

Cheap and Easy Diffusion

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Objective: To investigate a system that displays properties of diffusion and selective permeability.

Materials: soluble potato starch (any science supplier; a bottle will last years); Lugol's iodine (100 mL), plastic dropper pipet (one, handled by teacher), rubber bands, masking tape for labeling, clear plastic cups (10 oz, usually 36 in a bag), fold-top sandwich bags (usually 180 per box), small (50 mL) beakers or plastic cups, plastic spoons, source of warm water and tap water.

Background: Students have a working familiarity of diffusion, osmosis, relative sizes of atoms and molecules. Students have seen a demonstration of the starch-iodine indicator color change reaction. This demonstration can take place immediately before starting the activity.

Procedure: Student groups acquire materials for two nearly identical set-ups: (2) plastic cups, (2) rubber bands, (2) pieces of masking tape, (2) sandwich bags. In addition, each group needs one small beaker, one spoon, sample of starch, source of warm water.

Students add a small spoonful of soluble starch to the small beaker of warm water and stir and mush for a minute. This starch-water sample is then poured into one of the sandwich bags which is twisted and held upright in a water-filled plastic cup by a rubber band wrapped on the outside of the cup. This process is repeated for the second set-up except the starch-water sample is poured into the cup, additional water is added, and only water is placed into the suspended sandwich bag.

The teacher is then circulating and adding 5-7 drops of Lugol's iodine to the "only water" portions of the set-up: the exterior only water cup in the first set-up and the "only water" sample in the sandwich bag in the second set-up.

At this point, draw the two set-ups on the board; remind the students of the starch-iodine reaction; have students draw the set-ups; and have students predict what the cups will look like the next day. The teacher can initial the students' papers and predictions.

Upon returning the next day, students will find that the iodine in the first set-up has diffused into the sandwich bag where the starch remains, whereas the iodine has diffused out of the sandwich bag into the starchy water in the second set-up, as indicated by the presence of the purple color change for the iodine-starch reaction.

Follow-up Questions and discussion can address: diffusion as passive transport, "selective permeability" of the sandwich bag, selectivity of the bag based on relative size of the particles (iodine atoms and ions versus macromolecular starch), connections to cell processes and membrane properties.