S5 Biology Practice Paper (Set 2): Cell Division and Genetics, Enzymes and Metabolic Rate, Water Transport in Plants, Body Defence, Energy Flow and Population Estimation, Genetic Ratios and Data Handling

Senior Secondary Biology

S5 Biology practice paper, Set 2: 24 parts, 100 marks on cell division, enzymes, plant transport, defence, ecology and genetics, with full answers.

Cell Division and Genetics

A human body cell has a chromosome number of 2n = 46.

#	Question
1	What is the chromosome number of each daughter cell after a human body cell completes mitosis?
2	How many chromosomes are in a human gamete (sperm or egg), and why does this matter at fertilisation?
3	How many gametes arise from one primary reproductive cell by meiosis, and at which stage is the chromosome number halved?
4	What is the main difference between mitosis and meiosis in the genetic make-up of the products?

Enzymes and Metabolic Rate

The table shows the activity of an enzyme at different temperatures (units of product per minute): 10 C: 12, 20 C: 28, 30 C: 45, 40 C: 60, 50 C: 60, 60 C: 38, 70 C: 8.

#	Question
5	From the data, state the optimum temperature range of the enzyme.
6	Calculate the activity at 30 C as a percentage of the maximum activity.
7	When the temperature rises from 40 C to 70 C, by what percentage of the maximum does the activity fall?
8	Why does the activity fail to recover after exposure to 70 C?

Water Transport in Plants

A shoot with 3 leaves is placed in a potometer; it absorbs 24.0 cm3 of water in 30 minutes.

#	Question
9	Calculate the mean rate of water uptake of the shoot in cm3 per minute.
10	Convert this rate to water uptake per hour in cm3 per hour.
11	Assuming each leaf transpires at the same rate, how much water would a shoot with 5 leaves absorb per hour?
12	Explain how the number of leaves affects the rate of water uptake.

Body Defence

Two weeks after vaccination, a student shows a marked rise in blood antibody level and later shows no illness after contact with the same pathogen.

#	Question
13	Which type of immunity does vaccination produce? Give one feature of it.
14	Which type of white blood cell produces antibodies?
15	Why does a second dose of the same vaccine raise the antibody level faster and higher?
16	Can a vaccine treat an infection that has already developed? Explain.

Energy Flow and Population Estimation

Snails are estimated by mark-recapture: 40 are caught, marked and released; a second catch of 50 contains 8 marked individuals. Another survey shows producers fix 50000 kJ of energy.

#	Question
17	Estimate the population size by mark-recapture, giving the formula and the calculation.
18	State one assumption of this estimation method.
19	If some marks rub off before the second catch, is the estimate too high or too low? Explain.
20	Using the ten per cent rule, how much energy is available to primary and to secondary consumers?

Genetic Ratios and Data Handling

In peas the tall allele T is dominant to the dwarf allele t. Two tall plants (Tt x Tt) are crossed and 400 seeds are planted.

#	Question
21	Write the genotypes of the two parents and the gametes each produces.
22	Use a genetic diagram to derive the genotype and phenotype ratios of the offspring.
23	Among 400 offspring, how many are expected to be tall and how many dwarf?
24	If the actual result is 290 tall and 110 dwarf, how do you explain the difference from the expectation?