2 The chemicals of living cells

1 Apart from food, what other substances do cells need to take in?

2 Water has a high capacity for heat (thermal capacity). This is an advantage in living cells because …. (Select one of the following statements)
(a) any rise in temperature is small in comparison with the amount of heat absorbed by a cell
(b) any rise in temperature is large in comparison with the amount of heat absorbed by a cell
(c) the 75% water in a cell does not retain a lot of heat
(d) any change in temperature will cause a cell to heat up or cool down quickly.

3 (a) Give three examples of cell structures which contain structural proteins.
(b) What is the other type of protein in a cell?

4 Name the chemical elements present in a protein.

5 What name is given to the sub-units which make up all proteins?

6 A protein molecule which is denatured, has
(a) split into smaller molecules
(b) changed its shape
(c) combined with another molecule
(d) been diluted..

7 What kind of substance is a lipid?

8 In a cell, where are lipids found?

9 (a) What are the two types of chemical compound which combine to form a lipid?
(b) What elements are present in a lipid?

10 (a) Name four examples of compounds which are classed as carbohydrate.
(b) What elements are present in carbohydrates?

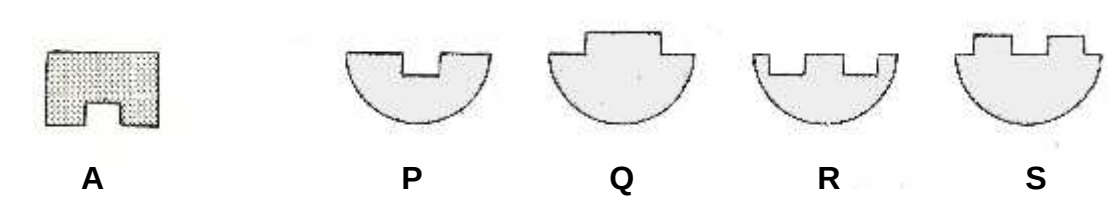
11 Write the formula for glucose.

12 If  represents a glucose molecule draw (a) a maltose molecule, (b) part of a starch molecule.

13 Select the most appropriate words from the list below to complete the following paragraph
All cells contain ……. which are ……. and act as …..…. which ….…. chemical reactions. The reactions do not ……the …… which can take part in further reactions.

substances, proteins, enzymes, catalysts, speed up, use up, slow down

14 Enzymes will usually react with only one substance. This can be explained by the 'lock and key' theory. If this theory is correct, which of the following substances, represented by P, Q, R and S would be acted on by enzyme A?



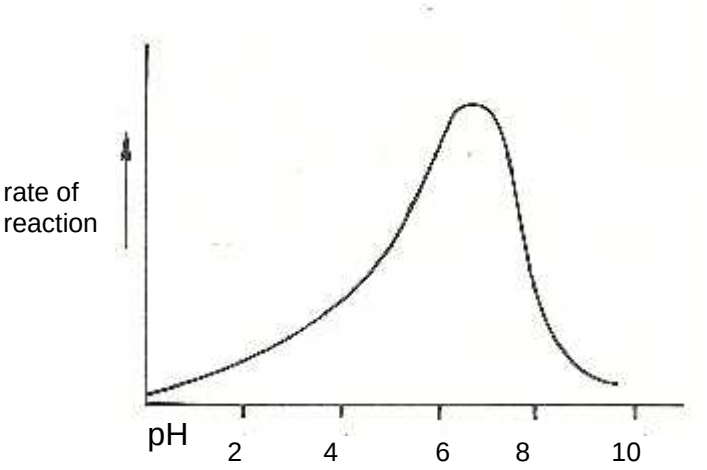
The chemicals of living cells (continued)

15 If an enzyme-controlled reaction normally takes place at 10ºC, in general terms how will the reaction be affected by (a) a fall in temperature to 2°C , (b) a rise in temperature to 20°C. (c) a rise in temperature to 65°C?

16 If an enzyme is denatured, why does it no longer work?

17 The graph shows the rate of an enzyme reaction at different levels of acidity or alkalinity (pH). From the graph, what is the optimum pH for this enzyme?

(a) pH 2 (c) pH 10
(b) pH 7 (d) none of these.



18 A protein-digesting enzyme when mixed with starch solution would

(a) have no action (c) produce glucose
(b) produce amino acids (d) digest the starch?

19 Select the most appropriate words from the list below to complete the following paragraph.
All enzymes are produced inside ……. Enzymes which do their work outside cells are called ……. Enzymes which do their work inside cells are called …….. Most of our digestive enzymes are examples of ……. enzymes.

animals, extra-cellular, intra-cellular, cells, digestive, nuclei, catalysts.

20 Give two examples of chemical reactions which are catalysed by enzymes in the course of brewing.

21 What does the enzyme catalase do?

22 Substance A is being investigated to see if it is an enzyme. When substance A is mixed with substance B a reaction takes place. A control experiment is conducted using a sample of A which has been boiled.

(a) Why is boiling used as a control?
(b) If the reaction still worked after A had been boiled, what might be your interpretation?

23 In an investigation to compare the rates at which starch is being broken down by an enzyme

(a) what test is used
(b) how do you know when the reaction is completed?

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.

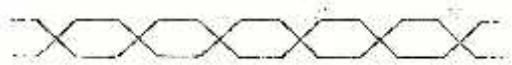
9 (a) lipids are formed from the combination of fatty acids with glycerol.
(b) lipids contain the elements carbon, hydrogen and oxygen.

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 $C_6H_{12}O_6$

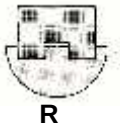
12 (a) Maltose 

(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.



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) a rise in temperature to 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.