Diameter and Mass of the Planets

The table shows the diameter, mass and density of each planet in the solar system. The diameter and mass measurements are relative to those of the earth, where the earth has been given a value of 1 (e.g. a diameter of 2 indicates that its diameter is twice as big as the earths).

Planet	Diameter (Earth = 1)	Mass (Earth = 1)	Density (g/cm^3)
Mercury	0.4	0.06	5.4
Venus	0.9	0.8	5.3
Earth	1.0	1.0	5.5
Mars	0.5	0.4	4.0
Jupiter	11.2	318	1.3
Saturn	9.4	95	0.7
Uranus	4.1	14.6	1.2
Neptune	3.9	17.2	1.7
Pluto (Dwarf Planet)	0.2	0.002	0.4

Draw a bar chart to show the diameter of each planet relative to that of the Earths.

Questions

1. List the planets in order of diameter, starting with the biggest.

2. If you were to list the planets in order of mass, starting with the biggest, would the order be the same as the list in question 1. If not, where would it be different?

3. The volume of a sphere is equal to $4/3\ \pi\ r^3$ where $\pi = 3.14$ and r = 0.5 x diameter. Calculate the volume of the Earth and Jupiter separately (no units are needed), and find the ratio of their volumes (volume of Jupiter ÷ volume of Earth).

4. The mass of Jupiter is 318 times the mass of Earth. How does this compare to the ratio of volumes?

5. Jupiter is lighter than perhaps expected because it is made mainly of gases, whereas the Earth is a rocky planet. Gases have a lower density than solids. Explain what this means.

6. Use the density data in the table to make a judgment about which planets may be rocky and which are gaseous. Find out if you are correct.

Diameter and Mass of the Planets - Answers

The table shows the diameter, mass and density of each planet in the solar system. The diameter and mass measurements are relative to those of the earth, where the earth has been given a value of 1 (e.g. a diameter of 2 indicates that its diameter is twice as big as the earths).

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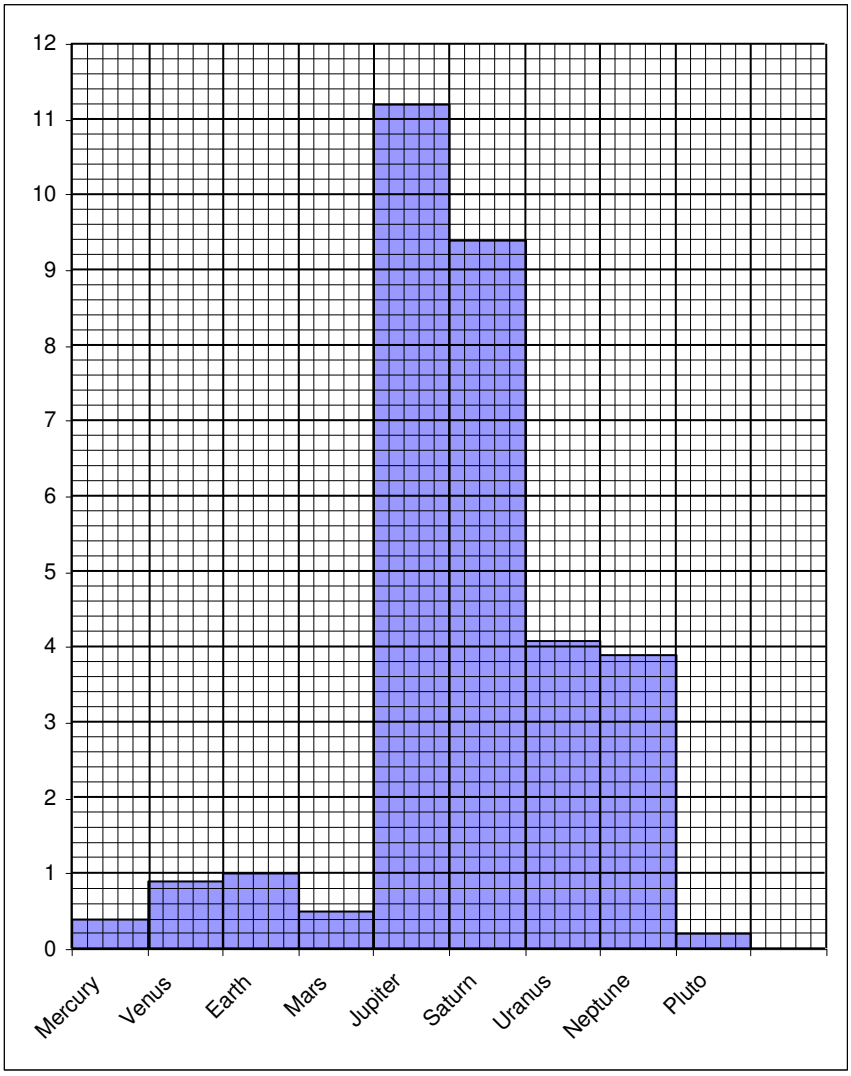
Draw a bar chart to show the diameter of each planet relative to that of the Earths.



Questions

7. List the planets in order of diameter, starting with the biggest.
   Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury, Pluto

8. If you were to list the planets in order of mass, starting with the biggest, would the order be the same as the list in question 1. If not, where would it be different?
   No. Neptune and Uranus reversed.

9. The volume of a sphere is equal to $4/3\ \pi\ r^3$ where $\pi = 3.14$ and r = 0.5 x diameter. Calculate the volume of the Earth and Jupiter separately (no units are needed), and find the ratio of their volumes (volume of Jupiter ÷ volume of Earth).

   Earth: $4/3\ \pi\ r^3$ = $4/3 \times 3.14 \times 0.5^3$ = 0.52 (no units)

   Jupiter: $4/3\ \pi\ r^3$ = $4/3 \times 3.14 \times 5.6^3$ = 735.25 (no units)

   Ratio = 735.25 / 0.52 = 1413.94 (or 1404.93 if answers above not rounded)

   This means that the volume of Jupiter is over 1400 times as big as the volume of earth.

10. The mass of Jupiter is 318 times the mass of Earth. How does this compare to the ratio of volumes?

    The ratio of volumes is over 4 times the ratio of masses.

11. Jupiter is lighter than perhaps expected because it is made mainly of gases, whereas the Earth is a rocky planet. Gases have a lower density than solids. Explain what this means.

    They have less mass per unit volume.

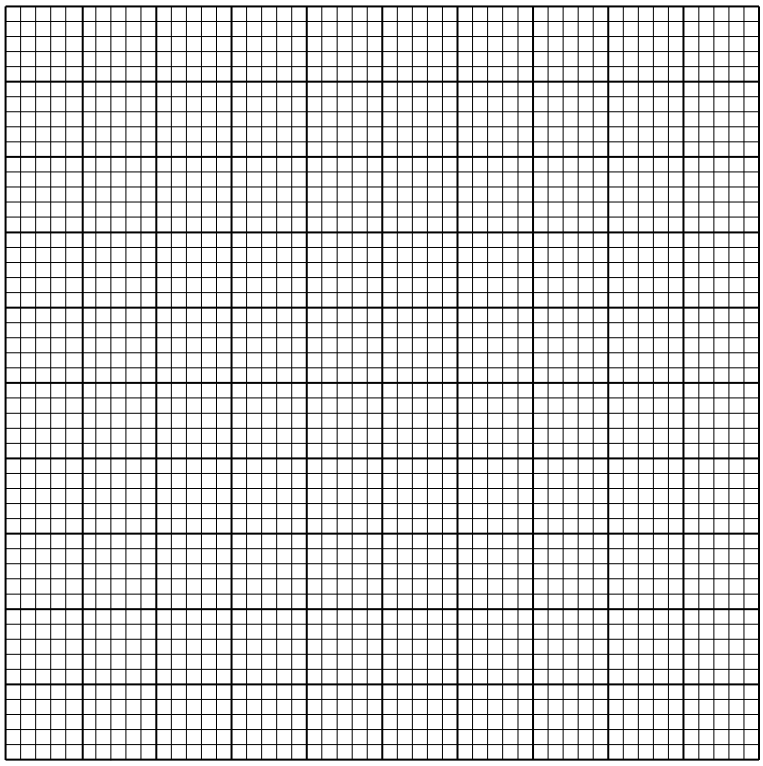
12. Use the density data in the table to make a judgment about which planets may be rocky and which are gaseous. Find out if you are correct.

Resistance of a Filament Lamp

A data logging device and a computer were used to measure the current flowing through a filament lamp, during the first few milliseconds after it was switched on. The table shows the results of this observation.

Time (milliseconds)	Current (A)
0.0	1.50
0.5	1.30
1.0	1.12
1.5	0.95
2.0	0.81
2.5	0.69
3.0	0.60
3.5	0.54
4.0	0.50
4.5	0.50
5.0	0.50

Making suitable use of the space available, plot the points on the grid below, and draw a line of best fit.



Questions

1. Describe in detail how the current varies with time.

_____

_____

_____

2. At what level does the current finally rest?

_____

3. How must the resistance of the lamp be changing as the current decreases?

_____

4. What do you think is causing this variation in the resistance of the lamp?

_____

_____

5. The power supply used to light the lamp was set at a potential difference of 12V. Using Ohms law (V=IR), calculate the resistance of the lamp at these times.

   a. 0 milliseconds
   b. 2 milliseconds
   c. 4 milliseconds

6. The lamp was replaced by a fixed resistor, and the observation repeated. The results showed that the values for the current were constant. In terms of resistance, how does the fixed resistor differ from the lamp?

_____

_____

_____

