

# Concept-Development Practice Page

# 18-2

## Scaling Cubes

1. Consider a cube, say 1 cm x 1 cm x 1 cm (about the size of a sugar cube). Its volume is 1 cm<sup>3</sup>. The surface area of one of its faces is 1 cm<sup>2</sup>. This is also the area of any cross-section (a slice through the cube that is parallel to any of its faces). The total surface area of the cube is 6 cm<sup>2</sup>, because it has 6 faces (4 sides and top and bottom; count them).

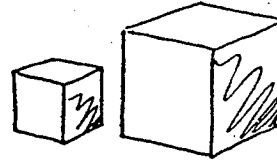
Now consider a second cube, scaled up by a factor of 2 so it is 2 cm x 2 cm x 2 cm.

- a. What is the total surface areas of each cube?

1st cube \_\_\_\_\_ cm<sup>2</sup>; 2nd cube \_\_\_\_\_ cm<sup>2</sup>

- b. How many times more is the total surface area of the second cube compared to that of the first?

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- c. What are the volumes of the cubes?

1st cube \_\_\_\_\_ cm<sup>3</sup>; 2nd cube \_\_\_\_\_ cm<sup>3</sup>

- d. How many times more is the volume of the second cube compared to that of the first?

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- e. Compare the surface-area-to-volume ratio for:

1st cube:  $\frac{\text{surface area}}{\text{volume}} = \frac{\quad}{\quad}$       2nd cube:  $\frac{\text{surface area}}{\text{volume}} = \frac{\quad}{\quad}$

2. As the size of a cube (or object of any shape) increases, the ratio of surface area to volume decreases. This means that the gain in surface area is proportionally less than the gain in volume (area gains only as the *square* of the increase, while volume gains as the *cube* of the increase). Apply this relationship and good thinking to explain the following:

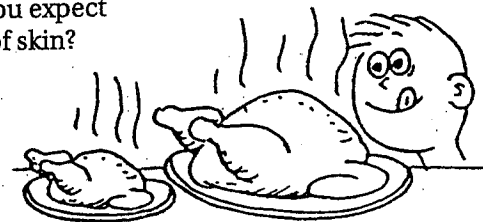
- a. Why does a cup of coffee cool faster than the pot from which it is poured? Or, if you want your coffee to stay warm, should you pour it into a cup or leave it in the pot? Explain.

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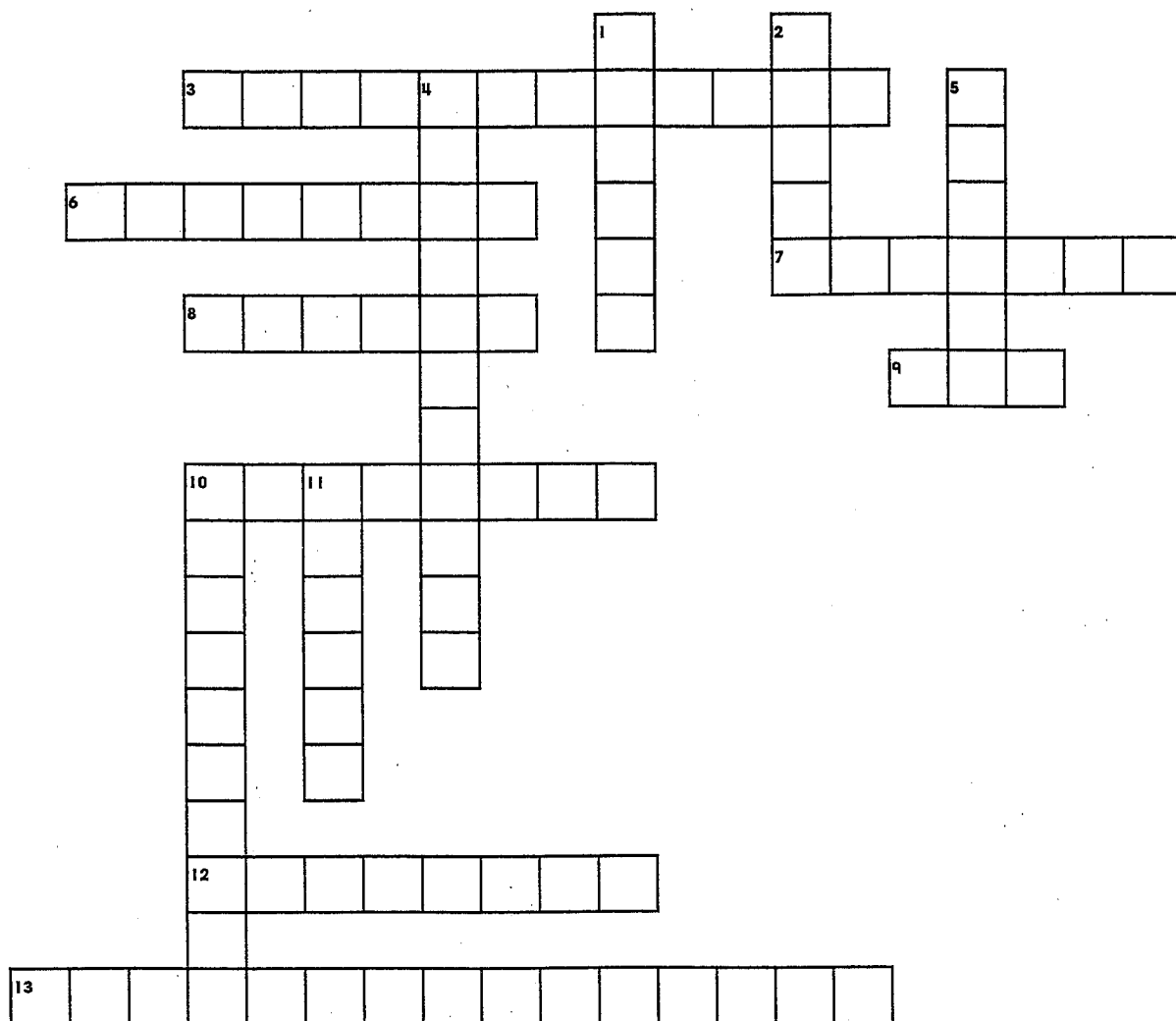


- b. Chickens, Cornish game hens, and turkeys have approximately the same body shape. If you had two birds, one with a body twice as wide, twice as thick, and twice as long, how would you expect their weights to compare? How about the amounts of skin?

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# States of Matter Crossword



**Across**

**Down**

- 3. Change of a gas to a liquid
- 6. This type of property can be observed without destroying the substance.
- 7. Mass of a substance divided by unit volume
- 8. Physical change of a solid to a liquid at the melting point
- 9. State of matter having no definite volume or shape
- 10. Homogeneous mixture
- 12. This type of change produces a new substance.
- 13. Change of a liquid to a solid

- 1. Anything that has mass and takes up space
- 2. State in which atoms or molecules are very close together and are regularly arranged
- 4. Change of a liquid to a gas
- 5. This state of matter consists of electrically charged particles.
- 10. Elements and compounds
- 11. State of matter having a definite volume but no definite shape