Important Concepts . . .

Preview Review

Science *Grade 9* *TEACHER KEY*

W1 - Lesson 4: Objects in Space

V5-07

Important Concepts of Grade 9 Science

W1 - Lesson 1 ..... Electrical Principles
W1 - Lesson 2 .....Electrical Circuits
W1 - Lesson 3A ..... Energy Consumption
W1 - Lesson 3B ..... The Distribution of Matter in Space
W1 - Lesson 4 .....Objects in Space
W1 - Lesson 5 .....Optical and Radio Telescopes
W1- Quiz
W2 - Lesson 1 ..... Physical and Chemical Properties of Materials
W2 - Lesson 2 ..... Chemical Reactions
W2 - Lesson 3 .....Using the Periodic Table
W2 - Lesson 4 .....Naming Chemical Compunds
W2 - Lesson 5 .....Writing Chemical Equations
W2 - Quiz
W3 - Lesson 1 .....Variation
W3 - Lesson 2 ..... Reproduction and Patterns of Inheritance
W3 - Lesson 3A ..... Genes and Cell Division
W3 - Lesson 3B .....Organisms and Matter in their Environment
W3 - Lesson 4 .....Biological and Chemical Monitoring/Acids and Bases
W3 - Lesson 5 ..... Transfer of Materials through the Air, Ground, and Water/Biological Impacts of Hazardous Chemicals
W3 - Quiz

Materials Required

Textbook:
Science in Action 9

Science Grade 9
Version 5
Preview/Review W1 - Lesson 4 TEACHER KEY

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The Alberta Distance Learning Centre has an Internet site that you may find useful. The address is as follows: **http://www.adlc.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Preview/Review Concepts
for
Grade Nine Science

TEACHER KEY

W1 - Lesson 4:
Objects in Space

OUTLINE

By the end of this lesson, you should

- determine the position of an object in space
- determine the motion of an object in space
- give a definition of an artificial satellite
- list the uses of artificial satellites
- identify some hazards associated with space junk

GLOSSARY

altitude - the height of a celestial body above the horizon, ranging from 0^{o} at sea level to 90^{o} straight up

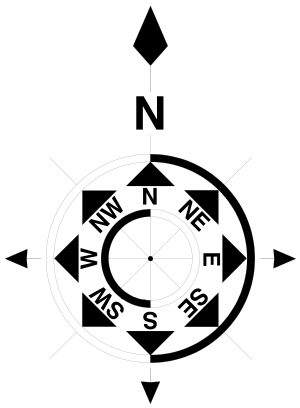
ecliptic - the apparent path of the Sun and planets through the stars during the year, as viewed from Earth

ellipse - an oval; the orbital paths of planets travelling around the Sun

satellite - a small body that orbits a larger one; satellites may be natural, such as the moon orbiting a planet, or artificial, such as a spacecraft put into orbit around Earth by humans for research or communication purposes

W1 - Lesson 4: Objects in Space

As you look into a clear night sky, you can see stars and constellations. You want to tell your best friend where to look so they can see the same thing you do. How do you do this?
In this lesson, you will learn how to determine the position of an object in space. Keep looking at the night sky. You see something that moves through the sky. What are you looking at? It could be an artificial satellite!

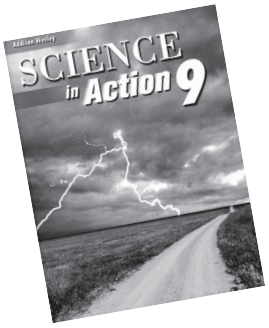


Determining the Position of an Object in Space

Scientists who study the stars are called **astronomers.** They use telescopes to try to identify the different objects floating through our solar system. One astronomer sees something important through a telescope and wants another person to verify that she has seen Mars, for example. To relay the information correctly, the first astronomer must determine the **altitude** and **azimuth** of Mars.

Altitude is how high an object is in the sky. To determine the altitude of an object in space, we would mark the land we see at the horizon at zero degrees. Ninety degrees would be straight above us. From this reference point, we would then assign a number of degrees to identify the location of the object.

The second thing we would measure is the **azimuth** of an object. To do this we use a compass direction. Due north is listed as zero degrees. Ninety degrees is due east. One hundred and eighty degrees is due south. Two hundred and seventy degrees is due west. We then assign a value to an object in space based on its direction.

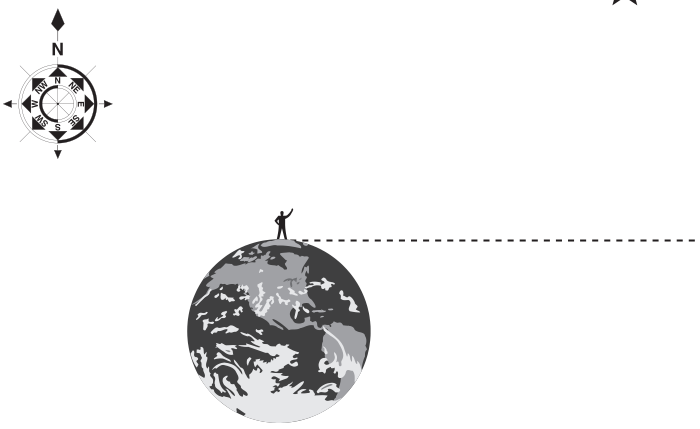


Read page 401 of *Science in Action 9*.

1. Look at the diagram below and estimate the altitude and azimuth of the star in the sky.

Altitude = ***45°*** _____

Azimuth = ***45°*** _____



2. Give a definition of the term **zenith**.

Zenith is the highest point directly overhead of a person looking up into the sky.

Determining the Motion of an Object in Space

You have seen the sun come up in the morning. It always rises in the east and sets in the west. This path that the sun appears to take in the sky is called the ecliptic. Earth and all other planets also have a familiar motion in our solar system.

How many days are in one year? If you said 365, you are correct. This number of days is the time Earth takes to travel or orbit once around the sun. The path that the Earth takes is an elliptical orbit. All the planets in the solar system orbit the sun in this way.

Planets orbit the sun in this way because the gravity of the sun holds the planets in place. People on Earth can see the movement of the planets in the sky over a matter of days or weeks. Star movement takes much longer to observe. Because of the large distance that stars are physically from Earth, they appear to move quite slowly through the night sky.

Asteroids also move through space, usually in an elliptical orbit. In the last lesson, you learned that the main asteroid belt is between Mars and Jupiter. When the asteroid belt comes close to another planet that is also orbiting the sun, an asteroid can be pulled out of its own gravitational field and fly into the solar system and potentially hit other planets. This is one theory of what caused the dinosaurs to become extinct. A large asteroid hit in what is now Mexico and caused the climate of the Earth to change. Comets also have elliptical orbits.

Read pages 394-396 of *Science in Action 9*.

3. List the nine planets of the solar system and identify the time required for each planet to go around the sun.
   Note: times are given in Earth days and years
   Mercury – 88 days ***Venus – 225 days*** ***Earth – 365.25 days***
   Mars – 607 days ***Jupiter – 11.9 years*** ***Saturn – 29.5 years***
   Uranus – 84 years ***Neptune – 165 years*** ***Pluto – 248 years***

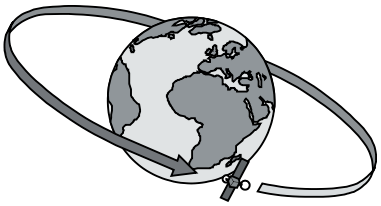
4. Why do the planets have elliptical orbits around the sun? Explain.

   The large mass of the sun holds the planets in an elliptical orbit due to gravity.

5. How does the motion of smaller bodies (asteroids and comets) in our solar system compare to the motion of the planets?

   Asteroids are found between Mars and Jupiter. The asteroids are held between them due to the gravitational pull of the planets. Comets orbit the outermost edge of the sun, which is similar to the movement of the planets.

Artificial Satellites

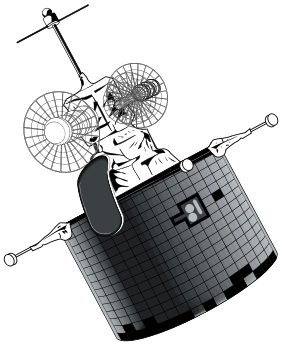


In 1957, communication on Earth changed in a major way. The Soviet Union launched *Sputnik*: the first artificial satellite. An **artificial satellite** is an object that is sent into Earth's orbit by humans. You may be interested to know that the first picture of the satellite *Sputnik* in North America was taken by a Canadian observatory in the northern Alberta hamlet of Newbrook. The launch of this satellite changed the history of space exploration. The United States formed NASA (National Aeronautics and Space Administration) in 1958 after losing the race to be first to launch a satellite into space.

A **natural satellite** is any small body that orbits a larger body naturally, such as a moon orbiting a planet.

Read page 427 of *Science in Action 9*.

6. Describe the structure of a satellite and identify some of the equipment it can carry.

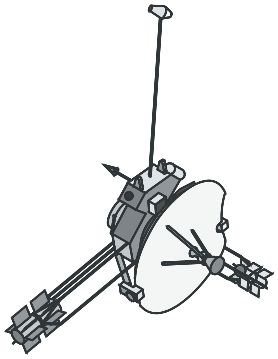


A satellite looks like a small spherical container or snap-together toy structure. A satellite is loaded with electronic equipment, digital imaging apparatus, and other instruments.

7. What roles do satellites perform for us?

Satellites help us communicate, observe and forecast weather, predict magnetic storms, and find our location on the planet. They allow us to watch TV and make long distance phone calls.

The Uses of Satellites



Satellites have many different uses. One major use is in communication. Satellites are used when we watch television, talk on cell phones, or surf the Internet. A satellite can send a digital image or sound from one location to the other side of the world.

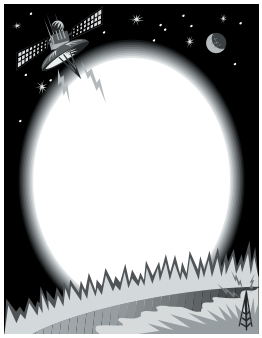
Satellites are also used for observation and research. A satellite can be placed in a **geosynchronous** orbit, which means that it can watch one particular location (such as Edmonton, Alberta) 24 hours a day. The satellite spins at the same rate as Earth. This type of satellite is useful for predicting and tracking the weather. Other satellites that are not in a geosynchronous orbit can observe forest fires, monitor soil quality, scout natural resources, and even follow ships at sea.

The third type of satellite is used for remote sensing. Special cameras in the satellite can take pictures of changes that occur in ecosystems by identifying heat or invisible energy waves. This information is used by urban planners when, for example, they design new subdivisions on the outskirts of a city.

Read page 429 of *Science in Action 9*.

8. How did communication take place in the early part of the 20th century? What problems were overcome by the introduction of satellites?

Communication travelled through wires called land lines. Cables were dug into the ground and laid through the ocean. Using wires was very costly. When satellites were introduced, communication became much cheaper.



9. Identify the name of a Canadian satellite that is used for land research. How much area does it see from space during an orbit?

Radarsat sees more than 1 000 000 km² of land area at a time.

10. What is the altitude of a remote sensing satellite?

A remote sensing satellite is from 200 to 1000 km above Earth.

Hazards of Introducing Artificial Satellites into Space

One of the problems associated with exploring space or introducing satellites into space is the creation of space junk. **Space junk** is all the pieces of debris that have fallen from rockets, satellites, space shuttles, and space stations and remain floating in space. Small projectiles are created because of the high speed at which they travel in space (20 000 km/h). When these small projectiles collide with the space station or satellites, they can do tremendous damage.

Another concern of the use of satellites is what happens to them when they lose the orbit around Earth. They can fall to Earth and burn up, releasing radioactive debris on Earth. An example of this occurred in 1978.

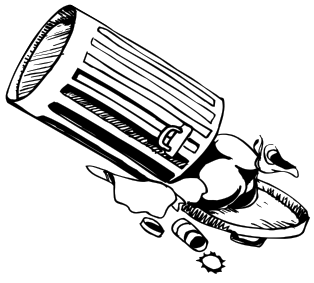
Read pages 458-459 of *Science in Action 9*.

11. How long can space junk stay in Earth's orbit?

Space junk can remain in Earth's orbit for thousands of years.

12. Describe what happened in 1978.

A nuclear powered Soviet satellite crashed into the Great Slave Lake area of the Northwest Territories. It showered radioactive debris over 124 000 km. Clean-up took 8 months and 15 million dollars.



13. Why are scientists concerned if small pieces break off a satellite?

These small items are traveling at 20 000 km/h. If they collide with a spaceship or satellite, they can cause great damage.

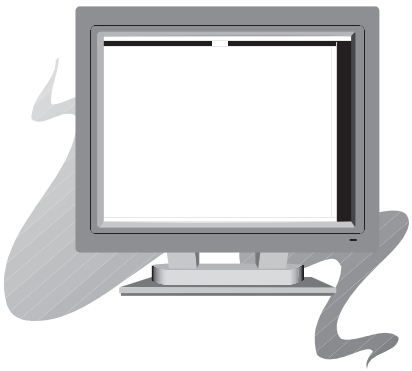
Internet Websites

The addresses for the websites below were valid at the time of printing.

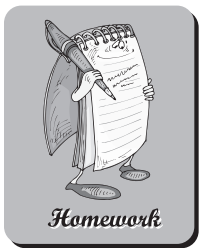
http://curious.astro.cornell.edu.question.php?number=549

http://spacelink.nasa.gov/Instructional.Materials/Curriculum.Support/Space.Science/Satellites

http://wwwghcc.msfc.nasa.gov/GOES/getsatellite.html



Now that you have completed this lesson, you should have a better understanding of how objects are tracked in space. You should also be able to identify the main purposes of satellites. Complete the following homework assignment.



Homework

14. Use the skills you have learned and identify the position of any star in the night sky using its altitude and azimuth. Teach your parents or your friends what you have learned, and see if they can find the same star that you did. Describe what you did.

Answers will vary.

15. Do some research on Halley's comet. Identify how long its orbit is and when it is due to return close to the Earth. (Hint: you can use your textbook for this!)

Halley's comet has an average 76 year orbit. It is due to return past the Earth in 2062.

16. Watch the weather forecast on your local television station and identify what type of information was obtained from satellites.

Information on the movement of clouds and precipitation.