S3 Biology Practice Paper | magnification, cell size ratio, photosynthesis, inheritance, energy pyramid

Junior Secondary Science

S3 Biology practice paper with answers: microscope magnification, cell surface area to volume ratio, photosynthesis rate, inheritance probabilities and enzyme Q10.

Question 1 Microscope magnification and image size

A student uses a x10 eyepiece and a x40 objective to view a specimen 0.05 mm long.

#	Question
1	(a) Find the total magnification.
2	(b) Find the length of the image seen, in mm.
3	(c) A structure measures 30 mm in the field of view. Find its real length in mm and in micrometres.
4	(d) With a x100 objective, how long is the image and how does the 1.8 mm field diameter change?

Question 2 Cell surface area to volume ratio

Three cube shaped cells have sides of 20, 10 and 40 micrometres.

#	Question
5	(a) For the 20 micrometre cell, find the surface area and the volume.
6	(b) Find its surface area to volume ratio.
7	(c) Find the ratio for the 10 and 40 micrometre cells and compare.
8	(d) Explain why cells cannot grow indefinitely and how a falling ratio affects diffusion.

Question 3 Photosynthesis and bubble rate

A pondweed releases 30 bubbles in 5 minutes under bright light.

#	Question
9	(a) Find the bubble rate per minute.
10	(b) With the lamp closer, 48 bubbles appear in 5 minutes. Find the new rate and the factor of increase.
11	(c) Each bubble is 0.02 cm3. Find the gas volume released per hour at the first rate.
12	(d) If light intensity is halved and all else is unchanged, predict the rate and name the limiting factor.

Question 4 Monohybrid cross and test cross

In peas, tall (T) is dominant to dwarf (t). Two heterozygous tall plants are crossed, giving 400 offspring.

#	Question
13	(a) State the parent genotypes and the genotype ratio of the offspring.
14	(b) How many tall and dwarf plants are expected?
15	(c) If a tall plant (Tt) is test crossed with a dwarf plant, find the phenotype ratio.
16	(d) In a test cross giving 200 offspring, how many tall are expected and why may the actual number differ?

Question 5 Energy pyramid and transfer efficiency

Producers in an ecosystem fix 50000 kJ of energy with a transfer efficiency of 10 per cent.

#	Question
17	(a) Find the energy available to primary, secondary and tertiary consumers.
18	(b) If efficiency were 15 per cent, what energy reaches the tertiary consumer?
19	(c) To supply 500 kJ to the tertiary consumer at 10 per cent efficiency, how much must producers fix?
20	(d) Explain where the rest of the energy goes at each trophic level.

Question 6 Enzyme activity and the Q10 temperature coefficient

An enzyme works at 12 units per minute at 20 C and 24 units per minute at 30 C.

#	Question
21	(a) Find the temperature coefficient Q10 between 20 C and 30 C.
22	(b) Predict the rate at 40 C if Q10 held, but the measured value is only 30 units per minute. Find the shortfall and explain.
23	(c) At 50 C the rate falls to 3 units per minute. Find this as a percentage of the 30 C rate.
24	(d) Deduce the optimum temperature of this human enzyme and describe the effect of further heating.