

2 The Chemicals of living cells - *answers*

- 1 Cells need to take in water and salts, in addition to food.
- 2 (a) A high thermal capacity means that any temperature rise is small in comparison with the amount of heat absorbed. This helps to protect the cell against extremes of temperature.
- 3 (a) Cytoplasm, the cell membrane, membrane systems in the cell, the nucleus and mitochondria all contain structural proteins.
(b) Enzymes are the other type of cell proteins.
- 4 Proteins contain the elements carbon, hydrogen, oxygen, nitrogen and sulphur.
- 5 All proteins are composed of sub-units called amino acids.
- 6 (b) A protein which is denatured has changed its shape.
- 7 A lipid is a fat or oil. It may be combined with other substances, e.g. phospho-lipid or lipo-protein.
- 8 Lipids are found in cell membranes and other membrane systems in the cell. Some cells may have food reserves in the form of lipid droplets.
- 9 (a) lipids are formed from the combination of fatty acids with glycerol.
(b) lipids contain the elements carbon, hydrogen and oxygen.
- 10 (a) Sugars (glucose, fructose, maltose, sucrose), starch, glycogen and cellulose are examples of carbohydrates.
(b) Carbohydrates contain the elements carbon, hydrogen and oxygen.
- 11 The formula for glucose is $C_6H_{12}O_6$

- 12 (a) Maltose



- (b) Part of a starch molecule



13 All cells contain *enzymes* which are *proteins* and act as *catalysts* which *speed up* chemical reactions. The reaction does not *use up* the *enzymes*, which can take part in further reactions.

14 Using the lock and key model, enzyme A is most likely to react with substance R.



R

- 15 If an enzyme normally works at 10°C , then
(a) a fall in temperature to 2°C will slow down the reaction

- (b) a rise in temperature to 20°C will speed up the reaction (by x2)
(c) Self-assessment question 2.04
(c) At a temperature of 65°C will denature the enzyme and stop it working (though the reaction may speed up at first).

The chemicals of living cells - answers (continued)

- 16** An enzyme which has been denatured has changed its shape and will no longer combine with its substrate (the substance it acts on).
- 17** (b) The optimum pH is 7 because the rate of reaction is greatest at this pH.
- 18** (a) A protein-digesting enzyme would have no effect on starch.
- 19** All enzymes are produced inside *cells*. Enzymes which do their work outside cells are called *extra-cellular*. Enzymes which do their work inside cells are called *intra-cellular*. Most of our digestive enzymes are examples of *extra-cellular* enzymes.
- 20** In the course of brewing, enzymes in the grain catalyse the conversion of starch to maltose; enzymes in yeast catalyse the conversion of maltose to alcohol.
- 21** Catalase speeds up the breakdown of hydrogen peroxide to water and oxygen.
- 22** (a) Boiling denatures enzymes. If a substance still works after boiling, it cannot be an enzyme.
(b) If the reaction still worked after A had been boiled, either A is not an enzyme or, if it is, it is not necessary for the reaction.
- 23** (a) The test for starch is iodine solution, which goes blue.
(b) When no blue colour appears after adding iodine, all the starch has gone and the reaction is complete.