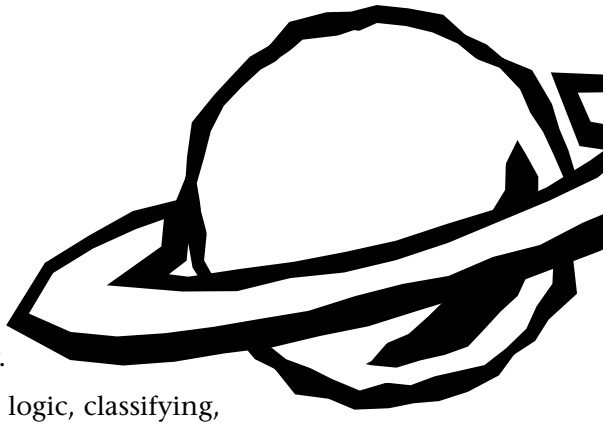
CLASSROOM ACTIVITY

Planetary Puzzle

General Information

- ★ Level: Grades 5 and 6 and Secondary I to V.
- ★ Students per group: 2 to 4.
- ★ How long: 2 60-minute periods.
- ★ Where: In class.
- ★ When: Before or after visiting the Planetarium.
- ★ Type of activity: Problem solving.
- ★ Key words: Solar system — planets — mythology.
- ★ Skills honed: Problems solving, questioning, using logic, classifying, deducing, making decisions.



Starting Point

Can I solve two puzzles using my knowledge of planets and the solar system?

Preconceptions

Students absorb a surprising amount of information on planets and the solar system, but some of these notions are often based on incomplete or outdated documentation.

Goals

This activity aims to acquaint students with the planets in the solar system. Students must solve two puzzles by gathering information on the planets through a series of clues provided.

Steps in the Activity

Preparations

Make the number of copies needed of the "Planetary Puzzle" student handout and solve the puzzles yourself for an idea of the difficulties your students might encounter. If need be, prepare suggestions of strategies for figuring out the puzzles.

Students may have trouble organizing the information they collect as they answer the clues. If so, hand out copies of the answer grid enclosed and suggest to students that they use it to jot down their answers.

Gather resources your students might use in this activity. Make sure the information is recent. For example, references before 1990 won't contain the discoveries about Uranus and Neptune made by the Voyager 2 probe. If you must offer both recent and older resources, plan to help your students when they come across contradictory information.

Also provide some reference material on mythology (including the names of Roman and Greek gods and goddesses). Attached is a family tree of the gods from Greek and Roman mythology.

Supplies

For each team of two to four students: A copy of the "Planetary Puzzle" student handout.
A copy of the answer grid (optional).

Assignment

❶ Explain to students that they'll complete an activity that tests their ability to solve problems and their knowledge of the heavenly bodies in our solar system. Tell them that this activity might prove frustrating at times but that their perseverance will pay off.

❷ Read aloud the introduction to the "Planetary Puzzle" student handout.

❸ Present students with documents and resources (such as tables, lists, graphs, publications, magazines, Web sites and the appended documents) that you've collected and explain to them that they can use all this available material or find other material at home. It would be useful to tell students that we now have access to a wealth of very recent information on the solar system (older resources may contain inaccuracies). Students should always check the publication date of a scientific document before consulting it.

❹ Form teams and define each member's tasks (group leader, secretary, presenter, etc.).

❺ Pass around the "Planetary Puzzle" student handout. Stress that there isn't only one way to solve the puzzles and that students needn't use the clues in the order given.

❻ Set aside at least one period so that your students can study the documentation and acquaint themselves with problem solving. Depending on the level of difficulty they encounter, you may hand out the answer grid to help them organize their answers to the clues. Suggest they continue trying to crack the puzzles at home.

❼ The next day, ask the members of each team to pool their knowledge. Assess your students' efforts at finding the solutions. Ask several students to share their answers and, more importantly, to share their approach to problem solving so that everyone can learn new ways to figure out puzzles.

By working in groups, students learn to collaborate. This teamwork can be useful when you adapt the activity to students with special needs. Make sure the responsibilities for research and problem solving are equally shared among the team members.

Wrap-up

Once all the teams have finished, ask each one to present its answer to each clue, to describe its problem-solving strategy and to give its solution to the two puzzles. This pooling together of the answers will help to share with other groups the strategies adopted and to compare newly gained knowledge with past knowledge.

Also have students discuss the problems they faced along the way (working as a team, finding the answers to the clues) and the means they used to carry out their tasks more easily.

Suggest to students other research on the discoveries of the Pioneer and Voyager probes and other spacecraft. Propose further research topics such as mythology, rocket science, propulsion systems and planetary geology.

APPENDIX 1

The Family Tree of Planets

Note: The planet names we use today come from the names of Roman gods and goddesses. The names in parentheses are the Greek names for the same gods and goddesses.

Sun (Phoebus): The Moon's twin brother and Jupiter's son. Traditionally, the Sun is a male deity because of its fervour and power.

Mercury (Hermes): Jupiter's son, the messenger of the gods, and the god of merchants. Associated with the planet that moves across the sky the fastest.

Venus (Aphrodite): Jupiter's daughter and the goddess of beauty and love. Identified with the sky's brightest planet with its luminous whitish light.

Earth (Gaia): The nourishing goddess. Sprang from Chaos at the beginning of time. Like Uranus, Gaia is an ancestor of the gods.

Moon (Phoebe): The Sun's twin sister and Jupiter's daughter. A female deity associated with gentleness. The cycle of the lunar phases lasts about the same time as a woman's menstrual cycle (29 days).

Mars (Ares): Jupiter's son and the god of war. Identified with the red planet (blood), rapid comings and goings (direct and retrograde movement), and great variations in brightness (the planet moves toward and away from the Earth very quickly).

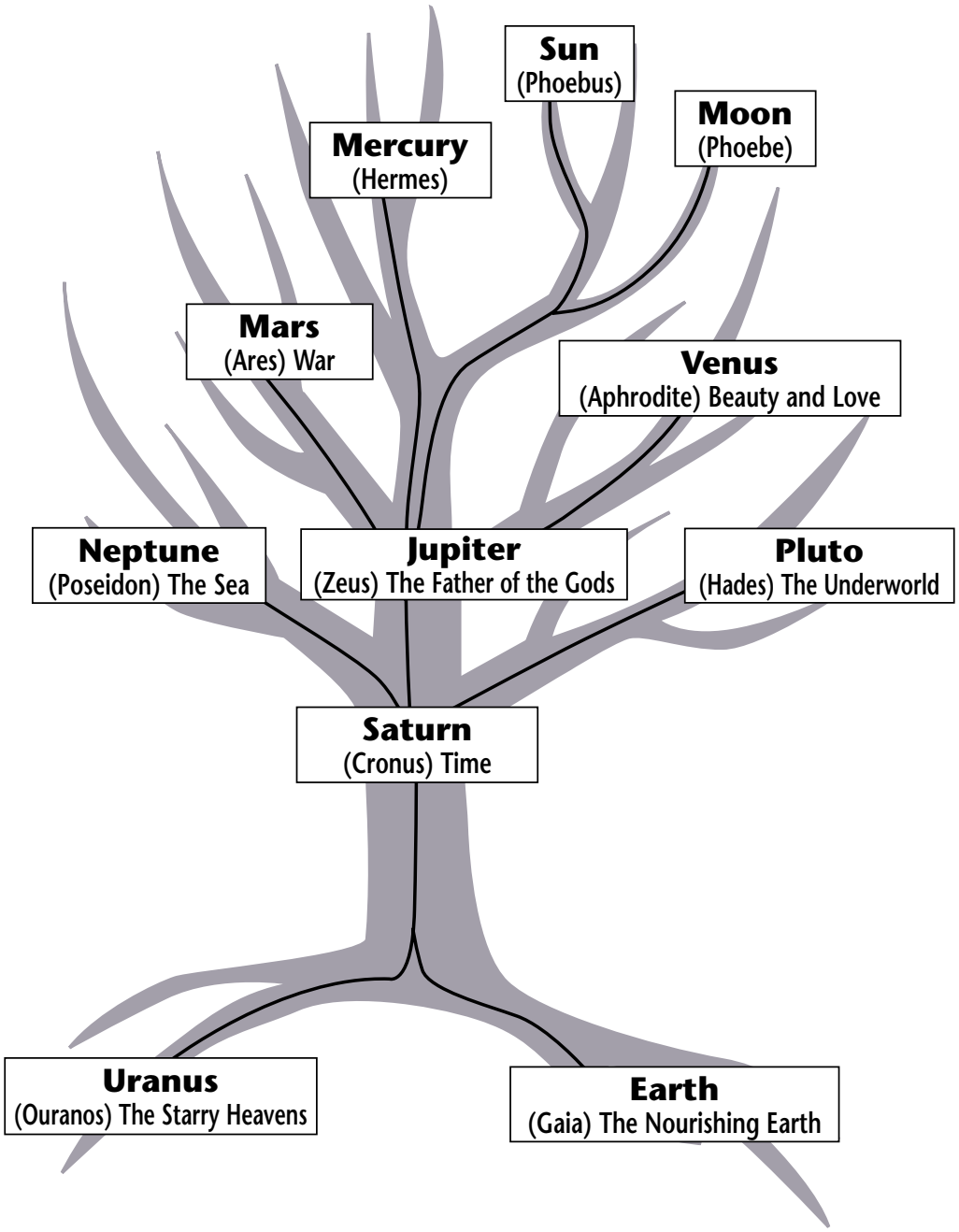
Jupiter (Zeus or Zeus-Pitar, Father Zeus): The father of the gods and the ruler of the universe. The son of Saturn and Rhea, he dethroned his father and bequeathed the sea and the underworld to his brothers Neptune and Pluto. Identified with the most stable planet, Jupiter, which scarcely twinkles in the sky.

Saturn (Cronus): The son of Uranus and Gaia (Heaven and Earth). The father of Jupiter and the god of time, he swallowed his children at birth. Identified with the lead-grey planet that is the slowest and dimmest in the sky.

Uranus (Ouranos): The starry heavens. Existed from the beginning of time, like Gaia. The father of Saturn. This name was given to the planet discovered in 1781, thereby completing the family line Mars-Jupiter-Saturn-Uranus.

Neptune (Poseidon): Jupiter's brother and the god of the sea. Identified with the dark blue planet discovered in 1846.

Pluto (Hades): Jupiter's brother and the god of the underworld. Identified with the planet discovered in 1930 by the astronomer Clyde Tombaugh at the observatory founded by Percival Lowell (whose initials, PL, show up in Pluto's symbol)



APPENDIX 2

Some Features of the Planets

Planet	**Distance from the Sun** (millions km)	**Equatorial diameter** (km)	**Period of revolution**	**Period of rotation**	**Number of Satellites**	**Rings**	**Temperature min/max** (degrees C)
Mercury	57,9	4 878	88,00 j	58,65 j	0	Non	-175/425
Venus	108,2	12 104	224,70 j	243,02 j	0	Non	460
Earth	149,6	12 756	365,26 j	23h56m	1	Non	-88/50
Mars	227,9	6 787	1,88 a	24h37m	2	Non	-140/20
Jupiter	778,3	142 980	11,86 a	09h55m	28	Oui	-110
Saturn	1 429,4	120 540	29,42 a	10h39m	30	Oui	-180
Uranus	2 875,0	51 120	83,75 a	17h14m	21	Oui	-221
Neptune	4 504,4	49 530	164,79 a	16h07m	8	Oui	-230
Pluto	5 915,8	2 300	248,03 a	6,39 j	1	Non	-238

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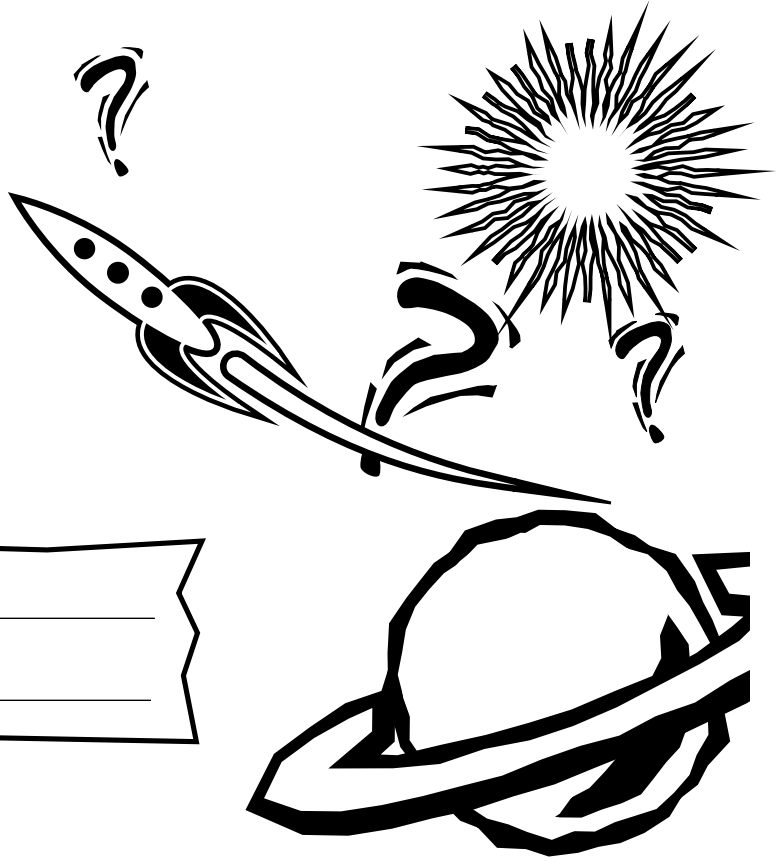

Planetary Puzzle

Name: _____

Class: _____ **Date:** _____

Instructions

Eight pilots from eight nations on Earth have been stationed on the other planets in the solar system for a few years. They're now coming home and have just taken off from their bases. Each spacecraft displays a different colour and features a different propulsion system. Your mission is to solve two puzzles:

★ **What propulsion system does the American pilot's spacecraft use?**

★ **Which planet did the Russian pilot's spacecraft take off from?**

Important

Before starting your mission, research the following:

- Roman and Greek mythology (gods and goddesses).
- The number of moons orbiting each planet in the solar system.
- Recent discoveries by the Voyager, Pioneer and Viking probes and other space missions.
- The physical and orbital features of the planets and their satellites.

Clues

1 The Japanese astronaut is piloting a white spacecraft.

2 The planet whose name refers to the god of war has an enormous volcano on its surface. (A.: Mars)

3 The red spacecraft, which features an ion propulsion engine, takes off from the sixth planet in the solar system.
(A.: Saturn)

4 The orange spacecraft departs from a planet with a single moon.
(A.: The Earth or Pluto, but the answer is Pluto because the astronauts are returning to Earth from other planets.)

5 The Australian pilot lifts off from a planet that has rings and is tipped on its side.
(A.: Uranus)

6 The grey spacecraft is outfitted with magnetic propulsion engines.

7 The American is flying a blue spacecraft that lifts off from a planet with two moons.
(A.: Mars)

8 The eighth planet in the solar system is named after the god of the sea.
(A.: Neptune.)

9 The purple spacecraft, which has an electric engine, flies off from the planet whose name refers to the messenger of the gods.
(A.: Mercury)

10 The spacecraft powered by a liquid-fuel engine launches from the second planet in the solar system.
(A.: Venus)

11 The green spacecraft lifts off using its solid-fuel engines.

12 The South African spacecraft travels from the ninth planet using its antimatter engines.
(A.: Pluto)

13 The second planet in the solar system, which features an atmosphere of carbon dioxide, was named after the goddess of beauty and love.
(A.: Venus)

14 The Chinese pilot takes off from the largest planet in the solar system.
(A.: Jupiter)

15 The green spacecraft lifts off from the planet with 18 moons.
(A.: Uranus)

16 The Quebec pilot is aboard a yellow spacecraft powered by a fusion engine.

17 In Greek mythology, the king of the gods is represented by a planet with 28 moons.
(A.: Jupiter)

18 The planet with a cratered surface (like our Moon's) has no satellites and lies closest to the Sun.
(A.: Mercury)

19 The French pilot leaves the ringed planet named after the god of time.
(A.: Saturn)

20 The spacecraft running on solar energy lifts off from the fourth planet in the solar system.
(A.: Mars)

21 The blue planet has eight moons.
(A.: Neptune)

22 The white spacecraft lifts off from a moonless planet.
(A.: Mercury or Venus. But since a previous clue shows that a purple spacecraft took off from Mercury, the answer is Venus.)

23 The grey spacecraft takes off from the fifth planet in the solar system.
(A.: Jupiter)

24 The yellow spacecraft flies away from the planet named after the god of the sea.
(A.: Neptune)

Solutions to the puzzles

★ **What propulsion system does the American pilot's spacecraft use?**

Solar-energy system

★ **Which planet did the Russian pilot's spacecraft take off from?** .

Mercury.

Note: This answer results from a process of elimination. This increases the activity's level of difficulty and stresses the importance of properly using all the clues rather than simply solving the two puzzles.

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Planetary Puzzle

Need to organize your findings?
Use the spaces below to jot down the answers to the clues given in the "Planetary Puzzle" student handout.

Astronaut (nationality): (A.: Russian) Propulsion system: (A.: electric propulsion) Spacecraft colour: (A.: Purple) Planet liftoff: **Mercury**	Astronaut (nationality): (A.: French) Propulsion system: (A.: Ion propulsion) Spacecraft colour: (A.: Red) Planet liftoff: **Saturn**
Astronaut (nationality): (A.: Japanese) Propulsion system: (A.: Liquid-fuel propulsion) Spacecraft colour: (A.: White) Planet liftoff: **Venus**	Astronaut (nationality): (A.: Australian) Propulsion system: (A.: Solid-fuel propulsion) Spacecraft colour: (A.: Green) Planet liftoff: **Uranus**
Astronaut (nationality): (A.: American) Propulsion system: (A.: Solar energy) Spacecraft colour: (A.: Blue) Planet liftoff: **Mars**	Astronaut (nationality): (A.: Quebec) Propulsion system: (A.: fusion propulsion) Spacecraft colour: (A.: Yellow) Planet liftoff: **Neptune**
Astronaut (nationality): (A. : Chinese) Propulsion system: (A.: Magnetic propulsion) Spacecraft colour: (A.: Grey) Planet liftoff: **Jupiter**	Astronaut (nationality): (A. : South African) Propulsion system: (A.: antimatter) Spacecraft colour: (A.: orange) Planet liftoff: **Pluto**

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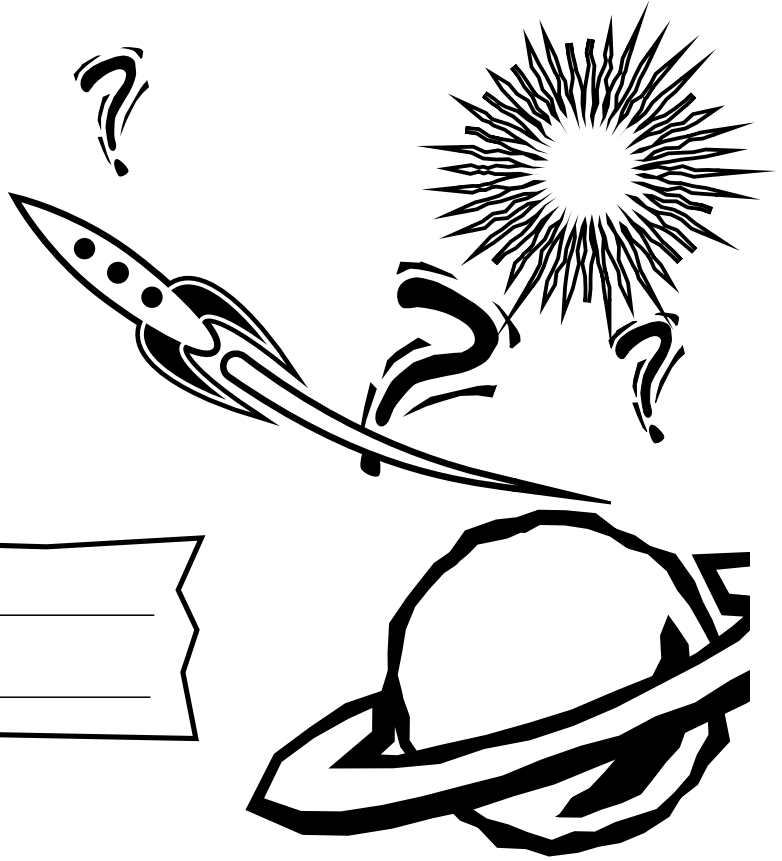

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