Mission 5
A Model of the Milky Way Galaxy

Making a Celestial Map–Directions

Name: ________________________________ Date:______________________

1. Obtain butcher paper and tape, if needed, from your teacher. The butcher paper should be roughly 1 meter by 1 meter.

2. Use a meter stick to draw a line down the center and across the middle of the butcher paper. Where the lines cross represents our Sun. Draw it in as a small dot and label it. Label the lines that you drew. Choose one end of the longest line, and label it 0°. Going counter-clockwise, label the next line 90°, the next 180°, and the last 270°.

   To orient you, 0° is the direction toward the center of the Milky Way Galaxy and 180° is the direction away from the center of the Milky Way Galaxy. From this point on, this chart will be referred to as the Vicinity Chart because you will be mapping or plotting the locations of various celestial objects that are the closest to our star, the Sun.

3. Using the data provided, plot the galactic longitude for the second celestial object on your chart, the star Altair. Its galactic longitude is 47°. This represents the direction in degrees from 0° degrees that must be used to plot the object. Center your protractor on the Sun to find this angle. With a ruler, draw a light pencil mark along this line to the edge of your paper.

4. Using the data provided, plot the distance in light-years. Using a scale of 1 cm = 15 light-years, you can now figure out how far away from our Sun the star Altair is. You must calculate this number and fill it in on your chart. Because Altair is 16.6 light-years away from our solar system, and 1 cm = 15 light-years, the star Altair would be only 1.1 cm away from the Sun on your map (16.6/15 = 1.1). It is one of the closer stars in our sky! Measure 1.1 cm along your galactic longitude line and make a small, dark dot at this point to show the location of the star Altair on your map. Congratulations! You have just plotted Altair.

5. Now plot the other objects from your Celestial Map Data–Worksheet. Use both the galactic longitude and the distance in light-years from the Sun to plot the location of each object, as you did with the star Altair. Label each object after you plot its location. If your teacher asks you to do so, draw a small picture of the object in the spot where you plotted it.

6. Some of the objects are so far away from us that they will not fit on your map, even at this scale! When you plot one of these far-away objects, just put a dot at the edge of the paper, and write how much farther you would have to go along that line to reach the object.

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Celestial Map Data–Worksheet

Name: ________________________________ Date: ________________________

Table 5.2.

Name of Celestial Object	Galactic Longitude	~Distance in Light-Years	Distance in Centimeters (1 cm = 15 light years)
Aldebaran (Star)	183^o	68.0	
Altair (star)	47^o	16.6	
Alpha Centauri (Star)	315^o	4.3	
American Nebula	84^o	2,600.0	
Antares (Star)	354^o	326.0	
Arcturus (Star)	15^o	36.0	
Barnard's Star	30^o	5.9	
Beehive Open Cluster	208^o	500.0	
Betelgeuse (Star)	202^o	651.0	
Capella (Star)	165^o	42.4	
Crab Nebula	185^o	6,552.0	
Cygnus Loop Nebula (Veil)	78^o	1,630.0	
Deneb (Star)	110^o	68.5	
Epsilon Eridani (Star)	195^o	10.8	
Hercules Globular Cluster	59^o	25,000.0	
Horsehead Nebula	204^o	12,000.0	
Lagoon Nebula	7^o	3,900.0	
Mizar (star)	112^o	58.7	
Omega Centauri Globular Cluster	132^o	17,000.0	
Orion Nebula	208^o	1,600.0	
Pleiades Open Cluster	168^o	440.0	
Polaris (North Star)	130^o	430.0	
Rigel (Star)	210^o	900.0	
Ring Nebula	63^o	4,100.0	
Sirius (Star)	228^o	8.6	
Spica (Star)	315^o	155.0	
Tau Ceti (Star)	175^o	11.7	
Trifid Nebula	8^o	3,260.0	
Vega (Star)	68^o	26.4	

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Celestial Map Questions–Worksheet

Name: ______________________________________ Date: _______________________

1. Although you indicated the *direction* of the center of the Milky Way Galaxy on your map, the actual galactic center is beyond your map because it is too far away from our Sun to include at the scale of 1 cm = 15 light-years. The galactic center is about 30,000 light-years away.

   a. Calculate the distance to the center of the Milky Way Galaxy at your map scale.

   The galactic center is _____________ meters away.

   b. At your map scale, calculate the distance to the far edge of the Milky Way Galaxy, which is another 50,000 light-years beyond the galactic center.

   The far edge of the Milky Way Galaxy is ______________ meters away.

   c. At your map scale, calculate the distance to the near edge of the Milky Way Galaxy, which is approximately 20,000 light-years in the opposite direction from the galactic center.

   The near edge of the Milky Way Galaxy is ____________ meters away.

2.

   a. Use your drawing compass to draw a 100 light-year circle around the Sun on your map. Name the stars that you mapped that are within this circle.

   b. Many of the stars that SETI has targeted for listening to with their radio telescopes are within this circle. Why do you think that this is so?

3.

   a. Using the data given below, figure out a way to plot the *Voyager* spacecraft trajectories on your map and show how far out they are now and where they will be at various times, far into the future. Both are moving directly away from the Sun.

Spacecraft	Galactic Longitude	Speed
Voyager I	30°	490 million km/yr
Voyager II	0°	490 million km/yr

   b. Each *Voyager* takes _______________ years to travel 1 light-year.

   c. How long will it take for a *Voyager* to travel 150 light-years? _____________

Mission 5
A Model of the Milky Way Galaxy

Our Home Galaxy–Directions

Name: ______________________________ Date: ____________________________

1. Obtain white paint, a brush, cotton, glue, and a sheet or piece of plastic from your teacher (maybe a plastic top to a coffee can or a Frisbee). Up until now, your Milky Way Galaxy model has been flat: two-dimensional. Now we will add the third dimension.

2. Measure the thickness of your plastic in millimeters. My plastic is __________ mm. The thickness of your plastic represents the “depth” of the Milky Way Galaxy on a new scale. The average diameter of the Milky Way Galaxy is about 50 times its thickness. In other words, our home galaxy is pretty flat.

3. Calculate the diameter for your galaxy model: My diameter is ___________ mm. Use a compass to draw a circle of this diameter on your plastic. Cut out this circle. You now have a three-dimensional model of our home galaxy.

4. Using the information that your teacher has given you and the pictures that you have been shown regarding the shape of the Milky Way Galaxy, paint an open spiral galaxy. Paint to the edges of the plastic.

5. The real Milky Way Galaxy has a bulge of stars in the center. This bulge is about 20,000 light-years across and it is longer than it is wide. Calculate how thick a piece of cotton would show this. Take the piece of cotton and glue it to the center of your spiral galaxy model. Put half of it on each side of the plastic. Gently pull the cotton to follow the contours of the spiral arms, tapering off as you go. Glue the cotton in place.

6. Using a metric ruler that has millimeter markings on it, measure the distance across your galaxy. Enter that distance here: _______________ mm.

   Knowing that the Milky Way is 100,000 light-years across, how many light-years does one mm represent? _________ light-years. This is your scale for this model.

   How many light-years long and wide is your Vicinity Chart that you completed yesterday?

   length: ________________ light-years

   width: ________________ light-years

How long and wide would your Vicinity Chart be if it were drawn to the scale of your galaxy? Hint: map length in light-years divided by galaxy scale, light-years/ mm.

length :_______________ light-years

width: ________________ light-years

3. Now that you know how big your Vicinity Chart should be compared to the entire Milky Way Galaxy, go ahead and draw the larger Vicinity Chart on the outer section of one of the spiral arms that you drew. Draw it to scale, and in roughly an appropriate location, that is, 20,000 light-years from the edge and 30,000 light-years from the center. If it is too small to draw, just put a dot with the tip of a sharp pencil.

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