Key Model of Star Patterns

U In this assessment you will explain the following **patterns** related to constellations:
  A. Why do we see the constellations of *Maang* (the Loon) and *Mishi bizhiw* (the Great Panther) one way from Earth but if we changed perspectives we would see them in a different pattern?
  B. Why is the *Maang* (the Loon) visible all year round while the *Mishi bizhiw* (the Great Panther) is visible only some of the time?

1. Fill in the table below to determine what we will need to model to explain these patterns:

What are the important parts of the system to include in the model?	+ Sun + Earth + Constellations: *Maang* (the Loon) and *Mishi bizhiw* (the Great Panther) + Stars
What are the important interactions between the parts to include in the model?	+ Earth orbits the Sun. + Earth's orbit is due to gravity.

2.The stars appear to be fixed in the sky as 2-D constellations when we view them from our perspective. But if we zoomed out from Earth far enough, we would see that the Sun is just one of many stars scattered through space in three dimensions. Describe how you will show stars at both scales in your model.

This question is preparing students to take perspectives that consider multiple scales in their models. Use this question as a diagnostic tool to see what students were thinking as they prepared to make their models. No scoring is needed. Student responses should include these ideas:

+ perspective from very far away from Earth where we can see the stars that make up the constellations
+ perspective from inside the solar system where we can see Earth and what the constellations look like from Earth
+ a box or circle showing where one scale fits into the other

3. In the box below, draw a model that explains both of these patterns:
  A. Why do we see the constellations of *Maang* (the Loon) and *Mishi bizhiw* (the Great Panther) one way from Earth but if we changed perspectives we would see them in a different pattern?
  B. Why is *Maang* (the Loon) visible all year round from the Northern Hemisphere while *Mishi bizhiw* (the Great Panther) is visible from the Northern Hemisphere only some of the time?

In your model, make sure to include the following:
  • At least two systems or subsystems at different scales.
    • Describe each system or subsystem and label the perspective an observer would have to zoom to in order to see each view.
  • Label the parts of each system or subsystem.
  • Show or describe the way the parts of the system interact.

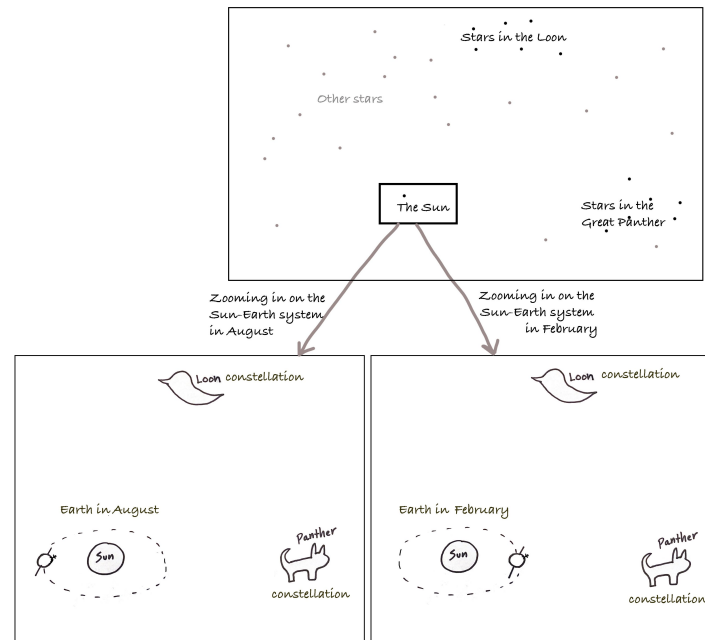| **What these patterns look like from Earth:**	**Draw a model in this box that explains patterns A and B.**
August at 12AM in Colorado February at 12AM in Colorado	

Student model includes these elements:
Two points in time
+ one where *Maang* (the Loon) and *Mishi bizhiw* (the Great Panther) are both visible, and the Great Panther is on the other side of Earth from the Sun
+ one where *Maang* (the Loon) is visible but *Mishi bizhiw* (the Great Panther) is not, and the Panther is on the other side of the Sun from Earth

Parts
+ Sun
+ Earth
+ shows Earth's axis tilted toward Polaris, *Maang* (the Loon)
+ *Maang* (the Loon) and *Mishi bizhiw* (the Great Panther)
+ stars that make up these constellations
Interactions
+ indicates that Earth orbits the Sun
+ indicates force pairs between Earth and the Sun
+ indicates that stars are moving at the larger scale
Scale and perspective
+shows at least two scale views (i.e., stars and solar system) and describes the difference in perspective, the difference in scale, or zooming from one system to the other.

4. Use this model to explain these two patterns in words to someone who doesn't understand what causes these patterns.
Ideal student response

Pattern A. The 2-D constellations that we see don't actually mean that those stars are close to each other because some could be really far and some could be closer. We can't tell how far away they are from looking with our eyes. But if we zoomed out, we would see that they are actually at different distances in three dimensions.

Pattern A student responses should include these ideas:
+Stars are scattered at different distances from the Earth-Sun system.
+We need to change our scale and/or our perspective in order to see this.
+From our perspective we see the familiar constellations.

Pattern B. As Earth orbits the Sun, the Sun appears to move through different constellations in the background. When the Sun is near a constellation, we will not be able to see that constellation because we are seeing the Sun at the same time, so it is daytime, and we can't see other stars in the daytime. The *Maang* (the Loon) is in a part of the sky that never sets because it is close to the North Star (Polaris), so we always see it.

Pattern B student responses should include these ideas:
+As Earth orbits the Sun, from the perspective of Earth the Sun appears to move through different constellations in the sky.
+When the Sun appears in the sky, we cannot see the stars around it.
+The constellation of the *Mishi bizhiw* (the Great Panther) sometimes appears to be near the Sun because of where Earth is in its orbit.
+The constellation of *Maang* (the Loon) will never appear near the Sun because Earth's axis is pointed toward it.