4. The following experiment was designed to test whether different concentration gradients affect the rate of diffusion. In this experiment, four solutions (0% NaCl, 1% NaCl, 5% NaCl , and 10% NaCl) were tested under identical conditions. Fifteen milliliters (mL) of 0% NaCl were put into a bag formed of dialysis tubing that is permeable to Na^+, Cl^-, and water. The same was done for each NaCl solution. Each bag was submerged in a separate beaker containing 300 mL of distilled water. The concentration of NaCl in mg/L in the water outside each bag was measured at 40-second intervals. The results from the 5% bag are shown in the table below.

CONCENTRATION IN mg/L OF NaCl OUTSIDE THE 5% NaCl BAG

Time (seconds)	NaCl (mg/L)
0	0
40	130
80	220
120	320
160	400

(a) On the axes provided, graph the data for the 5% NaCl solution.

(b) Using the same set of axes, draw and label three additional lines representing the results that you would predict for the 0% NaCl, 1% NaCl, and 10% NaCl solutions. Explain your predictions.

(c) Farmlands located near coastal regions are being threatened by encroaching seawater seeping into the soil. In terms of water movement into or out of plant cells, explain why seawater could decrease crop production. Include a discussion of water potential in your answer.

END OF EXAMINATION

Question 4

4. (a) **3 points maximum**

1 point correct orientation with dependent variable (concentration) on y (vertical) axis and independent variable (time) on x (horizontal) axis

1 point correct axes labels with units **and** scaling for 5% line on axes provided

1 point correct plotting of all data points including zero (0,0); line is not necessary but if drawn must not extend beyond last data point; dashing line beyond last data point is okay; arrow at end of line is okay

4. (b) **4 points maximum**

1 point correct prediction and legend (or label) for 0%, 1%, **and** 10% lines (0% line flat, 1% line below 5% line, 10% line above 5% line)

Explanation points

1 point correct explanation for 0% line (e.g., since there is no NaCl in the bag no Na^+Cl^- can diffuse into the water in the beaker)

1 point correct explanation for 1% line — must include a discussion of rate; connects concentration of NaCl with diffusion rate

1 point correct explanation for 10% line — must include a discussion of rate; connects concentration of NaCl with diffusion rate

or

1 point general explanation that solute concentration affects the rate of diffusion; answers that attempt to explain the 0%, 1% or 10 % NaCl lines are not eligible to receive this point

4. (c) **4 points maximum**

1 point statement that water will leave the plant **and** description of effect this has on plant cell (e.g., loss of turgor, plasmolysis, decrease in cell volume, decrease in central vacuole volume)

1 point concept of osmosis (e.g., movement of water across a selectively permeable membrane (cell or cell membrane) from solution with lower solute concentration (hypotonic) to solution with higher solute concentration (hypertonic)

1 point explanation that water moves from solution with higher (more positive/less negative) water potential (ψ) to solution with lower (more negative) water potential (ψ)

1 point explanation of how water loss can cause decreased crop production (e.g., stomates close, transpiration stops, photosynthesis stops, decreased metabolism)