



NEW HORIZONS

TO PLUTO AND BEYOND



<http://pluto.jhuapl.edu>

Note to Educators

Thanks for using this New Horizons educational poster in your classroom! We have developed six fun and educational activities (K-5) that you can use as stand-alone lessons or as a series centered on the theme, Pluto.

On the Poster

The front side of the New Horizons poster features:

- A scale diagram of the solar system — the orbits of the planets are drawn to scale with 2 centimeters = 1 Astronomical Unit (AU)
- Scale photos of the planets the photos of the planets are to scale with each other, but NOT on the same scale as the orbits.
Here 1 centimeter = 1 Earth Diameter (D_{Earth})
- A growth chart in centimeters, to be hung 90 cm above the floor

(Note: If the planets and orbits were shown on the same scale, the planets would be tiny specs. Planetary systems are actually very empty places with great distances between each world.)

On this (reverse) side of the New Horizons poster you will find:

- Pluto...A World of Extremes — student fact sheet featuring introductory material on Pluto and a crossword puzzle as a reading comprehension assessment
- Charting the Progress of New Horizons — a ready-to-photocopy activity sheet of one of the six educational activities
- Overview & Map of New Horizons Educational Activities — a table designed to provide at a glance: an idea of the purpose and content of each activity, the standards addressed, and the materials required

On the Web

All of the activities, the poster and teacher guides are available to download and print from the New Horizons Web site, <http://pluto.jhuapl.edu>. For each activity, we have provided 1) a student activity sheet to be copied and given to students and 2) a teacher activity sheet, which contains materials lists, background information, discussion questions and related facts. In addition, the site offers links to many more resources and Web sites related to Pluto and the New Horizons mission.

About the Mission

The study of Pluto and Charon is truly part of the current frontier in planetary science. No spacecraft has ever explored Pluto and Charon, yet they promise to teach us much about the outskirts of our solar system. New Horizons is the first mission to the last planet – the initial reconnaissance of the Pluto–Charon system and the Kuiper Belt.

New Horizons is the first mission in NASA's New Frontiers Program, which provides opportunities for the science community to propose high-priority solar system exploration initiatives.

The Johns Hopkins University Applied Physics Laboratory in Maryland manages the mission for NASA and will design, build, and operate the New Horizons spacecraft. Dr. Alan Stern, Director of the Southwest Research Institute's Department of Space Sciences in Colorado, is the mission's Principal Investigator, leading the engineering, design and integration of the spacecraft and science instruments as well as the multi-institutional science team.





Pluto...A World of Extremes



Planet: Pluto

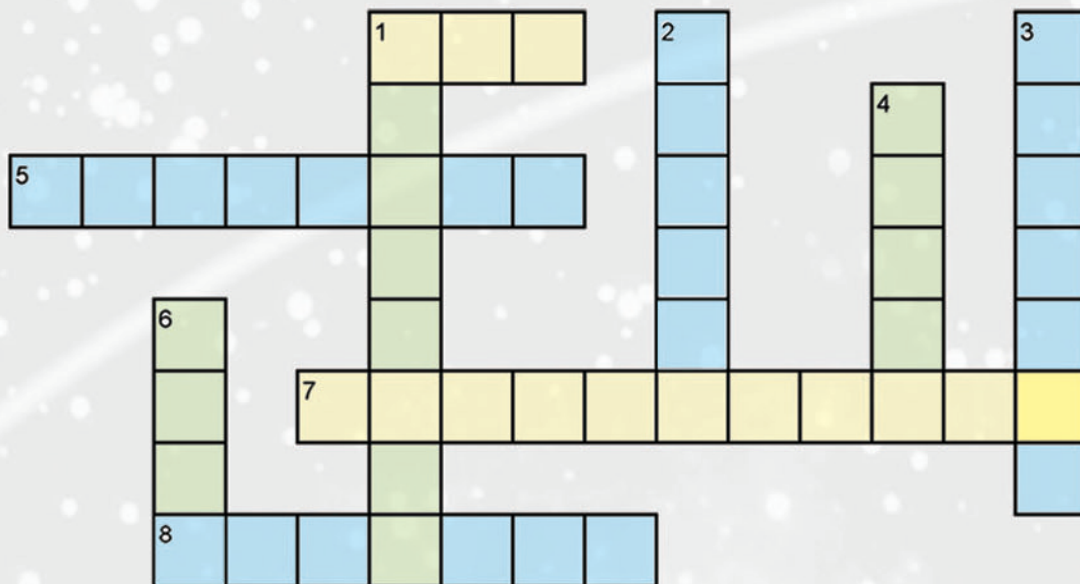
- Pluto is the smallest planet in the solar system.
- Pluto is the only planet classified as an “ice dwarf,” a small body with a solid surface made of ice and rock.
- Compared to the size of its planet, Charon is the largest moon — about half the size of Pluto.

Orbit: Pluto

- Pluto is usually the farthest planet from the Sun — its distance ranges between 30 – 48 AU.
- All planets travel along an ellipse as they orbit the Sun; Pluto’s orbit is elongated enough so that sometimes Pluto is closer to the Sun than Neptune.
- Even though the orbits of Pluto and Neptune cross, the two planets will never collide.
- Although the Sun is the closest and brightest star, it looks like a bright dot in a rather dark sky and provides little light and heat.
- It takes 248 years on Earth for Pluto to travel once around the Sun. (248 Earth years = 1 Pluto year)
- It takes 6½ Earth days for Pluto to rotate once on its axis. (6½ Earth days = 1 Pluto day)

Visit: Pluto

- Pluto is the only planet that has not been visited by a spacecraft from Earth. This is about to change as NASA’s New Horizons mission is scheduled to fly by the planet as early as 2015!



Across

- 1 Brightest star in Pluto’s sky
- 5 Pluto is this type of planet
- 7 Name of first spacecraft planning to fly by Pluto
- 8 From 1979 to 1999, this Planet was farther from the Sun than Pluto

Down

- 1 Is Pluto the smallest or largest planet in the solar system?
- 2 Compared to Earth, the temperature on Pluto is not hotter, it is ____
- 3 Shape of Pluto’s orbit
- 4 Ninth planet
- 6 Charon is the name of Pluto’s ____



Charting the Progress of New Horizons



Student Activity Sheet

Pluto is the farthest planet from the Sun in the solar system yet it has never been visited by a spacecraft! In 2006, NASA is planning to launch the New Horizons spacecraft to begin its journey toward Pluto. Since Pluto is so far away, it will take a long time for the New Horizons spacecraft to get there.

You can use this poster to track New Horizons' progress through the solar system.

Directions:

- Carefully cut off the bottom strip of the poster along the dotted line. Save the bookmark for your favorite book and cut off the picture of the New Horizons spacecraft for this activity.
- The poster shows a scale drawing of the orbits of the planets, which means that if the picture were expanded with a giant copy machine, the orbits would match the orbits of the real planets in space! All scale drawings, like maps, have a scale on them that relates distances or sizes on the picture to distances or sizes in real life. Find the distance scale on the poster. Here ___ cm = ___ AU. The abbreviation "cm" is for centimeters and "AU" is for Astronomical Units. The distance from the Sun to the Earth equals 1 AU.
- Using the scale on the right edge of the poster, estimate the distances of the planets from the Sun to the nearest cm. On a separate sheet of paper, make a table, like the one shown below but with rows for each of the nine planets. Record your estimates in column A. Write the number sentence that will change your measurement in cm to AU in column B. Write the approximate distances of the planets from the Sun in AU in column C. The information for the first planet, Mercury, has been filled in for you.

Planets	A Distance from Sun (cm)	B Change for cm to AU	C Distance from Sun (AU)
Mercury	0.8 cm	$0.8 \text{ cm} \div 2$	= 0.4 AU
Venus		$\div 2$	=

- To find out where New Horizons is today, log onto the New Horizons Web site at <http://pluto.jhuapl.edu> and go to the Education page. Write down the spacecraft's current distance from the Sun.
- New Horizons' distance from the Sun is given in AU. To change the distance in AU to a distance in cm, multiply the value by 2.
- Use a paperclip to fasten the picture of the New Horizons spacecraft onto the right edge of the poster at the correct distance from the Sun.
- Notice that there is also a scale for the sizes of the planets on the poster. Give two reasons why it is useful to have a scale drawing of the planets. Do the sizes of any of the planets surprise you? Why?



Overview Map of New Horizons Educational Activities

<http://pluto.jhuapl.edu>



Activity	Overview of Activity	Learning Goals	Materials	Standards	Grade Level
Charting the Progress of New Horizons	Students will learn that the New Horizons poster depicts a scale drawing of the solar system. They will use the poster to track the true progress of the space craft.	S—Understanding the long distances and timescales involved in space travel. M—Using fractions and multiplication to change scales/units.	<ul style="list-style-type: none"> • Poster • Student activity sheet • Pencil • Ruler (cm) 	S—D: Objects in the Sky; E: Abilities of Technological Design M—Measurement; Number and Operations; Problem Solving	Grades 2-5
Where Are We Going?	Students take imaginary trips through the solar system on a spacebus and use math skills to find out the next spacebus stop.	S—Understanding the order and distances of the planets from the Sun. M—Problem solving using multiplication, rounding and fractions.	<ul style="list-style-type: none"> • Student activity sheet • Pencil 	S—D: Objects in the Sky M—Number and Operations; Problem Solving	Grades 2-5
Modeling the Orbits of the Planets	Students will make a scale model of the orbits of the outer planets and explore the peculiarities of Pluto's orbit.	S—Understanding the scale of the solar system. Learning about Pluto's elliptical and inclined orbit.	<ul style="list-style-type: none"> • Student activity sheet (copied onto card stock if possible) • Pencil, markers • Scissors • Paper clips • Glue/glue stick/tape 	S—A: Abilities Necessary to Do Scientific Inquiry; D: Objects in the Sky	Grades K-5
Growing Up With A Mission	Students will measure their height, analyze the heights of classmates, and predict their height at the time New Horizons is scheduled to fly by Pluto using a growth chart.	S—Using a model and measurements to make predictions. M—Collecting data and finding the mean, mode, and median. Graphing points on a Cartesian coordinate system.	<ul style="list-style-type: none"> • Student activity sheet • Pencil 	M—Measurement; Data Analysis and Probability	Grades 2-5
Looking to the Future	Students will examine aspects of their life now and predict what it will be like in the future when New Horizons is scheduled to fly by Pluto.	S—Understanding the long timescales of space travel. Predicting and proposing technological solutions that could be used in the future.	<ul style="list-style-type: none"> • Student activity sheet • Pencil and markers • Scissors • Paper towel tube • Wrapping paper • String or ribbon 	S—Abilities of Technological Design E—5: Use the writing process to communicate; 8: Use technological resources to gather and synthesize information	Grades 2-5
Last Year on Pluto	Students will determine the length of one year on the nine planets and match historical events that occurred on Earth one year ago on these planets.	S—Learning the astronomical meaning of a year and the time scales associated with planets with large orbits.	<ul style="list-style-type: none"> • Student activity sheet • Pencil 	S—A: Abilities necessary to do scientific inquiry	Grades 2-5

M -- National Council of Teachers of Mathematics Standards, S -- National Science Education Standards, E -- National Council of Teachers of English Standards

Travel time to Pluto...

Bike:
47,600 years



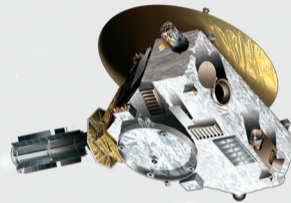
Car:
6,660 years



Jet Airplane:
700 years



Space Shuttle:
25 years



New Horizons:
9.5 years



New Horizons: NASA's Mission to Pluto and Beyond <http://pluto.jhuapl.edu>