1.6: Hierarchy- How the Objects Are Arranged

Learning Objectives

- You will be able to rank objects by size and distance
- You will be able to sort objects into the hierarchy of solar system – galaxy - universe

What Do You Think: Solar System or Galaxy

The Stargazers Club is taking their first observing trip of the year. They are looking at a band of light that goes across the sky.

- **Maggie**: I love how you can see the solar system out here! You could never see that back home.
- **Nelson**: I don't think that's the solar system—I think it is our own galaxy .
- **O'Shea**: I don't think we can see either one. How can we see our own solar system or our galaxy if we're inside them?

In the last few sections, we have discussed the many different scales encountered in the Universe. In addition, we have mentioned many different kinds of objects. Scientists have discovered a hierarchy of structures in the Universe, with small objects being collected into successively larger objects. On the smallest scales studied (below 10^{-15} m), there are subatomic particles. These particles and their interactions produce structures like atomic nuclei and atoms. In turn, the atoms form larger structures, the molecules and crystals, which form objects like rocks, oceans, and other parts of the macroscopic world. In living things, molecules are combined to form the parts of cells, which can subsequently be built up into plants and animals. Collections of these sorts of objects come together to make up Earth. This hierarchical structure goes all the way up to the cosmic web. Between the scales of the planets, about 10^7 to 10^8 m, and the scales of galaxy filaments and voids, hundreds of millions of light-years (about 10^{24} m), there are many intermediate-sized objects. The following activities will help you clarify their order.

Ranking Sizes and Distances

A. SIZE RANKING

When you play the activity, you will see seven tiles, each with the name of an astronomical object. Rank these objects from the smallest to largest.

When you are ready, click and drag each tile into the box you think best represents the size ordering of the objects. The smallest objects should be on the left, the largest on the right. When you have finished, click the “check” button to see how many got correct.

If you place a tile in a box and later decide that a different object would be better suited in that location, just drag and drop the new tile into the box and it will replace the old tile.

Play Activity

B. DISTANCE RANKING

Now rank the same seven objects from closest to Earth to farthest from Earth.

When you are ready, click and drag each tile into the box you think best represents the size ordering of the objects. The closest objects should be on the left, the farthest on the right. When you have finished, click the “check” button to see how many got correct.

If you place a tile in a box and later decide that a different object would be better suited in that location, just drag and drop the new tile into the box and it will replace the old tile.

Play Activity

ACTIVITY: Matching Sizes and Distances

Drag the tile to match the correct size or distance.

When you are done, click “check answers,” and modify your choices if needed.

Play Activity

ACTIVITY: Sorting the Solar System, Galaxy, Universe

Decide whether each object is a member of our Solar System, our Galaxy, or the Universe.

Once you feel that you have put each object into the correct bin, click “check,” and modify your choices if needed.

Play Activity

ACTIVITY: Hierarchy of the Universe

A hierarchy is an ordered list that is used to classify related objects. For example, cities are contained within states, which are contained within countries, which are all on Earth.

Arrange the astronomical object tiles from the list in hierarchical order, according to which objects are contained within the other objects.

You will note that some boxes have arrows leading away from them while others do not. To place an object within its encompassing object, drag and drop the tile to any of the boxes below it connected by an arrow. Astronomical objects which do not contain any of the items in the list will go in the boxes without arrows leading away.

When you have finished, click “check answers,” and modify your choices if needed.

Play Activity