

# Breath of Fresh Air



Use the pipette to add 4 mL of highlighter water to two graduated cylinders.



Use a straw to blow into the water in one of the cylinders until the liquid inside turns clear.

**!** Be sure you only blow into the water—do not suck on the straw!



Compare the liquid in the two graduated cylinders. What other differences do you notice?



Now add  $\frac{1}{4}$  teaspoon of zeolite to the clear liquid and swirl the graduated cylinder gently. What changes do you notice?



*The future of space travel will require a lot of recycling.*

**Astronauts use a variety of systems to reuse and recycle as much as they can—even the air must be treated and filtered so they can breathe.** In order to sustain life, air needs to contain enough oxygen ( $O_2$ ) and not too much carbon dioxide ( $CO_2$ ). Earth's atmosphere is composed of roughly 21% oxygen. When humans and other living beings breathe, we take in oxygen and breathe out carbon dioxide as waste. There is no breathable air in space, so when we travel beyond Earth's atmosphere, we have to create our own air, filter it, and treat it to ensure there's enough oxygen and not too much  $CO_2$ . When you blow into the highlighter liquid, the  $CO_2$  in your exhaled breath dissolves in water and makes it more acidic. Pyranine, the pH-sensitive ingredient in highlighter ink, reacts to this acid by turning clear. The zeolite mineral in the experiment changes the water back to yellow by adsorbing, or sticking to, the  $CO_2$  you added with your breath.



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The blue line of Earth's atmosphere as seen from space. Earth's atmosphere holds the air we breathe.

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Astronaut Daniel Bursch works on the Elektron Oxygen Generator on the ISS.

**The technology and systems being used on the International Space Station now help prepare us for future missions to the Moon and Mars.** With humans around,  $CO_2$  builds up quickly in a confined space like the International Space Station (ISS). To keep  $CO_2$  from accumulating in the ISS, the air is constantly circulated and blown over a filter that uses a refined zeolite, similar to the form of the mineral used in the experiment. Water and  $CO_2$  in the air stick to the zeolite. The water can be collected and reused to drink or split apart with electricity to make hydrogen and oxygen.

