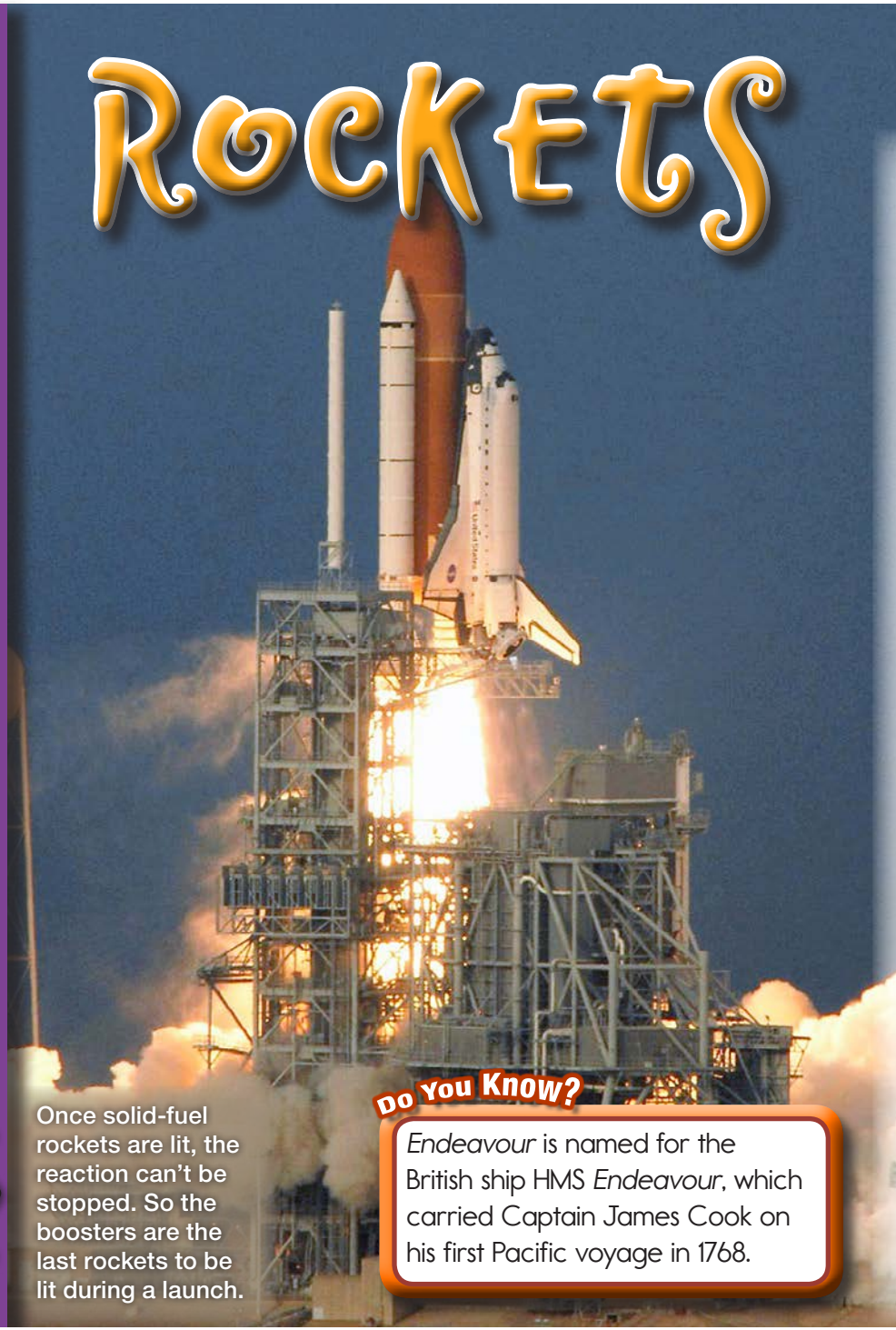
Science a-z

MIXING MATTER
Chemical Changes

Investigation File

Rockets



Once solid-fuel rockets are lit, the reaction can't be stopped. So the boosters are the last rockets to be lit during a launch.

Do You Know?

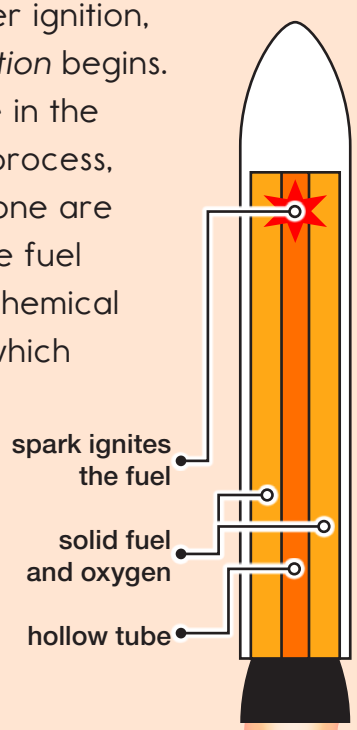
Endeavour is named for the British ship HMS *Endeavour*, which carried Captain James Cook on his first Pacific voyage in 1768.

WE HAVE LIFTOFF!

Just before sunset, the space shuttle *Endeavour* lifted off from Kennedy Space Center in Florida. Its next stop? The International Space Station. The shuttle and its fuel weighed 2 million kilograms (4.4 million lbs.). How did it get off the ground? It's rocket science!

Two solid-fuel booster rockets helped carry *Endeavour* the first 46 kilometers (28 mi.) of its trip. Inside a solid-fuel rocket are two solid chemicals—one provides the fuel and one provides the oxygen. After ignition, a chemical change called *combustion* begins. The fuel burns along a hollow tube in the middle of the rockets. During this process, no new atoms are created, and none are destroyed. Instead, atoms from the fuel combine with oxygen atoms. The chemical change releases a lot of energy, which helps the heavy rockets lift off.

The booster rockets carried the space shuttle for about two minutes. Then they detached and used parachutes to splash down into the ocean. *Endeavour* flew a total of 25 times between 1992 and 2011.



Inside this rocket, solid fuel and oxygen mix when there is a spark. This chemical change creates a lot of energy!

Credits: courtesy of NASA

Rocket Trails

Rockets aren't just for launching space shuttles. In 2012, NASA launched five rockets to study mysteriously fast winds in the upper atmosphere. These winds can blow up to 482 kilometers (300 mi.) per hour! They are part of the *upper jet stream*—a band of fast-moving winds near the outer edge of Earth's atmosphere.

The rockets released a chemical called a *tracer*, which reacts with oxygen in the air. This chemical change created a new chemical that glowed! Scientists then watched the glowing trails and studied how they moved in the jet stream.

Math Moment

NASA launched five rockets in total. The rockets were launched 80 seconds apart. How long after the first launch did the last launch happen?

Each of the five rockets released a chemical tracer at a different height.

oooh! Ahhhh!

Fireworks won't send anyone into space, but they are the oldest form of rocket. People in China invented fireworks over one thousand years ago.

A firework usually contains *gunpowder*, which is a mix of potassium nitrate, charcoal, and sulfur. When the firework is lit, a chemical change takes place. The chemicals in gunpowder react and release energy. This chemical change cannot be undone.

Other chemicals are near the tip of the firework. When the fuse reaches them, they release an explosion of color.

Do You Know?

Each firework contains lumps of chemicals, called *stars*. The order the stars are packed in determines the shape of the firework—circles, stars, or even hearts!