Answers to Workbook exercises Chapter 20

Exercise 20.1 Energy transfer in a food chain

a The position in a food chain at which an organisms feeds.

b In sequence: producer, primary consumer, secondary consumer, tertiary consumer.

c **i** $\dfrac{20}{20810} \times 100 = 0.1\%$

ii Much of it is lost as heat to the environment, through respiration. Some goes to the decomposer food chain.

d **i** There is not enough energy available at the higher trophic levels to support large populations.

ii By the time you reach a fifth or sixth link, there is not enough energy to support any organisms at all.

Exercise 20.2 Fish tank

a They had no light, so they could not photosynthesise.

b protein

c The dead phytoplankton were decomposed by the bacteria in the water. These secreted enzymes that digested the proteins and other compounds in the cells of the dead phytoplankton. The digested products were absorbed into the decomposers' cells.

d The ammonia came from the breakdown of nitrogen-containing substances, such as proteins, in the cells of the dead phytoplankton.

e Nitrate first appeared in December – that is, about one month after the start of the experiment. The quantity of nitrate increased sharply in April.

f The nitrate was produced from ammonia, by nitrifying bacteria.

Exercise 20.3 Goats on an island

a **i** The curve should be the classic S-shape, beginning fairly flat, then rising steeply before levelling off.

ii Limiting factors begin to cut in at the point where the curve begins to flatten out.

b **i** A change in a gene or chromosome.

ii The long-hair allele, **a**, is recessive, so a goat needs two copies (one from each parent) in order to have long hair. Only goat **P** can pass on an allele for long hair, not the females, so none of its offspring could have long hair.

iii Some of the offspring from goat **P** would have inherited one copy of the **a** allele. If these bred with each other (or with goat **P**), then there would be a 1 in 4 chance of each offspring having the genotype **aa** and having long hair.

c **i** The long-haired goats did not lose as much heat from their well-insulated bodies, and so needed to generate less heat through respiration. They therefore needed less glucose (or other nutrients) to use as fuel in respiration.

ii The goats with long hair would have been at a selective advantage – they would be more likely to survive and breed than the shorthaired goats. In each generation, there would therefore be more chance of the alleles for long hair being passed on than the alleles for short hair.