Oxford Cambridge and RSA

AS Level Biology A

H020/02 Depth in biology

Question Set 17

1. *Paramecium caudatum* is a protoctist. The structure of this organism is shown in Fig. 1.

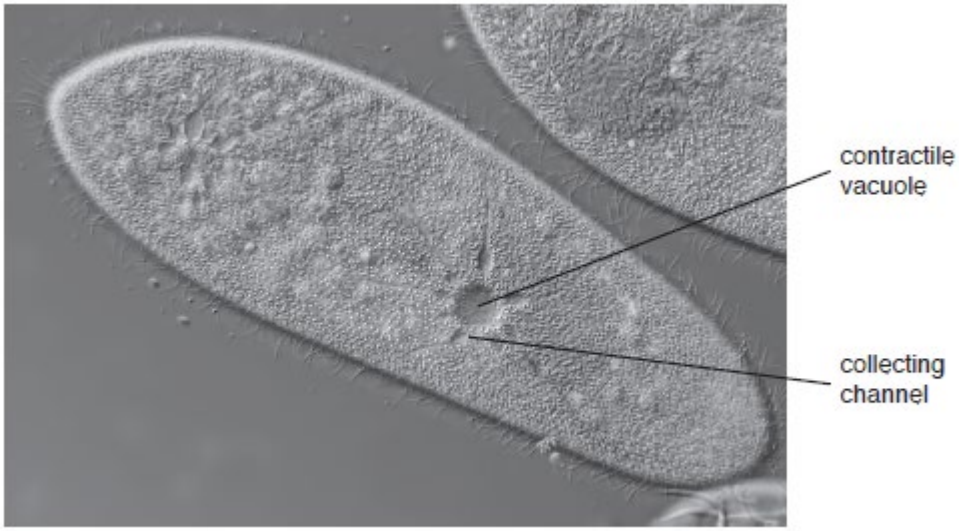

Fig. 1

Most species of *Paramecium* are freshwater organisms. Over a period of time water from the cytoplasm is collected by the collecting channels. They pass the water into the contractile vacuole. Once the contractile vacuole is full, it contracts, expelling the contents from the cell.

(a) Explain why *Paramecium* needs to expel water when in fresh water.

[2]

(b) An experiment was carried out in which the frequency of vacuole contraction was observed when *Paramecium* was bathed in different concentrations of sodium chloride solution. The results are shown in Table 1.

Concentration of sodium chloride solution (mol dm^{-3})	**Mean number of contractions (min^{-1})**
0.00	6.5
0.01	6.2
0.03	5.7
0.05	4.9
0.10	4.4
0.15	3.9
0.20	1.2

Table 1

(i) Calculate the percentage decrease in the mean number of contractions as the concentration of sodium chloride solution increases from 0.00 mol dm^{-3} to 0.15 mol dm^{-3}.

percentage decrease = ... %

[2]

(ii) Explain why there is a decrease in the activity of the contractile vacuole as the concentration of sodium chloride increases.

[2]

(iii) The cytoplasm of *Paramecium* contains salt crystals. These salt crystals can be used to alter the water potential of the cytoplasm.

Suggest and explain how the water potential can be altered **and** how this could benefit the *Paramecium* living in freshwater.

[3]

(iv) The experiment described in **Table 1** was extended to find out the effect of reducing the dissolved oxygen concentration on the mean number of contractions at each concentration of sodium chloride.

When the dissolved oxygen concentration of the solution was reduced, the mean number of contractions was lower at each concentration of sodium chloride.

Suggest an explanation for these findings.

[2]

Total Marks for Question Set 17: 11