

**OXFORD**

INTERNATIONAL  
AQA EXAMINATIONS

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# INTERNATIONAL A-LEVEL BIOLOGY

## **BL03 (9610)**

Unit 3 Populations and Genes

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Mark scheme

January 2023

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2 3 1 X B L 0 3 / M S

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Question	Marking guidance	Mark	Comments
01.1	A = water B = oxygen C = carbon dioxide D = glucose/carbohydrate/sugar;;	2	Allow correct formulas for all Allow triose phosphate (TP) for D All 4 correct = 2 marks 2 or 3 correct = 1 mark 0 or 1 correct = 0 marks

Question	Marking guidance	Mark	Comments
01.2	Light-dependent reactions = thylakoids/grana/internal membranes; Light-independent reactions = stroma;	2	

Question	Marking guidance	Mark	Comments
01.3	1. Light absorbed by chlorophyll and electrons emitted/excited / raised to higher energy level; 2. Electrons passed along/down ETC <b>and</b> then accepted by NADP; 3. Water is split / photolysis of water; 4. Electrons from water replace electrons in chlorophyll; 5. Protons/H <sup>+</sup> from water reduce NADP/produce NADPH;	4 max	Allow photoionization

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Question	Marking guidance	Mark	Comments
01.4	1.(Radioactive) carbon dioxide/ <sup>14</sup> C/C absorbed/incorporated/fixed (by RuBP); 2. Identifying compounds at different times allows sequence to be worked out;	2	2. Allow named compounds (GP, TP, glucose, sucrose, amino acids)

Question	Marking guidance	Mark	Comments
01.5	1. Easier to remove samples at specific times; 2. Easier/quicker to stop reactions; 3. More rapid absorption of (radioactive) carbon dioxide/light; 4. No need for complex extraction procedure to analyse products <b>OR</b> Products not used/produced in other cellular reactions;	2 max	

Question	Marking guidance	Mark	Comments
01.6	GP	1	

Question	Marking guidance	Mark	Comments
01.7	1. Reactions are a cycle/the Calvin cycle; 2. RuBP is regenerated (from GP/TP containing <sup>14</sup> C from <sup>14</sup> CO <sub>2</sub> ):	2	Accept reference to 'recycling'

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Question	Marking guidance	Mark	Comments
02.1	Units for energy, area/volume, time e.g. $\text{kJ m}^{-2} \text{ year}^{-1}$ ;;	2	Allow 1 mark for 2 correct units, allow correct alternatives

Question	Marking guidance	Mark	Comments
02.2	Process <b>E</b> = respiration	1	

Question	Marking guidance	Mark	Comments
02.3	5.14	2	Allow 1 mark for incorrect rounding/not 3 sig fig Allow 1 mark for $(87\,402 \times 100) / (1.7 \times 10^6)$ but wrong answer Allow 1 mark for (candidate's GPP $\times 100$ ) / $(1.7 \times 10^6)$ and correctly derived answer to 3 sig. figs.

Question	Marking guidance	Mark	Comments
02.4	Value <b>X</b> : 14146; Efficiency: 16.2 / 16.18 / 16;	2	Allow ecf = (candidate's <b>X</b> $\times 100$ ) / 87402 and correctly derived answer

Question	Marking guidance	Mark	Comments
02.5	(Higher,) because (all of) the alga are easier to digest than plants;	1	Allow (Higher,) because (all of) the alga are easier to break down than plants

Question	Marking guidance	Mark	Comments
02.6	1. Rotifers abundance remains fairly constant; 2. Copepods abundance is higher at night;	2	2. Allow reference to numbers

Question	Marking guidance	Mark	Comments
02.7	1. Copepods + cladocerans show vertical migration <b>or</b> <u>only</u> rotifers do not; 2. Copepods + cladocerans find more food/algae near the surface; 3. Predatory fish hunt near surface during daylight as can see prey; 4. Mutation / genetic variation (produces new allele / characteristic); 5. Zooplankton at deeper depths (during daylight) more likely to survive / fewer eaten / have selective advantage; 6. (Survivors reproduce &) pass on (beneficial) alleles; 7. Increase in frequency of beneficial alleles over time / over many generations;	6 max	Allow less migration with rotifers  5. Allow zooplankton that show migratory patterns more likely to survive / fewer eaten / have selective advantage;

Question	Marking guidance	Mark	Comments
03.1	X = acetyl coenzyme A; Y = Carbon dioxide;	2	Allow acetyl CoA

Question	Marking guidance	Mark	Comments
03.2	Mitochondria;	1	Ignore reference to matrix/cristae

Question	Marking guidance	Mark	Comments
03.3	2	1	

Question	Marking guidance	Mark	Comments
03.4	1. Reduced NAD/FAD carry hydrogen/electrons to the ETC; 2. As electrons are passed along ETC, protons/H <sup>+</sup> are <u>pumped</u> into the intermembrane space; 3. Protons/H <sup>+</sup> move back in(to matrix) by <u>diffusion</u> <b>OR</b> down concentration gradient; 4. Stalked particles/ATP synthase combines ADP and Pi to make ATP;	4	Allow active transport or use of energy for pumped

Question	Marking guidance	Mark	Comments
03.5	1. Pyruvate accepts hydrogen from NADH (forming lactate); 2. NAD allows glycolysis to continue (by accepting hydrogen);	2	1. Accept pyruvate reduced to lactate by NADH 2. Accept NAD is used in glycolysis



Question	Marking guidance	Mark	Comments
04.1	1. Suitable apparatus; 2. Method of controlling temperature; 3. Method of controlling/supplying carbon dioxide concentration; 4. Measure rate at several distances of lamp from plant; 5. Allow to equilibrate at new distance of lamp from plant before measuring rate; 6. Measure rate (eg count bubbles / collect oxygen and measure volume) at least 3 times & calculate mean (at each distance);	5 max	3. eg Add NaHCO <sub>3</sub>

Question	Marking guidance	Mark	Comments
04.2	1. Two main peaks/wavelengths/colours absorbed; 2. At approx. 485 AND 685 nm.	2	Allow numbers in range 470-495 AND 680-695 nm.

Question	Marking guidance	Mark	Comments
04.3	Contain a mixture of pigments which absorb different wavelengths/colours;	1	

Question	Marking guidance	Mark	Comments
04.4	The <u>wavelengths</u> absorbed are those used in photosynthesis.	1	

Question	Marking guidance	Mark	Comments
04.5	1. 540-625 nm; 2. Wavelengths not absorbed/very little absorption/are reflected (making plant green).	2	Allow numbers in range 530-630 nm Allow wavelengths give (very) low rate of photosynthesis

Question	Marking guidance	Mark	Comments
04.6	1. Blue light is not/less absorbed by water <b>OR</b> blue light can penetrate deeper;  2. Blue/other colours absorbed by seaweed <b>and</b> used for photosynthesis;	2	1. Allow Red light/other wavelengths absorbed by water  2. Allow Red light is not available for photosynthesis (and would be therefore reflected)

Question	Marking guidance	Mark	Comments
05.1	<p>1. The allele which is not expressed (in the phenotype) when heterozygous / when the other allele is present</p> <p><b>OR</b> <u>only</u> expressed (in the phenotype) if homozygous / if 2 copies of the allele are present;</p> <p>2. Gene carried on only X (or only Y) chromosome/one sex chromosome;</p>	2	

Question	Marking guidance	Mark	Comments
05.2	<p>1. Child 3 is rhesus positive male even though mother/2 is rhesus negative;</p> <p>2. Must have received his X chromosome from his recessive mother which would make him rhesus negative if sex linked;</p> <p><b>OR</b></p> <p>1. Child 9 is rhesus negative female even though her father/3 is rhesus positive;</p> <p>2. Must have received one X chromosome from father/3 which would carry the (rhesus positive) allele if sex linked;</p> <p><b>OR</b></p> <p>1. If rhesus positive allele were on the Y chromosome, only males would be rhesus positive;</p> <p>2. Cannot be on Y because there are rhesus-positive females in the diagram;</p>	2 max	<p>1. Allow 3 inherits rhesus positive from 1/father</p> <p>2. Allow but 3 does not receive X chromosome from 1/father or only receives X chromosome from 2/mother</p> <p>Ignore reference to mother/4</p> <p>Reject if evidence includes person 7</p> <p>Do not accept there are rhesus positive females without reference to Y chromosome</p>

Question	Marking guidance	Mark	Comments
05.3	28.6/29%;;	2	Allow 1 mark for idea of 2pq as heterozygous.  Allow range to account for rounding too early 28.2 (28) - 28.6 (29)

Question	Marking guidance	Mark	Comments
06.1	1. Dead organisms broken down by decomposers/saprophytes; 2. Reference to extracellular digestion; 3. Nitrogen containing compounds converted to/release ammonium ions/ammonia / ammonification; 4. Ammonium ions/ammonia converted to nitrite by nitrifying bacteria; 5. Nitrite converted to nitrate by nitrifying bacteria; 6. Nitrate absorbed by active transport in roots;	5 max	1. Allow saprobionts/saprotrophs 2. Allow secretion of enzymes  4/5 Allow ammonium ions/ammonia converted to nitrite/nitrate by correctly named bacteria 4/5 Allow ammonium ions/ammonia converted to nitrate by nitrifying bacteria for 1 mark

Question	Marking guidance	Mark	Comments
06.2	1. (Reduction of) <u>nitrate</u> to <u>ammonia/ammonium</u> ions; 2. Nitrogen as essential element in nucleotides/DNA/ATP;  3. Used to make <u>amino acids</u> which are used to make <u>proteins</u> ;  4. Example of proteins: enzymes/cell membrane components /cytochromes;	4	2. Allow other named organic-N substances e.g. RNA/NAD(P)/chlorophyll/organic bases /phospholipids/lignin

Question	Marking guidance	Mark	Comments
06.3	<p>1. High BOD initially as aerobic decomposers break down organic waste / suspended solids</p> <p><b>OR</b></p> <p>BOD decreases as organic matter / suspended solids broken down by decomposers</p> <p><b>OR</b></p> <p>Oxygen levels fall (sharply) due to high BOD/aerobic decomposition;</p> <p>2. Oxygen levels increase as it dissolves from air at surface</p> <p><b>OR</b></p> <p>Oxygen levels increase due to photosynthesis by algae/plants;</p> <p>3. Suspended solids decrease (rapidly) as they are broken down by decomposers;</p> <p>4. High levels of ammonium and phosphate initially from (breakdown of) the organic waste in the sewage;</p> <p>5. Levels of nitrate increase as ammonium is converted to nitrate;</p> <p>6. Nitrate and phosphate levels decrease as one moves down the river as they are used up by plants/algae;</p>	6	<p>5. If organisms mentioned, must be correct organisms</p>