

## Data Analysis: Phosphate absorption

Necessary background knowledge:

- 1) Diffusion (Question #11 Lecture)
- 2) Osmosis (Question #11 Lecture)
- 3) Membrane permeability (Question #11 Lecture)
- 4) Characteristics that make substances permeable (Question #'s 11 and 12 Lectures)
- 5) Active versus Passive Transport (Question #12 Lecture)
- 6) The role of oxygen in aerobic respiration (Question #'s 1 and 5 Lectures)
- 7) The role of ATP (Question #5 Lecture)

Oxygen /%	Nitrogen /%	Phosphate absorption/ $\mu\text{mol g}^{-1} \text{h}^{-1}$
0.1	99.9	0.07
0.3	99.7	0.15
0.9	99.1	0.27
2.1	97.1	0.32
21.0	79.0	0.33

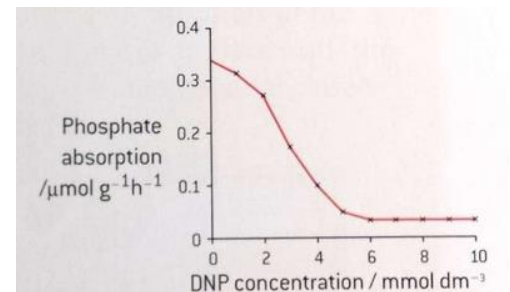
▲ Table 1

Roots were cut off from barley plants and were used to investigate phosphate absorption. Roots were placed in phosphate solutions and air was bubbled through. The phosphate concentration was the same in each case, but the percentage of oxygen and nitrogen was varied in the air bubbled through. The rate of phosphate absorption was measured. Table 1 shows the results.

- 1) Describe the effect of reducing the oxygen concentration below 21.0% on the rate of phosphate absorption by roots. You should only use information from the table in your answer.
  
- 2) Explain the effect of reducing the oxygen percent from 21.0 to 0.1 on phosphate absorption. In your answer you should use as much biological understanding as possible of how cells absorb mineral ions.

An experiment was done to test which method of membrane transport was used by the roots to absorb phosphate. Roots were placed in the phosphate solution as before, with 21.0% oxygen bubbling through. Varying concentrations of a substance called DNP were added. DNP blocks the production of ATP by aerobic cell respiration. Figure 11 shows the results of the experiment.

- 3) What is DNP an indirect measure of?
  
- 4) Use figure 11 to determine the rate of phosphate absorption at 3mmol DNP/dm<sup>3</sup>



▲ Figure 11 Effect of DNP concentration on phosphate absorption

- 5) Use figure 11 to determine the rate of phosphate absorption at  $7\text{mmol DNP/dm}^3$   
Show your work!
- 6) Relative to  $3\text{mmol DNP/dm}^3$ , is the rate at  $7\text{mmol DNP/dm}^3$  increasing, decreasing, or staying the same?
- 7) Sketch how Figure 11 above would look if time (in hours) was the independent variable, and phosphate absorption (in  $\mu\text{mol}$ ) was the dependent variable at the following concentrations of DNP:
- $3\text{mmol DNP/dm}^3$
  - $7\text{mmol DNP/dm}^3$
- 8) Justify whether the roots absorbed the phosphate by diffusion or active transport. A justification has 3 parts:  
1) Theory or knowledge (highlight in pink), 2) data for your analysis related to the theory or knowledge (highlight in yellow), 3) an explanation of HOW the data supports the theory or knowledge (highlight in green).