Why large organisms need transport

Student activity • observation and reasoning

YEAR 10 / LESSON 37 / BIOLOGY + SCIENCE (DOUBLE AWARD)

The question

Why is diffusion alone insufficient for many large organisms?

Use the supplied examples, record your reasoning and correct it using evidence.

Equipment

• Student booklet, paper models, pencil and ruler

Paper, modelling and written reasoning only. No chemicals or biological samples are handled.

Course coverage: Shared Biology / Double Award: 2.51–2.52. Diffusion and transport systems.

Plan, model or apparatus sketch

Draw and label the apparatus or biological model; identify one limitation.

Method and reasoning

Read the whole sequence before starting

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1. Compare a single cell with a multicellular body, marking distances from the outside to internal cells.

2. For model cubes of side 1 and 10 units, calculate area, volume and area/volume using $6l^2$ and l^3.

3. Explain why the larger cube has more total surface area but less area per unit volume.

4. Link increasing size to greater diffusion distances and demand from internal cells. Distinguish surface exchange from internal transport.

5. Compare a unicellular organism with an animal circulation and a plant vascular system; describe the problem each system helps solve.

6. Evaluate model limits: actual organisms are not cubes and can have thin, folded or branched exchange surfaces.

Cleanup

- Return models and keep the corrected work.

Record your evidence

Blank spaces are for your own work

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Reference and task data

Geometric model only: increasing linear size tenfold increases area one hundredfold and volume one thousandfold. Small organisms can have short exchange paths and high area relative to volume. Multicellular organisms often need specialised exchange surfaces and internal transport to maintain supply and removal.

Example / trial	Observation / evidence	Explanation / limit
Cube calculations		
Organism comparison		
Model limitation		

Show your calculations, labelled model or correction here.

Explain and evaluate

Use evidence and show calculation steps where relevant

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1. Calculate area/volume for the 1-unit cube.

2. Calculate it for the 10-unit cube.

3. Which cube has more total area?

4. Why does distance matter?

5. What is the difference between exchange and transport?

6. How can folding help an exchange surface?