



## ANSWER KEY


### Evaluating Scientific Explanations: Why do we have seasons on Earth?

 a. We experience seasons on Earth because of the earth's rotation. As the earth rotates, the side of the Earth facing toward the sun experiences summer while the side facing away experiences winter.


This explanation is terrible because as the earth rotates, the side of the earth facing toward the sun experiences DAY while the side facing away experiences NIGHT!

 b. We have seasons because Earth is closer to the sun in the summer and farther away from the sun in winter.


This one must have been written by one of those Harvard graduates we saw in the video! As you know, this answer is wrong wrong wrong. If it were true, then the entire Earth (northern and southern hemispheres) would be having the same season at the same time, which we know we don't! And not only that, the earth is actually closest to the sun in January and farthest in July! Although the earth's orbit is not a perfect circle, it is so nearly circular that DISTANCE DOES NOT AFFECT SEASONS ON EARTH!

 c. Earth is tilted on its axis, so as it revolves around the sun, at some parts of its orbit the northern hemisphere is tilting toward the sun and sometimes away from the sun. The part tilting toward the sun receives more direct, concentrated light (summer) while the opposite half that points away receives less direct, concentrated light (winter). This is why we have seasons.


We have a winner here! And this is exactly what we tried to model in the lab we did.

 d. We have seasons on Earth because the earth tilts toward the south in the summer and toward the north in the winter.

NO! The earth's axis always tilts in the same direction: to the north! In fact, if you drew an imaginary line extending from Earth's equally imaginary axis and extended it about 434 lightyears or so out into space, you'd run into the North Star: Polaris. That's why Polaris can show us how to find north! (Cool, right?!)

 e. The tilt of the Earth's axis is the most important reason why seasons occur. We have hot summers and cold winters because of the tilt of the Earth's axis. The tilt of the Earth means that while one half of Earth leans towards the Sun (Summer), the other half leans away from the Sun (Winter).

We have another winner here! It's not quite as thorough as explanation c, but it is still accurate!

 f. When it is summer in North America, the North Pole and the rest of the northern hemisphere are pointing toward the Sun. The Sun appears to stay in the sky longer each day, but really, we are just pointed toward the Sun for a longer period. When the northern hemisphere is pointing away from the sun, the days are shorter. Because we spend more time in the shadow of night, our part of the Earth stays cooler, and we experience winter.

This answer doesn't specifically mention the word "tilt," but it is still correct. When it says "pointing toward" and "pointing away from" it is talking about tilt. This answer also mentions how seasonal changes are more than just temperature changes. The change in length of days is also very important! I am sure you have noticed that every day lately it has been getting dark a little earlier.

☹ g. We have seasons because of the tilt of the earth's axis. When it is summer in the northern hemisphere, the earth is leaning toward the sun, so the northern hemisphere is closer to the sun and the southern hemisphere is farther from the sun. In the spring and fall, both hemispheres are equally distant from the sun.

Did this one fool you? Even though the first sentence is correct, the rest of this answer is horrifyingly wrong! How could one of the hemispheres be closer to the sun than the other one? The Earth is one big planet and the tilt doesn't make any difference in the distance. (Note: This was not modeled in our experiment! The flashlight was so close to the book that when we tilted it, the top part of the book was a little farther from the light than the bottom half. But this does NOT happen with the earth!)

So which is the best explanation? I think it is a tie between c & f. I will combine them here to give you a totally fabulous explanation:

Earth is tilted on its axis, so as it revolves around the sun, at some parts of its orbit the northern hemisphere is tilting toward the sun and sometimes away from the sun. The part tilting toward the sun receives more direct, concentrated light (summer) while the opposite half that points away receives less direct, concentrated light (winter). This is why we have seasons. When it is summer in North America, the North Pole and the rest of the northern hemisphere are pointing toward the Sun. The Sun appears to stay in the sky longer each day, but really, we are just pointed toward the Sun for a longer period. When the northern hemisphere is pointing away from the sun, the days are shorter. Because we spend more time in the shadow of night, our part of the Earth stays cooler, and we experience winter.

