cookie

Practice paper: mark scheme

GCSE Double Award Science Higher, practice paper: Biology Unit B1 (CCEA style)

In the style of CCEA GCSE Science Double Award (2017) Unit B1: Biology, Higher Tier

Practice paper written by cookie in the style of CCEA GCSE Science Double Award (2017) Unit B1: Biology, Higher Tier. Not a CCEA paper; not affiliated with or endorsed by CCEA.

This mark scheme was written by cookie with its practice paper. Each row gives the answer, the marks and how they are given; where an answer is worded differently but means the same, give the mark.

Key

- Each line is one marking point, worth one mark unless it says otherwise.
- allow an answer that is also acceptable; do not accept an answer that gets no mark; ignore words that neither gain nor lose the mark
- Extended responses (6 marks) are marked by level: decide the level from the descriptors, then the mark within it.

Do it online, timed and marked:
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Question	Answer and marking	Marks
1(a)(i)	**Answer: To stain the cells so that structures such as the nucleus can be seen.** to stain the cells / to make structures (such as the nucleus) easier to see; [1] *Allow 'to make the cells show up' or 'to add contrast'. Do not accept 'to test for starch'. Ignore 'to kill the cells'.*	**1**
1(a)(ii)	**Answer: So that air bubbles are not trapped under the coverslip.** to avoid trapping air bubbles (which would hide the cells / be mistaken for cells); [1] *Ignore 'so the coverslip does not break' on its own.*	**1**
1(b)	**Answer: A bacterial cell has no nucleus, has plasmids and its cell wall is not made of cellulose (any two).** bacterial cell has no nucleus / its DNA is not inside a nucleus; bacterial cell has plasmids; bacterial cell wall is not made of cellulose; bacterial cell has no chloroplasts; bacterial cell has no large permanent vacuole; any two for [2] *Each difference must make clear which cell it refers to; 'one has a nucleus and one does not' scores 0. Do not accept 'bacteria have no cell wall'. Do not accept 'bacteria have no cell membrane / cytoplasm'. Allow other correct structural differences, e.g. a bacterial cell may have a flagellum or a slime capsule.*	**2**
1(c)	**Answer: A structure made of several different tissues that work together to carry out a particular function, such as photosynthesis in a leaf.** made up of several / different tissues; [1] (which) work together to carry out a (particular) function / job, e.g. photosynthesis; [1] *Do not accept 'made of different cells' for the first mark. Allow a named leaf tissue, e.g. palisade mesophyll and epidermis, as 'different tissues'.*	**2**
2(a)	**Answer: Shake the sample with ethanol, then pour the ethanol into water; a white emulsion shows fat is present.** shake / mix the sample with ethanol, then add (the liquid) to water; [1] white emulsion (forms if fat is present); [1] *Allow 'milky white' or 'cloudy white' for white emulsion. Do not accept 'white precipitate'. A test with Benedict's, Biuret or iodine solution scores 0.*	**2**
2(b)(i)	**Answer: 2310 J/g** temperature rise = 41.0 − 19.0 = 22 (°C); [1] energy released = 20 × 4.2 × 22 = 1848 (J); [1] energy per gram = 1848 ÷ 0.80 = 2310 (J/g); [1] *An answer of 2310 (J/g) scores 3 marks. Allow 2.31 kJ/g. Carry an error through: e.g. a wrong temperature rise correctly used in both later steps scores 2. An answer of 1848 scores 2 marks.*	**3**

2(b)(ii) **Answer: Energy was lost heating the air and the boiling tube, and not all the cereal burned (any two valid reasons).** **2**

energy / heat lost to the surroundings / air (instead of heating the water);
energy used to heat the boiling tube / glass;
not all of the cereal burned / incomplete combustion / the flame went out;
energy lost while moving the burning cereal from the Bunsen burner to the tube;
the cereal was held too far below the tube;
any two for [2]

Ignore 'human error', 'the thermometer was wrong' or 'the student read the thermometer wrongly'. Two versions of the same idea (e.g. 'heat lost to the air' and 'heat lost to the surroundings') score 1.

3(a) **Answer: 40 °C** **1**

40 (°C); [1]

Allow any value from 35 °C to 45 °C. Do not accept a range, e.g. '30–50 °C'.

3(b) **Answer: At 20 °C the molecules have less kinetic energy and move more slowly, so there are fewer collisions between the enzyme and its substrate and the protein is digested more slowly.** **2**

(at the lower temperature) the enzyme and substrate molecules have less (kinetic) energy / move more slowly; [1]
so there are fewer collisions between the enzyme / active site and the substrate / protein (per second); [1]

Allow 'fewer enzyme–substrate complexes form'. Do not accept 'the enzyme is denatured at 20 °C'. Do not accept 'the enzyme is killed'.

3(c) **Answer: At 60 °C the protease was denatured: the shape of its active site changed so the protein no longer fitted. Denaturation is irreversible, so cooling to 40 °C did not restore the active site.** **3**

(at 60 °C) the enzyme / protease was denatured; [1]
the shape of the active site changed so the substrate / protein no longer fits (into it); [1]
denaturation is irreversible / permanent, so the active site does not return to its shape when cooled; [1]

Do not accept 'the enzyme was killed' or 'the enzyme died' for the first mark. Do not accept 'the substrate is denatured'. The third mark needs the idea that the change cannot be reversed.

3(d) **Answer: Molecules of X fit into the active site of the protease but are not broken down, so the protein cannot enter those active sites.** **2**

(molecules of) X fit into / bind to the active site (of the enzyme); [1]
X is not broken down / stays in the active site, so the substrate / protein cannot enter it / fewer enzyme–substrate complexes form; [1]

Do not accept 'X denatures the enzyme' or 'X changes the shape of the active site'. Do not accept 'X kills the enzyme'.

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4 — **6**

Answer: Destarch the plant in the dark for 48 hours, then place it in the light; boil a leaf in water, then in ethanol in a hot water bath with the Bunsen turned off, soften it in water and add iodine solution. Green areas turn blue-black (starch, so photosynthesis); white areas stay yellow-brown (no starch, so no photosynthesis without chlorophyll).

Band A (5–6 marks): Candidates use appropriate scientific terms throughout to give at least five points from the indicative content, in a logical order. Spelling, punctuation and grammar are good, and form and style are of a high standard.
Band B (3–4 marks): Candidates use appropriate scientific terms to give at least three points from the indicative content. Spelling, punctuation and grammar are satisfactory, and form and style are of a satisfactory standard.
Band C (1–2 marks): Candidates give at least one point from the indicative content. Spelling, punctuation and grammar are limited, and there is little use of specialist terms.
Band D (0 marks): Response not worthy of credit.
Indicative content:
destarch the plant by keeping it in the dark (for about 48 hours)
so that any starch found must have been made during the investigation
then place the plant in (bright) light for several hours
remove a leaf and boil it in water (for about a minute) to kill the cells / break down the cell membranes so iodine can get in
turn off the Bunsen burner because ethanol is flammable
place the leaf in (a boiling tube of) ethanol in a hot water bath to remove the chlorophyll / decolourise the leaf
dip the leaf in (warm) water to soften it (ethanol makes it brittle)
spread the leaf on a white tile and add iodine solution
the green areas turn blue-black, showing starch is present / photosynthesis took place
the white areas stay yellow-brown, showing no starch / no photosynthesis
so only the parts of the leaf with chlorophyll photosynthesise: chlorophyll is needed for photosynthesis
To reach Band A the answer must include destarching and the results for both the green and the white areas. Within a band, award the higher mark where the quality of written communication is better. Do not accept 'blue-black shows glucose'. A method that heats ethanol directly over a flame cannot reach Band A. Ignore references to measuring oxygen production.

5(a) — **2**

Answer: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ (+ energy)

correct formulae: $C_6H_{12}O_6$ and O_2 on the left; CO_2 and H_2O on the right; [1]
correctly balanced: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$; [1]
Ignore 'energy' on either side. The balancing mark depends on correct formulae. A word equation scores 0. Do not accept the equation written the wrong way round (the photosynthesis equation).

5(b)(i) — **2**

Answer: 11 times

volumes per minute: $12 \times 0.50 = 6.0$ (dm^3) and $30 \times 2.2 = 66$ (dm^3); [1]
$66 \div 6.0 = 11$ (times); [1]
An answer of 11 scores 2 marks. Carry an error through from one incorrect volume per minute for the second mark.

5(b)(ii) **2**

Answer: More air, and so more oxygen, is taken into the lungs each minute, so more oxygen diffuses into the blood and reaches the muscles; the muscle cells can respire aerobically faster, releasing more energy for contraction (and more carbon dioxide is removed).

more air / oxygen is taken in (each minute), so more oxygen diffuses into the blood / reaches the muscles; [1]

so the muscle cells can respire (aerobically) faster / more, releasing more energy for contraction / movement / so the extra carbon dioxide (from respiration) is removed; [1]

Do not accept 'to make / produce energy'. Do not accept 'the muscles breathe faster'. Ignore 'the heart beats faster' on its own.

5(c) **2**

Answer: Yeast produces alcohol, muscle produces lactic acid; yeast produces carbon dioxide, muscle does not.

yeast produces alcohol / ethanol but muscle produces lactic acid; [1]

yeast produces carbon dioxide but muscle does not; [1]

Each mark needs both organisms (or a clear comparison). Ignore references to energy (both release energy). Do not accept 'muscle produces carbon dioxide and water' for anaerobic respiration.

6(a)(i) **2**

Answer: 2 arbitrary units: there is no net exchange of carbon dioxide, because the rate of photosynthesis equals the rate of respiration.

2 (arbitrary units); [1]

(at this light intensity) the rate of photosynthesis equals the rate of respiration / the carbon dioxide used in photosynthesis equals the carbon dioxide released in respiration, so there is no net exchange; [1]

The second mark needs the idea that both processes are taking place at equal rates; do not accept 'the leaf is not photosynthesising or respiring' or 'no carbon dioxide is used'. The second mark can be awarded if the light intensity is wrong.

6(a)(ii) **2**

Answer: Yellow: at this light intensity the rate of respiration is greater than the rate of photosynthesis, so the leaf gives out carbon dioxide and the carbon dioxide concentration in the tube rises.

yellow; [1]

the rate of respiration is greater than the rate of photosynthesis, so (net) carbon dioxide is given out / the carbon dioxide concentration rises; [1]

Allow orange or yellow-orange for the first mark; do not accept red or purple. Do not accept 'no photosynthesis takes place' for the second mark.

6(b)(i) **2**

Answer: Carbon dioxide concentration: when only the carbon dioxide concentration was raised (from B to C, same light intensity and temperature), the rate increased from 20 to 34.

carbon dioxide (concentration); [1]

raising the carbon dioxide concentration (from 0.04% to 0.10%) with the same light intensity and temperature increased the rate (from 20 to 34 arbitrary units) / comparison of B and C; [1]

The second mark needs the comparison of B and C, with the idea that only carbon dioxide changed. Do not accept light intensity (it is high in both B and C) or temperature. The second mark cannot be awarded if the factor named is wrong.

6(b)(ii) **Answer: 5.9%** **2**

increase = 36 − 34 = 2 / (2 ÷ 34) × 100 seen; [1]
= 5.9 (%); [1]
An answer of 5.9 scores 2 marks. Allow 5.88 for 1 mark (not 2 significant figures). An answer of 5.6 (dividing by 36) scores 1 mark for the increase of 2. An answer of 106 scores 0.

7(a)(i) **Answer: Receptors in the skin of the foot send impulses along a sensory neurone to the spinal cord; across a synapse to an association neurone; across a synapse to a motor neurone; to the effector, a muscle in the leg, which contracts.** **3**

impulse travels along a sensory neurone (to the spinal cord);
(across a synapse) to an association / relay neurone (in the spinal cord);
(across a synapse) to a motor neurone;
(motor neurone carries the impulse) to the effector / a muscle, which contracts;
any three for [3]
The points must be in the correct sequence. Allow 'intermediate neurone' or 'connector neurone' for association neurone. Do not accept 'motor neurone' before 'sensory neurone'. Do not accept 'the impulse goes to the brain, which decides'.

7(a)(ii) **Answer: A reflex action is faster / is not under conscious control.** **1**

a reflex is faster / automatic / not under conscious control / does not involve a conscious decision; [1]
Allow the reverse argument for a voluntary action, e.g. 'a voluntary action is slower'. Ignore 'a reflex protects you'.

7(b)(i) **Answer: Glucose was absorbed from the small intestine into the blood, so the concentration rose; the pancreas detected the rise and released insulin; insulin caused the liver to absorb glucose from the blood (and store it as glycogen), so the concentration fell back to 5.0 mmol/dm^3.** **3**

the concentration rises because glucose is absorbed (from the small intestine / gut) into the blood;
the pancreas detects the rise / increase (in blood glucose concentration);
the pancreas produces / releases insulin (into the blood);
insulin causes the liver to absorb (more) glucose from the blood, so the concentration falls (back to normal / 5.0);
the liver converts the glucose to glycogen (and stores it) / respires it;
any three for [3]
Do not accept 'insulin converts glucose to glycogen' (the liver cells do). Do not accept 'glucagon' as an alternative to insulin. Do not accept 'the kidney removes the glucose'.

7(b)(ii) **Answer: Person Q's pancreas does not produce insulin, so the liver does not absorb the extra glucose from the blood.** **2**

(in Type 1 diabetes) the pancreas does not produce / produces no insulin; [1]
so the liver does not absorb the (extra) glucose from the blood / glucose is not converted to glycogen; [1]
Allow 'the pancreas has stopped producing insulin'. Do not accept 'the pancreas produces less insulin' for the first mark (that describes Type 2 diabetes). Ignore 'because they have diabetes' on its own.

8(a) **Answer: Ureter** **1**

ureter; [1]

Do not accept urethra. Allow phonetic spelling only if it cannot be confused with urethra.

8(b) **Answer: Water lost in sweat leaves less water in the blood; more ADH is released into the blood; ADH causes the kidneys to reabsorb more water into the blood, so less water is left to form urine.** **3**

more water is lost in sweat, so the blood contains less water / is more concentrated; [1]

more ADH is released into the blood; [1]

ADH causes the kidneys to reabsorb more water (back into the blood); [1]

Allow 'less water left in the urine' as part of the third point but not on its own. Do not accept 'ADH reabsorbs water'. Do not accept 'the kidneys filter less blood'. Ignore the name of the gland that releases ADH.

8(c) **Answer: The tip makes auxin, which passed into the agar; auxin moved from the block down the left-hand side of the shoot only, giving an uneven distribution of auxin; auxin causes cell elongation, so cells on the left-hand side elongated more than those on the right and the shoot bent to the right. In darkness light could not have caused the bend.** **3**

auxin (from the agar) moves down the left-hand side of the shoot (only) / there is more auxin on the left-hand side / auxin is unevenly distributed;

auxin causes cell elongation;

cells on the left-hand side elongate more / grow faster (than cells on the right-hand side);

so the shoot bends towards the side with less auxin / away from the side the block was on / to the right;

the shoot was in darkness, so the uneven distribution was caused by the position of the block, not by light;

any three for [3]

Do not accept 'auxin causes cell division' for cell elongation. Do not accept 'the cells on the right-hand side grow more'. Do not accept answers that give light as the cause of the bend. 'Auxin is produced in the shoot tip' on its own scores 0.

9(a) **Answer: Lay two tape measures at right angles along two edges of the field to make a grid, then use random numbers to choose the coordinates for each quadrat.** **2**

lay out two tape measures at right angles (along two edges of the field) / divide the field into a grid; [1]

use random numbers (e.g. from a random number generator / table) as coordinates for each quadrat; [1]

Do not accept 'throw the quadrat over your shoulder' for the second mark. Do not accept a belt transect / placing quadrats at regular intervals along a line.

9(b) **Answer: 24 000** **3**

mean number per quadrat = 30 ÷ 10 = 3.0; [1]

area of field ÷ area of quadrat = 2000 ÷ 0.25 = 8000 / mean number per m^2 = 3.0 ÷ 0.25 = 12; [1]

estimated population = 3.0 × 8000 / 12 × 2000 = 24 000; [1]

An answer of 24 000 scores 3 marks. Carry an error through: e.g. using a quadrat area of 0.5 m^2 gives 12 000 and scores 2 marks. Allow 2.4 × 10^4.

9(c) **4**

Answer: Nitrates stimulated the growth of algae and aquatic plants; the algae and plants then died (nitrate depletion, shading); aerobic microorganisms decomposed the dead material and, as their numbers grew, used up the dissolved oxygen in respiration; the fish could not get enough oxygen.

nitrates stimulate (rapid) growth of algae / aquatic plants;
algae / aquatic plants die (when the nitrate runs out) / plants below are shaded by algae and die;
aerobic microorganisms / bacteria decompose the dead algae / plants;
the microorganisms (increase in number and) use up the oxygen in the water (in respiration);
so there is too little oxygen for the fish (to respire);
any four for [4]

Do not accept 'the algae use up all the oxygen' or 'the fertiliser poisons the fish'. Do not accept 'anaerobic bacteria decompose the plants'. Allow 'decomposers' for microorganisms.

9(d) **2**

Answer: Ploughing lets air into the soil, so the soil becomes more aerobic; nitrifying bacteria, which need oxygen, convert more ammonia into nitrates, and denitrifying bacteria, which work in anaerobic conditions, convert fewer nitrates into nitrogen gas.

(ploughing lets air in, so) the soil contains more oxygen / becomes (more) aerobic; [1]
more nitrification: (nitrifying) bacteria that need oxygen convert ammonia / ammonium compounds into nitrates / less denitrification, so fewer nitrates are converted into nitrogen gas / faster aerobic decomposition releases more ammonia for nitrification; [1]

The second mark needs a named nitrogen-cycle process linked to oxygen. Do not accept 'ploughing adds nitrates to the soil' or 'nitrogen-fixing bacteria in the air are mixed into the soil'. Knowledge of the names of specific bacteria is not needed.

Total: 70 marks