question number	Answer	Notes	Marks
7 (a)	Any three from • wall is one cell thick for faster diffusion/short diffusion distance; • close network of blood vessels to decrease diffusion distance/maintain gradient; • contains microvilli to increase surface area (for absorption/diffusion); • contains a lacteal/lymph vessels to absorb fat/fatty acids/glycerol;	Adaptation and explanation needed for each mark	3
(b) (i)	Any two from • (immune system) does not recognise self-antigens/sees self-antigens as foreign; • white blood cells/immune system produce antibodies; • antibodies bind to (self) antigens;		2
(ii)	• villi damaged/destroyed/less villi; • decreased surface area; • less/slower absorption of nutrients/named nutrient;		3

Total for Question 7 = 8 Marks

Question number	Answer	Notes	Marks
8 (a) (i)	Any two from • DNA/RNA/genetic material; • surrounded by a protein coat/capsid; • (protein) spikes on outer surface;		2
(ii)	Any five from • transcription (of DNA); • into mRNA; • translation (of mRNA) at the ribosome; • by tRNA; • reference to (tRNA) anticodon pairing with (mRNA) codon; • amino acids assembled to form (viral) proteins;		5
(b) (i)	Human Immunodeficiency virus/HIV;		1
(ii)	• (1400000 – 650000) = 750000; • (750000 ÷ 1400000) (x 100) = 54%	Allow any figure that rounds to 54	2

Total for Question 8 = 10 Marks

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