1 Structure of the Earth

What are the three layers of the Earth called? Draw a line from the label to the correct layer on the diagram.

core

crust

mantle

Some people say that the structure of the earth is a bit like the inside of a boiled egg. Describe one difference and one similarity between the inside of the Earth and the inside of an egg

difference = _____

similarity = _____

_____

Draw lines on the chart to match the layer to its description.

name of layer	description
core	made of many plates of solid rock
crust	made of hot semi-solid rocks that can move very slowly
mantle	made of very hot liquid iron and nickel that is magnetic

Which layer is the most dense? _____

Which layer is the least dense? _____

Which layer floats on the outside? _____

Teacher Note

Worksheet 8.3 uses a program from PhET
http://phet.colorado.edu/en/simulation/plate-tectonics

On the crust section, there is a zoom facility which allows you to look at the relative sizes of the layers. It might be useful to introduce the program here.

The program will be used in 8.3 to investigate what happens

- when convection currents move the plates and
- when one plate hits another and goes beneath (subduction)

2 Moving plates

Some students investigate how the Earth's plates move. They use a model to help them. They use these pieces of equipment:

- a metal baking tray
- some syrup
- some flat bits of polystyrene
- a tripod to balance the tray on
- a Bunsen burner

Match the equipment to what they represent in the model.

equipment	what it represents
Bunsen burner	the crust floating on the mantle
bits of polystyrene	the semi-solid mantle that moves slowly
syrup	the very hot core that gives out heat

Describe what the students should do in this investigation.

_____

_____

_____

_____

Describe what the students would see during this experiment.

_____

_____

The students talk about the experiment.

Robin

I think the polystyrene moves because it gets hot.

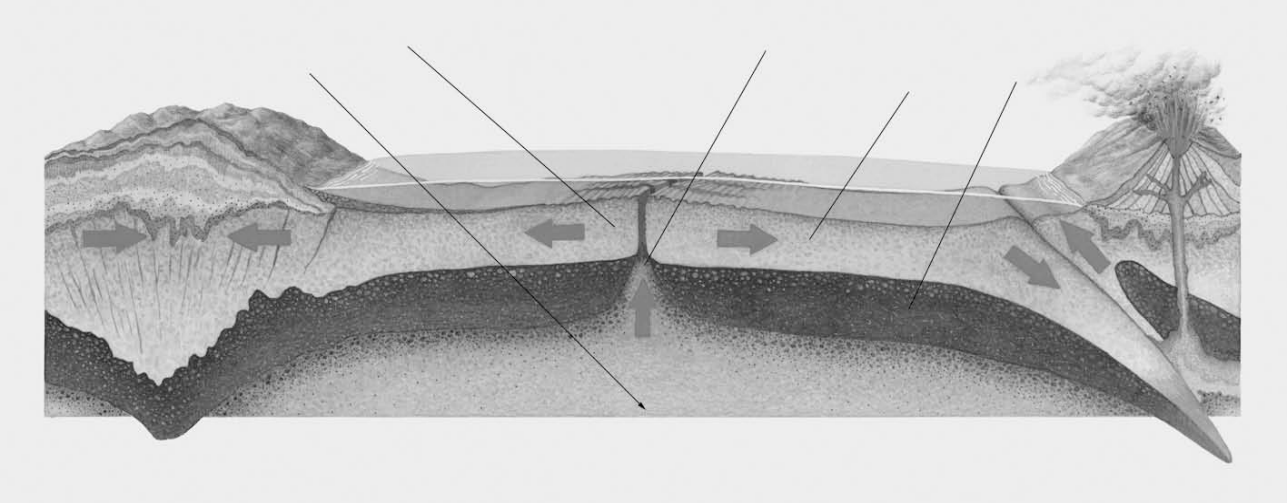
I think the polystyrene moves because of convection currents in the syrup.

Steve

Who is right?_____

Explain what causes the plates of the Earth's crust to move.

Label this diagram to help you.



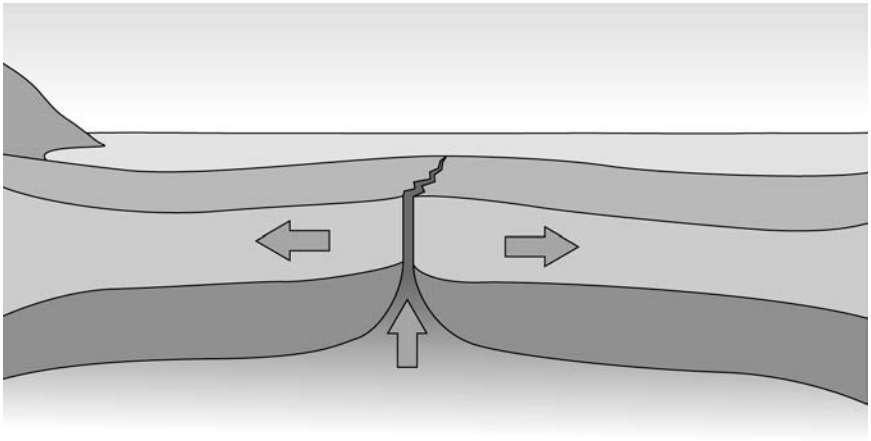
Choose words from this box to complete the labels:		
Crust	**hot magma rises**	**mantle**
plate in crust moves apart		**very hot core**

Sort these sentences into the correct order.

1	The core heats the rocks in the mantle to make magma
	This is upwards movement of hot magma is called a convection current.
	The plates move sideways.
	The plates in the crust thin and crack.
	The hot magma goes sideways when it hits the underneath of the crust.
	The magma rises up because it is hot.
7	This causes volcanoes and earthquakes.

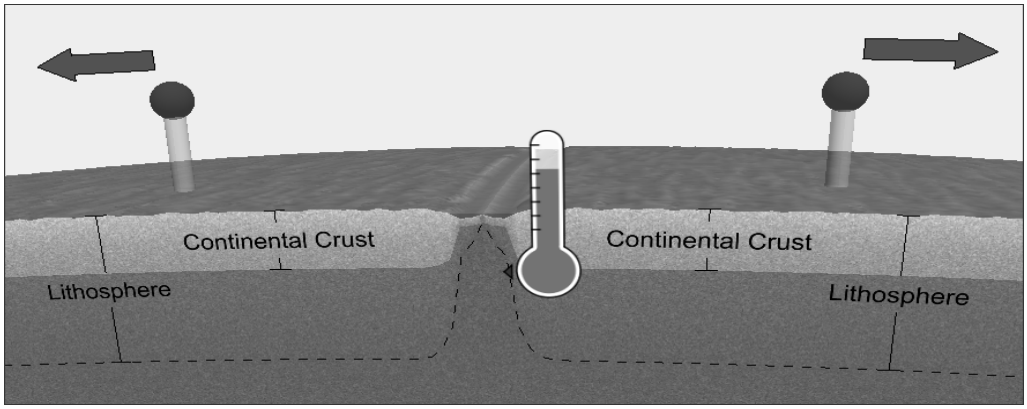
3 What happens at plate boundaries?

Some students use a computer program to investigate what happens at plate boundaries. This diagram shows the start.

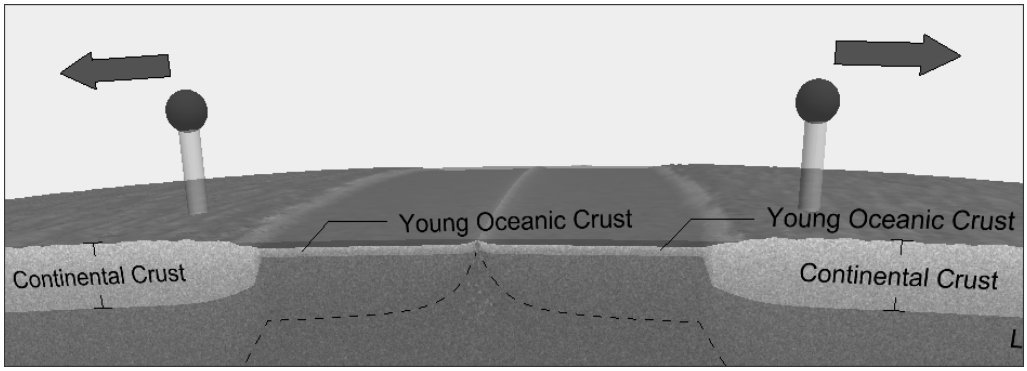


They use the program to find out what happens after 1 million years and 10 million years.

1 million years



10 million years



Describe what you can see has happened.

After 1 million years _____

_____

After 10 million years _____

_____

Use the program to find out what happens when the 2 plates move sideways (blue arrows) and what happens when the plates move together (green arrows).

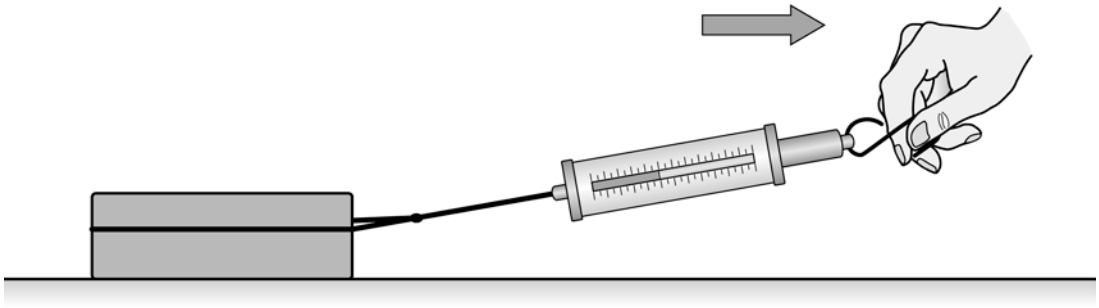
http://phet.colorado.edu/en/simulation/plate-tectonics

Use straight lines to join each plate movement to its effect.

Movement direction	Effect of plate movement (what happens)
plates move together	new crust is made
plates move sideways	mountains form
plates move apart	earth quakes happen

4 Investigating earthquakes

This diagram shows how to investigate earthquakes.



Label the diagram with words from this box.

direction of pull	**Newton meter**	**rough surface**
string	**wooden block**	

Describe what happens during this investigation.

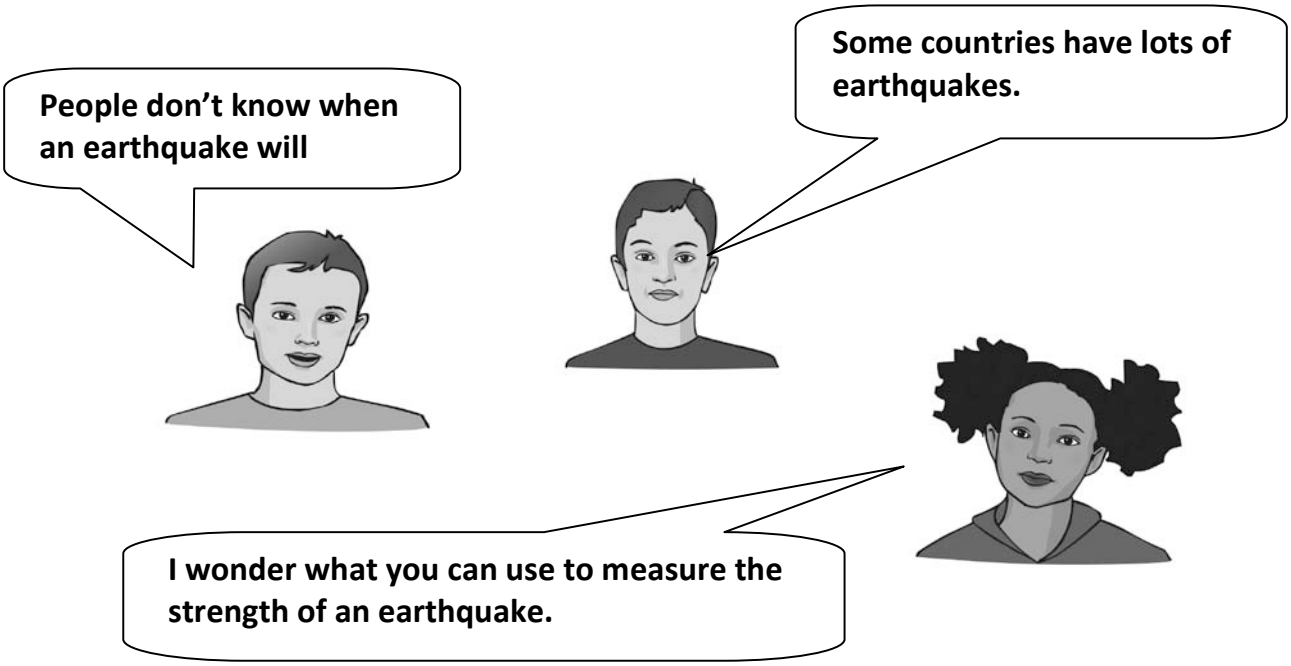
_____

_____

_____

_____

Some students talk about the experiment.



Watch the video about earthquakes.

Then use the internet or a text book to help you answer the following questions.

Why are earthquakes hard to predict in advance?

_____

What instrument is used to measure the strength of an earthquake?

_____

What is the Richter scale?

_____

Why do some countries have lots of earthquakes and others do not?

_____

_____

How do we work out where the centre of an earthquake is? Use a diagram to help you.

_____

_____

What is a tsunami?

_____

_____

Why are earthquakes dangerous?

_____

What happens during an earthquake?

_____

_____

Note to teacher:

Possible videos include:

http://www.bbc.co.uk/science/earth/natural_disasters/earthquake

http://video.nationalgeographic.com/video/environment/environment-natural-disasters/earthquakes/earthquake-montage/

http://video.nationalgeographic.com/video/environment/environment-natural-disasters/earthquakes/inside-earthquake/

http://video.nationalgeographic.com/video/environment/environment-natural-disasters/earthquakes/earthquake-101/

There are some good methods which *may* be suitable for L3 students on these sites:

http://www.geology.ar.gov/pdf/Locating_an_epicenter_activity.pdf

http://www.sciencecourseware.com/virtualearthquake/vquakeexecute.html

http://scearthquakes.cofc.edu/educators/toolkits/LocateEpicenter.pdf

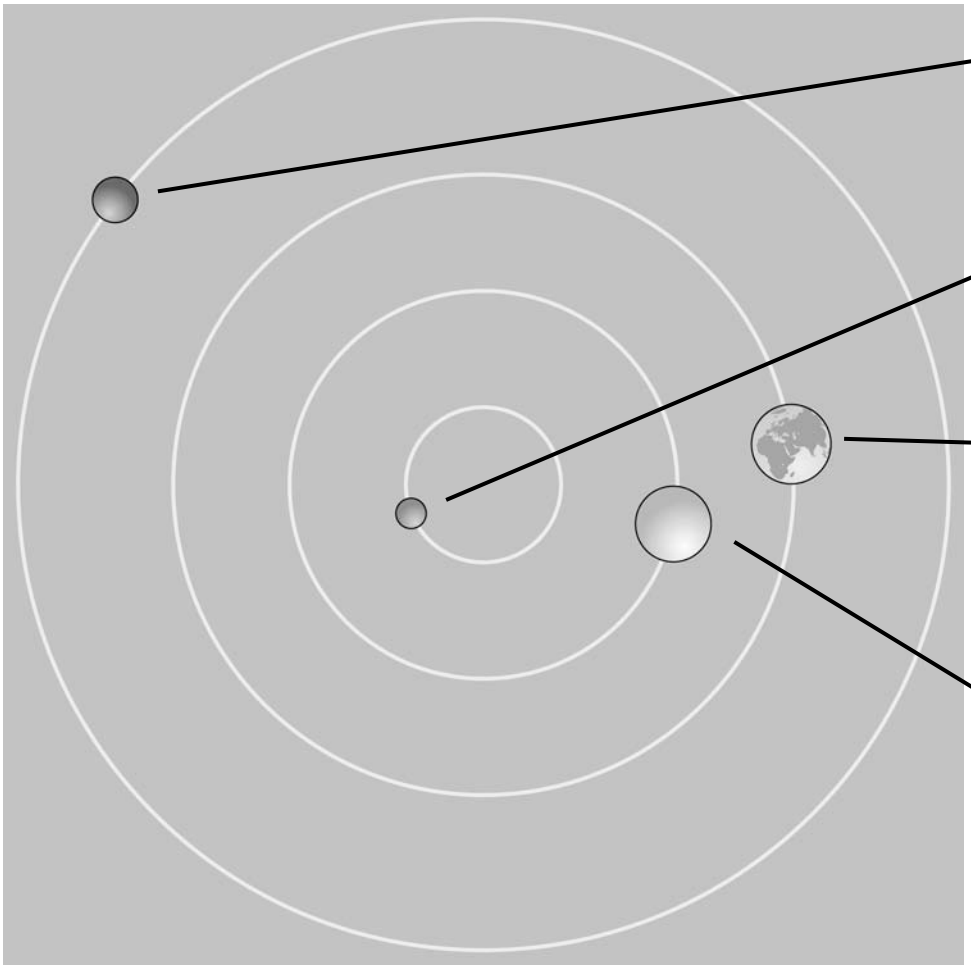
Also you may wish to look at the Friction program from Focus Educational http://www.focuseducational.com/ which simulates the experiment on this worksheet. (Essential Science 9-14 (larger picture) or Sc Investigation 1)

5 Our Solar System – planets

Use text books or the internet to help you fill in the blanks in these fact cards about the planets of our solar system.

The Inner Planets:

There are 4 inner planets. They are all rocky with solid surfaces.



M _____

M _____

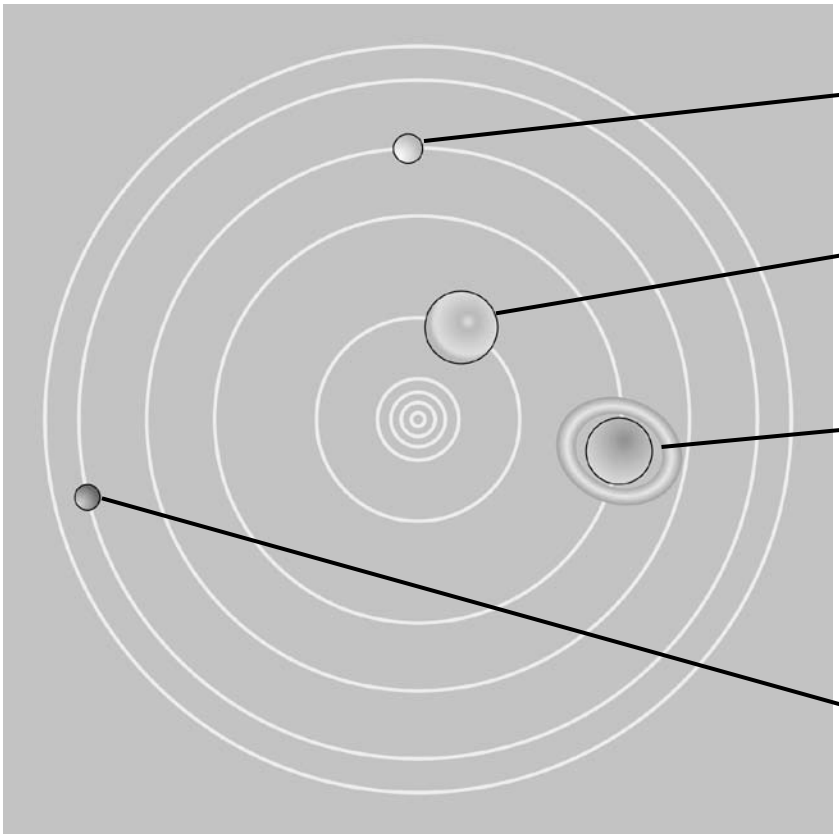
E _____

V _____

the planet which has	name of planet
the fastest speed	
a red colour	
the same size as the Earth	
a year almost twice as long as the Earth's	

The outer planets: sometimes called the gas giants

There are 4 of these and they are all made of gas.



U _____

J _____

S _____

N _____

the planet which has	name of planet
the longest year	
the biggest size	
lots of bright rings	
orbits the sun on its side	

Write the names of the planets underneath this rhyme to help you remember the order.

Mary's Violet Eyes Make John Sit Up Nights

_____

Most planets have moons, solid bodies which orbit around planets, in a similar way to how the planets orbit the Sun. The Earth has only one moon, called the Moon, Mars has two, named Phobos and Deimos. Jupiter, the largest planet in the Solar System, has at least 66!

Note to teacher:

You may find these sites useful

http://planetfacts.org/

http://www.childrensuniversity.manchester.ac.uk/interactives/science/earthandbeyond/planets/

http://en.wikipedia.org/wiki/Solar_system#Inner_planets

http://solarsystem.nasa.gov/planets/index.cfm

http://www.scienceu.com/observatory/facts/

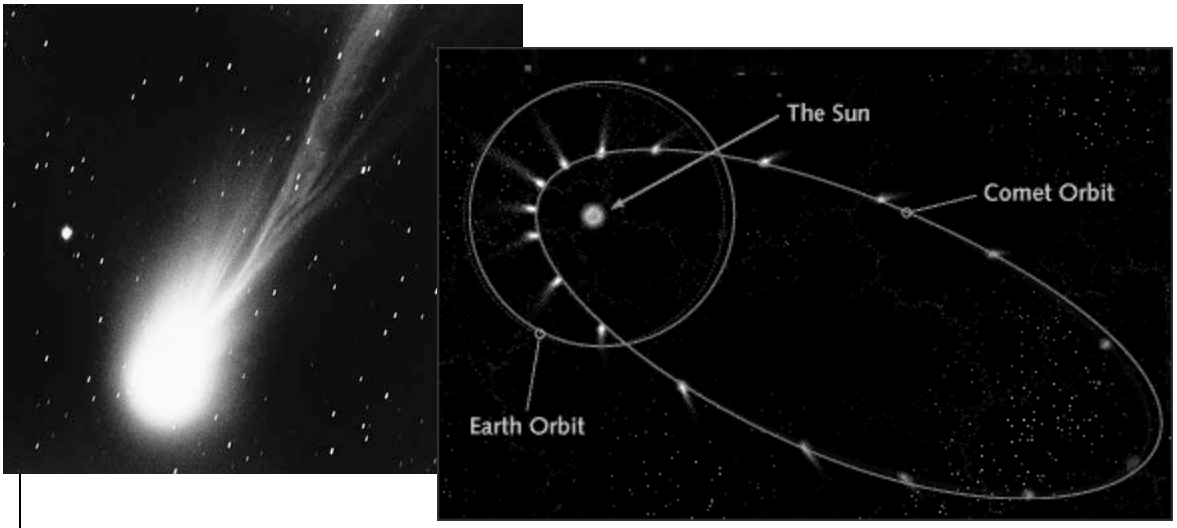
http://nineplanets.org/

6 Our Solar System – other objects

There are lots of other objects in our solar system. The main ones are comets, meteors and asteroids.

Use text books or the internet to help you fill in the blanks in these fact cards about these objects in our solar system.

Comets:



They are made up of _____ and are very _____

They move around the Sun in an _____ shaped orbit.

Some comets orbit quickly but others take _____ to orbit.

When comets get near the sun, they heat up and develop a long

_____ made of gas and _____

The tail of the comet always points _____

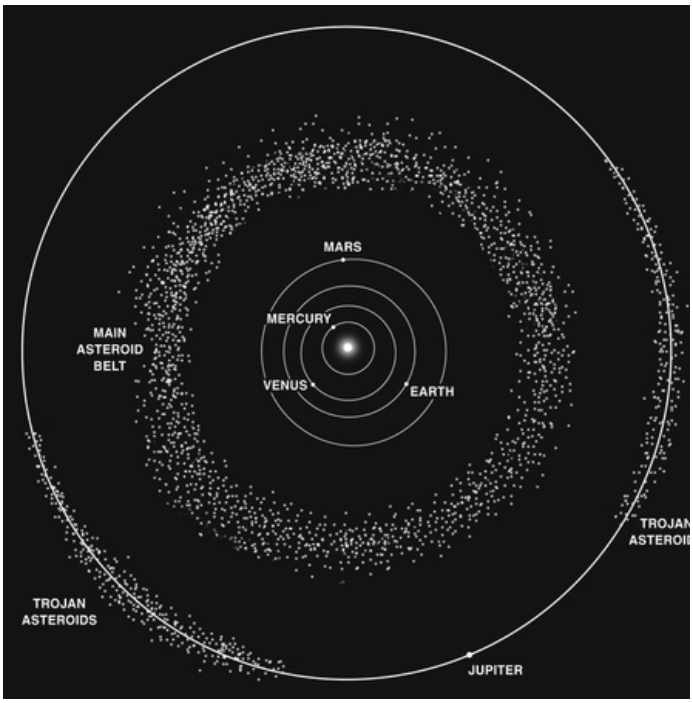
When comets cross the Earth's orbit, they can be seen with the

_____

Words to choose from:

away from the sun	**cold**	**dust**	**ice**
many years	**naked eye**	**oval**	**tail**

Asteroids:



Asteroids are lumps of _____

They have many different _____, some are as big as our

_____

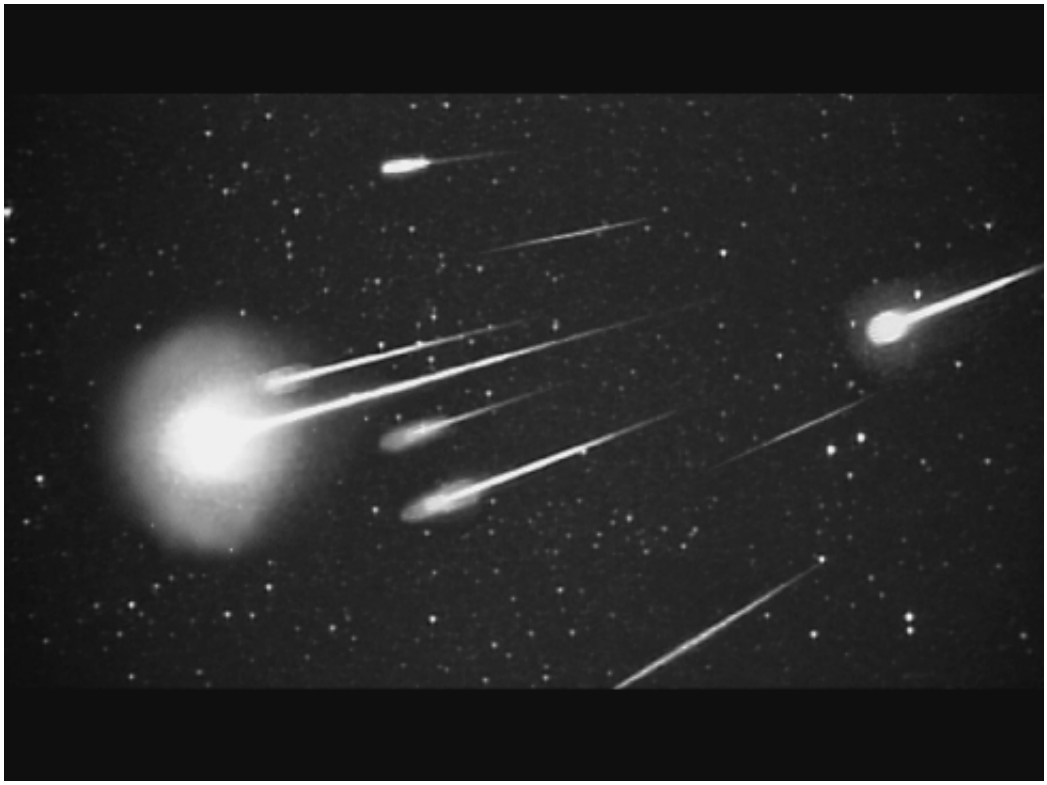
Most of them orbit the sun in a belt between Jupiter and _____

A few are found in the same orbit as _____

Words to choose from:

Jupiter **Mars** **Moon** **rock** **size**

Meteors:



Meteors are lumps of _____

that float in _____

When the Earth passes close to them,

some meteors hit the _____

Then they _____ as they move

and form a ‘shooting star’ across

the _____

Words to choose from:

Atmosphere **burn up** **rock** **sky** **space**

Notes to teacher:

Many sites are difficult for students at this level.

However, these might be useful:

http://cse.ssl.berkeley.edu/SegwayEd/lessons/cometstale/com3_a.html

http://solarsystem.nasa.gov/planets/index.cfm

http://science.nationalgeographic.com/science/space/solar-system/

http://www.space.com/53-comets-formation-discovery-and-exploration.html

http://www.space.com/51-asteroids-formation-discovery-and-exploration.html

this takes some practice: http://eyes.nasa.gov/exit.html

this is a downloadable booklet more suitable for a teacher than a student

http://solarsystem.nasa.gov/multimedia/downloads/21_Solar_System_FC1.pdf

this gives an extensive ppt which can be downloaded for use
http://solarsystem.nasa.gov/multimedia/download-detail.cfm?DL_ID=682

and its notes are
http://solarsystem.nasa.gov/multimedia/downloads/ExploreSolSysScript.pdf

7 Our place in the Universe

Put these objects in order of size.

Galaxy	moon	planet	solar system	star	universe

1, smallest = _____ 2 _____ 3_____

4 _____ 5 _____ 6. biggest = _____

Sandy has written some notes. Her teacher has marked some words wrong. Write the correct words in the box next to each sentence.

Our planet is called the ~~Moon.~~	
There are ~~seven~~ planets in our solar system.	
In the middle of our solar system is a star called the ~~Earth.~~	
The Moon is ~~closer to~~ the Sun than to Earth.	
Our solar system is ~~bigger than~~ a galaxy.	
The universe contains ~~only ten~~ galaxies.	
Our ~~solar system~~ is called the Milky Way	

Scientists have many ways of exploring our solar system and the stars.

Write what each of these is used for.

- telescopes are used for _____
- space probes are used for _____
- landers are used for _____

Space exploration is expensive to do. What are the benefits of space exploration?

_____

_____

Notes to teacher:

Specific devices to steer the students towards are:

Hubble telescope (one of the 4 great observatories):

http://en.wikipedia.org/wiki/Great_Observatories_program

Cassini space probe :
http://solarsystem.nasa.gov/missions/profile.cfm?InFlight=1&MCode=Cassini

Curiosity lander :

http://solarsystem.nasa.gov/missions/profile.cfm?Sort=Alpha&Letter=C&Alias=Curiosity

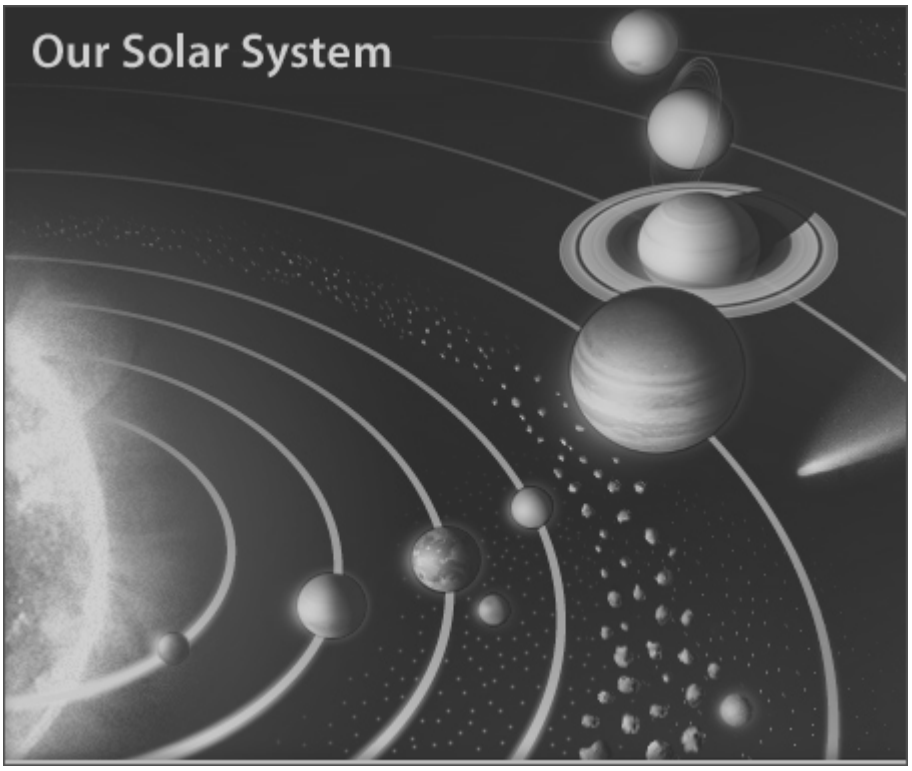
for space benefits this site is useful

http://en.wikipedia.org/wiki/NASA_spin-off

and this is a nice site to put on the data projector:

http://www.nasa.gov/externalflash/nasacity/index2.htm

8 Using data



	Diameter	Distance from the Sun	Year length	Day length	Average surface temperature in ˚C
	(compared to the Earth)	(compared to the Earth)			
Mercury	0.4	0.4	0.2	58.7	400 to -170
Venus	1.0	0.7	0.6	243	500
Earth	1.0	1.0	1.0	1	15
Mars	0.5	1.5	1.9	1	-60
Jupiter	11.0	5.2	11.9	0.4	-140
Saturn	9.1	9.5	29.5	0.43	-175
Uranus	4.0	19.2	84.0	0.75	-214
Neptune	3.9	30.1	164.8	0.8	-214

Use the data in this chart to answer the questions on the other side.

Which planet takes nearly 30 years to go round the sun? _____

Which planet is half the size of the Earth? _____

Which planet is the hottest? _____

Which planet can have liquid water on its surface? _____

Which planets have a longer day than ours? _____ & _____

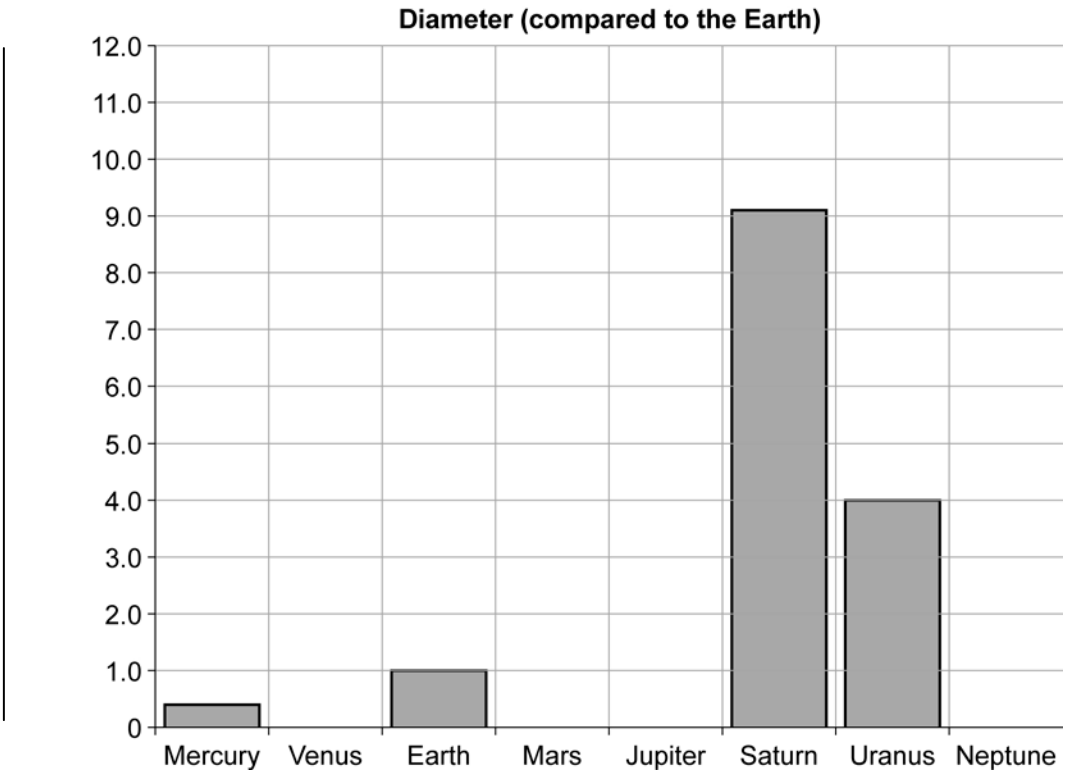
Which planet is thirty times further from the sun than the earth? _____

Write a pattern sentence about distance from the sun and the length of the year.

_____

Complete the bar chart below.

Include the correct labels on the axes.



_____

9 Living in space

We all need many things to live; food and water are just two of these things.

An astronaut (which means a space-sailor!) has to take everything with him, and sometimes this is a very long list.

1. Write down a list of things a spaceman needs for a two week stay in a space craft.

1. food	2. water
3.	4.
5.	6.
7.	8.
9.	10.

Space men have to wear special suits when they leave their spaceship.
Answer these questions to explain why they need spacesuits.

2. Why does every space suit need to take air?

   because there is no _____ in space and people have to _____

3. How much do people weigh in space?

   _____ so it is very important that they _____

4. What is the temperature in space?

   in the light it can get very _____ but usually it is very, very _____

5. What else does the spacesuit protect the spacemen from?

   in space there is _____ atmosphere to protect the spaceman from ionising

   _____ from the _____

6. How do spacemen move about in space?

   they have tiny _____ on their suits but are always attached by a

   _____ to their _____

air	**almost nothing**	**breathe**	**cold**	**exercise**	**hot**
line	**no**	**radiation**	**rockets**	**spaceship**	**sun**

Note to teacher:

The link from the spec is useful, but most of the fact sheets of downloadable (pdfs) information given is very ‘dry’ and at too high a reading level. The 4 main links are generally OK (Space Food, Space Wear, Space Work, Space Fun) but you will probably have to alter the zoom, to make it clear enough for a data projector.

You may find this link from Wikipedia useful for yourself, but it is rather too detailed for students.

http://en.wikipedia.org/wiki/Effect_of_spaceflight_on_the_human_body

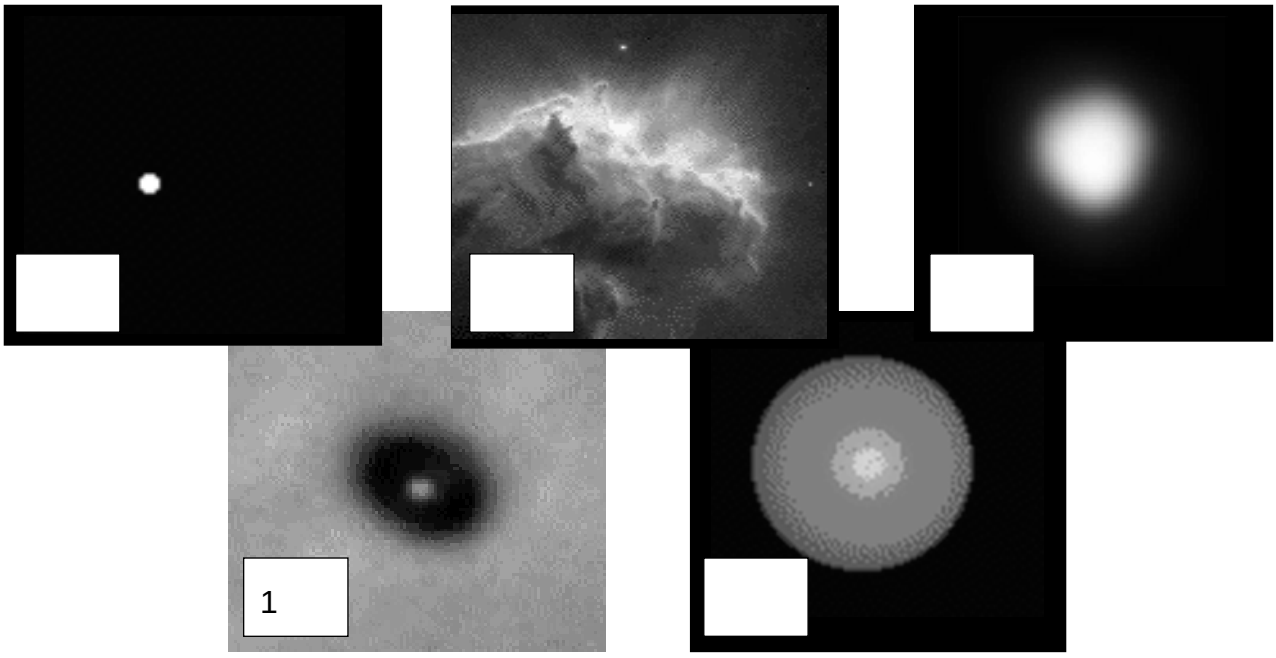
10 The life cycle of a star

Watch the video and make notes if you can.

Read the passage very carefully and use it to answer the questions that follow.

1. **A star is born from a nebula which is a giant cloud of hydrogen gas and dust in space.**
2. After a long time, gravity pulls the hydrogen gas together.
3. It begins to spin into a ball.
4. **It heats up and becomes a protostar.**
5. When the temperature reaches 15,000,000°C, nuclear fusion begins.
6. **It is now a main sequence star.**
7. Main sequence stars fuse hydrogen into helium and give out lots of energy.
8. It stays a main sequence star for billions of years.
9. When the hydrogen is used up, the outer part of the star starts to expand.
10. As it expands, it cools and glows red.
11. **The star is now a red giant.**
12. In the core of the red giant, helium fuses into carbon.
13. When all the helium is used up, the core collapses again.
14. When the core collapses, the outer layers of the star are thrown off.
15. These layers form a planetary nebula.
16. **The star is then a white dwarf.**
17. Eventually it cools and becomes a black dwarf.

Use the sentences in **bold** to help you sort these diagrams into order.



What is a nebula?

_____

What is a protostar?

_____

What causes the nebula to collapse into a ball?

_____

What temperature does the star start to fuse hydrogen?

_____

What does a main sequence star 'burn' as fuel?

_____

What does the main sequence star give out?

_____

How long does a star stay as a main sequence star?

_____

What happens to the star when it has used up all its hydrogen?

_____

What is a white dwarf?

_____

If you have time, use the internet to find out what happens to a star which is a lot bigger than our star (more massive). These words can help you.

supernova red supergiant neutron star black hole

_____

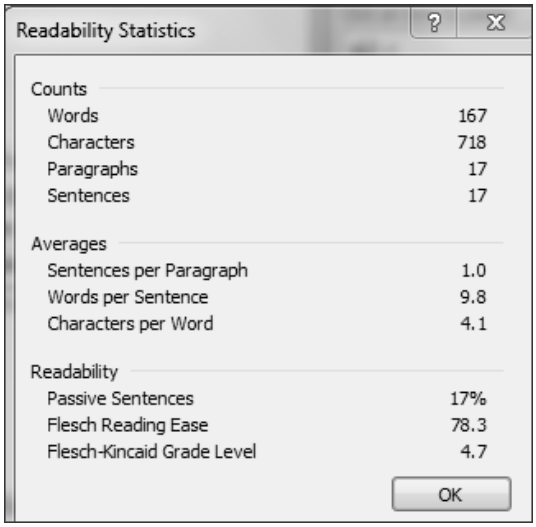
_____

_____

_____

Teacher Notes

The passage has been carefully edited so that it gives a full account, yet has a reading age of 10-11.



Nursery school	
Playgroup	1-2
Playgroup	2-3
Preschool	3-4
Pre-kindergarten	4-5
Kindergarten	5-6
Elementary school	
1st Grade	6-7
2nd Grade	7-8
3rd Grade	8-9
4th Grade	9-10
5th Grade	10-11
Middle school	
6th Grade	11-12
7th Grade	12-13
8th Grade	13-14
High school	
9th Grade (Freshman)	14-15
10th Grade (Sophomore)	15-16
11th Grade (Junior)	16-17
12th Grade (Senior)	17-18

http://www.bbc.co.uk/science/space/universe/sights/stars#p006szyk just the star formation

http://www.youtube.com/watch?v=PM9CQDlQI0A 5 mins nice life cycle for Institute of Physics....about the right level

http://www.youtube.com/watch?v=tnzRUYSiCnc A students version.....nice to show?

pdf from nasa

http://imagine.gsfc.nasa.gov/Images/teachers/posters/lifecycles/starchild.pdf

For your own background knowledge http://www.universetoday.com/24629/life-cycle-of-stars/ is about at the right level. Or this set of notes:

http://ircamera.as.arizona.edu/NatSci102/NatSci102/syllabus/syllabus.htm