Invisible Oxygen Journey

Use a model to explain diffusion and judge what the model leaves out.

LS.1.e "developing and using models construct and use models and simulations to illustrate, predict, and/or explain observable and unobservable phenomena, life processes, or mechanisms evaluate limitations of models"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each statement that tells what a model part represents, circle each limitation of the model, and number the change and the prediction the model makes.

Modeling Fish Gill Diffusion

1. Scientists cannot watch every oxygen molecule move from a fish's gills into its blood, so they use models. In one classroom model, a damp paper towel represents a thin gill surface. Blue water on one side represents water with dissolved oxygen, and clear water on the other represents blood. As blue color spreads through the towel, students can observe movement across a barrier. The model does not use real gill cells or actual oxygen molecules, but it can represent diffusion.

2. To use the model for a prediction, students change one condition at a time. They compare a towel folded into several layers with a single-layer towel. The multilayer towel represents a thicker barrier between water and blood. Color reaches the far side more slowly when it must cross several layers. From this result, the model predicts that oxygen would enter blood more slowly across a thicker gill surface. A simulation could also change water oxygen level, but its rules must match evidence about diffusion.

3. Even a useful model has limits. Food coloring is visible, while oxygen is colorless and far smaller. A paper towel has no living cells, blood flow, or an active fish. Temperature, water movement, and the amount of oxygen in water can affect diffusion in real gills, yet this simple setup does not show all of them. Therefore, students should use the model to explain a pattern, not to claim that a real gill is made of towel or that color travels exactly like oxygen. Scientists revise models when new evidence shows missing factors.

2 ANSWER WITH EVIDENCE

Use the passage

1. What does each part of the paper-towel model represent: the towel, the blue water, and the clear water?

2. What one condition do students change when they compare the two towels?

3. What observation in the model leads to the prediction that oxygen enters blood more slowly across a thicker gill surface?

4. Name one limitation of the paper-towel model and explain why that limitation means the model cannot show every part of real gill diffusion.

3 YOUR TURN

Your own words

Draw and label a model of carbon dioxide, CO_2, moving from a body cell into a nearby capillary. Include higher and lower CO_2 areas, arrows, and a key, then write exactly two sentences that state a prediction if the capillary already has high CO_2 and one limitation of your model.

ANSWER KEY

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GRADES 7-8 · LS.1.e

PART 1 · READ AND MARK

Underline each statement that tells what a model part represents, circle each limitation of the model, and number the change and the prediction the model makes. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What does each part of the paper-towel model represent: the towel, the blue water, and the clear water?	**The towel represents a thin gill surface. Blue water represents water with dissolved oxygen, and clear water represents blood.**
2	What one condition do students change when they compare the two towels?	**They change the thickness of the barrier by comparing several towel layers with one towel layer.**
3	What observation in the model leads to the prediction that oxygen enters blood more slowly across a thicker gill surface?	**Color reaches the far side more slowly when it must cross several layers.**
4	Name one limitation of the paper-towel model and explain why that limitation means the model cannot show every part of real gill diffusion.	**Answers may name that food coloring is visible and larger than oxygen, or that the towel lacks living cells, blood flow, an active fish, temperature effects, or water movement. The missing feature means the model cannot fully copy real gill conditions.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

My sketch labels a body cell with high CO_2, a capillary with lower CO_2, and a key that says arrows show CO_2 movement; if the capillary already had high CO_2, less CO_2 would diffuse from the cell. This model does not show blood flow, which can carry CO_2 away and maintain a difference in concentration.

Accept scientifically accurate component labels, arrows moving from higher to lower carbon dioxide concentration, and a prediction of reduced diffusion when the concentration difference is smaller. Accept limitations that identify a real feature missing from the model and explain how it affects the model's usefulness.