

What's wrong with this cake?

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NASA Space Place



How do astronauts on the International Space Station celebrate their birthdays? They could have a cake, if it were “glued” to the plate with frosting and the plate stuck to the table so it wouldn’t float off. But what about birthday candles? Would a candle even burn in space? Would it look any different from a candle flame on Earth?

Remember, combustion (burning) needs fuel (the melted candle wax, in this case) and oxygen. Of course, the Space Station has air (with oxygen) similar to Earth’s air so the astronauts can breathe, and a candle can burn. But what the Space Station doesn’t have is the effect of gravity.

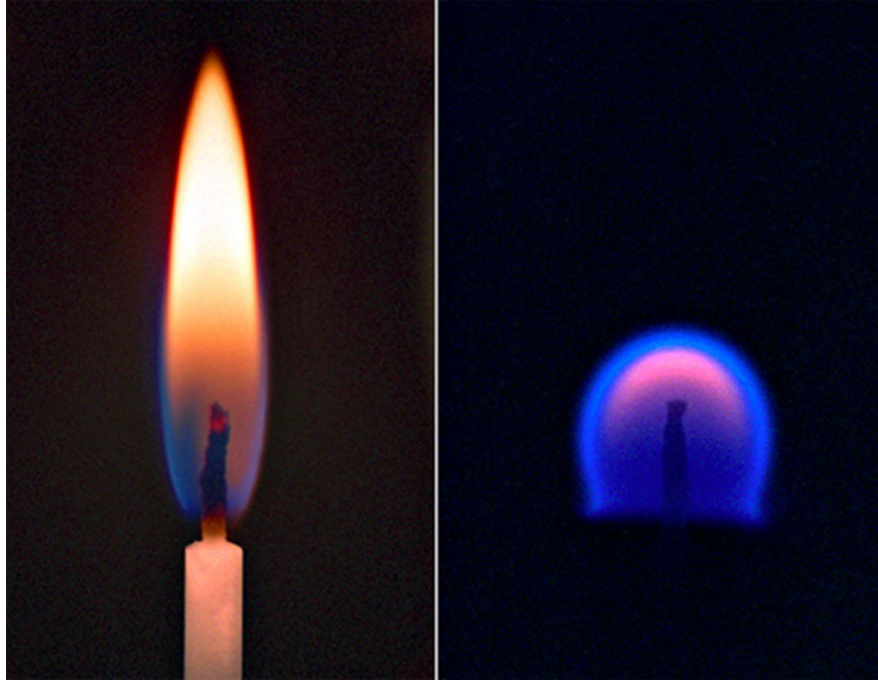
A candle flame on Earth has an elongated, teardrop shape. It takes this shape because the flame heats the air, making the air expand, becoming lighter than the surrounding air. As in a hot air balloon, the air warmed by the candle flame rises. As it does, it creates a tiny upward air current that pulls the flame up into its familiar shape.

In space, though, the flame can heat the air for hours, and still the warm air will not rise. Because there’s no gravity, it doesn’t matter whether the air is “light” or “heavy,” warm or cold. So the flame will be round instead of a long oval shape.

Not only that, but the space candle will burn very slowly. On Earth, the warm air rising from the flame is lacking oxygen, because it was used in combustion. But the air current also pulls in cooler air from below, bring a fresh supply of oxygen to feed the combustion process. This air current makes the candle flame keep burning and using up fuel. It also causes different parts of the flame to be different temperatures. The hottest part of the flame, near the bottom, is blue. As the warm air rises, it cools a bit and the flame appears yellow.

In space, the flame burns much more slowly. There is no air current to deliver a fresh supply of oxygen to the burning process. And without an air current, the flame is nearly the same hot temperature throughout, so it is nearly all blue, instead of mostly yellow.

Learn more about gravity and other kinds of experiments happening on the Space Station besides burning birthday candles. Visit <http://spaceplace.nasa.gov/what-is-gravity>.



Caption:

On the left is a candle flame burning on Earth's surface. On the right is a candle flame burning in the Space Station. How are they different and why?