Unit 2 · Life and Life Process

HARDER PRACTICE QUESTIONS · ANSWER KEY

Full marks 52

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

1 Spot the error

ANSWER U · 3

She compared grams, but the strips didn't start with the same mass. X: $(3.40 - 4.00) \div 4.00 \times 100\% = \mathbf{-15\%}$. Y: $(1.60 - 2.00) \div 2.00 \times 100\% = \mathbf{-20\%}$. The strip in Y lost a larger share of its mass, so **solution Y is the more concentrated**.

MARKING SCHEME

- ✓ The mistake: comparing grams when the starting masses differ.
- ✓ −15% in X and −20% in Y.
- ✓ Y is the more concentrated.

2 Read the measurements

ANSWER A · 5

i. **+8%, +4%, −2%, −7%, −12%** (for example, $(2.45 - 2.50) \div 2.50 \times 100\% = -2\%$).

ii. The change crosses zero between 0.2 and 0.3 mol/L: $0.2 + 0.1 \times 4 \div (4 + 2) =$ **about 0.27 mol/L**.

iii. −7% of 3.00 g: $3.00 \times 0.93 =$ **2.79 g**.

iv. Those above about 0.27 mol/L: **0.3, 0.4 and 0.5 mol/L**, which are hypertonic to the cell sap.

MARKING SCHEME

- ✓ +8%, +4%.
- ✓ −2%, −7%, −12%.
- ✓ About 0.27 mol/L.
- ✓ 2.79 g.
- ✓ 0.3, 0.4 and 0.5 mol/L, as hypertonic.

3 Count what's left

ANSWER A · 4

i. **60 zygospores**, one in each cell of the receiving filament, and **60 empty cells** in the other.

ii. $60 \times 4 =$ **240 nuclei**; three of every four degenerate: $60 \times 3 =$ **180**.

iii. One from each zygospore: **60 filaments**.

iv. Every second cell holds a zygospore: 30 zygospores, so **30 filaments**.

MARKING SCHEME

- ✓ 60 zygospores, 60 empty cells.
- ✓ 240 nuclei, 180 degenerate.
- ✓ 60 filaments.
- ✓ 30 filaments.

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4 Judge the case

ANSWER HA · 5

i. **No.** Most infected people have no symptoms and still pass cysts, sometimes millions a day; such carriers, often food handlers, are the main source of new infections.

ii. **No.** The cysts of *E. histolytica* and the harmless *E. dispar* look the same under a microscope, which is why the lab reports both. Only tests for its proteins or DNA can tell them apart.

iii. **No.** The chlorine in ordinary tap water does not reliably kill cysts; boiling does.

iv. The **trophozoite** does the harm, and the **cyst** spreads. A swallowed trophozoite is killed by the stomach's acid; the cyst's wall survives it.

MARKING SCHEME

- ✓ Rakesh is wrong: carriers without symptoms pass cysts.
- ✓ The report can't separate *E. histolytica* from the harmless *E. dispar*; proteins or DNA are needed.
- ✓ Amisha is wrong: ordinary chlorine doesn't reliably kill cysts.
- ✓ The trophozoite does the harm; the cyst spreads.
- ✓ A swallowed trophozoite is killed by stomach acid.

5 Two steps

ANSWER A · 4

i. $V = \pi r^2 d = 3.14 \times 0.4^2 \times 50 = 3.14 \times 0.16 \times 50 = 25.12\ mm^3$. Rate $= 25.12 \div 4 =$ **$6.28\ mm^3$ per minute**.

ii. Taken up in an hour: $6.28 \times 60 = 376.8\ mm^3 = 0.377$ g. Transpired: $0.377 \times 0.97 =$ **0.366 g**.

iii. $0.366 \times 2{,}400 =$ **about 880 J**.

MARKING SCHEME

- ✓ $V = 3.14 \times 0.16 \times 50 = 25.12\ mm^3$.
- ✓ $6.28\ mm^3$ per minute.
- ✓ 0.366 g in an hour.
- ✓ About 880 J.

6 Reading a day

ANSWER A · 4

i. Any two: **light** opens the stomata; **warmth** speeds evaporation; the air gets **drier** as it warms, so more vapor leaves the leaf.

ii. It is dark, so the stomata have mostly closed, and it is cooler.

iii. It measures how fast the shoot **takes up** water, not how fast it loses it. But nearly all the water taken up is transpired, so the two are almost the same.

MARKING SCHEME

- ✓ Any one factor with its reason.
- ✓ A second factor with its reason.
- ✓ Dark at 9 pm: stomata mostly closed.
- ✓ It measures uptake, and nearly all uptake is transpired.

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7 Design a fair test

ANSWER A · 4

i. Four: no jelly; jelly on the upper surface; jelly on the lower surface; jelly on both (the control). The cut stalk of each is sealed as well.
ii. The mass of each group at the start and after some hours, as a **percentage** change.
iii. Any two: same kind and age of leaf; same total leaf area; same place, light, temperature and air movement; same time.
iv. **No jelly > jelly on upper > jelly on lower > jelly on both**. Most stomata are on the lower surface, so covering it stops the most loss.

MARKING SCHEME

✓ Four groups as described (both surfaces greased as a control).
✓ Percentage change in mass over the same time.
✓ Any two things kept the same.
✓ No jelly > upper > lower > both.

8 From a jaand pot

ANSWER A · 4

180 g of glucose gives $2 \times 46 = 92$ g of ethanol and $2 \times 44 = 88$ g of carbon dioxide. 450 g = $450 \div 180 = 2.5$ mol.

i. $2.5 \times 92 =$ **230 g** of ethanol.
ii. $2.5 \times 88 =$ **220 g** of carbon dioxide. (Check: 230 + 220 = 450 g.)
iii. $2.5 \times 2 =$ **5 mol** of ATP.
iv. $5 \div 38 =$ **0.13 mol**, about 24 g of glucose.

MARKING SCHEME

✓ 230 g of ethanol.
✓ 220 g of carbon dioxide.
✓ 5 mol of ATP.
✓ 0.13 mol of glucose.

9 What if?

ANSWER HA · 4

i. **Stops**: oxygen takes the electrons at the end of the chain, and without it the whole chain stops.
ii. **Stops**: pyruvic acid no longer enters the path through the mitochondria; the Krebs cycle hands its hydrogen to carriers, which the chain can no longer free.
iii. **Goes on**: it needs no oxygen, as long as the pyruvic acid is cleared and the carriers are freed.
iv. It becomes **lactic acid**, which frees the carriers. The cell gets only the **2 ATP** of glycolysis per glucose.

MARKING SCHEME

✓ The chain stops, for want of oxygen to take the electrons.
✓ The Krebs cycle stops, its carriers no longer freed.
✓ Glycolysis goes on: it needs no oxygen.
✓ Pyruvic acid becomes lactic acid; 2 ATP per glucose.

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10 Correct the misconceptions

ANSWER U · 3

1. Breathing only exchanges gases; respiration happens **inside every living cell**, of every plant, animal, fungus and microbe, **day and night**.
2. It is not burning: it releases energy in small enzyme-controlled steps at body temperature and **catches a large part in ATP** (about 40% at 38 ATP), the rest being heat.
3. Lactic acid is cleared within about an hour of stopping; next-day soreness comes from **tiny injuries to the muscle fibers**.

MARKING SCHEME

- ✓ Respiration is in every living cell, day and night; it isn't breathing.
- ✓ Not burning: a large part of the energy is caught in ATP.
- ✓ Next-day soreness comes from tiny injuries to the fibers, not lactic acid.

11 Which explanation fits the evidence?

ANSWER HA · 3

Roshni's. The boiled potato has the same sugar in the cup and the same water outside, so if sugar alone did it, the level would rise there too. It doesn't. Boiling has broken down the cell membranes, so what is missing is the semipermeable membrane. So the membranes of living cells are needed for osmosis.

MARKING SCHEME

- ✓ Roshni's explanation.
- ✓ The boiled potato has the same sugar and water, yet no rise, so sugar alone can't do it.
- ✓ Boiling destroys the membranes, so a semipermeable membrane is needed.

12 Estimate it

ANSWER A · 3

i. $c = 340$ mol/m^3, $T = 300$ K: $\pi = 340 \times 8.314 \times 300 = 848{,}000$ Pa = $\mathbf{8.5 \times 10^5}$ **Pa**.

ii. $h = 848{,}000 \div (1000 \times 9.8) =$ **about 87 m**.

iii. **No**: 87 m is less than 110 m, and root pressure from osmosis really lifts water only a few meters. The **transpiration pull** does it: evaporation at the top pulls up a thread of water held by cohesion and adhesion.

MARKING SCHEME

- ✓ $\pi = 8.5 \times 10^5$ Pa.
- ✓ About 87 m.
- ✓ No; the transpiration pull lifts it.

13 Draw it

MARKING SCHEME A · 3

- ✓ The stages in order, back to the filament.
- ✓ Only the zygote and zygospore marked 2n.
- ✓ Meiosis at germination, mitosis in growth and in the fragmentation loop.

14 Think

ANSWER HA · 3

Each conjugation fuses two whole nuclei, so the number would **double** every time: n, 2n, 4n, 8n… Meiosis in the zygospore brings it back to n. *Entamoeba* has **no sexual reproduction**: no gametes ever fuse, so the number never doubles, and mitosis keeps it the same.

MARKING SCHEME

- ✓ The number would double at each conjugation.
- ✓ Meiosis in the zygospore undoes the doubling that fusion makes.
- ✓ *Entamoeba* has no fusion, and only mitosis, so the number stays the same.

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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 Terrarium** (exhibit): Look for drops on the glass: some of that water came up through the roots and left the leaves as vapor, by transpiration.
- **Touch-Me-Not Plant** (exhibit): Touch a leaf gently: cells at the base of each leaflet suddenly lose water and their turgor, so the leaflets fold shut.
- **Cobweb Spiderwort** (garden): Its leaves are wrapped in white, woolly hairs, which hold still, damp air against the leaf and slow its transpiration in dry weather.
- **Animal Cell Model** (exhibit): Find the mitochondria: aerobic respiration is completed there, using oxygen to release most of the energy stored in glucose.

Marks by level	Knowledge	Understanding	Application	Higher ability	Total
Marks	0	6	31	15	**52**

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