Mark Scheme (Results)

January 2023

Pearson Edexcel International GCSE
In Biology (4BI1)
Paper 2B

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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	Additional guidance	Mark
1(a)	9.5×10^8 (2)	**Allow** 9.48×10^8 **Allow** 950 000 000 **or** 948 000 000 **or** 9.50 / 9.48 with wrong power for standard form for **one mark** e.g. 95×10^7 correct answer gains full credit	**2**

Question Number	Answer	Additional guidance	Mark
1 (b)	carbon dioxide / CO_2 / water (vapour) / H_2O (1)		**1**

Question Number	Answer	Additional guidance	Mark
1 (c)	An explanation that makes reference to four from: • 40 °C (temperature) (1) • more particle movement / more (kinetic) energy / faster diffusion / eq (1) **OR** • long tubing / coiled tubing / eq (1) • to increase / large surface area / eq (1) **OR** • thin wall / thin membrane / eq (1) • to decrease diffusion path / short diffusion distance / eq (1) **OR** • circulating / moving dialysis fluid / eq (1) • to maintain diffusion gradient / concentration gradient / eq (1) **OR** • no urea (in dialysis fluid) (1) • (so there is a) concentration / diffusion gradient / eq (1)	**mark in pairs** **Allow** warm / body temperature **Allow** large surface area (1) for (fast) diffusion (1) **Allow** short distance through membrane for diffusion = two marks **Allow** fluid is pumped **Allow** high to low concentration	**4**

Question Number	Answer	Additional guidance	Mark
1 (d)(i)	A (Bowman's capsule) is the only correct answer *B is incorrect as ultrafiltration does not occur at the collecting duct* *C is incorrect as ultrafiltration does not occur at the distal convoluted tubule* *D is incorrect as ultrafiltration does not occur at the loop of Henle*		**1**

Question Number	Answer	Additional guidance	Mark
1(d)(ii)	A description that makes reference to two of the following: • selective reabsorption (1) • in proximal (convoluted) tubule / PCT (1) • active transport / uses energy / uses ATP (1) • against (concentration) gradient (1)		**2**

Question Number	Answer	Additional guidance	Mark
1(d) (iii)	A (renal artery / ureter) is the only correct answer *B is incorrect because the urethra does not exit the kidney* *C is incorrect because the renal vein does not bring blood into the kidney* *D is incorrect because the renal vein does not bring blood into the kidney*		**1**

Question Number	Answer	Additional guidance	Mark
1 (e)	An explanation that makes reference to three of the following: • osmoreceptors / hypothalamus, detects high salt concentration in blood / lower water potential in blood / eq (1) • (pituitary) releases (more) ADH (1) • (nephron) cells / collecting duct more permeable (1) • (more) water is reabsorbed / (more) water absorbed into blood /eq (1) • urine becomes more concentrated / lower volume of urine / eq (1)	**Allow** lower water concentration	**3**

Total 14 marks

Question Number	Answer	Additional guidance	Mark
2(a)(i)	C is the only correct answer *A is incorrect because it is the retina* *B is incorrect because it is the conjunctiva* *D is incorrect because it is the lens*		**1**

Question Number	Answer	Additional guidance	Mark
2 (a)(ii)	An explanation that makes reference to two of the following: • circular muscles <u>contract</u> (1) • radial muscles relax (1) • (so) pupil narrows / gets smaller / constricts / iris widens / eq (1)	**Ignore** ciliary	**2**

Question Number	Answer	Additional guidance	Mark
2 (b)(i)	• using one eye or both eyes / amount of eyes / number of eyes / eq (1)		**1**

Question Number	Answer	Additional guidance	Mark
2 (b)(ii)	An answer that makes reference one of: • light intensity / lighting / eq (1) • distance (from block) / eq (1) • size of pins / shape of pins / colour of pins / sideways distance between pins / number of pins / eq (1) • size of block / shape of block / angle of the block / size of grid / eq (1)		**1**

Question Number	Answer			Additional guidance	Mark
2 (b)(iii)		**Number of correctly identified pins**		**two marks** for all four correct **Allow one mark** for any **two** correct	**2**
		Using one eye	**Using both eyes**		
	Mode	3	6		
	Median	2	6		

Question Number	Answer	Additional guidance	Mark
2 (b)(iv)	An explanation that makes reference to three of: • better distance judgement (with two eyes) / better depth perception / poorer distance judgement with one eye / eq (1) • large area seen by <u>both eyes</u> / large overlapping visual field / eq (1) • to locate prey / catch prey / chase prey / see prey / eq (1) • do not need wide field of view as not preyed upon / do not need to see behind as not preyed on / eq (1)	**Allow** more pins were correct when using two eyes / higher mode / median when using two eyes / eq **Allow** converse for one eye **Ignore** larger field of view unqualified **Ignore** food **Allow** animal for prey	**3**

Total 10 marks

Question Number	Answer	Additional guidance	Mark
3 (a)	• a section / length of DNA that codes for a protein / polypeptide / chain of amino acids / eq (1)		**1**

Question Number	Answer		Additional guidance	Mark
3 (b)(i)	Cattle colour	Genotype	**Allow** RR, WW, WR **Allow** rr, ww, rw	**1**
	red	C^RC^R		
	white	C^WC^W		
	roan	C^WC^R / C^RC^W		

Question Number	Answer	Additional guidance	Mark
3 (b)(ii)	An answer that includes the following:		**4**
	• parental genotypes of C^WC^R and C^WC^R (1)	**Allow** WR and WR **Allow** Cc and Cc	
	• parental gametes of C^W or C^R (and C^W or C^R) (1)	**Allow** W or R **Allow** C or c	
	• offspring as 1 C^RC^R 2 C^WC^R 1 C^WC^W (1)	**Allow** 1 RR, 2 WR, 1 WW **Allow** 1 CC (red) and 1 cc (white) 2 Cc (roan) **Allow** different letters	
	• probability calculated as 0.25 / ¼ / 25% (1)	**ECF** for wrong parental genotypes for MP2 and MP3 only	

Question Number	Answer	Additional guidance	Mark
3 (c)(i)	An answer that makes reference to two of the following: • height is <u>polygenic</u> (1) • so multiple / many / more than one gene / different genes control height / eq (1) • animals may get a mixture of dominant and recessive <u>alleles</u> for <u>different</u> genes / eq (1) • environment / nutrition may affect height / eq (1)	**Allow** hair colour is <u>monogenic</u> **Allow** only one gene for hair colour **Ignore** multiple alleles **Allow** coat colour has no environmental effect / is entirely genetic	**2**

Question Number	Answer	Additional guidance	Mark
3 (c)(ii)	A description that makes reference to two of the following: • select cattle that are taller and mate them / eq (1) • select offspring (that are taller) and mate them / eq (1) • repeat (through generations) / eq (1)		**2**

Total 10 marks

Question Number	Answer	Additional guidance	Mark
4 (a)	An explanation that makes reference to two of the following: • plants will be <u>genetically</u> identical / same <u>genes</u> / will all have the <u>gene</u> / same DNA / eq (1) • <u>all</u> have same (saturated) fat / <u>all</u> have less (saturated) fat / eq (1) • (only one plant was made) and there were no others to breed with / eq (1) • no need to repeat genetic modification / eq (1) • fast method (to produce many) / can be produced any time of year / eq (1)	**Allow** no genetic variation **Allow** they are clones	**2**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	A description that makes reference to four of the following: • weigh beans / same mass of beans / (calculate) per gram of food / eq (1) • same volume of water / measure volume / same mass of water / stated volume of water / eq (1) • ignite bean / set fire, <u>and</u> hold under test tube / water / heat water / eq (1) • keep igniting until will no longer burn / burnt completely / eq (1) • measure temperature rise / start and end temp / start and highest temp / change in temp / eq (1) • repeats (1)	**Ignore** amount **Ignore** amount **Allow** hold bean at same distance from test tube If formula given, **allow** mp1, mp2 and mp5	**4**

Question Number	Answer	Additional guidance	Mark
4 (b)(ii)	An explanation that makes reference to one of the following: • wear eye protection / gloves / eq (1) • wear lab coat / tie back long hair / eq (1) • use a heat proof tile / place on safety flame when not using / use tongs / clamp test tube in stand / eq (1)		**1**

Question Number	Answer	Additional guidance	Mark
4 (b)(iii)	An explanation that makes reference to four of the following: • oxygen supply / oxygen gas inlet (1) • to ensure complete combustion / so burns fully / eq (1) **OR** • insulated coat / lid / insulation / eq (1) • to prevent heat loss / keep heat in / not affected by outside temp / eq (1) **OR** • stirrer / eq (1) • to provide even temperature / spreads heat around / eq (1) **OR** • large(r) volume of water / smaller surface area : volume ratio of water (1) • so less heat loss / eq (1) **OR** • burnt using ignition coil / ignition in the equipment / no need to move the burning bean / no need to relight / eq (1) • so less heat is lost / eq (1) **OR** • placed inside a steel container (1) • conducts / transfers heat to water / eq (1) **OR** • sample is surrounded by the water (1) • so more heat transferred to water / less heat lost / eq (1)	**Mark in pairs** **Allow** energy loss for heat loss throughout insulated coat and ignition coil in equipment reduces heat loss = 4 marks **Allow** lit inside the container	**4**

Total 11 marks

Question Number	Answer	Additional guidance	Mark
5 (a)(i)	• 48 (2)	**One mark** for division by 25 **or** 41200 – 40000 **or** 1200 correct answer gains full credit	**2**

Question Number	Answer	Additional guidance	Mark
5 (a)(ii)	An explanation that makes reference to three of the following: • carbon dioxide is a greenhouse gas / causes greenhouse effect / increased reflection of radiation / global warming / increased temperature / heat trapped / eq (1) • ice cap melting / glacier melting / sea level rise / flooding / habitat loss / eq (1) • climate change / weather pattern changes / droughts / storms / extreme weather / desertification / eq (1) • extinctions / change in distribution of organisms / migration / pest spread / food chains affected / ecosystem loss / eq (1) • ocean acidification / coral reef bleaching / eq (1)		**3**

Question Number	Answer	Additional guidance	Mark
5 (b)(i)	An explanation that makes reference to three of the following: • decomposition / decomposers / eq (1) • (decomposer) bacteria / fungi (1) • (organic waste) to ammonia / ammonification (1) • ammonium to nitrite / nitrite converted to nitrate (1) • nitrification / nitrifying bacteria (convert ammonium to nitrite / nitrite to nitrate / ammonium to nitrate) (1)	**Ignore** breakdown **Allow** decomposer bacteria for 2 marks **Allow** ammonia **Ignore** ammonium to nitrate	**3**

Question Number	Answer	Additional guidance	Mark
5(b)(ii)	An explanation that makes reference to one of the following: • does not consider plants / bacteria / fungi / protoctists / eq (1) • does not take into account the population sizes / numbers of organisms / abundance / some species may have different numbers / eq (1) • some species may be seasonal / migrate (1)		**1**

Question Number	Answer	Additional guidance	Mark
5 (b) (iii)	An explanation that makes reference to four of the following: • as nitrate increases, diversity decreases / deforestation reduces biodiversity /eq (1) • soil erosion / run off / leaching of minerals / leaching of nitrates / release of organic waste into river / eq (1) • eutrophication occurs / algae grow / (river) plants grow / eq (1) • less light penetration / eq (1) • death of plants / less photosynthesis (1) • (dead algae / organic waste) decomposes (1) • less oxygen / eq (1) • due to (bacterial) respiration (1) • fish / animal species die (1) • loss of food / disruption of food chains / loss of nesting sites / habitat / eq (1)	**Allow** converse **Allow** leaching occurs **Ignore** nutrients	**4**

Total 13 marks

Question Number	Answer	Additional guidance	Mark
6 (a)	B (bacteria, fungi, and protoctists) is the only correct answer *A is incorrect because protoctists also has pathogens* *C is incorrect because fungi also has pathogens* *D is incorrect because bacteria also has pathogens*		**1**

Question Number	Answer	Additional guidance	Mark
6(b)(i)	An explanation that makes reference to three of the following: • weak(er) / inactivated virus / inactive pathogen / microbe / eq (1) • antigens (in vaccine) (1) • lymphocytes (recognise antigens) (1) • memory cells (1) • faster / sooner / larger number of antibodies made (when virus encountered again) / secondary immune response occurs (if virus encountered again) (1)	**Ignore** small amount / dead virus **Allow** wbc **Ignore** phagocyte	**3**

Question Number	Answer	Additional guidance	Mark
6 (b)(ii)	An answer that makes reference to four of the following: • rabies cases are high <u>before vaccination</u> / before 1947 / eq (1) • (continuous) fall in cases <u>after vaccination</u> / after 1940s / after 1950s (1) • cases of rabies, plateau / level off (from 1950s / 1960s) (1) • correlation between rabies cases in dogs and humans / rabies cases in dogs and humans fall at same times / eq (1) • human rabies cases fluctuate / there are still some cases of human rabies / human rabies has not been eradicated / eq (1) • (most) human rabies must have been from dogs / vaccinated dogs do not pass rabies on to humans / eq (1) • some human rabies cases from other animal species / wild dogs / wild animals / eq (1) • data is reliable as it is for a long time / large area / whole country / eq (1)	**Allow** for human or dog **Allow** for human or dog **Allow** for human or dog **Allow** cases in dogs and humans both fall <u>after vaccination</u> **= 2 marks** **Allow** fewer dogs can pass on rabies to humans / vaccination means fewer hosts for virus / virus can't reproduce in vaccinated dogs	**4**

Question Number	Answer	Additional guidance	Mark
6 (b)(iii)	A description that makes reference to four of the following points: • ribosomes (bind to RNA) (1) • translation occurs (1) • triplet / codon on RNA codes for an amino acid / eq (1) • tRNA binds to RNA / anticodon binds to codon / eq (1) • tRNA brings amino acids / eq (1) • amino acids are joined together (to make protein) / forms a chain of amino acids / peptide bonds form / polypeptide forms / eq (1)	**Allow** mRNA for the vaccine RNA **Ignore** to make protein unqualified	**4**

Total 12 marks

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