Unit 2 · Life and Life Process

HARDER PRACTICE QUESTIONS

Full marks 52

Write your answers on separate paper. Show your working.

1 Spot the error [3]

Two potato strips were left in two sugar solutions, X and Y, for an hour. In X, a 4.00 g strip became 3.40 g. In Y, a 2.00 g strip became 1.60 g. Binita wrote: "The strip in X lost 0.60 g and the strip in Y lost only 0.40 g, so **solution X is the more concentrated**."
Find her mistake and give the right conclusion.

2 Read the measurements [5]

Sapana soaked strips of radish in sugar solutions for an hour (made-up figures).

Sugar solution (mol/L)	0.1	0.2	0.3	0.4	0.5
Mass at start (g)	2.00	2.50	2.50	2.00	2.00
Mass after an hour (g)	2.16	2.60	2.45	1.86	1.76

i. Find the percentage change for each strip.
ii. Find the concentration isotonic with the radish's cell sap.
iii. What mass would a 3.00 g strip have after an hour in the 0.4 mol/L solution?
iv. In which solutions would the cells be plasmolyzing?

3 Count what's left [4]

Two *Spirogyra* filaments of 60 cells each lie side by side, and all 60 pairs of facing cells conjugate.

i. How many zygospores form, and how many empty cells are left?
ii. Each zygospore germinates. How many haploid nuclei does meiosis make in all, and how many degenerate?
iii. How many new filaments grow?
iv. If one filament of 60 cells conjugates alone by the lateral way, with every second cell empty, how many new filaments would it give?

4 Judge the case [5]

In a made-up school, several students have fallen ill with amoebic dysentery. The cook feels perfectly well. A lab test of the cook's stool reports "*E. histolytica/E. dispar* cysts seen", and a test of the school's chlorinated tap water finds cysts as well.

i. Rakesh says: "The cook isn't ill, so the cook can't be spreading it." Is he right?
ii. Does the lab report prove the cook carries *E. histolytica*? Explain.
iii. Amisha says: "The tap water is chlorinated, so it can't be the source." Is she right?
iv. Name the form of the parasite that does the harm in the students and the form that spreads, and say why swallowing the first form wouldn't infect anyone.

5 Two steps [4]

In a potometer, the air bubble moves 50 mm in 4 minutes along a tube of internal radius 0.4 mm. Take $\pi = 3.14$, 1 mm^3 of water as 1 mg, and 97% of the water taken up as transpired.

i. Find the rate of water uptake in mm^3 per minute.
ii. How much water, in grams, is transpired in an hour?
iii. Each gram of water evaporated carries away about 2,400 J. How much heat does this shoot lose in an hour by transpiring?

6 Reading a day [4]

A potometer's shoot stood outdoors for a sunny, dry day (made-up figures).

Time	6 am	9 am	12 noon	3 pm	6 pm	9 pm
Uptake (mm^3 per minute)	2	9	16	14	5	1

i. Explain the rise between 6 am and noon, using two factors.
ii. Why is the rate so low at 9 pm?
iii. Chiring says the table shows "transpiration exactly". What does a potometer really measure? Why is it still a fair guide?

7 Design a fair test [4]

Dolma wants to show by weighing that most of a leaf's water is lost from its lower surface. She has fresh leaves of one kind, petroleum jelly (which water vapor can't pass), thread and a balance. Plan a fair test.

i. How many groups of leaves will she use, and what is done to each?
ii. What will she measure?
iii. Name two things she must keep the same.
iv. Put the groups in order, from most mass lost to least.

8 From a jaand pot [4]

Yeast in a made-up pot ferments 450 g of glucose completely. (C = 12, H = 1, O = 16)

i. What mass of ethanol does it make?
ii. What mass of carbon dioxide leaves the pot?
iii. How many moles of ATP does the yeast gain?
iv. How many moles of glucose would give the same ATP if respired aerobically, at 38 ATP per glucose?

9 What if? [4]

All oxygen stops reaching a muscle cell for a short time. For each of these, say whether it goes on or stops, and why.

i. the electron transport chain
ii. the Krebs cycle
iii. glycolysis
iv. What happens to the pyruvic acid, and how much ATP is the cell now getting from each glucose?

10 Correct the misconceptions [3]

The paragraph has three mistakes. Write each mistake and correct it.

Salim wrote: "Breathing and respiration are the same thing, which is why plants, having no lungs, respire only at night. Respiration is a slow burning of glucose, so all its energy comes out as heat. Sore muscles the day after hard exercise are caused by lactic acid left in them."

11 Which explanation fits the evidence? [3]

In a potato osmometer, the sugar solution rose in the raw potato and hardly changed in the boiled one. Two students explain the rise:

Kiran: "Sugar pulls water towards it wherever it is."
Roshni: "Water crosses because the living cells' membranes let water through but not sugar."
Which does the boiled potato support? Explain.

12 Estimate it [3]

The osmotic pressure of a dilute solution is $\pi = cRT$, with c in mol/m^3, $R = 8.314$ J/(mol K) and T in kelvin. Take a cell sap with the effect of a 0.34 mol/L sugar solution at 27 °C.

i. Find its osmotic pressure.

ii. Pressure of a water column = ρgh, with $\rho = 1000$ kg/m^3 and g = 9.8 m/s^2. How tall a column would this hold up?

iii. Does this explain water reaching the top of a 110 m redwood? What does?

13 Draw it [3]

On plain paper, draw the life cycle of *Spirogyra* as a ring, from a filament back to a filament. Write n or 2n beside each stage. Mark on the ring where meiosis happens and where mitosis happens, and show fragmentation as a short side loop.

14 Think [3]

Suppose *Spirogyra*'s zygospore germinated with no meiosis. What would the chromosome number do over several rounds of conjugation? *Entamoeba* has no meiosis at all, and its number doesn't change. Why not?