SCIENCE FOUNDATIONS

Diffusion and osmosis

Difficulty level: Intermediate

Science Foundations

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Overview of the concept

This is how the smell of fresh baking spreads across a kitchen and how water moves into plant roots or out of salty food, without anything pushing it. A cook brines a turkey because water and salt slowly move into the meat on their own. A gardener knows that watering salty soil can pull water out of the roots instead of into them. Knowing diffusion and osmosis tells you why things spread and mix by themselves, from a drop of food colouring in water to oxygen reaching your cells.



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Rule

Diffusion and osmosis: particles spread from where they are more concentrated to where they are less concentrated, until they are evenly spread.

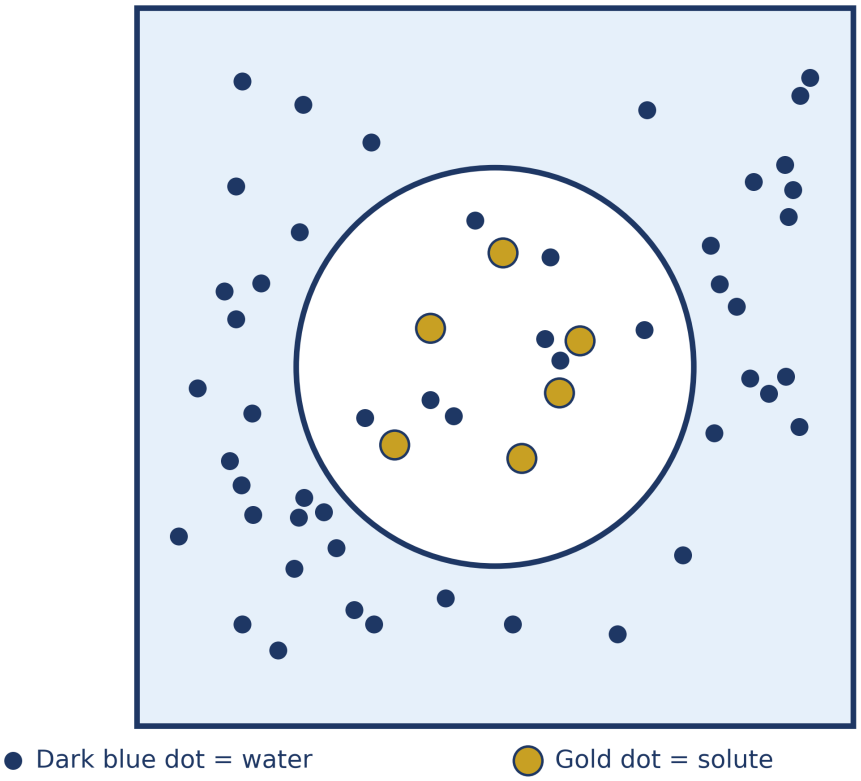
Osmosis is the same idea for water moving across a membrane, from where water is more concentrated to where it is less concentrated. Neither needs energy.

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Worked examples

EXAMPLE 1

Q A cell is placed in pure water. Which way does the water move?



SOLUTION

Compare water outside and inside: outside has more water, less solute.

Water moves from high water concentration to low.

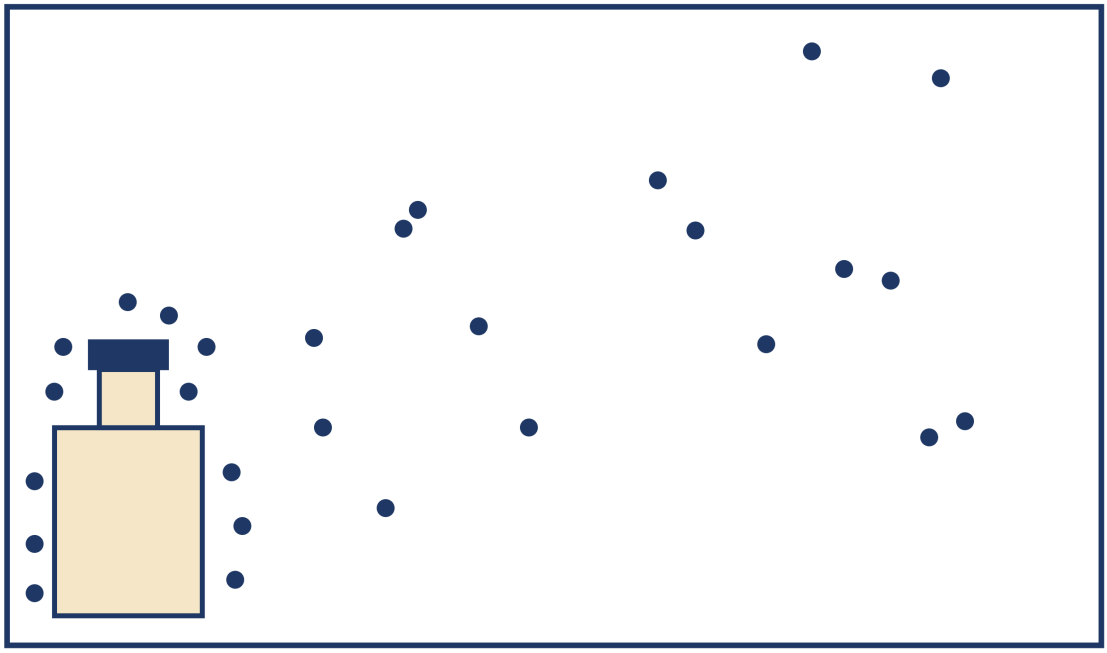
Direction: into the cell

The result is water moves into the cell; the cell may swell.

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EXAMPLE 2

Q Perfume is released in a room. Which way do the perfume particles move?



SOLUTION

Compare concentrations: high near the source, low elsewhere.

Particles spread from high to low concentration.

Direction: outward through the room

Result: perfume spreads by diffusion.

Once the perfume is evenly spread, particles keep moving both ways, so the even spread stays even.

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Practice questions

1 A slice of cucumber is placed in very salty water. Which way does water move?

- **A** Out of the cucumber
- **B** Into the cucumber
- **C** Salt moves into the cucumber
- **D** Nothing moves

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2 A red blood cell is placed in distilled water. Why does it swell?

- **A** Water moves into the cell
- **B** Water moves out of the cell
- **C** Salt moves into the cell
- **D** Nothing moves

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A red blood cell is placed in a solution with the same salt concentration as inside the cell. What happens to the cell?

A It stays the same size

B It swells as water enters the cell

C It shrinks as water leaves the cell

D It bursts as salt enters the cell

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4 **Bread is baking in the kitchen. Describe how the smell reaches the next room and what process this is.**

- **A** It spreads from high concentration near the oven to low concentration through the house, by diffusion
- **B** It is carried by the wind from the oven
- **C** It rises straight up and stays there, by osmosis
- **D** It spreads from low concentration to high concentration, by diffusion

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Why does food colouring spread faster in hot water than in cold water?

A The particles move faster when they are warmer

B Hot water has more particles in it

C Cold water stops diffusion completely

D The colour only dissolves in hot water

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Diffusion definition?

A Particles spread from high to low concentration

B Particles spread from low to high concentration

C Particles stay where they are

D Particles move only when stirred

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7 Osmosis definition?

- **A** Water across a membrane, from high water to low water concentration
- **B** Water across a membrane, from low water to high water concentration
- **C** Salt across a membrane, from high salt to low salt concentration
- **D** Water through the cell wall, from low water to high water concentration

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8 Does diffusion need energy?

- **A** Yes
- **B** No

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Osmosis moves water without using energy from the cell. Is osmosis an example of active transport?

A No, it is passive transport, it needs no energy

B Yes, it uses energy from the cell

C Yes, but only in plant cells

D No, it is diffusion of salt

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Osmosis moves what substance?

A Water

B Salt

C Sugar

D Air

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ANSWER KEY

1. Out of the cucumber

2. Water moves into the cell

3. It stays the same size

4. It spreads from high concentration near the oven to low concentration through the house, by diffusion

5. The particles move faster when they are warmer

6. Particles spread from high to low concentration

7. Water across a membrane, from high water to low water concentration

8. No

9. No, it is passive transport, it needs no energy

10. Water

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