

SCHOOL: Your school name

SENIOR FOUR BIOLOGY
END OF TERM EXAMINATION · FREE SAMPLE
MARKING SCHEME (TEACHER'S COPY)

Academic year: 20..... – 20.....

Date:/...../20.....

Duration: 2 hours

Total marks: 39

Content covered: Unit 1: Introduction to biodiversity · Unit 2: Introduction to classification · Unit 3: Microscopy · Unit 4: Cell structure and specialisation

INSTRUCTIONS

1. A full paper has THREE sections and 100 marks: A 55 marks (all questions), B 30 marks (any three of four), C 15 marks (one of two).
2. This free sample shows one extract of each section.
3. Write your answers in the answer booklet provided.
4. Use correct biological terms and draw labelled diagrams where they help.

SECTION A (extract of 55 marks)

Attempt ALL questions.

1. Species evenness describes: (1 mark)

- A. the total area of a habitat sampled
- B. the age of an ecosystem in years
- C. the total number of species in an area
- D. how equal the numbers of each species are

Answer: D. how equal the numbers of each species are

Explanation: Even communities have higher D.

2. A bacterial disease of animals that can spread to humans is: (1 mark)

- A. polio
- B. anthrax
- C. influenza
- D. measles

Answer: B. anthrax

Explanation: Caused by *Bacillus anthracis*.

3. Using only the fine focus at high power prevents: (1 mark)

- A. stain from drying
- B. the light from switching off
- C. the objective crushing the slide
- D. the specimen from moving

Answer: C. the objective crushing the slide

Explanation: Clearance is very small at high power.

4. Matching. Match each item in column A with the correct answer in column B. Write the letter in the answer column. (4 marks)

Column A	Answer	Column B
1. Lenses should be cleaned with:	b	a. number of legs
2. A sample gives n/N values 0.5, 0.3 and 0.2. Simpson's index is:	d	b. lens tissue
3. Bacteria that fix nitrogen in legume nodules are:	c	c. <i>Rhizobium</i>
4. A good feature to use in a key is:	a	d. 0.62

Answer: 1 → b, 2 → d, 3 → c, 4 → a

Marking: 1 mark for each correct match (4 marks).

5. Fill in the blanks. Use the words in the box to complete the sentences. One word in the box is not needed. (3 marks)

mountain gorillas	1000 nanometres	improve reliability	introduce bias
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- (i) Sampling is repeated many times to **improve reliability**.
 (ii) Volcanoes National Park mainly protects **mountain gorillas**.
 (iii) One micrometre equals **1000 nanometres**.

Answer: (i) improve reliability; (ii) mountain gorillas; (iii) 1000 nanometres

Marking: 1 mark for each correct word (3 marks).

6. Using the Gram stain, explain why E. coli stains pink and Staphylococcus stains purple. (4 marks)

Model answer: Staphylococcus is **Gram-positive**: its **thick peptidoglycan** wall keeps the crystal violet-iodine complex after alcohol washing, so it stays **purple**. E. coli is **Gram-negative**: its **thin** peptidoglycan layer and outer membrane lose the purple stain, and it takes up the red counterstain (safranin), so it appears **pink**.

Marking: 1 mark for each correct key point or step in the model answer, up to 4 marks. Accept any correct method.

SECTION B (extract of 30 marks)

Attempt any **THREE** questions.

7. Microscopy (10 marks)

- (a) Compare TEM and SEM and say which you would use to study (a) the surface of an insect's eye; (b) the membranes inside a chloroplast. (4 marks)

Model answer: TEM: electrons pass through very thin sections, giving 2D images of internal ultrastructure at very high resolution. [1]

SEM: electrons are reflected from the specimen surface, giving 3D images, at slightly lower resolution. [1]

(a) Surface of an insect's eye: SEM, because it shows 3D surface detail. [1]

(b) Chloroplast membranes: TEM, because they are internal structures. [1]

Marking: Give the marks shown in brackets [] for each step. Accept any correct equivalent answer.

Watch out: Match the type of image (surface or internal) to the question.

- (b) (i) A virus is 100 nm across. Calculate the magnification needed to make it 10 mm in an image. [3] (6 marks)
 (ii) Explain whether a light microscope could resolve it. [3]

Model answer: 10 mm = 10 000 000 nm (or 10 000 µm; 100 nm = 0.1 µm) [1]

Magnification = 10 000 000 ÷ 100 [1]

= ×100 000 [1]

No [1]

Light microscope resolution is about 0.2 μm (200 nm) [1]

The virus (100 nm) is smaller than this, so it cannot be seen as a separate object [1]

Marking: Give the marks shown in brackets [] for each point. Accept other correct wording.

SECTION C (extract of 15 marks)

Attempt only ONE question.

8. Introduction to classification

(15 marks)

A health centre in Nyagatare reports cases of brucellosis among people who drink unboiled milk from cows.

Key unit competence: Apply the acquired knowledge of classification to group living organisms into the three domains.

(a) State the type of organism that causes brucellosis.

(1 mark)

Model answer: A bacterium (Brucella).

Marking: Remember level: 1 mark for a complete, correct answer; part marks for correct points.

(b) Explain how people catch brucellosis from milk.

(2 marks)

Model answer: Bacteria from infected cows are present in raw milk and enter the gut when drunk unboiled.

Marking: Understand level: 2 marks for a complete, correct answer; part marks for correct points.

(c) Suggest two ways to prevent brucellosis in families.

(2 marks)

Model answer: Boil or pasteurise milk; vaccinate cattle; hygiene when handling animals and births.

Marking: Apply level: 2 marks for a complete, correct answer; part marks for correct points.

(d) Why could antibiotics treat brucellosis but not a viral disease like rabies?

(3 marks)

Model answer: Antibiotics target bacterial structures (walls, ribosomes); viruses lack these.

Marking: Analyse level: 3 marks for a complete, correct answer; part marks for correct points.

(e) A farmer says boiling milk destroys its value. Is this a good reason to drink raw milk? Justify.

(3 marks)

Model answer: No: boiling only slightly reduces some vitamins but kills dangerous bacteria; health benefits are much greater.

Marking: Evaluate level: 3 marks for a complete, correct answer; part marks for correct points.

- (f)** Plan a district campaign against zoonotic bacterial diseases. (4 marks)

Model answer: Cattle vaccination, testing herds, teaching milk boiling and safe meat inspection, protective gloves for handling births, and reporting sick animals to veterinarians.

Marking: Create level: 4 marks for a complete, correct answer; part marks for correct points.

END