



Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. cytology
2. cellulose
3. semi-permeable
4. mitochondria
5. ribosomes
6. lysosomes
7. leucoplasts
8. chromosomes

K • 4

Each carries 0.5 mark.

2 Label the diagram

- | | |
|------------------|------------------|
| 1. cell wall | 5. mitochondrion |
| 2. cell membrane | 6. cytoplasm |
| 3. nucleus | 7. vacuole |
| 4. chloroplast | 8. Golgi body |

K • 4

Each carries 0.5 mark.

3 Multiple choice

- i. b. cytology

K • 1

Cytology is the study of cells. Histology is the study of tissues, cytogenetics the study of chromosomes, and anatomy the study of the body's structure.

- ii. d. ATP

K • 1

The mitochondria store the energy released from glucose in ATP (adenosine triphosphate), which carries it around the cell. DNA and RNA carry instructions, and RBCs (red blood cells) are cells.

- iii. b. the cell would die

U • 1

The membrane holds the cell together and controls everything that goes in and out. Without it, the contents would spill out, nothing could be kept in or out, and the cell would die. (The other options would happen too, as part of that.)

- iv. c. leucoplasts

A • 1

Leucoplasts are colorless plastids that store starch, and a potato grows underground in the dark. But leave a potato in the light for a few days and its skin turns green: some of the plastids change into chloroplasts. (Don't eat the green parts; they contain a poison, solanine.)

- v. c. taking part in cell division

U • 1

The body grows because its cells divide, and each division starts with the division of the nucleus. (Proteins are made by ribosomes, not by the nucleus itself.)

4 Very short answers

- a. MARKING SCHEME
✓ Robert Hooke.

K • 1

- b. MARKING SCHEME
✓ 46 (23 pairs).

K • 1



- c. MARKING SCHEME U · 1
✓ Chromoplasts.

5 Short answers

- a. MARKING SCHEME U · 2
✓ Ribosomes join amino acids together, following instructions from the DNA.
✓ So they make all the cell's proteins, as a factory makes goods.
- b. MARKING SCHEME U · 2
✓ The cell wall is a thick, rigid layer of cellulose that doesn't change shape easily.
✓ The water-filled vacuole presses the cell against it from inside, so the cell keeps the wall's shape.
- c. MARKING SCHEME U · 2
✓ Any one difference, e.g. a chloroplast is green, with chlorophyll; a chromoplast is red, orange or yellow, with other pigments.
✓ Any second difference, e.g. a chloroplast makes food by photosynthesis (in leaves); a chromoplast colors flowers and fruits to attract animals for pollination and seed dispersal.
- d. MARKING SCHEME K · 2
✓ Golgi body: sorts, packs and sends out the cell's products (mucus, enzymes, hormones); or helps make the new cell membrane or cell plate in cell division.
✓ Vacuole: stores cell sap (water, salts, sugars, pigments); or keeps a plant cell firm; or collects wastes.

6 Long answers

- a. ANSWER K · 4
Mitochondria are found in the **cytoplasm** of the cells of all eukaryotes, plants and animals alike: many of them, especially in busy cells such as muscle cells.
Functions:
1. They carry out cellular respiration: they break down glucose with oxygen and release energy.
 2. They store this energy in ATP, which supplies the rest of the cell, so they are called the power-houses of the cell.
 3. They have a little DNA of their own, which is passed to the offspring.

MARKING SCHEME

- ✓ In the cytoplasm of the cells of plants and animals (all eukaryotes), many in busy cells such as muscle cells.
- ✓ They break down glucose with oxygen in cellular respiration, releasing energy.
- ✓ They store this energy in ATP, which supplies every part of the cell, so they are called the power-houses of the cell.
- ✓ They have a little DNA of their own, which is passed on to the offspring.



b. ANSWER

U • 4

No single cell or tissue can carry out a life process alone. In digestion, for example, muscle tissue in the stomach and intestine pushes food along while gland tissue makes the enzymes that digest it, and both must work at the right time and place. Cells make tissues, tissues make organs and organs make systems, each depending on the others. If they are not coordinated, the process fails.

MARKING SCHEME

- ✓ Cells of the same kind form a tissue, tissues form an organ, and organs form an organ system (cell → tissue → organ → organ system → organism).
- ✓ The muscle tissue in the walls of the stomach and intestine squeezes in waves (peristalsis) and pushes food along.
- ✓ The glandular tissue lining them makes digestive juices with enzymes that break down the food.
- ✓ Both tissues must work together at the right time and place; the stomach, intestine and other organs together make the digestive system, which feeds every cell.

7 Numerical problems

a. ANSWER

A • 2

$10 \text{ mm} \div 0.25 \text{ mm} = 40$.

MARKING SCHEME

- ✓ 1 cm changed to 10 mm and divided by 0.25 mm.
- ✓ 40 Paramecia.

b. ANSWER

A • 2

$120 \div 4 = 30$ times. $120 \div 30 = 4$ months.

MARKING SCHEME

- ✓ $120 \div 4 = 30$ times.
- ✓ $120 \div 30 = 4$ months.

8 Think

ANSWER

HA • 2

Its membrane is protected on the inside, so the enzymes can't break it down. And the enzymes work only in acid: the inside of a lysosome is acidic, but the cytoplasm around it is not, so even if a few enzymes leak out, they hardly work. Only when many lysosomes burst at once, in a badly damaged or dying cell, is the cell digested.

MARKING SCHEME

- ✓ Its membrane is protected on the inside, so the enzymes can't break it down.
- ✓ The enzymes work only in acid; the inside of a lysosome is acidic but the cytoplasm is not, so a few leaked enzymes hardly work.

9 Activity: Onion cells and cheek cells (Activities 3.2 and 3.3)

(not marked)

WHAT STUDENTS SHOULD FIND

Onion cells are long and many-sided, fitted together like bricks with no gaps, each with a clear cell wall, a large vacuole filling the middle, and the nucleus near the edge. Cheek cells are flat, irregular and rounded, scattered or in small groups, with no cell wall and no large vacuole, and the nucleus near the center.

See it at Science Playground

Exhibits and plants at the center, Bhaktapur, that go with this unit. Book a class visit at science-playground.com/booking.

- **Plant Cell Model** (exhibit): Find the three parts a plant cell has and yours lacks: wall, chloroplasts, big vacuole.



- **Animal Cell Model** (exhibit): Find the nucleus, the mitochondria and the ribosomes on a cell big enough to hold.
- **Inside the Body** (exhibit): Trace food from the stomach through the intestines: organs working together as one system.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	18	13	5	2	38





Unit 3 • Living Beings and Their Structure: classification and microorganisms

Give the marks for the points in the marking scheme; an answer in other words that says the same is right.

1 Key words

1. classification
2. Monera
3. Protista
4. acellular
5. capsid
6. pseudopodia
7. hyphae
8. fermentation

K • 4

Each carries 0.5 mark.

2 Label the diagram

1. head (capsid)
2. tail fibers
3. DNA
4. RNA (its genes)
5. spike proteins
6. envelope

K • 3

Each carries 0.5 mark.

3 Multiple choice

- i. c. Linnaeus

K • 1

Carl Linnaeus divided all living things into plants and animals. Whittaker proposed the five-kingdom system in 1969.

- ii. b. they have no chlorophyll and absorb their food from other organisms

U • 1

Mushrooms have cell walls and don't move, like plants, but they have **no chlorophyll**: they can't make their own food. They absorb it from dead matter (or from living hosts). That way of life, and their cell walls of chitin rather than cellulose, put them in their own kingdom.

- iii. b. Protista

K • 1

Protozoa such as Amoeba and Paramecium are unicellular eukaryotes, so they are in **Protista**.

- iv. c. dry it until only the right small amount of moisture is left

A • 1

Gundruk is preserved by **drying** until it has very little moisture left, so microbes can't grow, but not scorched, which would spoil its taste and nutrients. Sealing it wet would let it rot.

- v. c. it multiplies inside a living cell, but outside it shows no signs of life

U • 1

Inside a host cell, a virus multiplies, like a living thing. Outside, it has no metabolism and does nothing at all, like a non-living particle. Viruses have no cells and make no food.

4 Very short answers

- a. MARKING SCHEME

K • 1

✓ Germs and microbes.

- b. MARKING SCHEME

K • 1

✓ Rhizobium.

- c. MARKING SCHEME

U • 1

✓ The cold makes most microbes inactive, so they grow very slowly or not at all.



5 Short answers

a. MARKING SCHEME

U • 2

- ✓ It has no cell, no cytoplasm and no metabolism: only DNA or RNA in a protein coat.
- ✓ It can't feed, grow or multiply by itself, only inside a living host cell, where it causes infection.

b. MARKING SCHEME

U • 2

- ✓ Microorganisms need water to grow and multiply.
- ✓ Well-dried fruit has very little water, so bacteria and molds can't grow on it and it doesn't rot.

c. MARKING SCHEME

U • 2

- ✓ Any one difference, e.g. bacteria are cells (unicellular prokaryotes); viruses are not cells (acellular).
- ✓ Any second difference, e.g. bacteria carry out metabolism and multiply on their own, viruses only inside a living host cell; or bacteria belong to Monera, viruses to no kingdom; or antibiotics kill bacteria but not viruses.

d. MARKING SCHEME

K • 2

- ✓ Two virus diseases, e.g. COVID-19, the common cold, flu, measles, AIDS.
- ✓ Two bacterial diseases, e.g. typhoid, tuberculosis, cholera, pneumonia.

6 Long answers

a. ANSWER

U • 4

The main methods are **dry preservation**, **wet preservation** and **cold preservation**.

Dry preservation: food is dried in the sun or in a dryer, at a moderate warmth (about 20–30 °C), until very little moisture is left. Microbes can't grow without water, so the food keeps for months at room temperature. Grain, sukuti, dried fish, gundruk and dried fruit are preserved this way.

Importance: preservation keeps food safe from microbes and food poisoning, keeps its nutrients, lets us store food for times when it isn't grown (for winter, or for a bad harvest), reduces waste and loss to farmers, and lets food be carried to faraway places.

MARKING SCHEME

- ✓ The three methods named: dry, wet and cold preservation.
- ✓ One method described, e.g. dry preservation: food is dried in the sun or a dryer until very little moisture is left (grain, sukuti, gundruk).
- ✓ How it stops microbes, e.g. without water microbes can't grow, so the food keeps for months.
- ✓ Importance, e.g. keeps food safe from microbes and food poisoning and keeps its nutrients; lets food be stored for later and reduces waste.

b. ANSWER

K • 4

Merits: it was the first scientific system of classification; it is simple; it divides living things into two clear groups, plants and animals, which are easy to tell apart.

Drawbacks: it puts prokaryotes (bacteria) with eukaryotes; it doesn't separate unicellular from multicellular organisms; it puts fungi, which have no chlorophyll, with green plants; and organisms such as Euglena and lichens fit in neither kingdom.

MARKING SCHEME

- ✓ Any one merit, e.g. it was the first scientific system of classification.
- ✓ Any second merit, e.g. it is simple: plants and animals are easy to tell apart.
- ✓ Any one drawback, e.g. prokaryotes (bacteria) are put with eukaryotes.
- ✓ Any second drawback, e.g. unicellular and multicellular organisms aren't separated; fungi, with no chlorophyll, are put with green plants; Euglena and lichens fit in neither kingdom.



7 Numerical problems

a. ANSWER

A - 2

2 hours = 120 minutes = 6 splits. $1 \rightarrow 2 \rightarrow 4 \rightarrow 8 \rightarrow 16 \rightarrow 32 \rightarrow 64$ bacteria.

MARKING SCHEME

✓ $120 \div 20 = 6$ doublings.

✓ $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 64$ bacteria.

b. ANSWER

A - 2

Water removed = $500 - 50 = 450$ g. Percentage = $450 \div 500 \times 100 = 90\%$.

MARKING SCHEME

✓ Water removed = $500 \text{ g} - 50 \text{ g} = 450 \text{ g}$.

✓ $450 \div 500 \times 100 = 90\%$.

8 Think

ANSWER

HA - 2

Why: mold spores get in when the jar is opened with a wet or dirty spoon, or when it isn't closed airtight, or if the vegetables weren't dried well, or there isn't enough salt, oil or acid to cover them. Where there is moisture and air, the spores grow.

Protection: wash and dry the vegetables (and the jar) well before making the pickle; use enough salt, acid and oil, with the pickle covered by oil; close the jar airtight; always take pickle out with a clean, dry spoon; keep the jar in the sun from time to time, or in a cool place.

MARKING SCHEME

✓ Mold spores get in with a wet or dirty spoon or through a lid not closed airtight, or the vegetables weren't dried well or there isn't enough salt, oil or acid; with moisture and air, the spores grow.

✓ Dry the vegetables and jar well, use enough salt, acid and oil to cover the pickle, close the jar airtight and use a clean, dry spoon.

9 Activity: Which bread goes moldy first?

(not marked)

WHAT STUDENTS SHOULD FIND

The damp bread in the warm place goes moldy first, usually within 3 to 5 days. The bread in the fridge lasts much longer (cold preservation), and the dried bread may not go moldy at all (dry preservation). Mold needs both warmth and water. The bags are thrown away unopened at the end.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	17	13	5	2	37

