Chapter 2: Quick Activities

Particles of Matter

The Fragrant Balloon

How good is an inflated rubber balloon at holding air? As it deflates over time, how does the air escape?

PROCEDURE

1. Pour about 5 mL of water into a large rubber balloon. Inflate the balloon to full size and then tie the balloon so it remains inflated.
2. Add a few drops of a fragrant material, such as cinnamon oil or perfume, to about 5 mL of water. Pour this solution into a second large balloon. If available, use a dropper or a funnel to avoid spilling any of this fragrant solution onto the outside of the balloon. Inflate this second balloon to the same size of the first balloon and then tie it shut.
3. Switch both balloons and then present them to some one who did not see you preparing these balloons. Ask the person which balloon contains the fragrant material.

ANALYZE AND CONCLUDE

1. Explain how the fragrance gets out of the rubber balloon.
2. Mylar balloon stay inflated for a very long time. Can you think of a reason why this is so?
3. If the fragrance-containing balloon were heated in a microwave oven for a few moments, would the smell be more or less pronounced? Why?
4. Might water molecules also be coming out of the inflated balloons? (Hint: Fragrance molecules tend to be much larger than water molecules.)
5. Are air molecules also coming out of the inflated balloon? How do you know?

Pixel Perfect

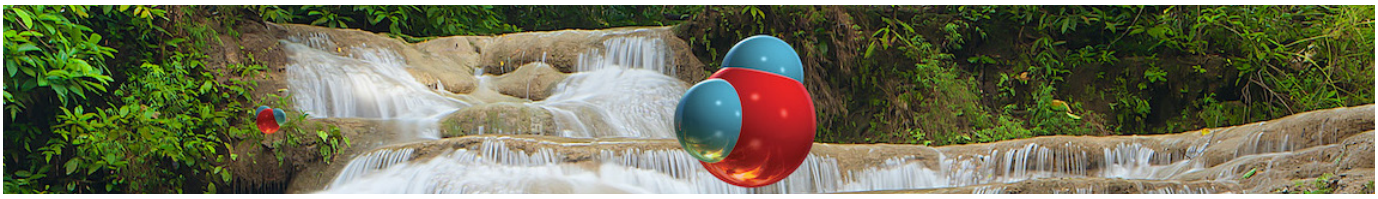
A video screen looked at from a distance appears as a smooth continuous flow of images. Up close, however, we see this is an illusion. What really exists are a series of tiny dots (pixels) that change color in a coordinated way to produce images. Use a magnifying glass to examine closely the screen of a computer monitor or television set.

Kool-Aid Diffusion
Add a pinch of red-colored Kool-Aid crystals to a still glass of hot water. Add the same amount of crystals to a second still glass of cold water. With no stirring, which would you expect to become uniform in color first: the hot water or the cold water? Why?

Sensing Pennies
Pennies dated 1982 or earlier are nearly pure copper, each having a mass of about 3.5 grams. Pennies dated after 1982 are made of copper-coated zinc, each having a mass of about 2.9 grams. Hold a pre-1982 penny on the tip of your index finger and a post-1982 penny on the tip of your other index finger. Move your forearms up and down to feel the difference in inertia—the difference of 0.6 grams (600 milligrams) is subtle but not beyond a set of well-tuned senses. If one penny on each finger is below your threshold, try two pre-1982s stacked on one finger and two post-1982s stacked on the other. Share this activity with a friend.

Hands-On Balloon
Air molecules stuck inside an inflated balloon are perpetually colliding with the inner surface of the balloon. Each collision provides a little push outward on the balloon. All the many collisions working together is what keeps the balloon inflated. To get a "feel" for what's happening here, add about a tablespoon of tiny beads to a large balloon. (Beans, grains of rice, etc., will also work.) Inflate the balloon to its full size and tie it shut. Hold the balloon in the palms of both hands and shake rapidly. Can you feel the collisions? As you shake the balloon wildly, the flying beads represent the gaseous phase. How should you move the balloon so that the beads represent the liquid phase? The solid phase? Absolute zero?

Perplexing Displacement
Fill a tall glass two-thirds full with water and mark the water level with masking tape. Fill a small plastic canister, such as a film canister, with pennies. Cap the canister and place it in the water. Note the new water level with a second strip of tape. Remove the canister, being careful not to splash water out of the glass. Remove half the pennies from the canister so as to decrease its mass. Cap the canister; predict how much the water level will rise when you submerge the canister. Which of the following statements do your results support? (a) The volume of water an object displaces depends only on the dimensions of the object and not on its mass. (b) The volume of water an object displaces depends on both the dimensions and the mass of the object.



Author Responses to Quick Activities

The Fragrant Balloon

1. Fragrant molecules pass through micropores of the balloon.
2. The Mylar material lacks micropores through which gasses can readily pass.
3. Heated molecules move faster and thus will have a greater rate of exiting the balloon.
4. Yes, water molecules would also be passing through the balloon.
5. Yes, air molecules are also passing through the balloon as evidence by the balloon deflating over time.

Pixel Perfect

No question asked.

Kool-Aid Diffusion

The dye should become dispersed uniformly within the hot water first. The higher the temperature, the greater the average kinetic energy of the molecules. Because the molecules within the hot water are moving faster, their effect on the dye of the Kool-aid crystals is quicker. Furthermore, the hot water will tend to have more convection currents that will also help to distribute the dye throughout the water.

Hands-On Balloon

To represent the liquid phase, simply shake the balloon very gently so that the beads still remain together but tumble over one another. To represent the solid phase, gently vibrate the balloon. Notice that in both these cases you are adding energy to the balloon. Holding the balloon still would represent absolute zero!

Perplexing Displacement

The volume of water that gets displaced by a submerged object only depends on the volume of the submerged object.