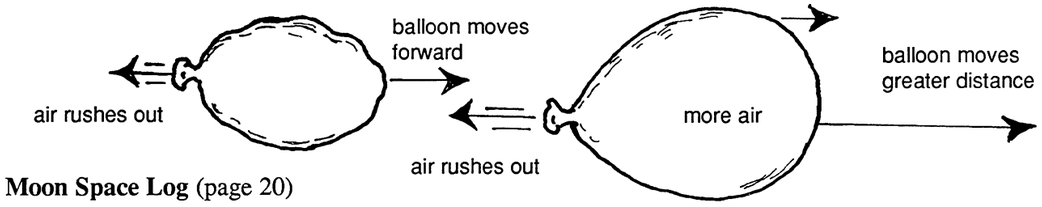
Answer Key *(cont.)*

Balloon Rocket (page 17)

The balloon remains at rest as long as the air is held inside it. When the air begins to rush out, it pushes the balloon forward (first law of motion). The more air in the balloon, the greater distance it will fly (second law). The balloon is pushed in the opposite direction of the air flow (third law).



Moon Space Log (page 20)

Moon's rotation speed at equator:

3476km x 3.14 = 10.915 km ÷ 656 = 16.64 kilometres per hour
diameter circumference hours in day rotation speed at equator

Age on the moon would be the same as on Earth since it moves with the Earth around the sun.

Diameter of the Sun (page 30)

Diameter of sun—1,400,091km ÷ Earth's diameter—12,831 km = 109 x 10 cm = 1090 cm (10.9 m)

Rotation Speed of Planets (Answers for Space Logs of the Planets)

Categories	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Diameter in kilometres	4,880	12,100	12,756	6,794	142,984	120,536	51,100	49,500	2,300
Diameter in kilometres	15,323	37,994	40,054	21,333	448,970	378,483	160,454	155,433	7,222
Length of day in hours	1416 h	5832 h	24 h	25 h	10 h	11 h	17 h	16 h	153 h
Rotation Speed kph	11	7	1,669	853	4,489	34,408	9,438	9,715	47

Mars Data (page 32)

Mars is closest to Earth at position 4/D and most distant at 12/L. Mars would look larger at the closest point (4/D) and smaller at 12/L. There are more positions in Mars' orbit since it takes longer than Earth (1.5 Earth years) to travel around the sun.

Jupiter's Moons (page 33)

Galileo saw four moons around Jupiter (his telescope was not good enough to see all 16 moons). His drawings showed the moons stayed close to Jupiter, sometimes appearing on one side and sometimes the other side of the planet, indicating they were rotating around it. When fewer than four moons could be seen, the missing moons were behind or in front of the planet and therefore invisible to Galileo.

The Solar System

Before you begin reading *The Magic School Bus® Lost in the Solar System,* you need to know the size of the planets and their distances from the sun and each other. Complete the activities "How Big Are the Planets?" and "Planets' Distances from the Sun." (pages 5 and 8)

How Big Are the Planets?

Before making a scale model of the planets, show how big you think they are. The size of the Earth has been drawn to give you a scale for the planets. Draw the remaining planets (**Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune,** and **Pluto)** to show how large they are compared to Earth. Be sure to label each planet.

Scale Drawing of the Planets

○
Earth

Now, use the information on the next page to help you make paper scale models of the planets. When you are finished with that project, compare the drawing you have just made with your model planets to see how accurate you were.

Planet Data

To the Teacher: *This chart should be distributed to the students when they begin their Space Log (page 20). They can use it as a reference when adding descriptions of each planet they visit during this unit. Discuss the chart with the students after distributing it so they will understand how to interpret the data.*

Categories	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Diameter in kilometres	4,880	12,100	12.756	6,794	142,984	120,536	51,100	49,500	2,300
Diameters relative to Earth's	.38	.95	1.0	.53	11.2	9.4	4	3.9	.18
Average Distance from sun in millions of Kilometres	57.9	108.2	149.6	227.9	778.3	1,429	2,875	4,504	5,900
Relative to Earth's	0.4 AU*	0.7 AU	1.0 AU	1.5 AU	5.2 AU	9.6 AU	19.3 AU	30.3 AU	39.7AU
Length of year (trip around sun)	88 days	224.7 days	365.3 days	687 days	11.86 years	29.46 years	84 years	165 years	248 years
Length of Day (turn around once axis)	59 days	243 days Retro **	23h 56m	24h 37m	9h 55m	10h 40m	17h 18m Retro**	16h 7m Retro**	6days 9h18m
Gravity at Surface	.38 g	.91 g	1.00 g	.38 g	2.53 g	1.07 g	.91 g	1.16 g	.05g(?)
Number of Moons	0	0	1	2	16	18	15	8	1
Number of Rings	0	0	0	0	3	1,000 (?)	11	4	0

*AU = Astronomical Unit, average distance between Earth and sun which is 149.6 million kilometres. The data below each planet shows its distance in astronomical units.
**Retro means "retrograde" or backward motion from the rest of the planets. Earth turns (rotates) on its axis from west to east; planets which have retrograde motion rotate east to west.

Statistics for the planets were taken from the most recent information available from NASA and other reliable sources. You may find different data in recent articles since this information is continuously being revised through the use of new equipment, such as the Hubble Telescope.

Answer Key *(cont.)*

Comparing the Giant Planets (page 35)

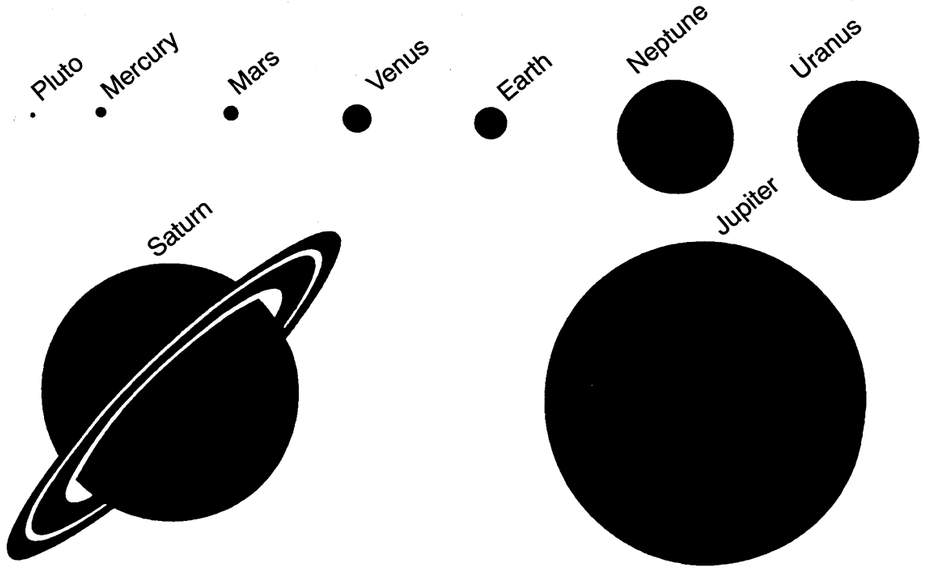
The chart below shows a sample weight comparison of someone who is 39 kg on Earth with the equivalent weight on Jupiter, Saturn, Uranus, and Neptune.

The rotation speed is so fast on these giant planets that they literally pull their atmosphere around as a beater does with cake batter. This creates tremendous wind forces in the atmosphere.

Data	Earth	Jupiter	Saturn	Uranus	Neptune
Surface Gravity	1.00 g	2.53 g	1.07 g	.91 g	1.16 g
Your Weight on . . .	39 kg	99 kg	42 kg	36 kg	45 kg
Diameter Relative to Earth's	1.00	10.79	8.91	4.05	3.91
Rotation Speed at Equator	1,669 kph	44,897 kph	34,408 kph	9,438 kph	9,715 kph

The Planets Drawn to Scale (Earth = 5 mm)

The drawings of the planets below show the actual scale size to be used on the space logs.



Introduction

The use of good trade books can enhance the study of science. The key to selecting these books is to check them for scientific accuracy and appropriateness for the level of the students. *The Magic School Bus®* series, written by Joanna Cole, contains outstanding examples of books which can help students enjoy and learn about science. These books are delightfully written and scientifically accurate, thanks to the thorough research done by the author as she writes each of her books.

This Science/Literature Unit is directly related to *The Magic School Bus® Lost in the Solar System.* The activities in this unit are particularly appropriate for years 4–6. Teachers who use this unit will find a variety of lessons to do before, during, and after reading the book with their students. These include the following:

- Pre-reading Activities—making scale models of the planets and solar system
- A Biographical Sketch and Picture of the Author
- A Book Summary
- Activity oriented lessons which expand the topics covered in the story:
  - drawing orbits of the planets
  - investigating Earth's motion
  - building and testing a rocket
  - keeping a space log
  - simulating a trip to the moon
  - measuring the sun
  - plotting Mars-Earth orbits
  - comparing the giant planets to Earth
  - simulating the motions of the planets
- Post-reading Activities—constructing a comet
- Unit Assessment—Vacation in Space
- Answer Key

This unit is designed to help you build on the interest your students already have about our solar system. The activities will help them develop a better understanding of the size, location, and physical features of the planets and our moon.

Table of Contents

