

# The Solar System & Orbit

**Q 1.** Two students collect data from the Internet about planets in the Solar System.

The table shows the data that they collect about the first six planets.

Name of planet	Distance from the Sun in arbitrary units	Time for one orbit of the Sun in years	Mean surface temperature of the planet in °C
Mercury	0.4	0.2	+ 125
Venus	0.7	0.6	+ 465
Earth	1.0	1.0	+ 22
Mars	1.5	1.9	- 48
Jupiter	5.2	11.9	
Saturn	9.6	29.5	- 180

(a) One student says that the mean surface temperature of planets gets less the further they are from the Sun. The other student agrees but says that one planet does not fit the pattern.

Which planet does not fit the pattern ?

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(1 mark)

**(b)** Estimate a value for the mean surface temperature of Jupiter.

Mean surface temperature of Jupiter = ..... °C

*(1 mark)*

**(c)** Use words from the box to complete the following conclusion reached using the data in the table.

You can use the words once, more than once or not at all.

<b>decreases</b>	<b>increases</b>	<b>stays the same</b>
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As the distance from the Sun to a planet \_\_\_\_\_

the time taken for the planet to orbit the Sun \_\_\_\_\_

*(1 mark)*

**Q 2.** The table gives data on the Solar System.

Name of planet	Average distance from the Sun in millions of kilometres	Average orbital speed in kilometres per second
Mercury	60	48
Venus	108	35
Earth	150	30
Mars	228	24
Jupiter	778	13
Saturn	1430	9.6
Uranus	2860	6.8

**(a)** A student studies this data and comes to the following conclusion.

For the planets in the table, the average orbital speed is very nearly inversely proportional to the planet's average distance from the Sun.

**(a)(i)** This conclusion is **not** correct.

Use the data for Saturn and Uranus to explain how the student's conclusion is not correct.

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*(2 marks)*

**(a) (ii)** For all the listed planets, write a correct conclusion for the connection between the average distance from the Sun and the orbital speed.

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*(2 marks)*

**(b)** The student knows the following:

The planets all move in ellipses (slightly squashed circles).

What is the connection between this statement and the headings in the table?

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*(2 marks)*

**Q 3.** This page is from a science magazine.

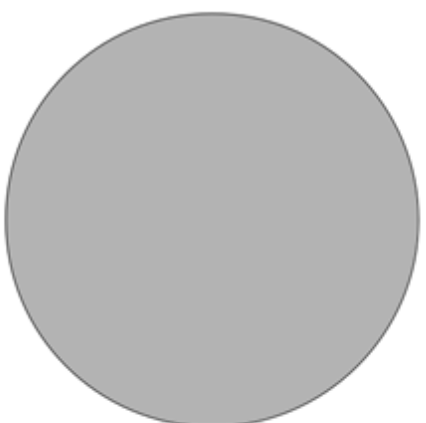
**The Red Planet**

The two natural satellites, or moons, of Mars are Phobos (fear) and Deimos (terror). They are named after the horses which pulled the chariot of Mars, the god of war in the mythology of Ancient Greece.

Phobos takes less than eight hours to orbit Mars and gets slightly closer every time it does so. Scientists predict that in about 100 million years time it will either be ripped apart by the gravitational force or will crash onto the surface of Mars.

● Deimos

● Phobos



Not to scale

**(a)** Suggest how scientists have arrived at their prediction of about 100 million years.

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*(2 marks)*

**(b)** The centripetal force on Phobos is gradually changing as it orbits Mars. Is the force increasing or decreasing?

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Explain your answer.

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*(2 marks)*

**(c)** Scientists expect that the mass of Mars and the mass of Phobos will not increase. Explain what will happen to the gravitational force on Phobos as it orbits Mars.

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*(2 marks)*

**Q 4.** A student collects data from the Internet about planets in the solar system. She arranges the data into a table.

Name of the planet	Distance from the Sun in millions of kilometres	Time taken for one orbit of the Sun in years	Time taken to spin on its axis in hours	Average temperature on the side facing the Sun in ° C
Mercury	60	0.24	1400	+430
Venus	110	0.60	5800	+470
Earth	150	1	24	+20
Mars	230	2	25	-20
Jupiter	780	12	10	-150
Saturn	1400	30	10	-180
Uranus	2900	84	17	-220
Neptune	4500	160	16	-230

(a) Name the **two** variables in the student's table which **always** have the relationship:

As one increases, so does the other.

\_\_\_\_\_ and \_\_\_\_\_

(1 mark)

(b) (i) Give an example of **two** variables in the student's table which **generally** have the relationship:

As one increases, the other decreases

\_\_\_\_\_ and \_\_\_\_\_

(1 mark)

**(b)(ii)** Which piece of data does not seem to fit the relationship in (b)(i)?

\_\_\_\_\_

(1 mark)

**(c)** Scientists plan to launch a satellite which will orbit Mars above its equator. It will be a geostationary satellite.

How many hours will it take to orbit Mars?

\_\_\_\_\_ hours

(1 mark)

**(d)** Mars has two moons.

Neither of them is in a geostationary orbit and they both take different times to orbit the planet.

Which **one** of these statements is correct?

Put a tick (☑) in the box next to your answer.

The two moons will always be above the same point on the surface of Mars.

The two moons will be in different positions at different times.

You can never see both moons at the same time.



(e) Use words from the box to complete the **three** spaces in the passage.

<b>circular</b>	<b>direction</b>	<b>friction</b>	<b>gravitational</b>	<b>speed</b>	<b>universal</b>
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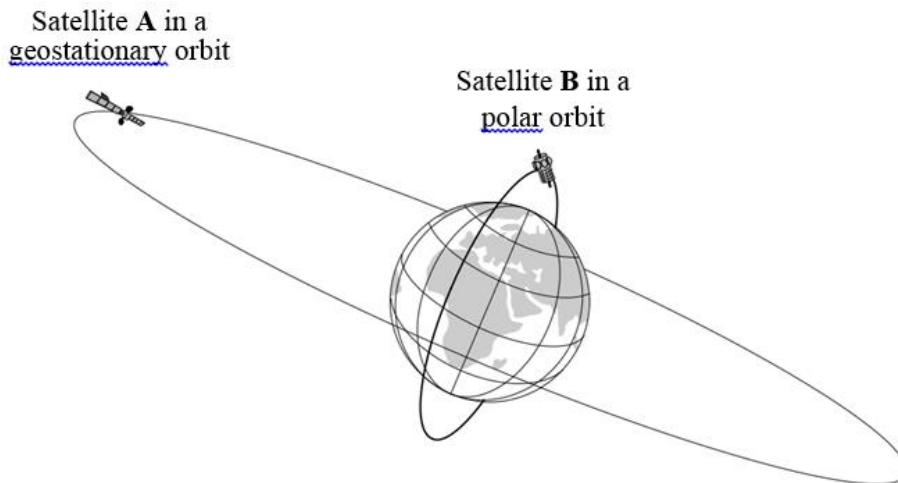
The moons of the planet Neptune move in circular paths around the planet.

They continuously accelerate towards the centre of Neptune.

The acceleration changes the \_\_\_\_\_ of each moon but does not \_\_\_\_\_ change its \_\_\_\_\_. The force causing the acceleration is a \_\_\_\_\_ force.

(2 marks)

**Q 5.** The diagram shows two satellites orbiting the Earth. Both satellites have the same mass



(a) Complete the following sentences by drawing a ring around the correct line in each box.

(i) The time taken for one orbit by satellite A is the \_\_\_\_\_ one orbit by satellite B.

less than same as the greater than
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time taken for

(1 mark)

(ii) The force of attraction between the Earth and satellite A is the \_\_\_\_\_ force of attraction between the Earth and satellite B.

less than same as the greater than
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(1 mark)

(iii) The gravitational force of attraction between the Earth and a satellite provides a \_\_\_\_\_ force. (1 mark)

centripetal  
cosmic  
friction

The time taken for satellite A to complete one orbit is \_\_\_\_\_ (1 mark)

24 hours  
1 week  
1 month  
1 year

(b) Use phrases from the box to complete the sentences.

Geostationary orbit    high polar orbit    low polar orbit

(i) Communications satellites are usually put in a \_\_\_\_\_ (1 mark).

(ii) Monitoring satellites are usually put in a \_\_\_\_\_ (1 mark).