SimpleStudy

PRACTICE MARKING SCHEME

LEAVING CERTIFICATE · ORDINARY LEVEL · SAMPLE PAPER 2 · 2027

Biology

Total marks	Duration	Structure
300	2 hr 30 min	7 questions

About this document

A practice marking scheme produced by SimpleStudy to help students and teachers prepare for the Leaving Certificate examination in Biology. The State Examinations Commission has published this sample paper without a marking scheme; the mark allocations and answers set out here are indicative.

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Marking Scheme

This marking scheme accompanies the State Examinations Commission's Sample Paper 2 in Leaving Certificate Biology, Ordinary Level. It is intended to support candidates and teachers preparing for the examination. It is not an official State Examinations Commission document.

General Marking Guidelines

- Accept all reasonable responses; the lists in this scheme are indicative, not exhaustive.
- Credit content that is correct even where it is poorly expressed.
- No penalty for spelling or grammar unless the meaning is unclear.
- Where a candidate contradicts themselves, award the lower mark.
- Credit accurate labelling on diagrams, and credit a correct answer given as a labelled diagram where the question does not require prose.
- Where a candidate offers more points than the number asked for, mark the first *n* presented, unless a later point is clearly labelled as a replacement.

Seven additions for this paper:

- There are seven questions, each worth 50 marks. Question 1 is compulsory and candidates answer any five of Questions 2 to 7, so six questions make up the 300 marks. Where a candidate answers all seven, mark all seven and credit the best six.
- **Named examples and terminology.** Where a part asks the candidate to name a structure, process or organism, the accepted biological term is required. A description that makes the identification unambiguous earns the mark; a vague term that could apply to several structures does not.
- **Diagrams.** Where a part asks for a labelled diagram, the marks divide between the drawing and the labels, and a label is credited only where it points to the correct structure.
- **Error carried forward.** Where a candidate uses an incorrect value or answer from an earlier part correctly in a later one, award the later marks in full. An error is penalised once only.
- **Graphical answers.** Where a part asks the candidate to draw on a printed graph or diagram, the marks are for the construction itself. **Credit only what the candidate has to supply:** where the grid already carries its axes, scale or labels, or where a line is already plotted, no marks are available for that work. This applies at 3(b)(iv) and 6(c)(ii).
- **Data questions.** Where a part asks the candidate to draw a conclusion or describe a trend, the answer must be supported by something read from the data or the graph; a correct statement made without reference to the evidence supplied earns the stating marks only.
- **Consequential answers.** Where a part asks the candidate to build on an earlier answer, the later part is marked against the candidate's own earlier answer.

How the marks are set

The paper prints a total of 50 marks for each question and no sub-part marks, so every internal split is indicative. The splits reconcile upward to each question total and to the paper total of 300 marks, and follow one set of rates:

- **A row of a tick, matching or completion table** carries **2 marks**.
- **A one-word answer in a single-line box**, or an answer read or selected from material printed on the page, carries **2 marks**.

- **A term supplied from the candidate's own knowledge, with the brief development the printed space allows**, carries **3 marks**.
- **Ticking one box from a printed list**, where the tick is the whole answer, carries **3 marks**; where a justification is also required, the tick carries 2 and the balance goes to the justification.
- **Developed points** are priced on the printed answer space, with the command verb as a tie-breaker.

Questions 1 and 4 pack twenty-one and fifteen parts respectively into fifty marks, so the single-tick rate compresses to 2 in those two questions. Elsewhere the rates above apply as printed.

Marking at Ordinary Level

This paper is assessed at Ordinary Level. The specification differentiates the two levels through the learning outcomes themselves: Ordinary level covers only the outcomes presented in normal type, while Higher level covers all of them, including those in bold type. Table 1 of the specification describes Ordinary level students as engaging with a broad range of knowledge, mainly concrete in nature but with some elements of abstraction or theory, and as demonstrating and using a moderate range of cognitive skills and tools, selecting from a range of procedures and applying known solutions to a variety of problems in both familiar and unfamiliar contexts.

Paper Structure

Question 1	**50 marks**	Compulsory. DNA profiling, photosynthesis and the carbon cycle, the natterjack toad, the dandelion life cycle, and the male reproductive system.
Question 2	**50 marks**	Preparing a slide of plant cells, plant and animal cell structure, microscopy, and the chloroplast and mitochondrion.
Question 3	**50 marks**	Active and passive transport, an investigation of surface area and osmosis, and roots.
Question 4	**50 marks**	Chromosomes and DNA structure, genetics of white spotting in cats, and evolution with a phylogenetic tree.
Question 5	**50 marks**	A balanced diet, digestion and digestive enzymes, the digestive organs, and a food test.
Question 6	**50 marks**	Blood and blood cells, the blood vessels and the coronary artery, and adrenaline.
Question 7	**50 marks**	Bacteria and fungi, pathogens, antibiotic resistance and the nitrogen cycle.
Total	**300 marks**	Question 1 and any five of Questions 2 to 7.

Grading Descriptors (all parts carrying a development element)

High (H)	Point accurately stated and developed with correct biological reasoning, applied to the organism, data or diagram the part supplies. Full marks for the point.
Mid (M)	Relevant point stated with partial development, or biologically correct but not applied to the material the part supplies. Award the stating marks in full plus roughly half the development marks, rounded up to a whole mark.

Low (L) Point stated or asserted only; vague, or development that does not follow from the point stated. Stating marks only.

No criterion grid is used on this paper. *The longer parts — for example 2(a), 5(d) and 7(b)(iii) — are marked by required elements rather than holistically.*

Question 1 — 50 marks

Compulsory. Candidates answer all parts.

Indicative mark allocation: (a)(i) 3 · (a)(ii) 3 · (b)(i) 2 · (b)(ii) 2 · (b)(iii) 3 · (b)(iv) 4 · (c)(i) 3 · (c)(ii) 2 · (c)(iii) 2 · (c)(iv) 2 · (c)(v) 2 · (d)(i) 2 · (d)(ii) 2 · (d)(iii) 2 · (d)(iv) 2 · (d)(v) 2 · (e)(i) 2 · (e)(ii) 4 · (e)(iii) 2 · (e)(iv) 2 · (e)(v) 2 = 50 marks.

Part	Acceptable Answer(s)	Marks
(a)(i) The two samples	Ticks beside **hair follicle** and **blood**. Both are required; a footprint carries no cells and so no DNA.	**3**
(a)(ii) The matching suspect	**Suspect A** (1). Justification (2): the pattern of bands in Suspect A's profile is identical to the pattern in the crime scene profile — the same number of bands in the same positions — whereas the victim's and Suspect B's profiles show different band patterns.	**3**
(b)(i) Source of the energy	**Sunlight** (solar or light energy)	**2**
(b)(ii) The pigment	**Chlorophyll**	**2**
(b)(iii) Catabolic or anabolic	A tick beside **Anabolic**.	**3**
(b)(iv) The two processes *2 marks each*	**Respiration** and **combustion** (burning of fuels). Accept decay or decomposition in place of either.	**4**
(c)(i) Genus and species	*Epidalea* ticked as **genus** and *calamita* ticked as **species**. Both required.	**3**
(c)(ii) The kingdom	**Animalia** (the animal kingdom)	**2**
(c)(iii) A suitable habitat	Coastal ponds; sand dunes. Accept freshwater pond, or the created ponds described in the article.	**2**
(c)(iv) A group involved	The **National Parks and Wildlife Service**; **Dingle Oceanworld**; **Fota Wildlife Park**. Accept local farmers.	**2**
(c)(v) Why so many released	The species is endangered and the wild population very small, so large numbers are released to build it up (1); most toadlets will not survive to adulthood — predation, disease and unsuitable conditions kill many — so a large number must be released for a few to survive and breed (1).	**2**
(d)(i) Sexual reproductive structure	**Flower**	**2**
(d)(ii) The anther produces	**Pollen**	**2**

Part	Acceptable Answer(s)	Marks
(d)(iii) Transfer of pollen	**Pollination**	**2**
(d)(iv) The seed's outer layer	**Testa**	**2**
(d)(v) Seeds grow into a new plant	**Germination**	**2**
(e)(i) The arrow from X	An arrow drawn from X to the **tube running through the penis** — the urethra.	**2**
(e)(ii) Parts A and B ***2 marks each***	A: **penis** B: **testis** (testicle)	**4**
(e)(iii) The hormone from B	**Testosterone**	**2**
(e)(iv) Another contraceptive method	The contraceptive pill; an IUD or coil; the implant or injection; sterilisation, by vasectomy or tubal ligation; natural or rhythm methods; a diaphragm or cap.	**2**
(e)(v) A health benefit of the condom	It acts as a barrier preventing the exchange of body fluids, so it reduces the risk of passing on a sexually transmitted infection such as HIV, chlamydia or gonorrhoea.	**2**

Question 2 — 50 marks

Candidates answer any five of Questions 2 to 7. Each carries 50 marks.

Indicative mark allocation: (a) 10 · (b)(i) 3 · (b)(ii) 3 · (b)(iii) 3 · (b)(iv) 3 · (c)(i) 2 · (c)(ii) 5 · (c)(iii) 3 · (c)(iv) 3 · (d)(i) 3 · (d)(ii) 4 · (d)(iii) 4 · (d)(iv) 4 = 50 marks.

(a) Preparing and mounting plant cells (10 marks)

Part	Acceptable Answer(s)	Marks
Required elements	*A labelled diagram earns the marks equally.* • Peel a thin layer of epidermis from an onion, or take a thin section of the tissue, so that light can pass through it (2) • Place it flat on a clean glass slide, taking care not to fold it (2) • Add a drop of water or stain — iodine for plant cells (2) • Lower a coverslip gently at an angle with a mounting needle so that no air bubbles are trapped (2) • Blot away surplus liquid, place the slide on the stage and focus, beginning with the lowest-power objective (2)	**10**

(b) The plant cells (12 marks)

Part	Acceptable Answer(s)	Marks
(i) The part labelled X	The **nucleus**.	**3**
(ii) Unicellular or multicellular	A tick beside **Multicellular organism** — the photograph shows many cells joined together in a tissue.	**3**
(iii) Function of the cell wall	It is made of cellulose and gives the cell its shape and support, holding it rigid and preventing it from bursting when it takes in water.	**3**
(iv) Primary or secondary data	A tick beside **Primary data** — the student gathered it themselves.	**3**

(c) The animal cell (13 marks)

Part	Acceptable Answer(s)	Marks
(i) The arrow to the nucleus	An arrow from the word Nucleus to the **large round dense body** within the cell, distinct from the outer boundary.	**2**
(ii) Prokaryotic or eukaryotic	A tick beside **Eukaryotic** (2). Justification (3): the cell has a true nucleus, enclosed in its own membrane and visible in the image, together with other membrane-bound organelles. A prokaryotic cell has no nucleus — its DNA lies free in the cytoplasm.	**5**
(iii) Another type of microscope	The **electron microscope**. Accept transmission or scanning electron microscope.	**3**

Part	Acceptable Answer(s)	Marks
(iv) Why it may be needed	It magnifies far more and resolves much finer detail than a light microscope, so the internal structure of organelles such as mitochondria and ribosomes — far too small to see under a light microscope — becomes visible.	**3**

(d) The two organelles (15 marks)

Part	Acceptable Answer(s)	Marks
(i) Which is the mitochondrion	**Image B**	**3**
(ii) Metabolism	All of the chemical reactions that take place within a living organism (2), including both those that build up large molecules from small ones and those that break large molecules down to release energy (2).	**4**
(iii) Matching the processes ***2 marks per row***	Photosynthesis — **Image A** Respiration — **Image B**	**4**
(iv) The role of respiration	It releases the energy stored in food, particularly glucose (2), making it available as ATP for the organism's activities — movement, growth, active transport, the building of new molecules and the maintenance of body temperature (2).	**4**

Examiner note on (d)(i) and (iii). *Image A shows the stacked flattened membranes of the grana and is green, which identifies it as a chloroplast; Image B shows the folded cristae projecting inwards from a double membrane, which identifies the mitochondrion. The two answers must be consistent with each other.*

Question 3 — 50 marks

Candidates answer any five of Questions 2 to 7. Each carries 50 marks.

Indicative mark allocation: (a)(i) 3 · (a)(ii) 4 · (a)(iii) 3 · (b)(i) 4 · (b)(ii) 3 · (b)(iii) 4 · (b)(iv)1 3 · (b)(iv)2 8 · (b)(iv)3 4 · (b)(v) 4 · (c)(i) 2 · (c)(ii) 3 · (c)(iii) 3 · (c)(iv) 2 = 50 marks.

(a) Transport across the membrane (10 marks)

Part	Acceptable Answer(s)	Marks
(i) Which is active transport	**Process Y**	**3**
(ii) Justification	Y is the process shown with **energy** being supplied (2). Active transport requires energy from the cell, as ATP, because it moves substances against the concentration gradient, whereas passive transport needs no energy and moves substances down the gradient (2).	**4**
(iii) Another gas moving by diffusion	**Carbon dioxide**, which diffuses out of the blood into the alveoli.	**3**

(b) Surface area and osmosis (30 marks)

Part	Acceptable Answer(s)	Marks
(i) A hypothesis	A testable statement relating the two variables, for example: *increasing the surface area of the potato increases the rate of osmosis*, or *diced potato will lose mass faster than a whole piece of the same mass.* *3 marks for a statement that is testable and links the two variables, 1 for the direction being the one the set-up tests.* A restatement of the aim without a predicted relationship earns 2.	**4**
(ii) Ensuring fairness	Every other factor was kept the same for A and B — the same mass of potato at 25 g, the same volume of salt solution at 250 cm^3, the same concentration at 20% and the same temperature at 15 °C — so that only the surface area differed. Any one, quoted from the table.	**3**
(iii) The two variables ***2 marks each***	**Dependent:** the loss in mass of the potato. **Independent:** the surface area, that is whether the potato is whole or diced.	**4**
(iv) 1. Time to lose 2 g	Reading the printed curve, the whole piece reaches a 2 g loss at about **25 minutes**. *1 mark for showing the construction on the graph, 2 for the reading.* Accept 23 to 27 minutes.	**3**

Part	Acceptable Answer(s)	Marks
(iv) 2. Plotting the diced line	The seven points plotted — (0, 0), (10, 2.0), (20, 4.0), (30, 5.0), (40, 5.5), (50, 6.0), (60, 6.0) — and joined with a line distinguishable from the printed one, with a key or label added. *1 mark per point accurately plotted, and 1 for joining them and distinguishing the line.* All seven points are the candidate's work, since only the whole-potato line is printed. Both axes and the scale are already printed, so no marks are available for axes, scale or labels.	**8**
(iv) 3. The prediction	A third line sketched **above the diced line**, rising more steeply in the first twenty minutes and levelling off sooner, at about the same final loss or a little higher (3); labelled to show what it represents (1).	**4**
(v) A conclusion	The greater the surface area, the faster the rate of osmosis (2). The diced potato lost mass much more quickly — 4.0 g in twenty minutes against 1.75 g for the whole piece — and reached its maximum of 6.0 g by fifty minutes, roughly twice the final loss of the whole piece (2).	**4**

Examiner note on the printed graph. *The printed line for the whole piece levels off at about 2.75 g, whereas the table gives 3.0 g at fifty and sixty minutes. Accept either figure for the final loss of the whole piece, and do not penalise a candidate whose reading of the graph differs from the table. The discrepancy does not affect part (iv) 1: the printed curve crosses 2.0 g at just under 25 minutes.*

(c) Roots (10 marks)

Part	Acceptable Answer(s)	Marks
(i) The arrow to the roots	An arrow from R to the **fibrous branching structures below soil level** at the base of the plant.	**2**
(ii) Another function of roots	They anchor the plant firmly in the soil and hold it upright. Accept storage of food, as in the potato tuber.	**3**
(iii) How root hairs help	Each root hair is a long thin extension of a single cell, and together they greatly increase the surface area of the root in contact with the soil water (2), so that much more water can be absorbed by osmosis in a given time (1).	**3**
(iv) The transport tissue	**Xylem**	**2**

Question 4 — 50 marks

Candidates answer any five of Questions 2 to 7. Each carries 50 marks.

Indicative mark allocation: (a)(i) 2 · (a)(ii) 3 · (a)(iii) 4 · (a)(iv) 6 · (a)(v) 3 · (b)(i) 2 · (b)(ii) 3 · (b)(iii) 3 · (b)(iv) 8 · (b)(v) 3 · (b)(vi) 2 · (c)(i) 3 · (c)(ii) 2 · (c)(iii) 3 · (c)(iv) 3 = 50 marks. Parts (a)(i), (b)(i), (b)(vi) and (c)(ii) are single ticks and carry 2 each, since this question packs fifteen parts into fifty marks.

(a) Chromosomes and DNA (18 marks)

Part	Acceptable Answer(s)	Marks
(i) The second substance	A tick beside **Protein**.	**2**
(ii) The shape of DNA	A **double helix**.	**3**
(iii) Parts Y and Z *2 marks each*	Y: **deoxyribose sugar** — the blue pentagon Z: **nitrogenous base** — the green double ring	**4**
(iv) The complementary strand	A pairs with T and C pairs with G throughout: **T G C T T A A G T C** *6 marks for all ten correct; deduct 1 for each error, to a minimum of zero.*	**6**
(v) Another cause of variation	**Meiosis** — the independent assortment of chromosomes and crossing over producing new combinations of alleles; or the **random fusion of gametes** at fertilisation. Accept sexual reproduction.	**3**

(b) Genetics of white spotting (21 marks)

Part	Acceptable Answer(s)	Marks
(i) Homozygous or heterozygous	A tick beside **Homozygous**.	**2**
(ii) Explanation	Cat 2 has the genotype ww, so both of its alleles for this gene are the same — two recessive alleles — and homozygous means having two identical alleles.	**3**
(iii) The other white-spotted genotype	**WW**	**3**
(iv) The genetic cross	Parents **Ww × ww**; gametes **W and w** from cat 1, **w only** from cat 2 (2) A Punnett square or equivalent correctly constructed, giving Ww, Ww, ww, ww (3) Offspring genotypes **Ww and ww in a 1 : 1 ratio** (2) Phenotypes **white spotted and without white spotting, 1 : 1** (1)	**8**
(v) Percentage chance	**50%**. Error carried forward from (iv).	**3**

Part	Acceptable Answer(s)	Marks
(vi) True or false	A tick beside **True**.	**2**

(c) Evolution (11 marks)

Part	Acceptable Answer(s)	Marks
(i) An organism without hair	Angel fish; frog; crocodile. Any one — the three branching before the "hairy body" characteristic.	**3**
(ii) The term for species X	A tick beside **Common ancestor**.	**2**
(iii) Most closely related to the elephant	The **kangaroo** — the two share the most recent branch point on the tree, after the "live birth" characteristic.	**3**
(iv) Completing the paragraph ***1 mark per blank***	Organisms reproduce at high rates and there is **competition**. Those with better **adaptations** survive. The survivors **reproduce** and pass genes on.	**3**

Question 5 — 50 marks

Candidates answer any five of Questions 2 to 7. Each carries 50 marks.

Indicative mark allocation: (a)(i) 4 · (a)(ii) 3 · (a)(iii) 4 · (b)(i) 6 · (b)(ii) 3 · (b)(iii) 4 · (c)(i) 6 · (c)(ii) 5 · (c)(iii) 3 · (d) 12 = 50 marks.

Part	Acceptable Answer(s)	Marks
(a)(i) Protein and carbohydrate *2 marks each*	**Protein:** meat, fish, eggs, cheese, beans or nuts. **Carbohydrate:** bread, pasta, rice, potatoes or cereal.	**4**
(a)(ii) A factor influencing need	Age; sex; body size; level of physical activity or occupation; whether the person is pregnant or breastfeeding; state of health; climate.	**3**
(a)(iii) Why large molecules are digested	Large molecules such as starch are too big to pass through the wall of the small intestine and into the blood (2), so they must first be broken down into small soluble molecules such as glucose, which can be absorbed and carried to the cells that need them (2).	**4**
(b)(i) Matching the molecules *2 marks per row*	Starch → **maltose** Protein → **peptides or amino acids** Lipid → **glycerol and three fatty acids**	**6**
(b)(ii) The enzyme in saliva	**Amylase** (salivary amylase, or ptyalin)	**3**
(b)(iii) The role of teeth	The teeth carry out physical or mechanical digestion (2): they cut, tear and grind the food into smaller pieces, which increases its surface area so that enzymes can act on it more quickly, and makes it easier to swallow (2).	**4**
(c)(i) Matching the organs *2 marks each*	Liver: **E** Pancreas: **D** Stomach: **F**	**6**
(c)(ii) Movement through the large intestine	By **peristalsis** (2): the circular muscles in the wall of the intestine contract behind the mass of undigested food and relax in front of it (2), producing a wave of contraction that squeezes the material along the tube (1).	**5**
(c)(iii) The term	A tick beside **Egestion**.	**3**

Part	Acceptable Answer(s)	Marks
(d) Investigating a food biomolecule	*Marked by required elements; a labelled diagram earns the marks equally.* • The **food named** and the **biomolecule being tested for** stated (2) • The **reagent named** — Benedict's solution for reducing sugar, iodine for starch, Biuret reagent for protein, brown paper or ethanol for fat (2) • The food prepared as a solution or suspension, and the reagent added (2) • Any heating described where the test requires it — Benedict's needs a hot water bath (2) • The **positive result** stated — brick-red precipitate for reducing sugar, blue-black for starch, purple or lilac for protein, a translucent spot for fat (2) • A **control** described: the same test on distilled water, or on a food known not to contain the biomolecule, giving no colour change, so that the change seen with the food can be attributed to the biomolecule (2)	**12**

Question 6 — 50 marks

Candidates answer any five of Questions 2 to 7. Each carries 50 marks.

Indicative mark allocation: (a)(i) 3 · (a)(ii) 3 · (a)(iii) 4 · (a)(iv) 2 · (a)(v) 3 · (a)(vi) 3 · (b)(i) 6 · (b)(ii) 2 · (b)(iii) 3 · (b)(iv) 3 · (c)(i) 3 · (c)(ii) 6 · (c)(iii) 3 · (c)(iv) 2 · (c)(v) 2 · (c)(vi) 2 = 50 marks.

(a) Blood (18 marks)

Part	Acceptable Answer(s)	Marks
(i) Component R	**Plasma**	**3**
(ii) What makes up most of it	A tick beside **Water**.	**3**
(iii) Cells X and Y ***2 marks each***	X: **red blood cell** (erythrocyte) Y: **white blood cell** (leucocyte)	**4**
(iv) The chemical carrying oxygen	A tick beside **Haemoglobin**.	**2**
(v) Function of cell Y	White blood cells defend the body against infection: some engulf and digest pathogens by phagocytosis, and others produce antibodies against them.	**3**
(vi) A blood grouping system	The **ABO** system. Accept the rhesus (Rh) system.	**3**

(b) Blood vessels (14 marks)

Part	Acceptable Answer(s)	Marks
(i) The three vessels ***2 marks each***	A: **artery** B: **vein** C: **capillary**	**6**
(ii) Direction of blood flow	An arrow drawn **in the direction the valve cusps open** — upwards in the printed diagram, since valves open in the direction of flow, towards the heart.	**2**
(iii) If the coronary artery were blocked	The cardiac muscle supplied by that artery would receive no blood and so no oxygen or glucose (2); those cells would be unable to respire and would die, which is a heart attack, and the heart would pump less effectively or stop (1).	**3**
(iv) A lifestyle choice	Take regular exercise; eat a diet low in saturated fat and salt and high in fibre; do not smoke; keep to a healthy weight; limit alcohol; manage stress.	**3**

(c) Adrenaline (18 marks)

Part	Acceptable Answer(s)	Marks
(i) Gland A	The **adrenal gland**.	**3**
(ii) The graph	A **bar chart** drawn on the printed grid, with bars at **20, 60, 80, 100 and 120** for rest and the four exercise times. *1 mark per bar drawn to the correct height, and 1 for bars of equal width with gaps between them.* Both axes, the scale and all five activity labels are already printed, so no marks are available for axes, scale or labels. Accept a line graph where the points are correctly plotted.	**6**
(iii) The relationship	The longer the exercise continues, the higher the concentration of adrenaline in the blood — it rises steadily from 20 at rest to 120 after sixty minutes, so the two increase together.	**3**
(iv) After exercise stops	The concentration would **fall**, returning gradually towards its resting level as the adrenaline is broken down and no more is released.	**2**
(v) The biomolecule	A tick beside **Protein**.	**2**
(vi) Hormonal manipulation in sport	Athletes may take anabolic steroids to build muscle and strength, or EPO to raise the red blood cell count and so the oxygen carried to the muscles; both are forms of doping and are banned.	**2**

Question 7 — 50 marks

Candidates answer any five of Questions 2 to 7. Each carries 50 marks.

Indicative mark allocation: (a)(i) 6 · (a)(ii) 6 · (b)(i) 3 · (b)(ii) 3 · (b)(iii) 8 · (c)(i) 4 · (c)(ii) 2 · (c)(iii) 2 · (c)(iv) 4 · (d)(i) 4 · (d)(ii) 3 · (d)(iii) 3 · (d)(iv) 2 = 50 marks.

(a) Bacteria and fungi (12 marks)

Part	Acceptable Answer(s)	Marks
(i) Bacteria or fungi ***2 marks per row***	All members are unicellular: **Bacteria** Some members can make their own food: **Bacteria** Cells contain a nucleus: **Fungi**	**6**
(ii) Labelling ***Rhizopus*** ***2 marks each***	A: **spores** B: **sporangium** C: **rhizoid**	**6**

(b) Pathogens (14 marks)

Part	Acceptable Answer(s)	Marks
(i) The name for disease-causing agents	A tick beside **Pathogen**.	**3**
(ii) Another agent causing disease	A **virus**. Accept protozoan, parasitic worm or prion.	**3**
(iii) Diagram of a bacterial cell	*2 marks per correctly drawn and labelled structure, to a maximum of 8.* Cell wall; cell membrane; cytoplasm; circular DNA or nucleoid; ribosomes; plasmid; capsule; flagellum. The drawing must show no nucleus and no membrane-bound organelles.	**8**

(c) Antibiotics (12 marks)

Part	Acceptable Answer(s)	Marks
(i) Antibiotic resistance	The ability of a bacterium to survive and grow in the presence of an antibiotic that would once have killed it (2), because a mutation has arisen that protects it and, under the selection pressure of the antibiotic, resistant bacteria survive and multiply while the others die (2).	**4**
(ii) A disc that was not effective	**A**, **C** or **D** — any disc with the bacterial lawn growing right up to its edge and no clear zone around it. **Accept B. Do not accept E**, which has the second largest zone of inhibition on the plate.	**2**
(iii) The most effective disc	**F**	**2**

Part	Acceptable Answer(s)	Marks
(iv) How you decided	F has the **largest clear zone** around it — the widest ring of agar where no bacteria have grown (2). The size of that zone of inhibition shows how far the antibiotic diffused while still being strong enough to kill the bacteria or stop them growing, so the largest zone indicates the most effective antibiotic (2).	**4**

Examiner note on the plate. *Two discs show clear zones: F has by far the largest and darkest, and E has a smaller but unmistakable one, so E is the second most effective antibiotic and must not be credited as ineffective. A, C and D sit in the pale bacterial lawn with streak marks running right up to their edges and are the safe answers at (ii); B is also acceptable, though its growth is less dense on one side.*

(d) The nitrogen cycle (12 marks)

Part	Acceptable Answer(s)	Marks
(i) Processes X and Y ***2 marks each***	X: **nitrogen fixation** — the arrow running from nitrogen gas down into the soil Y: **denitrification** — the arrow running from the soil up to nitrogen gas	**4**
(ii) Another process in the cycle	**Nitrification**; **decomposition** or putrefaction; absorption of nitrates by plant roots; the action of nitrogen-fixing bacteria in root nodules.	**3**
(iii) Climate warming and the soil microbiome	Higher temperatures speed up the activity of soil bacteria and fungi, so decomposition and respiration increase and more carbon dioxide is released (2); but drier, hotter soils can also kill off species that need moisture, reducing the diversity of the microbiome and changing which processes dominate (1).	**3**
(iv) A microbiome in the human body	The **gut** or large intestine. Accept the skin, mouth, nose or vagina.	**2**

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