

# The Mechanical Universe

## NAVIGATING IN SPACE 19min



Read the following questions before the video begins. Answer the questions while the video is in progress. This is an **INDIVIDUAL** effort, so complete it by yourself.

**DON'T ASK OTHERS FOR ANSWERS** since doing so would be cheating.

Most of the important information (and answers to the questions on this sheet) is in the text spoken during the presentation. So don't become entranced by the visuals and imagery; concentrate and stay focused on the words!

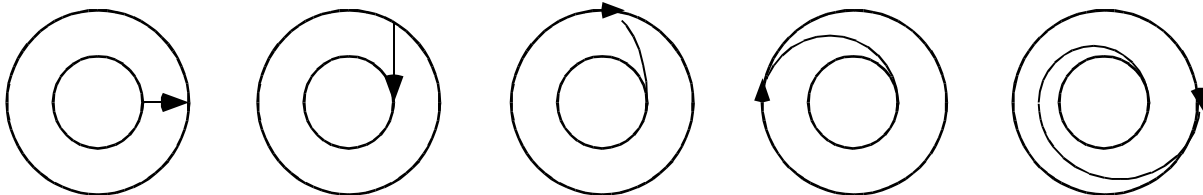
1. Where did Mariner go in 1973?

2. Flying a spaceship from one point to another in a straight line in the solar system would
- A. be the most efficient method.
  - B. require an extensive temporal interval to complete the voyage.
  - C. require an exorbitant amount of propulsive capability.
  - D. take full advantage of Kepler's laws.

3. When aerospace engineers launch a space craft from Earth to Mars, the fuel burns from the time of launch until

- A. 30 seconds after launch
- B. 30 minutes after launch
- C. 30 hours after launch
- D. 30 days after launch
- E. the craft reaches Mars

4. Circle the correct depiction of the transfer orbit from Earth to Mars from the choices below.



5. The opportunity to launch a craft from Earth to Mars occurs

- A. when Mars, the Earth, and the Sun form a straight line.
- B. when Mars leads Earth by  $44^\circ$  in its orbit.
- C. when Mars trails Earth by  $54^\circ$  in its orbit.
- D. when Jupiter aligns with Mars.
- E. when Peace will guide the planets and Love will steer the stars.

6. The space craft's path from Earth to Mars is a(n) \_\_\_\_\_; the path to

escape Earth is a(n) \_\_\_\_\_. (Choose Circle, Ellipse, Hyperbola, Parabola)

7. The outer four (gas giant) planets align so that one craft can visit all four of them once every \_\_\_\_\_ years.

8. The gravitational pull of a planet can be used to change the \_\_\_\_\_ and \_\_\_\_\_ of a space craft.

9. In “gravity assist,” the space craft

A. adds momentum and energy to the planet.

B. stays in the same orbit (relative to the sun) before and after passing the planet.

C. steals momentum and energy from the planet.

D. leaves the planet with higher speed than it approached with, relative to the planet.

10. FREE!

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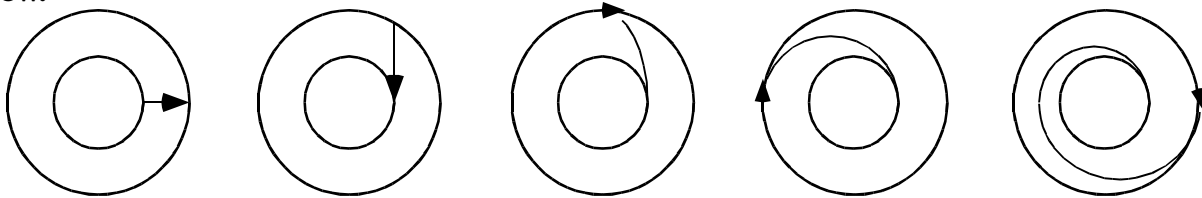
1. When was Viking launched to Mars?

2. Flying a spaceship from one point to another in a straight line in the solar system would
- A. be the most efficient method.
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5. Opportunities to travel to Venus occur every \_\_\_\_\_ months.

6. The space craft's path from Earth to Mars is a(n) \_\_\_\_\_; the path to escape Earth is a(n) \_\_\_\_\_. (Choose Circle, Ellipse, Hyperbola, Parabola)

7. The outer four (gas giant) planets align so that one craft can visit all four of them once every \_\_\_\_\_ years.

**8. In the planet's frame of reference, the spacecraft leaves the planet with**

**A. more speed than it came in with.**

**B. less speed than it came in with.**

**C. the same speed it came in with.**

**9. CONCENTRATE.**Theorists from the past made the heavens possible; space-age

navigators make the heavens p\_\_\_\_\_.

**10. FREE!**