

**KEEP IT SIMPLE SCIENCE**

Plate Tectonics

Year 9 Earth & Space Sciences

KISS topic number → Year level designation in Nat. Curriculum

Topic 17.9E

Science Understanding Strand
 B = Biological Sciences
 C = Chemical Sciences
 E = Earth & Space Sciences
 P = Physical Sciences

WORKSHEETS

Attention Teachers

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1.

KISS Worksheets are designed to consolidate students' knowledge & understanding and/or develop or practice a skill, such as graphing, calculating, reporting prac.work, etc. Some are suitable to issue as homework assignments. Some can be used as a "quick quiz".

2.

In both the "PhotoMaster" and "OnScreen" resources, an information box (as shown) indicates the appropriate point for each worksheet to be completed.

Please complete
Worksheets 1 & 2
before going on.

3.

KISS Worksheets are formatted for photocopying so that they may be used as in-class paper exercises, quiz tests or homework assignments.

They can also be converted for use as Microsoft Word[™] documents, or with software allowing annotations, (eg Microsoft OneNote[™]) or apps such as "Notability"[™] and "iAnnotate PDF"[™] in tablets & iPads. This allows KISS Worksheets to be completed by students in their computer, then submitted by email, for example.

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Answer Section begins on p9

*Suggested answers to the "Discussion / Activity" pages
("OnScreen" resources) are in a separate file in the folder for this topic.*



Make your own "Mind-Map" TITLE PAGE.
 Cut out the boxes. Sort them into an appropriate
 lay-out on a page of your workbook, then glue them down.
 Add connecting arrows and colour in.

Plate Tectonics

**Evidence for
the Moving
Plates**

**Structure
of the Earth**

Alfred Wegener
& Continental
Drift

Locations of
Volcanoes &
Earthquakes

New Technology,
New Evidence

**The Moving
Plates**

**Tectonic
Australia**

Spreading,
Collision &
Subduction

**Tectonic
Impacts**

Sea-Floor
Evidence

Fossil & Mineral
Evidence

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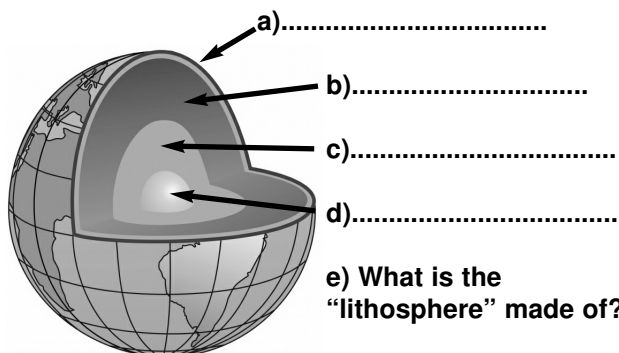


Worksheet 1

Student Name.....

Earth & Lithosphere

1. Label this diagram to identify the layers of the Earth.



3. Give an outline of how we know about the layer structure of the Earth.

4.

a) What does a "seismometer" measure?

b) What are "P" & "S" waves & how can they be used to find the distance to an earthquake?

2. What is the major difference between lithosphere under a continent compared to under the ocean floor?

c) Apart from learning about the Earth itself, what is a practical reason for seismology?

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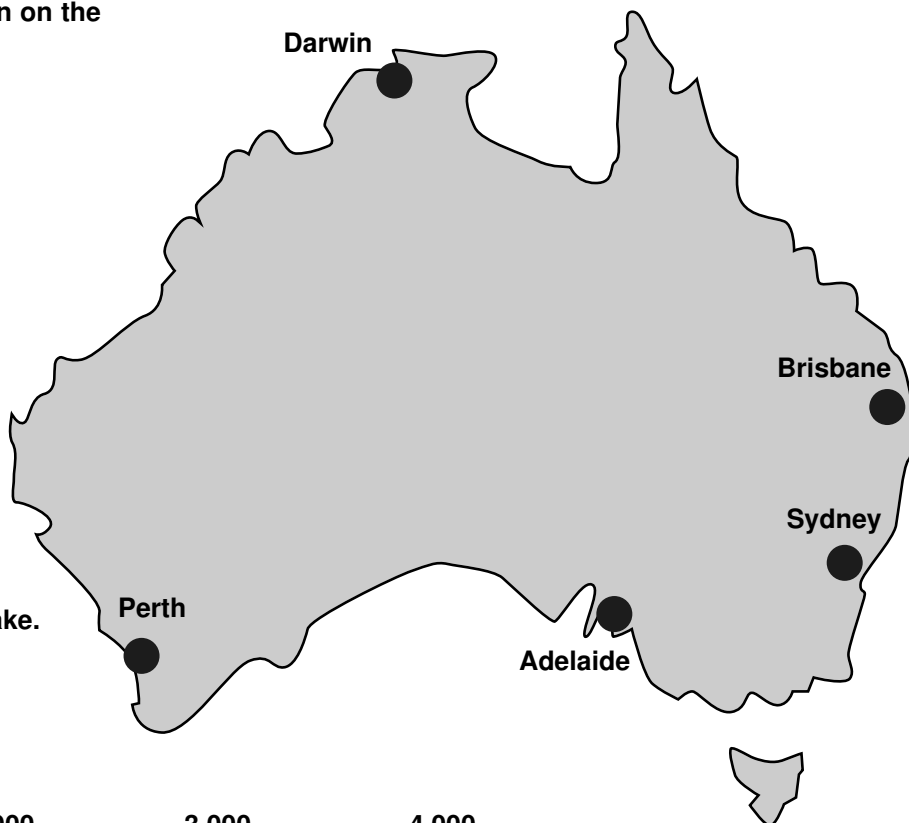
Worksheet 2

Locating an Earthquake

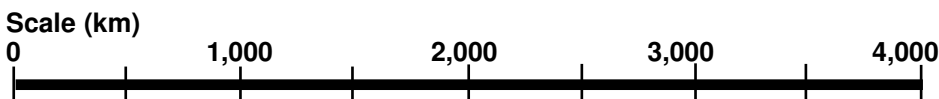
Student Name.....

Earthquake shock waves were detected by seismometers in all the cities shown on the map. Here are data from 3 stations.

City	P-S time gap	Distance (km)
Adelaide	271s
Brisbane	238s
Darwin	137s
Sydney
Perth



- Each 1 sec gap between the P and S waves = 7km. Calculate the distance from the 3 stations to the earthquake.
- Use compasses to locate the earthquake epicentre.
- Complete the missing data for Sydney & Perth.





Worksheet 3

Student Name.....

Plate Tectonics

Fill in the blank spaces.

The theory of “a)..... Drift” was proposed by Alfred b)..... in 1915. He thought that the continents had once been joined together and had moved apart. His evidence included identical c)..... and rock formations which are now separated by oceans. His theory was not well accepted, mainly because he could not explain d).....

During 1950-1970’s new technologies produced new evidence. e)..... allowed mapping of the f).....

Deep-sea drilling allowed g)..... to be collected, and the h)..... in the rocks could be measured by magnetometers.

From the accumulation of evidence we now believe that the lithosphere is made up of a number of separate i)..... which slide across the j)..... being pushed by slow-moving k)..... which carry heat from the earth’s l).....

Two adjoining plates must either m)....., or n)....., or slide sideways past each other.

It is the sudden movement of a plate which causes most o).....

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Worksheet 4 When Plates Move

Fill in the blank spaces.

If 2 plates move apart, a)..... immediately erupts to fill the gap and create new b).....

This occurs mainly along the “c).....” ridges on the ocean floors. Many small d)..... occur as the plates move apart. In a few places the erupting material builds up enough to form an e).....

Where plates collide, different things can occur depending on the plate types. When “oceanic plates” collide, one of them will be pushed down into the mantle, or “f).....”. When the plate bends down sharply there is a g)..... trench. As rock melts and moves upwards, a chain of volcanic h)..... may form.

Student Name.....

The plate movements may be irregular and sometimes produce huge i)..... Since these occur under water, they may set off a j).....

Subduction also occurs if the collision is between an oceanic plate and one carrying a k)..... The continent edge is l)..... forming a m).....

If 2 continents collide neither one can be n)..... Both are o)..... and creating a mountain range such as the p)..... range.

We believe that 200 mya, all the continents were joined together in a “supercontinent” called “q).....”

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Worksheet 5

Student Name.....

Evidence of Moving Plates

Fill in the blank spaces.

The most obvious evidence is the a)..... of some continents which seem to fit together like a jig-saw. This is especially true along the “b).....”, rather than the coastlines.

There are many examples of identical c)..... of plants and animals found on different continents. Similarly, there are identical d)..... and mineral deposits now on separate continents.

Many pieces of evidence have come from studies of the deep ocean floor, especially along the “e)..... Ridges”.

There are a series of parallel ridges, with a central f)..... The rocks in the centre are the g)..... (age) and they get progressively h)..... as you move further from the ridge.

The ocean sediments are very i)..... at the ridge and get j)..... as you move outwards.

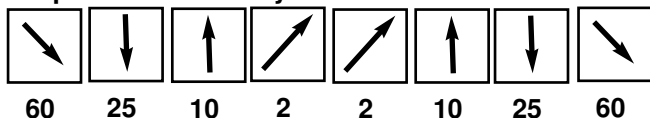
There are a series of matching “bands” of k)..... in the rocks on either side of the rift. All these facts point to the oceanic crust being created and spreading from the central rift.

Seismology patterns give more evidence. The vast majority of l)..... and occur along the plate m).....

Worksheet 6 Plate Tectonics

Student Name.....

1. This data was collected from rocks on either side of a mid-ocean ridge. The arrows show the magnetic field direction of each sample and the numbers are the approximate age of the rock sample in millions of years.



a) How would you explain the patterns in this data?

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b) Where, in this sequence of samples, would you expect to find the thickest layers of sediments on top of the rock? Explain.

2. Fossils of a plant called *Glossopteris* have been discovered in Sth America, Africa, India, Australia and Antarctica. This plant lived about 180 million years ago. It had soft seeds without a seed case, so it is unlikely that seeds could survive drifting across an ocean. Explain the distribution of the fossils.

3. Most of the active volcanoes in the world occur in the “Ring of Fire” around the perimeter of the Pacific Ocean. Why?

4. Australia has no active volcanoes and experiences few earthquakes. Why is that?



Worksheet 7

Student Name.....

The Changing Map of the World

1. Describe the supercontinent we have called "Pangaea".

3. a) Which parts of Australia are the most ancient?

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b) What sort of tectonic events caused the formation of much of eastern Australia?

2. About 180 mya, Pangaea split into 2 parts, called "Laurasia" & "Gondwana".

a) List the modern continents which comprised Laurasia.

c) What has been the main geological process in Australia for the last 100 my?

b) List the 5 major "chunks" of the modern world that were once Gondwana.

d) Why is modern Australia a fairly quiet place, tectonically?

Worksheet 8 Tectonic Impacts

Student Name.....

Volcanoes can have major effects on the atmosphere. Some eruptions can inject a)..... into the high atmosphere. This b)..... sun-light and can c)..... the Earth for several years.

There are many impacts on the lithosphere as the plates move around. k).....- spreading widens the oceans. At a l)..... zone, m)..... islands grow from the ocean floor, and n)..... ranges are created along the edge of a continent.

Gases released also have effects. Sulfur dioxide can cause d).....-rain. Huge amounts of e)..... gas are released and this can cause "f)..... warming".

The biosphere can be affected both negatively and positively.

Effects on the hydrosphere include g)....., caused by underwater earthquakes. Long-term changes to the ocean basins and positions of the continents cause h)..... changes. In an "ice-age" the sea-level i)..... If ice-caps totally melt, the sea-levels rise by over j)..... metres.

Volcanic eruptions can destroy a local ecosystem, but global climate change can cause a o)....., such as when 95% of living things died out about 250 mya.

Tectonic events also create new p)....., such as q)..... around volcanic islands. Many important chemicals are r)..... by the creation and subduction of the tectonic plates.



Topic Test

Plate Tectonics

Student Name

Score = / 40

Answer all questions in the spaces provided.

1. (6 marks)
Match each description to an item from the list. To answer, write the letter (A,B,C, etc) of the list item beside the description.

Description	matches with	List Item
a) Layer of crust with mantle rock attached.
b) Study of earthquakes and their shock waves.
c) Scientist who first proposed "Continental Drift".
d) Zone where a tectonic plate is destroyed.
e) Result of 2 continental plates colliding.
f) Seismic water wave created by underwater earthquake.

List Items Not all will be used. Some may be used more than once.

- | | |
|-----------------|-------------------|
| A. subduction | E. Wegener |
| B. island chain | F. mountain range |
| C. lithosphere | G. seismology |
| D. tsunami | H. Einstein |

2. (6 marks)
a) Label the layers of the Earth

i).....

ii).....

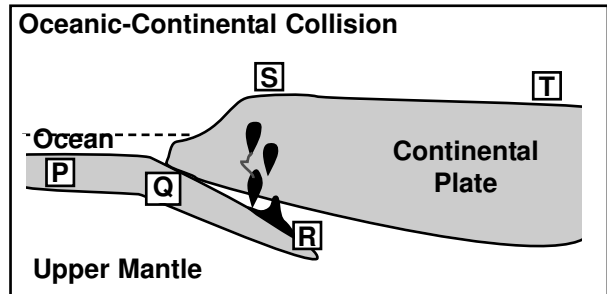
iii).....

iv).....

b) Give a brief outline to explain how we know about this layer structure.

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3. (5 marks)
This diagram shows a collision between 2 tectonic plates. Answer the following by using the positions P,Q,R,S & T.
(may be used more than once, or not at all)



- In which position:
- a) would there probably be a mountain range?
- b) would there be a deep-ocean trench?
- c) might there be a volcano?
- d) would be the focus of an earthquake?
- e) Name a place on Earth where a collision like this is occurring.
-

4. (5 marks)
a) Describe a piece of evidence from sea-floor studies which supports the theory of Plate Tectonics.

b) Describe some fossil evidence which supports the theory.

c) Describe the pattern of earthquakes which helps us locate plate boundaries.



Topic Test (cont.)

5. (4 marks)

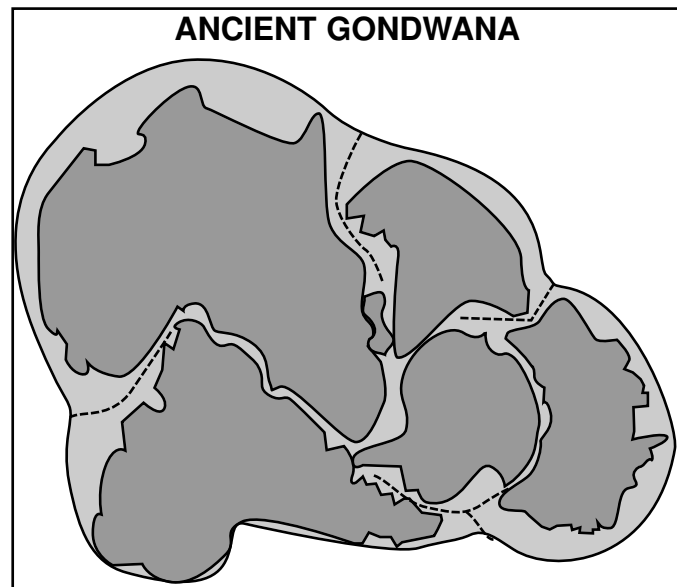
a) What is meant by the “supercontinent supercycle”?

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b) Scientists have found that there is a connection between the “super-cycle” of the continents and world climate. Give an outline of this general connection.

6. (5 marks)

a) The diagram shows the ancient continent called “Gondwana”. Label the modern names of its parts.



7. (5 marks)

a) What is a tsunami and what causes it?

b) What is a “pyroclastic flow”? Comment on whether this is dangerous to people.

c) What is a “lahar”?

8. (4 marks)

a) Explain how a lot of volcanic activity can cause the Earth’s climate to cool.

b) Explain how volcanic activity can also cause the Earth’s climate to warm up



Answer Section

Worksheet 1

1.
a) crust b) mantle
c) outer core d) inner core

2.
Thickness. Very thick under a continent, much thinner under the ocean floor.

3.
Knowledge has come from seismology, from studying the way that earthquake shock waves behave as they pass through the Earth.

4.
a) Earthquake shock waves.
b) They are different types of shock waves which travel at different speeds. P waves always arrive before S waves. The time difference allows measurement of distance to the 'quake.
c) To predict possible tsunamis or volcanic eruptions and allow evacuation of danger areas.

Worksheet 2

1. Distances (nearest 10km)
Adelaide 1900 km
Brisbane 1670 km
Darwin 960 km
2. Epicentre is on southern coast of Gulf of Carpentaria.
3. Missing data (approx)
Sydney 295 s 2060 km
Perth 410 s 2860 km

Worksheet 3

- a) Continental b) Wegener
c) fossils
d) what could make the continents move.
e) Sonar f) ocean floor
g) rock samples h) magnetism
i) plates j) mantle
k) convection currents
l) core m) move apart
n) collide o) earthquakes

Worksheet 4

- a) molten rock b) crust
c) mid-ocean d) earthquakes
e) island f) subducted
g) deep ocean h) islands
i) earthquakes j) tsunami
k) continent l) buckled/folded
m) mountain range n) subducted
o) folded & faulted p) Himalaya
q) Pangaea

Worksheet 5

- a) shape b) continental shelf
c) fossils d) rocks
e) mid-ocean f) rift valley
g) youngest h) older
i) thin j) thicker
k) magnetism
l) earthquakes & volcanoes
m) boundaries

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Worksheet 6

1.
a) The crust keeps splitting open in the middle and new crust rock forms in the gap. This is why the rock is youngest in the middle and gets older outwards. This also explains the symmetrical pattern of magnetism on either side of middle.
b) Furthest away from the centre, because the oldest rocks have had more time for sediments to settle.
2. The plant grew all across the super-continent and fossils formed. Later, the fossil deposits have been separated by movements of the plates.
3.
There are plate boundaries all around the ocean perimeter. Volcanoes occur (mostly) near the edges of plates.
4.
Australia is not near the edge of a plate, so there is little tectonic activity.



Answer Section (cont.)

Worksheet 7

1. Pangaea was made up of all the world's major continents joined together.
2.
 - a) Nth America, Greenland, Europe, Asia.
 - b) Africa, Sth America, India, Antarctica & Australia.
3.
 - a) Western Australia.
 - b) A subduction zone formed where 2 plates were colliding. This caused mountain building and volcanoes creating eastern Australia. Erosion into shallow seas built vast sedimentary deposits.
 - c) Erosion. (That's why Aust. is so low and flat)
 - d) Because it is in the centre of a tectonic plate. Volcanoes and earthquakes tend to occur at the boundaries, not in the middle.

Worksheet 8

- a) fine dust particles
- b) reflects
- c) cool
- d) acid
- e) carbon dioxide
- f) greenhouse
- g) tsunamis
- h) climate
- i) falls.
- j) 100
- k) sea-floor
- l) subduction
- m) volcanic
- n) mountain
- o) mass extinction
- p) habitats
- q) coral reefs
- r) recycled

Topic Test

1.
 - a) C
 - b) G
 - c) E
 - d) A
 - e) F
 - f) D
2.
 - a) i) crust
 - ii) mantle
 - iii) outer core
 - iv) inner core
- b) Seismology studies.
Layer structure figured out from the way earthquake waves behave as they travel through the Earth.

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3.
 - a) S
 - b) Q
 - c) S
 - d) Q or R
 - e) Pacific coast of Sth America.
(Andes Mtns)
4.
 - a) Rocks are youngest at the mid-ocean ridges and get older as you move away in each direction. This is evidence for "sea-floor spreading".
 - b) Fossils are found on different continents which match the "jig-saw" idea. The plant/animal lived all over an ancient super-continent, and fossils have been separated by plate movements.
 - c) Most earthquakes occur along the plate boundaries.
5.
 - a) The Earth's continents periodically join together in one vast continent, then split apart separately, then join up again.
 - b) When there is one super-continent the world climate is generally cold and dry. When there are many continents the climate is warmer and wetter.
6. (Clockwise from top left) Africa, India, Australia, Antarctica, Sth America.
7.
 - a) A large, destructive ocean wave caused by an undersea earthquake.
 - b) A red-hot mixture of poisonous gases and ash which may pour down the slopes during a volcanic eruption. Extreme danger; nothing can survive.
 - c) A flood of water, mud, ash & debris from a collapsed lake or melted glacier on a volcano.
8.
 - a) Ash flung into the upper atmosphere can reflect so much radiation from the Sun that less heat gets through and the Earth cools.
 - b) Volcanoes can produce vast amounts of CO₂ gas. This can increase the "greenhouse effect" and cause the Earth to warm up.