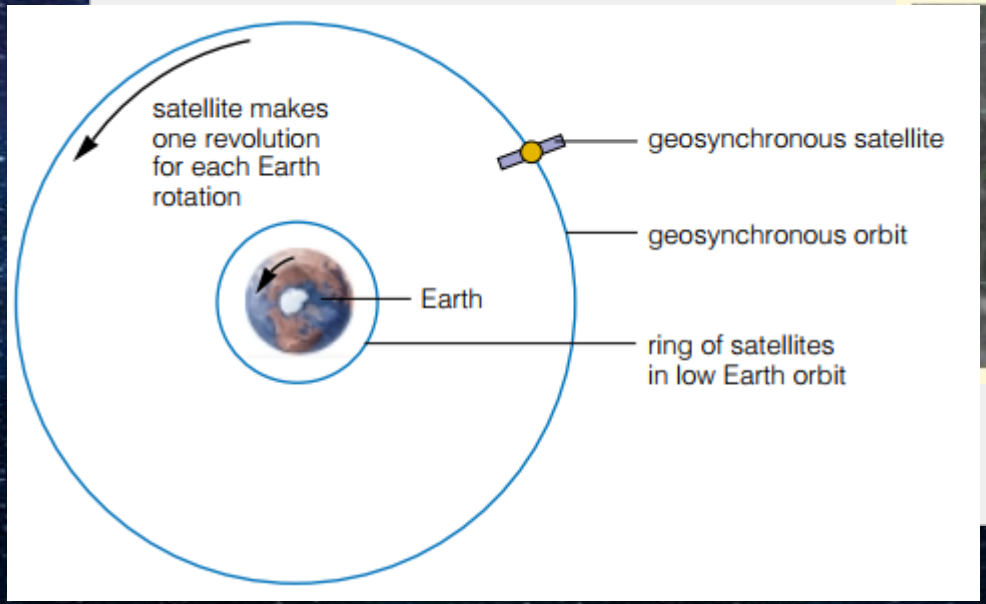
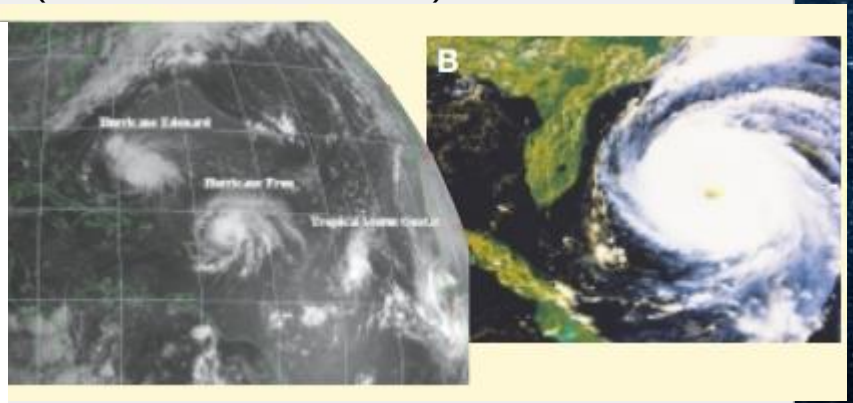
SATELLITES

- **A satellite is a smaller body that orbits a larger one**
- Can be natural (example: the moon) or artificial (weather satellites, GPS)





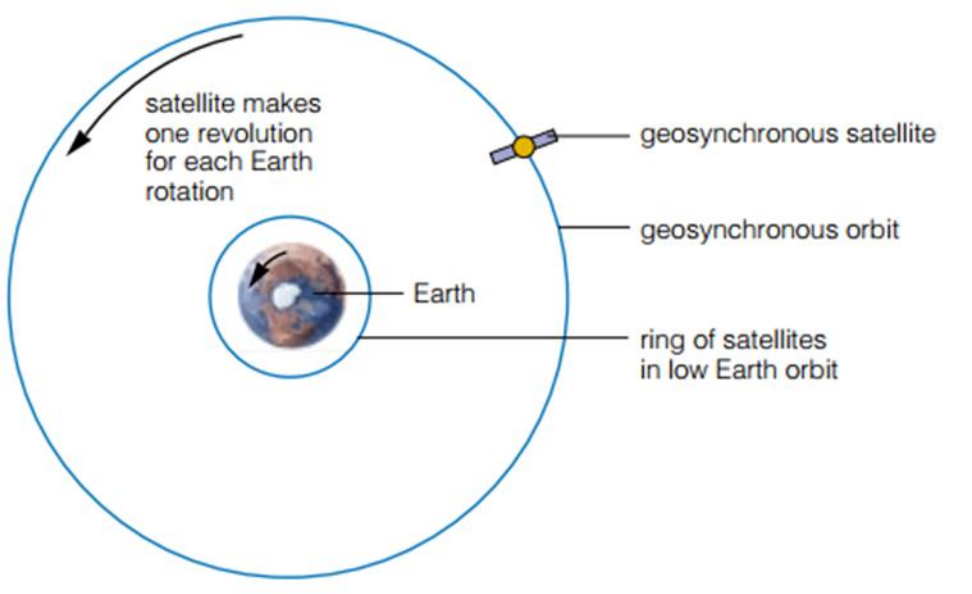
ARTIFICIAL SATELLITES

1. **Geosynchronous orbit** – the satellite is high above Earth and moves at the same rate Earth spins
   Example: radio & TV satellites

2. **Medium orbit** – example: **Global Positioning Systems (GPS)**
   GPS uses **triangulation** to determine a location – how many satellites are needed to find the nearest pizza place?

3. **Low Earth orbit** – the satellite is close to Earth and moves faster than Earth spins
   Example: **International Space Station**
   Example: phone satellites

ARTIFICIAL SATELLITES



Q: Which satellites can transmit signals to a greater area of Earth?

A: Geosynchronous – the higher the satellite, the greater its area of coverage.

Global Positioning System (GPS)

There are 24 total GPS satellites orbiting Earth.

At any given time, there are 3 GPS satellites in range of any given location on Earth.

PROBES

A probe is a type of spacecraft that is robotic and explores space

- Carried into space by a rocket
- **Gathers information and sends it back to Earth**

Voyager 2 in interplanetary space.

The *Curiosity* rover on the surface of Mars.

✓ Check Your Understanding

For a particular satellite to provide an uninterrupted television signal to a particular viewer 24 hours a day and seven days a week, it must

A. travel in a low Earth orbit
B. travel in a geosynchronous orbit
C. be a remote-sensing satellite
D. be a Global Positioning System satellite

✓ Check Your Understanding

Which of the following technologies provides the **least** information about celestial bodies in our solar system?

A. Telescope
B. Interferometry
C. Spectral analysis
D. Global Positioning System

✓ Check Your Understanding

Sometimes the PAT is about "process of elimination"!

Over time, several technologies have been developed to study and explore space.

Technologies

1 Shuttle
2 Radio telescope
3 Probe

Numerical Response

5. Match each of the technologies numbered above with its description given below.

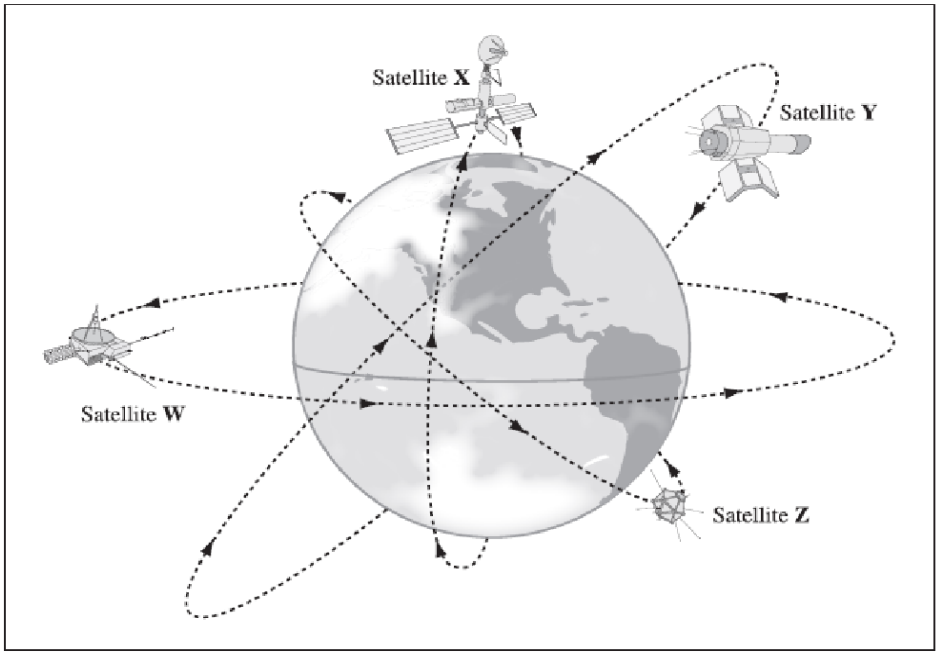
Designed to detect low-frequency energy from space **2** (Record in the **first** column)

Designed to explore celestial bodies beyond the Moon **3** (Record in the **second** column)

Designed to transport equipment to the International Space Station **1** (Record in the **third** column)

(Record all **three digits** of your answer in the numerical-response section on the answer sheet.)

✓ Check Your Understanding



Which pair of satellites in the diagram above can transmit signals over the greatest area of Earth's surface?

A. Satellites W and Y
B. Satellites W and Z
C. Satellites X and Y
D. Satellites X and Z

UNIT 5

Space Exploration

Part 3

- SCIENCE 9 -

How do we get to space?
How do we survive in space?
What are the dangers of space travel?

TOPIC 3: SPACE ISSUES & OPPORTUNITIES

I Can...

- Recognize the risks and dangers associated with space exploration
- Identify challenges that must be met for surviving in space
- Identify factors that are important to decisions regarding space exploration and development

SPACE SHUTTLE

A space shuttle is a spacecraft that transports people and equipment to space

- Powered by a rocket

– powered by chemical reactions (fuel)

Risks

On January 28, 1986, *Challenger* disintegrated 73 seconds after launch due to the failure of the right SRB, killing all seven astronauts on board.

ISS

The International Space Station (ISS) is an orbiting spacecraft that is designed for humans to live on for extended periods of time.

The International Space Station on 23 May 2010 as seen from the departing Space Shuttle *Atlantis* during STS-132.

ISS – Water recycling

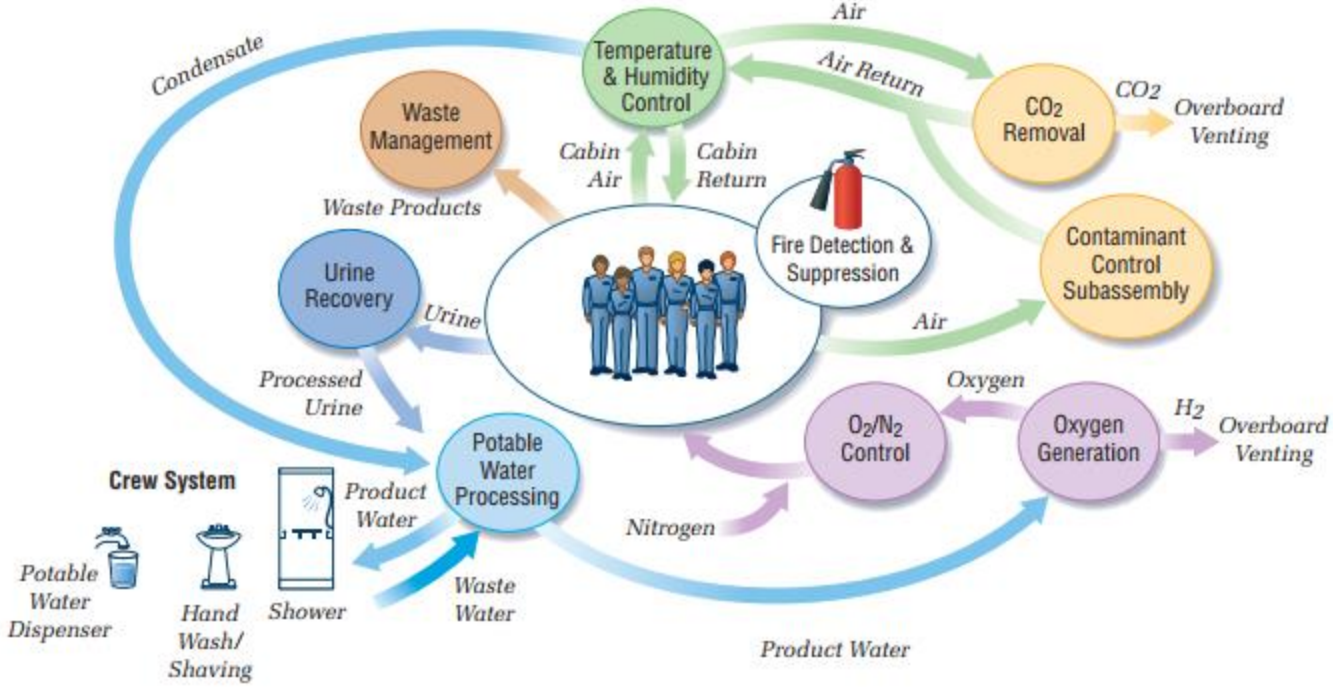


Figure 2.19 The water recycling system aboard the International Space Station

LIVING IN SPACE – MICROGRAVITY

Microgravity refers to the greatly reduced force of gravity that exists in space

Problems with living in microgravity:

- Bones expand because there is less pressure on them
- The heart doesn't have to pump as hard
- **Muscles weaken**
- Visual depth perception is affected

Solution

- **Vigorous exercise** to help keep muscles and heart fit

LIVING IN SPACE – SPACE WALKS

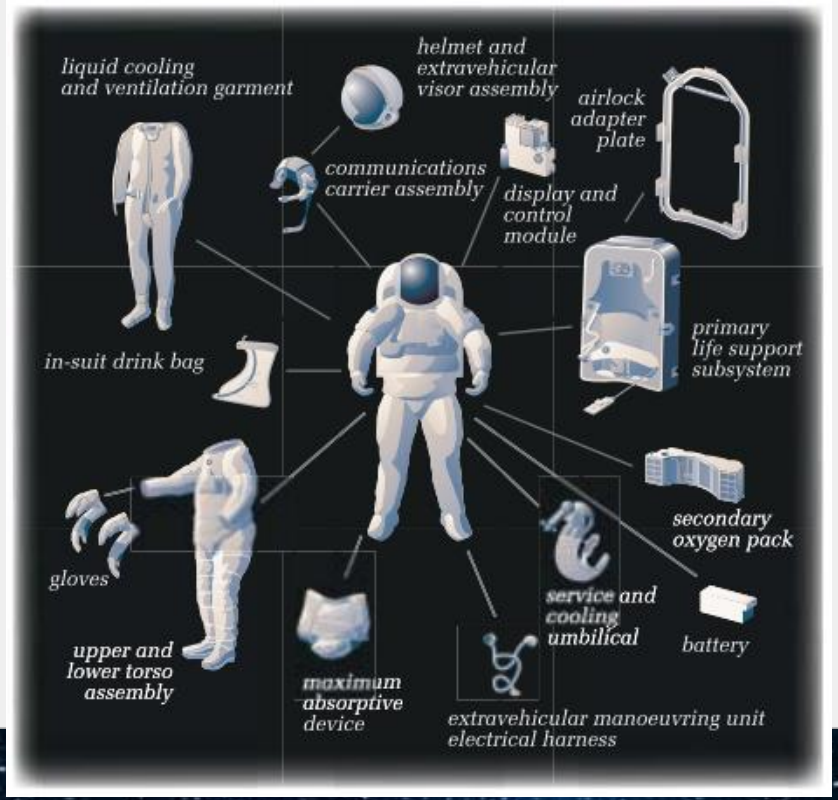
In order to replace or replace external parts of the ISS, astronauts sometimes need to go on “space walks” where they leave the safety of the ISS.

Problem:

- No oxygen to breathe
- No Water to drink
- Too cold

Solution:

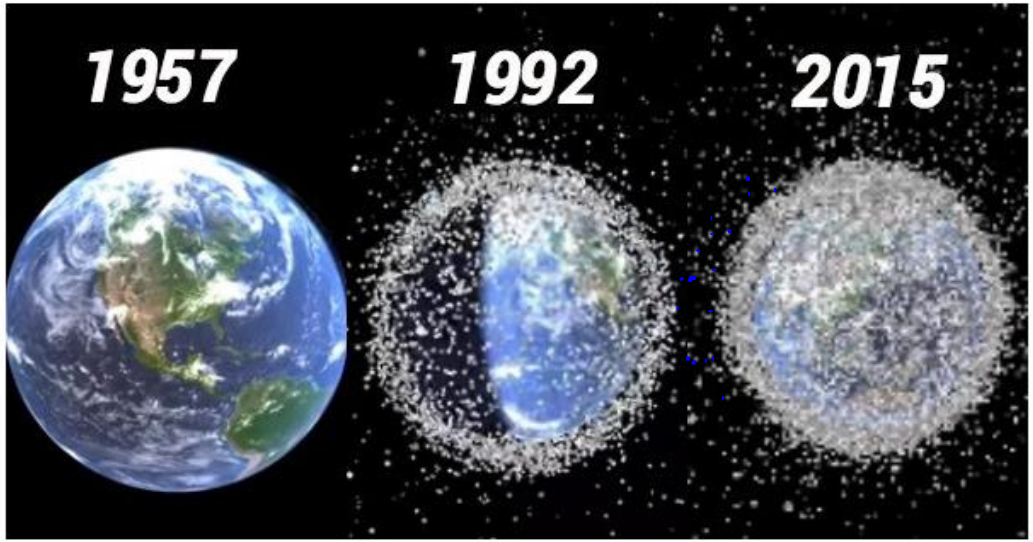
- Space suit!



LIVING IN SPACE – SPACE JUNK

Space junk refers to all the pieces of debris that have fallen off rockets, satellites, space shuttles, and space stations

- Even small pieces can do damage to spacecraft or astronauts because they reach speeds faster than bullets.



The amount of space junk in our atmosphere has skyrocketed, with dangerous consequences.

✓ Check Your Understanding

When satellites become obsolete, they are typically guided back into the atmosphere where they are destroyed. However, in January 2007, China used a ground-based missile to destroy one of its obsolete satellites that was orbiting Earth.

If other nations were to use satellite-destruction practices similar to China's, then the **most likely** result would be that

A. space program costs could decrease
B. shuttles could be targeted by missiles
C. space junk would decrease, making space exploration easy
D. space junk would increase, making space exploration difficult

✓ Check Your Understanding

Astronauts on the International Space Station recycle the water that they use, purify dirty water when necessary, and recover water from the humidity of the air within the station.

To manage their water requirements aboard the space station, astronauts do **not** need

A. processes to purify drinking water
B. containers to store large quantities of water
C. a system to recover moisture from inside the space station
D. solar panels to provide electrical power for the water recycling process

✓ Check Your Understanding

Over time, several technologies have been developed to study and explore space.

Technologies

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2 Radio telescope
3 Probe

Numerical Response

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equipment to the International Space Station _____ (Record in the **third** column)

(Record all **three digits** of your answer in the numerical-response section on the answer sheet.)

✓ Check Your Understanding

Polaris (the North Star) is directly above Earth's geographic North Pole and is the only star in the sky that does not appear to move.

The diagram below shows the location of the Big Dipper relative to Polaris on a spring evening. The locations of the Big Dipper at the same time of day in the summer, autumn, and winter are represented by positions W, X, and Y respectively.

Seasonal Positions of the Big Dipper

Which of the following diagrams shows the orientation of the Big Dipper when viewed on an autumn evening at position X?

A.

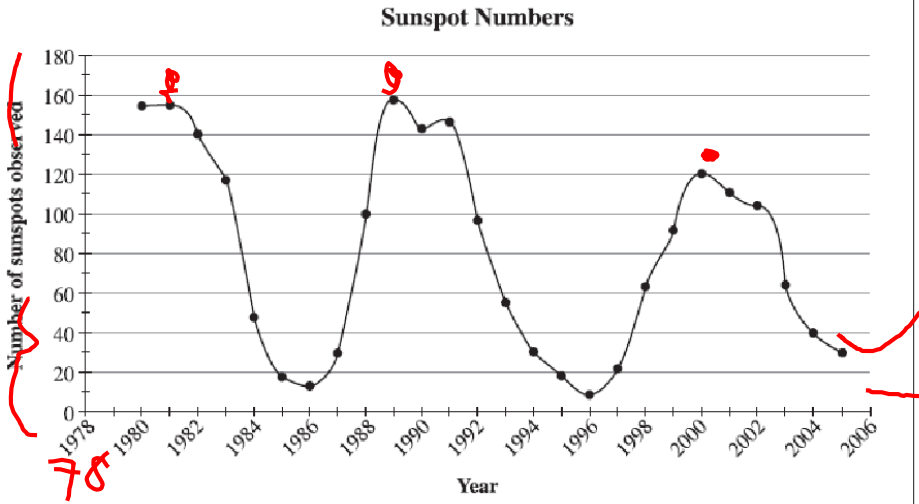
B.

C.

D.

✓ Check Your Understanding

Sunspots are associated with solar flares and coronal mass ejections (CMEs). The number of sunspots alternates between periods of high numbers (solar maximum) and periods of low numbers (solar minimum).

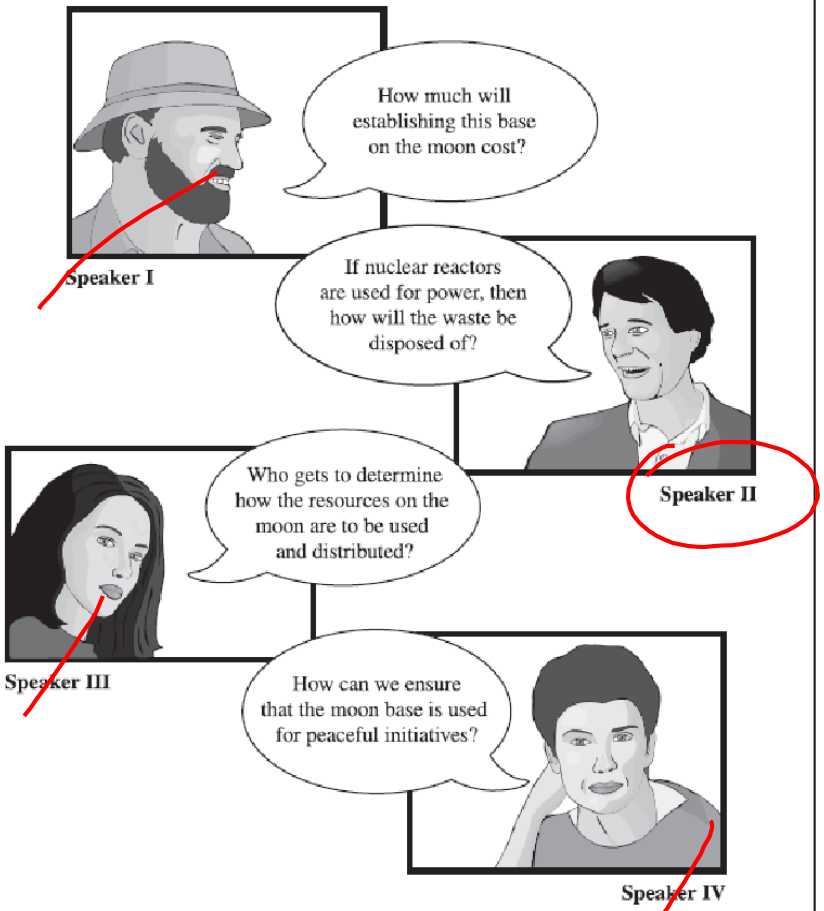


In the year 2011, there will most likely be ___i___ *in CMEs associated with a solar* ___ii___ .

The statement above is completed by the information in row

Row	*i*	*ii*
A.	an increase	maximum
B.	an increase	minimum
C.	a decrease	maximum
D.	a decrease	minimum

The year 2020 is the target date for the creation of a base on the Moon.



Which speaker's question reflects an environmental perspective?

A. Speaker I
B. Speaker II
C. Speaker III
D. Speaker IV

Earth
- safety
of
planet

LET'S PLAY

QUIZ – QUIZ – TRADE!!

GEOCENTRIC MODEL
HELIOCENTRIC MODEL
ELLIPSES
TERRESTRIAL PLANETS
GASEOUS PLANETS
STAR
NEBULA
GALAXY
CONSTELLATION
TELESCOPE
REFRACTING TELESCOPE
REFLECTING TELESCOPE
HUBBLE TELESCOPE
ALTITUDE
ASTROLABE
AZIMUTH
ZENITH
SPECTROSCOPE
SPECTRAL ANALYSIS
RED SHIFT
BLUE SHIFT
LIGHT YEAR
PARALLAX
TRIANGULATION
SATELLITE
GEOSYNCHRONOUS ORBIT
LOW EARTH ORBIT
PROBE
SPACE SHUTTLE
ISS
MICROGRAVITY
SPACE JUNK