



Topic P4: where are we in space?

Self-study pack



Best practice:

- 1) Focus on one lesson summary at a time
- 2) Study the summary page
- 3) When ready turn to the key questions
- 4) Write answers out without checking
- 5) Check answers using next page
- 6) Repeat until get 100%

Quick practice:

- 1) Read a lesson summary
- 2) Turn to key questions and try to answer in head
- 3) Check answers using next slide

Big question: where are we in space?

We live on Earth, a planet constantly moving through the universe. It rotates on its axis every 24 hours, giving us day and night.

The sun's gravity is always changing our planet's direction, making it curve in an orbit around the sun. Each orbit takes one year. England has summer and winter because the Earth's axis is slightly tilted. For part of each orbit England is tilted towards the sun and absorbs more energy. This makes the UK hotter and gives us summer

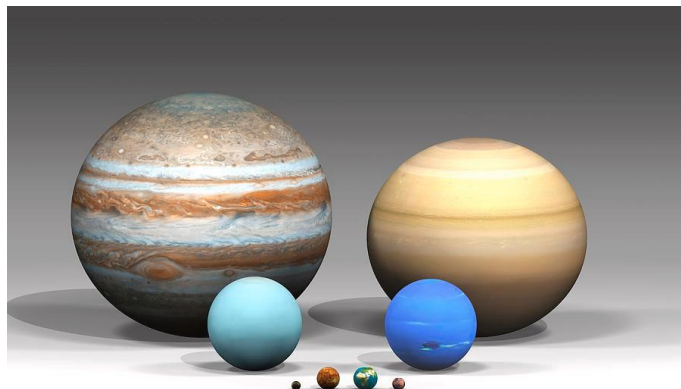
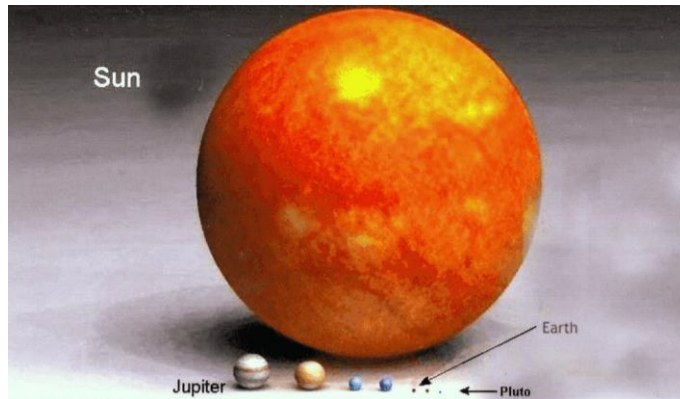
Our sun is an average-sized star among billions in the universe. It belongs to the Milky Way, a collection of billions of stars called a galaxy. The Milky Way is just one of around 200 billion galaxies, each containing billions of stars, that make up our universe.



L0: Introduction to space? (Optional lesson)

The sun is a star at the centre of the solar system. The sun radiates heat and light to all the planets in the solar system. It looks much bigger than other stars because it is much closer to the Earth. The solar system is made up of the sun, eight planets (and their moons), lots of asteroids and a few dwarf planets.

The four closest planets to the sun are all made of rock. The rocky planets are mercury, Venus, Earth and Mars. The four planets furthest from the sun are giant planets made of gas and have lots of moons. The gas giants are Jupiter, Saturn, Uranus and Neptune.





L0: Introduction to space? (Optional lesson)

1	What is the Earth's main source of light?
2	What is at the centre of the solar system?
3	What is the solar system?



L0: Introduction to space? (Optional lesson)

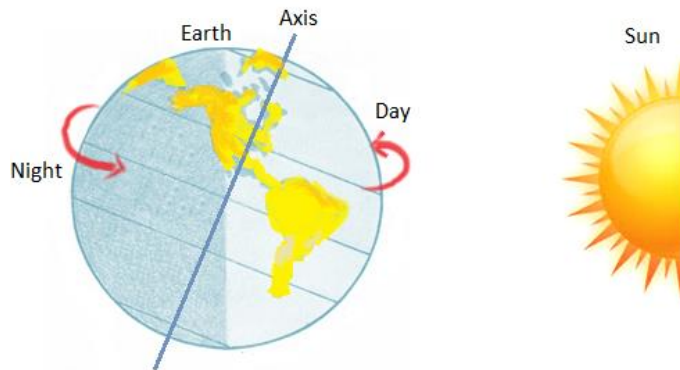
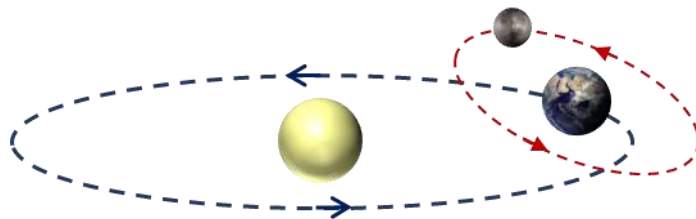
1	What is the Earths main source of light?	The sun
2	What is at the centre of the solar system?	The sun
3	What is the solar system?	The sun, eight planets (and their moons), lots of asteroids and a few dwarf planets



L1: What are days, months and years?

The earth is a giant sphere, and we live on its surface. The Earth seems flat because it is so big. The earth moves through space in a curved orbit around the sun and spins on its axis. The moon moves around the earth in a roughly circular orbit.

We experience night and day because of the earth's rotation. As the earth rotates, the half of the earth illuminated by the sun (day) and the half in shade (night) slowly changes. The Earth rotates once every 24 hours. A year is the time taken for the earth to complete an orbit of the sun and a month is the time taken for the moon to complete an orbit of the earth.





L1: What are days, months and years?

4	The earth is a giant _____ and we live on its _____
5	What causes night and day?
6	How long does it take the Earth to rotate once?
7	How long does the earth take to orbit the sun?
8	How long does the moon take to orbit the earth?



L1: What are days, months and years?

4	The earth is a giant _____ and we live on its _____	Sphere, surface
5	What causes night and day?	The rotation of the earth
6	How long does it take the Earth to rotate once?	24 hours
7	How long does the earth take to orbit the sun?	One year
8	How long does the moon take to orbit the earth?	One lunar month (28 days)



L2: What is gravity?

Objects are attracted to Earth by the force of gravity. When dropped, all objects fall towards the Earth. The gravitational force exerted by the Earth on other objects is a non-contact force so can act at a distance. Gravity always pulls objects towards the centre of the Earth – this means “down” is always towards the centre of the Earth wherever you are on its surface.

All objects exert a gravitational attraction on other objects. More massive objects exert a larger force of attraction. More massive planets have stronger gravity than less massive planets. The moon is less massive than the Earth so exerts a smaller gravitational pull.



Earth and moon to scale



L2: What is gravity?

9	Is 'the force of gravity' a contact or non-contact force?
10	What is a non-contact force?
11	On Earth gravity all pulls towards the _____ of the Earth
12	What does the size of a planet's gravity depend on?
13	Why is the moons gravity weaker than the Earth's gravity?



L2: What is gravity?

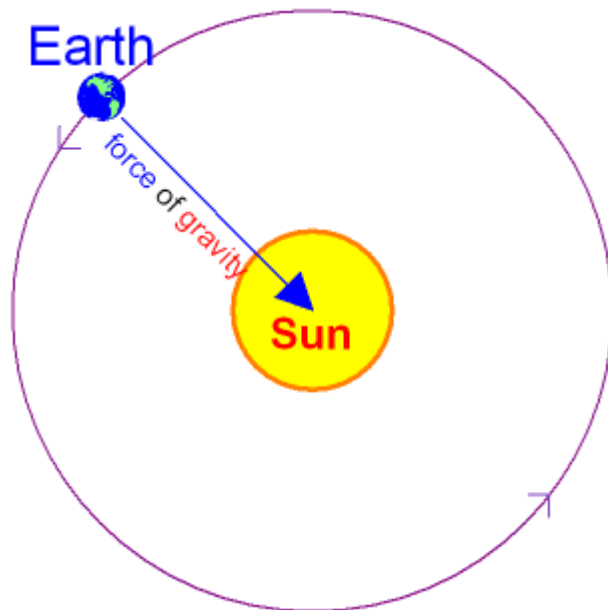
9	Is 'the force of gravity' a contact or non-contact force?	non-contact force
10	What is a non-contact force?	A force that can act at a distance
11	On Earth gravity all pulls towards the _____ of the Earth	centre
12	What does the size of a planet's gravity depend on?	How massive the planet is
13	Why is the moons gravity weaker than the Earth's gravity?	Because the moon is less massive than the Earth



L3. How does gravity effect the solar system?

The sun is the most massive object in the solar system, so it exerts the strongest gravitational pull. The gravitational pull exerted from the sun gets weaker with distance but does not stop. Even the outer planets are pulled towards the sun.

The sun exerts a pulling force towards the centre of the solar system. This means all planets have a resultant force that pulls them towards the centre of the solar system. This resultant force causes planets to change their direction and follow a curved path. Gravity causes the planets to orbit around the sun. Without the sun's gravity planets would move in straight lines and the solar system would fly apart.





L3. How does gravity effect the solar system?

14	What object in the solar system has the strongest gravity?
15	How does gravity change with distance from an object?
16	The resultant force on all planets acts towards the _____ of the solar system.
17	How does the resultant force on planets effect their motion?
18	What causes planets to orbit the sun?



L3. How does gravity effect the solar system?

14	What object in the solar system has the strongest gravity?	The sun
15	How does gravity change with distance from an object?	Decreases but does not stop
16	The resultant force on all planets acts towards the _____ of the solar system.	centre
17	How does the resultant force on planets effect their motion?	Causes them to change direction
18	What causes planets to orbit the sun?	The gravitational pull of the sun. (Gravity)

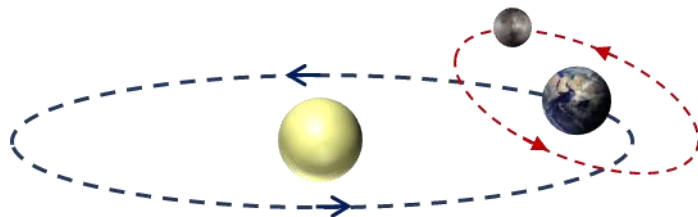
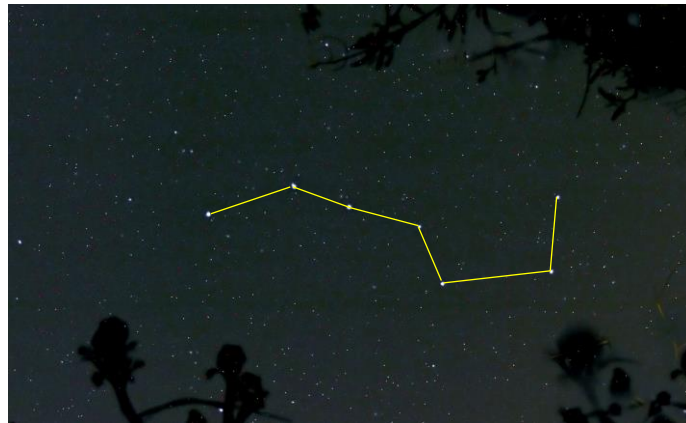


L4. Why does the night sky change? (optional)

The position of the moon and the stars in the sky changes during the night. The stars all move together so their patterns remain the same. We have names for some of the patterns formed by stars – we call them constellations.

The apparent motion of the stars through the sky happens because the Earth is spinning on its axis. Our view out to space gradually changes as the Earth spins this causes the stars and moon to seem to slowly move across the night sky.

The part of space we can see in the night sky changes as the earth orbits around the sun. This means that different constellations of stars are only visible for certain months of the year.





L4. Why does the night sky change? (optional)

19	Why does the moon move across the night sky?
20	What is a constellation
21	Why do stars appear to move across the night sky?
22	Why are different constellations visible at different points in the year?



L4. Why does the night sky change? (optional)

19	Why does the moon move across the night sky?	Because the Earth is rotating
20	What is a constellation	A pattern formed by stars in the sky
21	Why do stars appear to move across the night sky?	Because the earth is rotating
22	Why are different constellations visible at different points in the year?	because the Earth is orbiting the sun

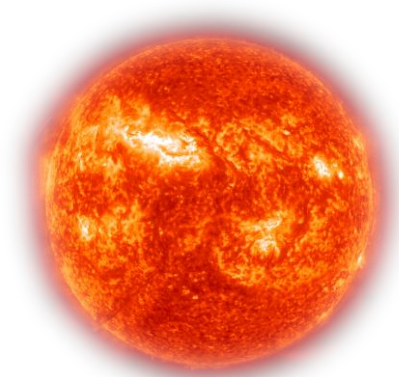


L5. Where are we in space?

All the stars we see are nuclear stores of energy which radiate light. The sun appears larger and brighter than other stars as it is much closer, so its radiation is less spread out.

We can only see a tiny part of the universe from Earth. The stars we see are a few hundred light years away. A light year is the distance light travels through space in one year. Sun light takes eight minutes to reach Earth - so one light year is x65,000 further than the distance to the sun.

Stars are found in groups called galaxies. Our galaxy contains billions of starts and is called the milky way. Scientists estimate there are around 200 billion galaxies in the universe.





L5. Where are we in space?

23	What is the main energy store in stars?
24	Why does the sun seem brighter and larger than other stars?
25	What is a light year?
26	What is a galaxy?



L5. Where are we in space?

23	What is the main energy store in stars?	Nuclear store of energy
24	Why does the sun seem brighter and larger than other stars?	It is much closer to Earth
25	What is a light year?	The distance light travels through space in one year.
26	What is a galaxy?	A group of billions of stars



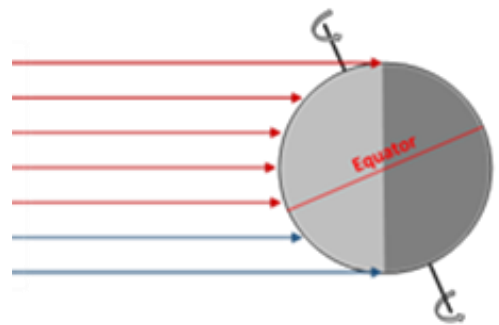
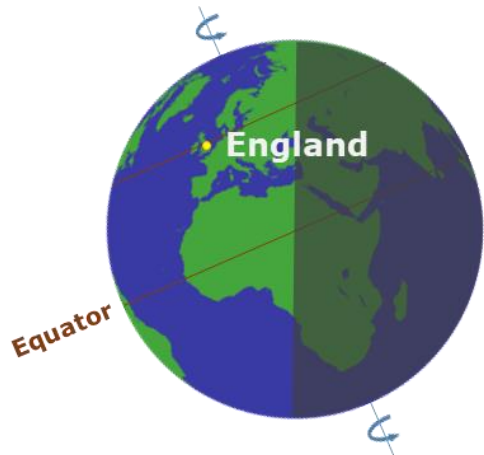
L6. Why do we get seasons?

The Earth rotates around an axis that goes through the north and south pole. The Earth's axis is tilted at an angle compared to the sun. We can divide the Earth into two halves: the northern hemisphere and the Southern hemisphere.

When one hemisphere is tilted towards the sun the other is tilted away.. When a hemisphere is tilted towards the sun more energy is transferred so it becomes hotter – we call this summer. This happens because:

- It is illuminated for longer than 12 hours each day.
- Sunlight is less spread out (more intense).

The hemisphere that is tilted towards the sun swaps every half orbit - every six months When it is summer in one hemisphere it is winter in the other.





L6. Why do we get seasons?

27	The Earth spins on an axis which is _____ at a _____ compared to the sun
28	What are the two hemispheres of the Earth?
29	How often does the hemisphere tilted towards the sun change?
30	What season is it when a hemisphere is tilted away from the sun?
31	Why is more energy transferred to a hemisphere from the sun in summer?



L6. Why do we get seasons?

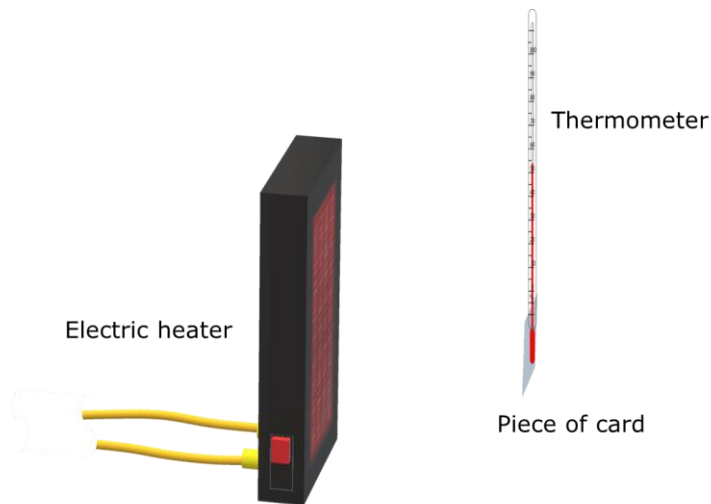
27	The Earth spins on an axis which is _____ at a _____ compared to the sun	Tilted, angle
28	What are the two hemispheres of the Earth?	Northern and south ern hemisphere
29	How often does the hemisphere tilted towards the sun change?	Every half orbit, every six months
30	What season is it when a hemisphere is tilted away from the sun?	winter
31	Why is more energy transferred to a hemisphere from the sun in summer?	Tilted towards sun so: (surface) is illuminated for longer each day Sun light is less spread out



L7. Why is it hotter in summer? (optional)

The sun has a massive nuclear store of energy and transfers energy to the Earth by radiating light. As the surface of the Earth absorbs light it heats up and its temperature increases. It is summer in the UK the northern hemisphere is tilted towards the sun. This means it is light for longer in the day and sun light is less spread out.

We can investigate either the effect of either the amount of time the surface is illuminated or how spread out the light is. Physicists only change one variable during an experiment so they can be sure it is the only thing effecting their results. Any other variable that could affect the results should be controlled.





L7. Why is it hotter in summer? (optional)

32	How many variables are usually changed in an investigation?
33	Why is only one variable changed during an investigation
34	Why do scientists control some variables during an investigation?



L7. Why is it hotter in summer? (optional)

32	How many variables are usually changed in an investigation?	One
33	Why is only one variable changed during an investigation	So, they can be sure it is the only factor effecting their results
34	Why do scientists control some variables during an investigation?	because they could affect the result