DISCOVERING OUR WORLD
Discovering our Universe

The facts and figures used to describe our universe are so mind bogglingly large that they defy normal human comprehension. The universe itself is billions of years old and contains billions of galaxies, that in turn, contain billions of suns and solar systems. Our sun is a million times bigger than our earth, while a red giant star is many million times larger than our sun. The nearest star to our own is light years away and everything seems to be speeding away through space as a result of the Big Bang.

As awesome as the universe is, we are forced to view it from an earth-bound vantage point. Our closest neighbour is our moon that orbits the earth just as we orbit the sun, and as our solar system orbits the centre of our galaxy, the Milky Way. This clockwork precision is due to the forces of gravity and inertia that affect all bodies in the universe.

A little further out from the moon are the other eight planets that constitute our solar system. From the inner, smaller, rocky planets such as our own, to the outer gaseous giants such as Jupiter, all the solar system's planets were probably formed at around the same time as a gas and dust cloud coalesced into our sun and the various planets.

Further out from our solar system lie countless galaxies and suns. These suns range from stable yellow suns such as our own through to super-hot blue suns and cooler red suns. Just like living things, all suns have a life cycle that includes birth and death, often with spectacular results. When a sun has consumed all its energy it expands rapidly

Our Solar System.

to become a red giant. With time the gravitational forces at work will force the red giant to collapse in on itself to form either a super-dense white dwarf or to create a spectacular explosion, or supernova, that can give off the energy of a million suns.

We are only just starting to understand how our universe was formed and how it operates. As research continues in this field, expect many more discoveries about where we have all come from and what the ultimate future of our earth and solar system will be.

Word Check: Rotation, Revolution, Orbit, Gravity, Inertia, Corona, Eclipse, Red Giant, White Dwarf, Supernova, Light Year, Big Bang Theory.

Pre-viewing Questions:

1. Why did it take so long for people to accept that the earth orbits the sun and not the other way round?

2. A lot of space exploration is aimed at finding signs of life beyond the earth. Why do you think this is so important?

Discovering our World

DISCOVERING OUR UNIVERSE

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You can cut and paste text from the pdf file to compile your own set of questions or to enter links into a web browser.

ASTARTE resources

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Our Universe: QUESTIONS

Chapter 1: The Earth-Moon System

1. How many planets from the sun is our earth?
2. How did the ancient thinker Ptolemy see the solar system operating?
3. How did Nicolas Copernicus change this view of the solar system?
4. What is an astronomer?
5. What is the earth's rotation?
6. Why do the stars and our sun appear to move across the sky when in fact they are stationary?
7. What is the earth's revolution?
8. At how many miles per hour does the earth move around the sun?
9. What is an orbit?
10. How long does it take for the earth to complete one orbit around the sun?
11. How did Isaac Newton's work help explain how bodies orbit one another?
12. What does Newton's law of inertia describe?
13. What is gravity?
14. Why does the force of gravity vary between objects of different sizes?
15. Which Apollo mission successfully placed humans on the moon for the first time?
16. Why did the lunar astronauts find it was easier to hop on the moon rather than walk?

Chapter 2: The Solar System

17. What is our sun made from?
18. How much larger than the earth is our sun?
19. How far is the earth from the sun?
20. What is nuclear fusion?
21. Compared to the annual energy needs of the United States, how much energy does the sun produce in one minute?
22. What is the solar corona?
23. How many recognised planets are in our solar system?
24. How and when did our solar system form?
25. What is the difference between the inner and outer planets in our solar system?
26. Describe what the surface of Mars is like.
27. What causes the volcanoes on Jupiter's moon, Io, to erupt?

Chapter 3: Beyond the Solar System

28. What is a light-year?
29. What are the three major types of suns?
30. What are red giants and a white dwarfs?
31. How many years do we have before our sun begins to turn into a red giant?
32. What is a supernova?
33. A supernova observed in 1987 was 170,000 light years away from earth. How long before 1987 did this star actually explode?
34. What is a black hole?
35. What does the Big Bang theory describe?

FURTHER INFORMATION

A comprehensive guide to space by the New Scientist Magazine:
http://www.newscientistspace.com/home.ns

The Australian Astronomy Society:
http://www.astronomy.org.au/ngn/engine.php

The South Australian Astronomy Society:
http://www.assa.org.au/observing/welcome/

For information on our solar system:
http://www.museum.vic.gov.au/planetarium/solarsystem/solar.html

Information and images on our solar system:
http://www.seds.org/billa/tnp/

Our Universe: ANSWERS

Chapter 1: The Earth-Moon System

1. Our earth is the third planet from the sun.
2. Ptolemy imagined that the earth was at the centre of the solar system.
3. Copernicus was able to demonstrated that the earth rotated around the sun, not the other way around.
4. An astronomer studies the motion and properties of objects found in space.
5. The earth's rotation is the spinning of the earth as it revolves around its axis.
6. The stars and sun appear to move due to our viewpoint from the rotating earth.
7. The earth's revolution describes its yearly movement around the sun.
8. The earth travels at a speed of 66,000 miles (106,000 km) per hour.
9. An orbit is the path a body takes as it revolves around another object. The earth's orbit around the sun is not circular, but elliptical.
10. It takes a little over 365 days (1 year) for the earth to complete one orbit around the sun.
11. Newton was the first to describe the laws of motion and gravity that cause bodies to orbit one another.
12. Inertia means that a moving body will keep moving at a constant rate unless other forces are applied to it.
13. Gravity is the force of attraction between objects, no matter how big or small they might be.
14. Newton's law of gravity holds that the greater the mass of an object, the greater the gravitational forces it produces.
15. Humans landed on the moon in 1969 during the Apollo 11 mission.
16. As the moon's gravitational pull is only about one sixth as strong as it is on earth, and because of the bulky space-suits, it was easier to 'kangaroo hop' rather than walk.

Chapter 2: The Solar System

17. Our sun is a ball of gas that gives off enormous amounts of energy.
18. The sun is over a million times more massive than the earth.
19. The earth is 93,000,000 miles (148,800,000 km) from the sun.
20. Nuclear fusion occurs in the super dense core of the sun when hydrogen atoms are crushed together to form helium.
21. In one minute the sun releases enough energy to match the annual energy needs of the United States for 50 million years.
22. The solar corona is a band of extremely hot gasses that extends for millions of kilometres around the sun. The solar corona is clearly visible during a solar eclipse.
23. At present there are nine recognised planets in our solar system; Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto.
24. About 5 billion years ago a swirling cloud of gas and dust coalesced to form the planets.
25. The inner planets (Mercury-Mars) are smaller and rocky, while the outer planets are gas giants.
26. The surface of Mars is dry and barren but has features such as volcanoes and canyons that one would find on earth.
27. Io's volcanoes erupt because the immense gravitational pull of nearby Jupiter literally sucks the magma from Io's core.

Chapter 3: Beyond the Solar System

28. A light year is the distance light travels in one year (around 6 trillion miles or 9,600,000,000,000 km).
29. Depending on their size and energy, suns either look blue, yellow or red.
30. When a sun like ours uses up its hydrogen it expands to become a red giant. Eventually, the gravitational pull of the red giant becomes so great that it collapses to form a super-dense white dwarf.
31. Our sun has enough energy to continue as it is for another 5 billion years.
32. A supernova is an explosion caused when a large star collapses in on itself.
33. This supernova occurred 170,000 years ago as it took that long for the light to reach earth.
34. A black hole is a point, perhaps caused by a collapsing star, where gravity is so strong that nothing, not even light, can escape.
35. This theory holds that all the universe began at a single point about 15 billion years ago.

DISCOVERING OUR WORLD
Discovering our Planet Earth

Our planet earth is slowly revealing its mysteries to us - but this understanding is only recent.

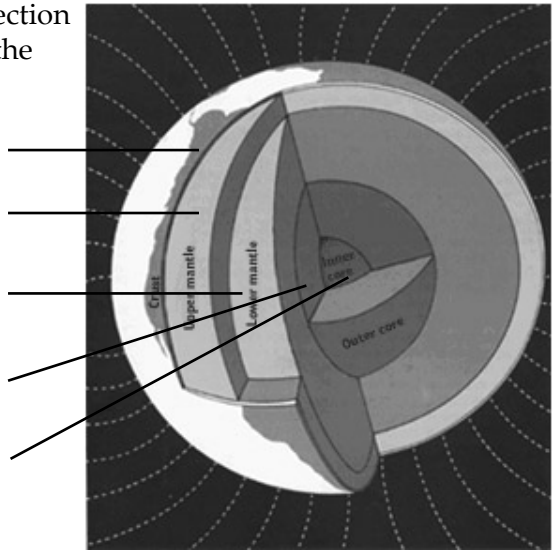
First outlined by German thinker Alfred Wegener, the theory of Plate Tectonics is now accepted. This theory holds that the earth's crust is divided into many plates, some oceanic, some continental, that all move independently of each other. Like a skim on milk, the continents are now understood to float on the molten mantle, pushed this way and that by convection currents within the mantle. The lighter plates such as the large, but oceanic Pacific Plate, move as much as 25 mm a year.

Even today we can only theorise on how this process works. Geologists envision the earth having a super-hot, but solid core, a molten outer core, then the semi-molten mantle and finally the solidified crust. Within this mix are rocks and minerals; many of which are exploited by humans for various purposes.

While minerals, a material with a unique chemical composition, and rocks, a mixture of two or more minerals, have the same origins, they are classified differently. Minerals are described in terms of their physical properties such as strength or lustre. Rocks, on the other hand, are classified by the method in which they were made. With unique histories, the three main forms of rock, igneous, sedimentary and metamorphic, are the basis of all rocks we have on earth.

The study of the earth's rocks and minerals

A cross section through the earth.



inevitably leads to questions about the history of the earth. Especially since fossils can be used to illustrate past environments, as well as the age of the rock in which that were found. In this way the four major geological era, the Precambrian, Palaeozoic, Mesozoic and Cenozoic are characterised by different forms of life slowly evolving over a vast geological time scale.

Word Check:
Plate Tectonics, Subduction, Minerals, Rocks, Igneous, Sedimentary, Metamorphic, Precambrian, Palaeozoic, Mesozoic, Cenozoic.

Pre-viewing Questions:

1. Can you think of any evidence that you have seen or heard that would indicate that the continents have not always been where they are today?

2. Name some ways in which rocks and minerals help make our lives better or easier.

Discovering our World
DISCOVERING OUR PLANET EARTH

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Our Planet Earth QUESTIONS

Chapter 1: Plate Tectonics

1. What is a geologist?
2. What is the difference between the inner and outer core of the earth?
3. What is the earth's mantle composed of?
4. How do the plates that make up the earth's crust move?
5. What did the German scientist Alfred Wegener contribute to our understanding of how continents move?
6. What evidence prompted Alfred Wegener to think that the continents had shifted with time?
7. What did Alfred Wegener call the super-continent from which all today's continents formed?
8. What is continental drift?
9. What drives continental drift?
10. If new rocks are being made at mid-ocean ridges, what happens to the old rock?
11. Why is plate tectonics important to people today?
12. What is the 'Ring of Fire'?

Chapter 2: Locating Places on the Earth

13. How do the equator and the prime meridian divide the earth?
14. Latitude lines run east-west. What degree latitude are the equator and the poles?
15. Where is zero degrees longitude located?
16. What information does a topographic map show?
17. What is a map legend?
18. What function does a map's scale perform?

Chapter 3: Rocks and Minerals

19. What is a mineral?
20. What is a rock?
21. How many known minerals are there?
22. Are minerals a renewable or non-renewable resource?
23. Minerals are classified by their physical properties. How are rocks classified?
24. What are the three major forms of rocks?
25. What does metamorphic mean?
26. Why do intrusive igneous rocks have strong, interlocking crystals?
27. What are extrusive igneous rocks?
28. What are sedimentary rocks?
29. How is coal formed?
30. How are metamorphic rocks formed?
31. What is the rock cycle?

Chapter 4: Earth History

32. What is geologic time?
33. How do fossils help map the history of the earth?
34. What is the earliest era of the earth?
35. What sort of life existed during the Precambrian era?
36. What forms of life existed during the Palaeozoic era?
37. Why is the Mesozoic era called the 'Age of Reptiles'?
38. In which geologic era do we live?

FURTHER INFORMATION

Lots of links to information on rocks and minerals:
http://www.teachers.ash.org.au/jmresources/rocks/links.html

The Australian Museum's Earth Science site:
http://www.amonline.net.au/earth_sciences/

Museum Victoria's great site on the prehistory of the earth:
http://www.museum.vic.gov.au/prehistoric/index.html

On Australian and other volcanoes:
http://www.volcanolive.com/contents.html

Our Planet Earth: ANSWERS

Chapter 1: Plate Tectonics

1. A geologist is a person who studies the earth.
2. The inner core of the earth is solid, while the outer core is molten.
3. The mantle is comprised of both molten and solid rock.
4. The plates move by sliding on the molten rocks of the mantle.
5. Alfred Wegener was the first to show that continents had not always been where they are now.
6. Alfred Wegener's saw that some continents joined together like a jigsaw and that the same rocks and fossils were found on continents now separated by ocean.
7. The super-continent is called Pangaea which means 'all lands' in ancient Greek.
8. Continental drift explains how the continents move across the earth's crust.
9. Sea floor spreading pushes the plates apart and sets them in motion.
10. On the outer edge of the plate the old rocks are forced down into the mantle at oceanic trenches in a process known as subduction.
11. Plate tectonics is important because a lot of geological activity such as earthquakes and volcanoes happen at plate boundaries.
12. The Ring of Fire describes the edge of the large Pacific plate around which volcanoes and earthquakes are frequent.

Chapter 2: Locating Places on the Earth

13. The equator cuts the earth into a northern and southern hemisphere, while the prime meridian cuts the earth into eastern and western hemispheres.
14. The equator is at zero degrees, while the poles are at ninety degrees latitude.
15. Zero degrees longitude is located on the prime meridian.
16. A topographic map shows the altitude of the landscape.
17. A map's legend tells the viewer how to interpret features such as roads and rivers that are shown on a map.
18. The scale on a map shows the relationship between the distance shown on the map to the actual distance in the landscape.

Chapter 3: Rocks and Minerals

19. A mineral is a material with a unique chemical composition.
20. Rocks form when several minerals combine into a complex structure.
21. There are over 2500 known minerals.
22. All minerals, even common ones such as salt, are a non-renewable resources as they take so long to form.
23. Rocks are classified according to how they formed.
24. The major forms of rock are igneous, sedimentary and metamorphic rocks.
25. Metamorphic means 'changed'.
26. Intrusive igneous rocks cool slowly beneath the ground so the crystals have time to grow and interlock.
27. Extrusive igneous rocks are a result of lava cooling on the earth's surface.
28. Sedimentary rocks form when eroded materials are compressed together, often under the sea.
29. Coal is formed when peat (the remains of swamp vegetation) is compressed into rock.
30. Metamorphic rocks are formed when igneous or sedimentary rocks are buried and transformed by heat and pressure into metamorphic rock.
31. The rock cycle explains how rocks change from one form to another over time.

Chapter 4: Earth History

32. Geologic time is used to describe the long time it takes to observe changes in things such as rocks.
33. Fossils show what plants and animals were around in the past and changes in these plants and animals help geologists date strata of rock.
34. The Precambrian era is the earliest geological era on earth.
35. At the end of the Precambrian single cell plants and animals (algae, bacteria) appeared.
36. The Palaeozoic era is characterised by more complex multi-celled plants and animals.
37. During the Mesozoic era reptiles, including dinosaurs, dominated the earth.
38. We live in the Cenozoic era.