Hubble Space Telescope Scavenger Hunt

Science Central School Visit Packet
Dear Teachers,

Science Central is thrilled to be collaborating with you in your endeavor to motivate students to explore concepts in science and technology! We want to do all we can to help you achieve this mission by creating an atmosphere of fun and excitement as well as providing you with valuable resources as you prepare for your field trip to our facility.

This guide provides activities about the Hubble Space Telescope and astronomy that will help prepare you for your visit and reinforce the concepts learned at the Hubble Telescope exhibit. Please feel free to copy any material that may help your students. These activities are only suggestions. You may decide to adapt them to your particular classroom and curriculum.

Our goal is to provide your students with an educational, exciting experience and to provide you with resources for enhancing hands-on science while still meeting the state standards. The following page contains a list of standards addressed in your visit to the Hubble Telescope exhibit. The highlighted standards are addressed both in the exhibit and with the accompanying material.

Sincerely,

The Educational Team

Contact us at 424-2400 and use these important extensions if you have questions:

- **Education Director:** ext. 442 for information regarding school group visits, labs, school group programming, teaching guides, teacher tours and educational events.

- **Outreach Manager:** ext. 417 for Science U information.

- **Special Programs Manager:** Ext 427 to make an appointment to visit our Educator Resource Center which contains NASA materials, GEMS guides as well as a lending library.
Indiana State Science Standards Applicable to the Hubble Telescope Exhibit

6.1.1 Explain that some scientific knowledge, such as the length of the year, is very old and yet is still applicable today. Understand, however, that scientific knowledge is never exempt from review and criticism.

6.1.2 Give examples of different ways scientists investigate natural phenomena and identify processes all scientists use, such as collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations, in order to make sense of the evidence.

6.1.4 Give examples of employers who hire scientists, such as colleges and universities, businesses and industries, hospitals, and many government agencies.

6.1.5 Identify places where scientists work including offices, classrooms, laboratories, farms, factories, and natural field settings ranging from space to the ocean floor.

6.1.6 Explain that computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data; prepare research reports; and share data and ideas with investigators all over the world.

6.1.7 Explain that technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.

6.1.8 Describe instances showing that technology cannot always provide successful solutions for problems or fulfill every human need.

6.2.6 Read simple tables and graphs produced by others and describe in words what they show.

6.3.1 Compare and contrast the size, composition, and surface features of the planets that comprise the solar system, as well as the objects orbiting them. Explain that the planets, except Pluto, move around the sun in nearly circular orbits.

6.3.2 Observe and describe that planets change their position relative to the background of stars.

6.3.4 Explain that Earth is one of several planets that orbit the sun, and that the moon, as well as many artificial satellites and debris, orbit around Earth.

6.3.17 Recognize and describe that energy is a property of many objects and is associated with heat, light, electricity, mechanical motion, and sound.

6.3.19 Investigate that materials may be composed of parts that are too small to be seen without magnification.

6.3.20 Investigate that equal volumes of different substances usually have different masses as well as different densities.

6.3.21 Investigate, using a prism for example, that light is made up of a mixture of many different colors of light, even though the light is perceived as almost white.

6.5.2 Evaluate the precision and usefulness of data based on measurements taken.

6.5.4 Demonstrate how graphs may help to show patterns, such as trends, varying rates of change, gaps, or clusters, which can be used to make predictions.
6.6.2 Understand and describe that scientists are still working out the details of what the basic kinds of matter are on the smallest scale, and of how they combine, or can be made to combine, to make other substances.

6.7.1 Describe that a system, such as the human body, is composed of subsystems.

6.7.2 Use models to illustrate processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or are potentially dangerous.
Hubble Space Telescope Scavenger Hunt

Explore the exhibit to find the answers to these questions.

1. What is the most useful unit of measurement in space?
   ________________________________________________________

2. How was the solar system formed?
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________

3. What was Shoemaker-Levy 9? How big was the impact?
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________

4. What types of objects are there in space?
   ________________________________________________________
   ________________________________________________________

5. What is the progression of stars (from birth to death)?
   ________________________________________________________
   ________________________________________________________
   ________________________________________________________

6. Where are stars formed?
   ________________________________________________________
   ________________________________________________________

7. What kinds of galaxies are present in the universe?
   ________________________________________________________
8. How many galaxies are part of our Local Group?

9. How fast does light travel?

10. How big is the Hubble telescope?

11. How does the Hubble power itself?

12. Why does the Hubble “see” better than ground-based telescopes?

13. What was the Big Bang?

14. How old is the universe?

14a. Do scientists agree on exactly how old the universe is?

15. Is the universe moving? In what way?
16. Does the universe have an edge?

17. How has the universe evolved?

18. How are the Webb and Hubble telescopes different?

19. What is a gravitational lens?

20. What is the electromagnetic spectrum?

20a. What is the relationship between temperature and electromagnetic radiation?

21. What is infrared light?

21a. Why do telescopes sometimes use infrared imaging?
Hubble Space Telescope Scavenger Hunt
Teacher Answer Key

Explore the exhibit to find the answers to these questions.

1. What is the most useful unit of measurement in space?
   The light year

2. How was the solar system formed?
   4.6 billion years ago a cloud of dust and gas collapsed and began to spin. The
   as in the center became the sun and the dust clumped together to form planets.

3. What was Shoemaker-Levy 9? How big was the impact?
   Shoemaker-Levy 9 was a comet that collided with Jupiter. The impact was like
   millions of nuclear bombs.

4. What types of objects are there in space?
   Planets, stars, galaxies, nebulae, comets, asteroids

5. What is the progression of stars (from birth to death)?
   Birth – small, dense, blue star – large orange star – death, OR birth - yellow star -
   orange/red star -death

6. Where are stars formed?
   In nebulae (like the Orion or Eagle nebula)

7. What kinds of galaxies are present in the universe?
   Spiral, elliptical and irregular

8. How many galaxies are part of our Local Group?
   About 30

9. How fast does light travel?
   300,000 km/second

10. How big is the Hubble telescope?
    13.2 m (43.5 ft) long, weighs 11,110 Kg (24,500 lbs)

11. How does the Hubble power itself?
    It uses solar power it collects on its attached panels.

12. Why does the Hubble “see” better than ground-based telescopes?
    The Earth’s atmosphere distorts images from ground-based telescopes. The
    Hubble orbits above the atmosphere so there is no distortion.
13. What was the Big Bang?
The Big Bang was the beginning of our universe; it was an explosion that transformed an incredibly tiny, dense collection of energy and matter into huge collection of matter and energy that gave birth to all galaxies, stars and planets.

14. How old is the universe?
About 14 billion years old, or 12-17 billion years old (depending who you ask!).

14a. Do scientists agree on exactly how old the universe is?
No

15. Is the universe moving? In what way?
Yes, the universe is moving. It is always expanding.

Does the universe have an edge?
No

16. How has the universe evolved?
Before the Big Bang, the universe was an extremely tiny collection of matter and energy. After the Big Bang, matter and energy filled all space uniformly. In the first 1 billion years, galaxies began to form. The galaxies collided and formed larger galaxies. The universe is still expanding today.

17. How are the Webb and Hubble telescopes different?
The Hubble telescope orbits relatively close to the Earth and collects images in visible light and limited infrared. The Webb telescope will travel much farther from the Earth and will only collect infrared images, but from a much wider spectrum.

18. What is a gravitational lens?
It is distortion caused by gravity from galaxies and dark matter. It appears as wispy streaks in Hubble images; the streaks are light coming from galaxies that would otherwise be too far away to see.

19. What is the electromagnetic spectrum?
It is all the radiation that exists in the universe, from radio waves to gamma rays and including visible light, ultraviolet light and infrared light.

19a. What is the relationship between temperature and electromagnetic radiation?
Electromagnetic radiation with shorter wavelength has higher temperature.

20. What is infrared light?
Infrared light is invisible light generated by heat.

20a. Why do telescopes sometimes use infrared imaging?
Telescopes use infrared imaging to see stars and other objects that do not emit visible light. It allows them to see celestial events that would otherwise be invisible.