Unit 5: Space Exploration

Name: _____ Class / No: _____ Date: _____

Learning outcomes

- AST.5.1 — The purpose and history of space activity
- AST.5.2 — Spacecraft
- AST.5.3 — Space technology in everyday life
- AST.5.4 — Building a colony in space
- AST.5.5 — Life beyond Earth

Questions

1. (AST.5.1) Put these events in chronological order: Apollo 11, Sputnik 1, Gagarin’s flight, the launch of Hubble.

2. (AST.5.1) Who was the first Turkish astronaut to visit the International Space Station?
   ○ A) Tuva Cihangir Atasever ○ B) Alper Gezeravcı
   ○ C) Yuri Gagarin ○ D) Valentina Tereshkova

3. (AST.5.2) Why are most communications satellites placed at an altitude of 35,786 km?

4. (AST.5.2) The craft that flew to Pluto and studied it up close belongs to which group?
   ○ A) Space station ○ B) Geostationary satellite
   ○ C) Space probe ○ D) Launch vehicle

5. (AST.5.3) Which of the following is a technology developed for the space programme?
   ○ A) Teflon ○ B) Velcro
   ○ C) The CMOS sensor in phone cameras ○ D) Tang

6. (AST.5.3) What would happen if no relativity correction were applied to GPS satellite clocks?

7. (AST.5.4) Why can a colony on Mars not get instant help from Earth?

8. (AST.5.4) What is the most practical way to protect a space colony from radiation?

   ○ A) Cover the shelters with regolith or build them underground
   ○ B) Make the shelters of glass
   ○ C) Go outside only at night
   ○ D) Produce more oxygen

9. (AST.5.5) Why is Europa an important candidate in the search for life beyond Earth?

   _____

   _____

10. (AST.5.5) What should you check first when judging a story headlined “Life found on an exoplanet”?

    ○ A) How many times it was shared
    ○ B) Whether it rests on a peer-reviewed paper and independent confirmation
    ○ C) The exclamation mark in the headline
    ○ D) The story’s pictures

Score: ____ / 10

Practical tasks

1. AST.5.1: Using the records below and the events in the table, build a timeline; add Turkey’s space milestones in a different colour. Verify each date in at least two sources. (SpaceTRC records: Sputnik, Apollo 11, Apollo 11 flight plan, Voyager 1, Hubble launch, Chandrayaan-3)
2. AST.5.2: Draw a “purpose – orbit – example” concept map with the craft in the tables. Choose one of the probe records below and write which body it studied, with which instruments. (SpaceTRC records: Voyager 1, New Horizons, Rosetta and Philae, Hayabusa’s return)
3. AST.5.3: Choose five objects at home or at school and research on the NASA Spinoff site whether they have a space connection. From your results, draw a generalisation answering “into which fields does space technology pass most?” (SpaceTRC records: NASA Spinoff, Einstein, NOAA space weather)
4. AST.5.4: Design a Moon or Mars colony for 10 people using the headings in the teacher note. For each heading write one solution, one risk and one sustainability measure; add the oxygen and communication calculations to your design. (SpaceTRC records: Apollo 11, Chandrayaan-3, Habitability)
5. AST.5.5: Through the link in the NASA Exoplanet Archive record, find three exoplanets in the habitable zone. Find a news story about each and evaluate it with a “claim – evidence – independent confirmation?” table. (SpaceTRC records: NASA Exoplanet Archive, Habitability, 51 Pegasi b, Pulsar planets, Webb’s first images)

Answer key — Unit 5: Space Exploration

1. Sputnik 1 (1957) → Gagarin (1961) → Apollo 11 (1969) → Hubble (1990).
2. B. Alper Gezeravcı flew to the station on the Ax-3 mission in January 2024; Tuva Cihangir Atasever made a suborbital flight in June 2024.
3. At this altitude the orbital period equals one sidereal day (23 h 56 min); the satellite turns with the Earth and appears fixed in the sky, so dish antennas can point in one fixed direction.
4. C. New Horizons is a space probe, sent to study another body up close.
5. C. The CMOS active-pixel sensor was developed at NASA JPL. The other three existed before the space programme.
6. The clocks would drift by ~38 microseconds a day; multiplied by the speed of light, that is a position error of ~11 km a day. The positioning system would become useless within hours.
7. Radio signals travel at the speed of light and take 3–22 minutes one way, depending on the Mars–Earth distance; a question and answer take 6–44 minutes. The colony must make its own decisions in emergencies.
8. A. A thick layer of soil stops most cosmic and solar radiation.
9. It is thought to have a global ocean of liquid water beneath its ice shell; contact between the ocean and the rocky sea floor could supply chemical energy.
10. B. An extraordinary claim gains strength from peer-reviewed publication and independent confirmation by other teams.

Teacher note

For AST.5.4, ask groups of 4–5 students to design a Moon or Mars colony for 10 people: for air, water, food, energy, shelter, radiation protection, health and communication they write one solution and one risk each. The lesson’s oxygen and signal-delay calculations give a sense of scale.

Common misconceptions: (1) There is no gravity in space; at the altitude of the International Space Station gravity is ~90% of that on the ground, and astronauts feel weightless because they are in continuous free fall. (2) Tang, Teflon and Velcro were invented by NASA; all three existed before the space programme. (3) Finding an exoplanet means finding life; very few known exoplanets lie in the habitable zone and none shows evidence of life.