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Mark Scheme (Results)

January 2023

Pearson Edexcel International GCSE
In Biology (4BI1) Paper 1BR

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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.

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Question Number	Answer	Additional guidance	Mark
1(a)(i)	The only correct answer is B (bronchiole) A is incorrect as X is not an alveolus C is incorrect as X is not a bronchus D is incorrect as X is not the trachea		**1**

Question Number	Answer	Additional guidance	Mark
1 (a)(ii)	The only correct answer is A (diaphragm contracts and moves downwards) B is incorrect because the diaphragm does not move upwards C is incorrect because the diaphragm contracts D is incorrect because the diaphragm contracts		**1**

Question Number	Answer	Additional guidance	Mark
1 (b)(i)	An explanation that makes reference to three of the following: • inhaled air contains more oxygen (than exhaled air) / inhaled air contains less carbon dioxide than exhaled air / eq (1) • oxygen has diffused into the blood / carbon dioxide has diffused out of the blood (1) • oxygen is used by respiration / eq (1) • carbon dioxide is produced by respiration / eq (1) • nitrogen is not used / released (by respiration) / eq (1)	**Allow** oxygen has diffused into red blood cells **Allow** used in metabolic processes **Allow** produced by metabolic processes **Allow** not needed	**3**

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Question Number	Answer	Additional guidance	Mark
1 (b)(ii)	An explanation that makes reference to two of the following: • exhaled air is a mixture of inhaled air and alveolar air / eq (1) • no gas exchange occurs in the trachea / bronchi / bronchioles / eq (1) • gas exchange (only) occurs at the alveoli (1)	**Allow** some air is breathed straight out / some air does not reach the alveoli / some air remains in bronchi / some air remains in trachea **Allow** diffusion of oxygen / carbon dioxide occurs in alveoli **Allow** movement of oxygen into blood / movement of carbon dioxide out of blood (only) occurs in the alveoli	**2**

(Total for Question 1 = 7 marks)

Question Number	Answer	Additional guidance	Mark
2(a)(i)	The only correct answer is C (protein) A is incorrect because viruses do not contain cellulose B is incorrect because viruses do not contain chitin D is incorrect because viruses do not contain starch		**1**

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Question Number	Answer	Additional guidance	Mark
2 (a)(ii)	• x 76, 700 or 77000 (3) **Allow** range between 73 000 up to 80 000 (3 marks)	**One mark** for correct measurement of length (between 22 and 24 mm) OR **One mark** for correct conversion of mm (or cm) to μm / or reverse for 0.3 OR **One mark** for correct division by 0.3 (1) **Two marks** for 23 000 (allow range between 22 000 and 24 000) **Two marks** for 76.667 (and allow range between 73.33 to 80) **Allow two marks** for correct method from wrong initial measurement Correct answer with no working gains full marks	**3**

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Question Number	Answer	Additional guidance	Mark
2 (b)	An explanation that makes reference to three of the following: • less / no light (energy) absorbed / taken in / eq (1) • (less) photosynthesis (1) • (less) glucose (1) • (less) starch / cellulose / less energy (for growth) / less ATP made / less active transport / (less glucose so) less respiration / eq (1)	**Allow** chlorophyll / chloroplasts absorb light **Ignore** energy **produced** **Allow** less protein synthesis / fewer amino acids made	**3**

(Total for Question 2 = 7 marks)

Question Number	Answer	Mark
3 (a)(i)	The only correct answer is A (aphid) B is incorrect because blackbirds are secondary / tertiary consumers C is incorrect because foxes are secondary / tertiary / quaternary consumers D is incorrect because oak trees are producers	**1**

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Question Number	Answer	Mark
3 (a)(ii)	The only correct answer is D (all of the different species in the area) A is incorrect because it describes an ecosystem B is incorrect because it describes a population C is incorrect because it describes an ecosystem	**1**

Question Number	Answer	Additional guidance	Mark
3 (b) (i)	An answer that makes reference to the following: • symmetrical pyramid with correct shape (1) • pyramid labelled (1) • pyramid bars drawn to scale (1)	Pyramid should be narrow at base, wider in middle and narrow at top **Allow** asymmetric pyramids +/- 1 small square Bar heights should be the same	**3**

Question Number	Answer	Additional guidance	Mark
3 (b)(ii)	100 (kJ) (2)	Allow one mark for 2000 **or** ÷ 20 Correct answer with no working gains full marks	**2**

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Question Number	Answer	Additional guidance	Mark
3 (b)(iii)	An explanation that makes reference to three of the following: • not all organisms are eaten / some parts not eaten / eq (1) • energy is lost due to respiration / heat loss / movement / eq (1) • some die / decompose / eq (1) • some is not digested / absorbed / some is egested / some lost as faeces / eq (1) • energy lost as excretion / urea / eq (1)	Excrete faeces alone / excrete undigested food = 1 mark	**3**

(Total for Question 3 = 10 marks)

Question Number	Answer	Mark
4 (a)(i)	The only correct answer is B (carbon, hydrogen, and oxygen only) A is incorrect because carbohydrates also contain oxygen C is incorrect because carbohydrates do not contain nitrogen D is incorrect because carbohydrates do not contain nitrogen	**1**

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Question Number	Answer	Additional guidance	Mark
4 (a)(ii)	A description that makes reference to two of: • add biuret solution (1) • lilac / purple / pink colour (1)	**Allow** potassium / sodium hydroxide and copper sulfate other tests for protein **Allow** correct use of clinistix /uristix xanthoproteic test / ninhydrin with correct answer for two marks	**2**

Question Number	Answer	Additional guidance	Mark
4(b)(i)	• 1254(.4) / 1250 / 1300 (g) (2)	One mark for 5.6 **or** × 224 **or** 1400 ÷ 250 Correct answer with no working gains full marks	**2**

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Question Number	Answer	Additional guidance	Mark
4 (b)(ii)	An answer that makes reference to five of the following points:		**5**
	• rice has less **protein** (than cow's milk) (1)	**Allow** soy has more protein / same protein (as cow's milk) / eq	
	• lack of protein / rice, could lead to less growth / repair / eq (1)	**Allow** converse for soy **Allow** rice could cause kwashiorkor / marasmus	
	• soy / rice has **less fat** than cow's milk / soy has more fat than rice / eq (1)	**Allow** soy / rice does not have enough fat	
	• soy / rice has **less energy** (than cow's milk) / rice has more energy than soy / soy has less energy than rice / eq (1)	**Allow** soy / rice do not have enough energy	
	• soy has **less carbohydrate** (than cow's milk) / rice has more carbohydrate than soy / rice has more carbohydrate (than cow's milk) / eq (1)	**Allow** rice has too much carbohydrate	
	• (less energy means) children may be less active / respire less / get tired easily / eq (1)		
	• rice has very little / less / not enough calcium (1)	**Allow** converse for soy	
	• lack of calcium / rice, could lead to rickets / weak bones teeth / eq (1)	**Allow** converse for soy	
	• (overall) soy is closer to cow's milk compared with rice / soy is a better substitute than rice / eq (1)	**Allow** soy is a suitable replacement	

(Total for Question 4 = 10 marks)

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Question Number	Answer	Additional guidance	Mark
5 (a)	• it is a control (experiment) / to compare the results / check that change is due to the treatments / eq (1)	**Allow** see the difference / to see if any other factors affected the results / to see if there was a change without treatments / eq	**1**

Question Number	Answer	Additional guidance	Mark
5 (b)	• linear scales that use at least half grid (1) • both axes labelled (as **months** and **number of ants)** (1) • points plotted correctly (1) • points joined with straight lines (1) • key / lines labelled (1)	Ignore no treatment line **Allow** graph scales that use half grid with no treatment line +/- half square Bar chart loses line mark No line mark if extrapolated	**5**

Question Number	Answer	Additional guidance	Mark
5 (c)	A description that makes reference to two of the following: • decrease and an increase (1) • increases from 6 months (1)	**Allow** goes up from 12 months **Allow** decreases until 6 months	**2**

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Question Number	Answer	Additional guidance	Mark
5 (d)	An answer that makes reference to five of the following: • with no treatment red fire ants increase (1) • both treatments / pesticide and pesticide + phorid flies reduce number of red fire ants (over first 6 months) / eq (1) • when using pesticides (alone) ants increase (later) / when using phorid flies ants do not increase / level off / eq (1) • when population is constant, reproduction rate equals death rate / predation / eq (1) • using (pesticides and) phorid flies / biological control lasts longer / is a long-term solution / only needs to be done once / eq (1) • phorid flies will breed / reproduce (for longer time) / eq (1) • pesticides wear off / wash off / stop working / eq (1) • fire ants mutate / eq (1) • (fire ants) become resistant (to the pesticides) / eq (1) • natural selection occurs / eq (1)	**Allow** refs to biological control for phorid flies and not biological control for pesticides Can piece together **Allow** pesticides reduce number in both treatments **Allow** survive and reproduce / pass allele on to next generation	**5**

(Total for Question 5 = 13 marks)

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Question Number	Answer	Additional guidance	Mark
6	• plasma (1) • insulin (1) • pancreas (1) • liver / muscles (1) • glycogen (1) • (positive) phototropism (1) • Auxin/ I.A.A (1)	**Allow** islets of Langerhans / beta cells **Allow** named muscles **Reject** glucagon	**7**

(Total for Question 6 = 7 marks)

Question Number	Answer	Mark
7 (a)	The only correct explanation is B (6 and 12) A is incorrect because the root cell will not have 6 chromosomes C is incorrect because the pollen grain will not have 12 chromosomes D is incorrect because the pollen grain will not have 12 chromosomes	**1**

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Question Number	Answer	Additional guidance	Mark
7 (b)	An explanation that makes reference to four of the following: (mark in pairs) • anthers hang outside / long / hinged filament / eq (1) • so blow pollen in the wind / eq (1) • stigma is feathery / hairy / hangs out of flower / eq (1) • to catch pollen / eq (1) • petal is small / not coloured / no nectary in flower (1) • as insects are not attracted to it / eq (1) • pollen is light / dust like / produced in large quantities (1) • so easily carried by wind (1)	**Allow** stamens **Ignore** scents	**4**

Question Number	Answer	Additional guidance	Mark
7 (c)(i)	percentage / % of tubes that grow / number of / how many grow /eq (1)		**1**

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Question Number	Answer	Additional guidance	Mark
7 (c)(ii)	An explanation that makes reference to three of the following: • fewer (pollen tubes) grow when self-pollinated / more (pollen tubes) grow when cross pollinated / eq (1) • (cross pollination) produces (more) genetic variation / eq (1) • (so that) natural selection can occur / for natural selection to act on / eq (1) • some plants will have (different) adaptations / will have an advantage / are more adaptable / can survive different weather / eq (1)	**Allow** fewer grow when from same plant / more grow when from different plants / eq **Allow** some will have a selective advantage for 2 marks	**3**

Question Number	Answer	Additional guidance	Mark
7 (d)(i)	• mitosis (1)		**1**

Question Number	Answer	Additional guidance	Mark
7 (d)(ii)	An answer that makes reference to two of the following: • plants will be genetically identical / have same gene / eq (1) • plants will have same characteristics / phenotype / eq (1) • many are produced / quick / eq (1) • can be produced at any time of year / eq (1)	**Allow** favourable characteristics retained **Allow** high yield	**2**

(Total for Question 7 = 12 marks)

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Question Number	Answer	Additional guidance	Mark
8 (a)(i)	brain / named part of brain/ spinal cord/ eq (1)	Ignore neurons	**1**

Question Number	Answer	Additional guidance	Mark
8(a)(ii)	A description that makes reference to four of the following points: • receptor receives / senses / detects (object) / eq (1) • impulse (1) • (impulse moves along) sensory neurone to CNS / spinal cord / relay neurone (1) • (chemical diffusion of) neurotransmitters across synapse (1) • motor neurone to effector / muscle (1) • (muscle) <u>contracts</u> (1)	**Ignore** signal / message	**4**

Question Number	Answer	Mark
8 (b)(i)	The only correct answer is B (XY) A is incorrect because XX is female C is incorrect because males have one X chromosome D is incorrect because males have one X chromosome	**1**

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Question Number	Answer	Mark
8 (b)(ii)	The only correct answer is D (6) A is incorrect because 6 dogs must be heterozygous B is incorrect because 6 dogs must be heterozygous C is incorrect because 6 dogs must be heterozygous	**1**

Question Number	Answer	Additional guidance	Mark
8 (b)(iii)	An answer that makes reference to the following points: • both parents identified as Nn and Nn (1) • gametes as N or n (for both parents) (1) • offspring identified as NN, Nn, Nn, nn (1) • (probability determined as) 0.125 / 1/8 / 12.5 % (1)	**Allow** other letters **Allow** Punnet square ECF for mp2, 3, 4	**4**

Question Number	Answer	Additional guidance	Mark
8 (b)(iv)	An explanation that makes reference to three of the following points: • do a test cross to identify dogs that are NN / homozygous (dominant) / eq (1) • breed using dogs with no family history of sensory neuropathy / eq (1) • mate dogs that do not have sensory neuropathy / do not breed from dogs with sensory neuropathy / eq (1) • only allow homozygous dominant dogs to breed / breed with homozygous dominant dogs (1) • select / mate / breed from offspring that do not have sensory neuropathy / are homozygous dominant / eq (1) • repeat over several generations / eq (1)	**Allow** mate dogs that did not produce any offspring with sensory neuropathy	**3**

(Total for Question 8 = 14 marks)

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Question Number	Answer	Additional guidance	Mark
9 (a)(i)	• hepatic portal vein (1)		**1**

Question Number	Answer	Mark
9 (a)(ii)	The only correct answer is B (X) A is incorrect because W is the pulmonary artery C is incorrect because Y is the aorta D is incorrect because Z is the hepatic portal vein	**1**

Question Number	Answer	Additional guidance	Mark
9 (b)	An answer that makes reference to two of the following points: • (V / vein has) thin(ner) wall (1) • (V / vein has) less / thin muscle (1) • (V / vein has) fewer elastic fibres / less elastic (1) • (V / vein has) valves (present) (1) • (V / vein has) wide(r) lumen / space / hole / eq (1)	**Allow** vena cava for V and aorta for Y **Allow** converse for aorta (Y) Y has thicker wall Y has more muscle Y has more elastic Y does not have valves Y has a narrow lumen	**2**

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Question Number	Answer	Additional guidance	Mark
9 (c)(i)	An answer that makes reference to two of the following points: • obesity / eq (1) • diabetes (1) • high (saturated) fat diet / high cholesterol / eq (1) • high salt diet / eq (1) • low exercise / eq (1) • smoking / alcohol (1) • stress / eq (1) • age (1)		**2**

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Question Number	Answer	Additional guidance	Mark
9 (c)(ii)	An answer that makes reference to four of the following points: • increasing blood pressure increases deaths / eq (1) • Northern / Eastern Europe have a steep / big increase (as blood pressure increases) / Japan has less / low increase / steady increase (as blood pressure increases) / eq (1) • Japan has lowest number of deaths (at all blood pressures) / Northern / Eastern Europe has highest / Japan has lower death rate / eq (1) • (Northern / Eastern) Europe has more deaths (compared with Japan) when blood pressure is healthy / below 130 / eq (1) • decrease in number of deaths in Eastern Europe from 120 to 130 a.u. / at 130 / eq (1) • Japan may have lower death rates due to genetics / heredity / eq (1) • people in Japan may have better diet / healthy lifestyle / more exercise / less stress / less smoking / less obesity (so reduces deaths or heart disease) / eq (1) • no idea of sample sizes / no record of other factors / age / sex / lifestyle / diet / exercise / smoking / data / eq (1)	**Allow** increased blood pressure has less effect in Japan **Allow** converse for Japan **Allow** anomaly at 130 a.u. **Allow** converse for Europe **Allow** different regions may have different genetic factors **Allow** converse for Europe **Allow** different regions may have different diets / stress / smoking / eq **Allow** data not at same blood pressures for each country	**4**

(Total for Question 9 = 10 marks)

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Question Number	Answer	Additional guidance	Mark
10 (a)	• $6CO_2 + 6H_2O$ (1) • $C_6H_{12}O_6$ (1)	**Allow** in either order	**2**

Question Number	Answer	Additional guidance	Mark
10 (b)(i)	An answer that makes reference to two of the following points: (mark in pairs) • temperature (1) • use a water bath / eq (1) OR • pH (1) • use a buffer (1)		**2**

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Question Number	Answer	Additional guidance	Mark
10 (b)(ii)	An explanation that makes reference to the following points: • as distance (of lamp) increases, light (intensity) decreases / eq (1) • decreasing light intensity / increasing distance (at either concentration), decreases (rate of) photosynthesis / number of bubbles / eq (1) • as less energy (is absorbed) / eq (1) • with 5% solution there is no change in bubble production (from 5 cm) up to 15 cm / rate levels off between 15 cm and 5 cm / eq (1) • with 5% solution carbon dioxide is the limiting factor (between 5 cm and 15 cm) / carbon dioxide does not limit the rate of photosynthesis in the 10 % solution / eq (1) • light is a limiting factor (at both concentrations) for distances at / over 15 cm (1)	**Allow** converse **Allow** converse **Allow** converse **Allow** rate is constant until 20 cm / rate decreases after 15 cm **Allow** reducing carbon dioxide concentration reduces the rate as carbon dioxide is a limiting factor **Allow** light is the limiting factor for the 10 % solution **Allow** light is not the limiting factor up to 15 cm in the 5 % solution	**4**

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Question Number	Answer	Additional guidance	Mark
10 (b)(iii)	An answer that makes reference to the following points: • (collect / measure) volume (1) • using a measuring cylinder / syringe / burette / eq (1)	**Allow** measure in cm^3 / eq **Allow** graduated test tube / test tube with scale / height of bubble in test tube	**2**

Question Number	Answer	Additional guidance	Mark
10 (b)(iv)	A description that makes reference to two of the following points: • repeat (1) • calculate means / averages (1) • identify / remove anomalies / check that results are concordant / eq (1)		**2**

(Total for Question 10 = 12 marks)

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Question Number	Answer	Additional guidance	Mark
11 (a)	A description that makes reference to the following points: • restriction enzymes cut out (protease) gene / cut plasmid / cut DNA (1) • ligase joins / combine / glue (protease) gene plasmid / DNA (1)		**2**

Question Number	Answer	Additional guidance	Mark
11 (b)	An answer that makes reference to the following points: • C: range of at least three temperatures / use a wide range of temperatures (1) • O: same concentration of enzyme / mass of washing powder / type of washing powder / type of enzyme / eq (1) • R: repeats (1) • M1: measure area / size of stain / mass of stain / colour of stain / mass of protein / eq (1) • M2: stated time period (1) • S1 same pH / water volume / washing movements / same type of material / clothing / size of material / eq (1) • S2 same mass of protein / area of protein / type of protein stain / same blood / same named protein / eq (1)	**Allow** amount of washing powder **Ignore** amount of stain **Allow** M1 and M2 for time taken to remove stain (2 marks) **Allow** times between 10 minutes and 24 hours **Allow** same concentration of stain	**6**

(Total for Question 11 = 8 marks)

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