YEAR 6: AUTUMN 2 – AFTERSHOCK

GEOGRAPHY: PHYSICAL – EARTHQUAKES & HUMAN – DETECTION AND PREVENTION

UNDERSTAND, DESCRIBE AND EXPLAIN: PLATE TECTONICS AND EARTHQUAKES

Physical Geography:
Understanding the physical change/impact to land terrain over time:
The cause and effect of earthquakes

Earthquake	***Plate boundaries***	***Destructive***	***Constructive***	***Transform***	***Focus***	***Epicentre***	***Seismic waves***	***Magnitude***
Earth's crust	***Tectonic plates***	***Mantle***	***Magma***	***Convection currents***	***Subduction zone***		***Moment Magnitude Scale (MMS)***	

The 8 major tectonic plates:	***The African Plate***	***The Antarctic Plate***	***The Eurasian Plate***	***The Indo-Australian Plate***	***The North American Plate***	***The Pacific Plate***	***The South American Plate***	***The Nazca Plate***

The 3 plate boundaries:	***Transform Plate Boundary***	***Constructive Plate Boundary***	***Destructive Plate Boundary***
	*Two plates move **past** each other*	*Two plates move **apart** from one another*	*Two plates move **towards** each other*

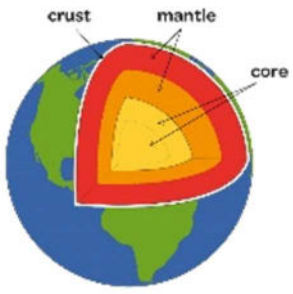
Learning links:
Geography:
Y4: Mountains and Volcanoes Earth's crust/ Tectonic plates/ Plate boundaries/ Fault lines

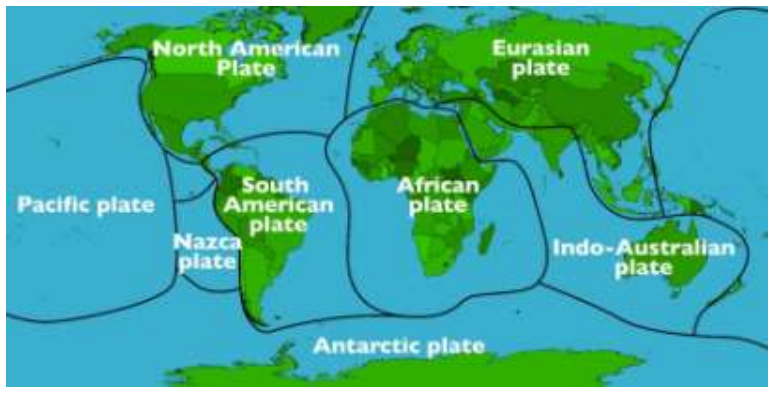
Learning links:
Science:
Y3: Rocks Magma/Molten rock

<u>The Earth's Crust, Tectonic Plates and Plate Boundaries:</u>

Every ***30 seconds*** there is an ***earthquake*** in the ***world*** and ***each year*** there are approximately ***100 earthquakes*** that cause ***serious damage***.
The Earth's surface – ***the crust*** - is not one smooth unbroken covering.
Rather, it is made of different sections called ***plates*** (like a ***cracked egg shell***).
There are ***eight major plates***:

1. ***Eurasian***
2. ***Pacific***
3. ***Indo-Australian***
4. ***Antarctic***
5. ***Nazca***
6. ***North American***
7. ***South American***
8. ***African***





<u>THINKING POINT:</u>

Without looking, name as many of the major tectonic plates as you can.

The ***Earth's plates*** are ***constantly moving.*** On average, this movement is ***between 1 and 10 cm per year***.
Convection currents in the ***mantle*** cause the ***tectonic plates to move***.
The ***mantle*** is made of ***molten*** **rock (magma).** As the ***magma*** moves, so do the plates above.
Where the ***plates meet*** is called the ***plate boundary***.
Each plate ***moves*** in a ***certain direction***.
Because of this, at the ***plate boundaries***, the plates ***react*** differently.

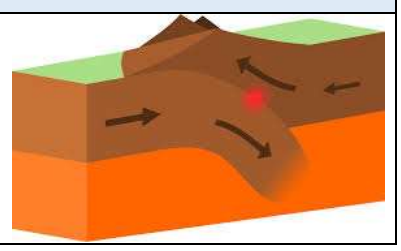
<u>THINKING POINT:</u>

What do you think the word molten means?

There are ***3*** types of ***plate boundary***:

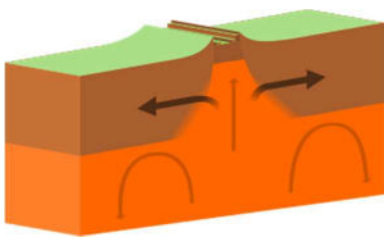
Destructive Plate Boundaries:

At a ***destructive plate boundary*** (also called ***convergent*** boundaries) two ***plates*** move ***towards*** another.
One plate is then ***pushed underneath*** the other. It is the ***heavier plate*** that is ***forced beneath*** the lighter plate.
The ***point*** at which one plate is ***forced beneath*** the other is called the ***subduction zone***.
The ***plate*** then ***melts*** to become ***molten rock*** (***magma***).
The ***magma*** then ***forces*** its way up to the plate boundary to ***form a volcano***.
Example: Eurasian plate and Pacific plate where over 400 volcanoes are formed – most underwater.



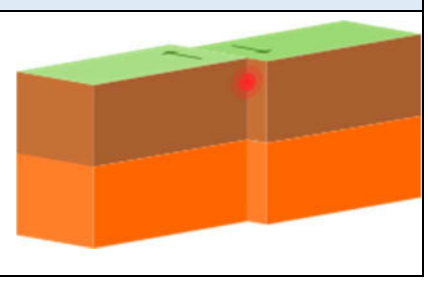
Constructive Plate Boundaries:

Constructive plate boundaries (also called ***divergent*** boundaries) ***move apart*** from each other.
As they ***move apart***, ***molten rock (magma) rises*** from the ***mantle***, then ***cools*** and ***hardens*** to form new rock.
Example: Eurasian plate and North American plate (Iceland)



Transform Plate Boundaries:

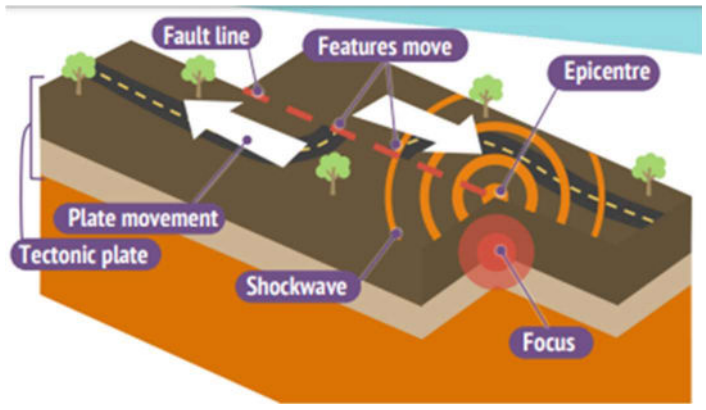
At ***transform plate boundaries*** two ***plates move past each other***.
Friction (rubbing) may ***cause them to stick***, but when they eventu***ally become unstuck***, often with a ***violent jolt***, an ***earthquake*** results.



<u>THINKING POINT:</u>

Without looking at the text, can you describe the differences between the three types of plate boundary to a friend?

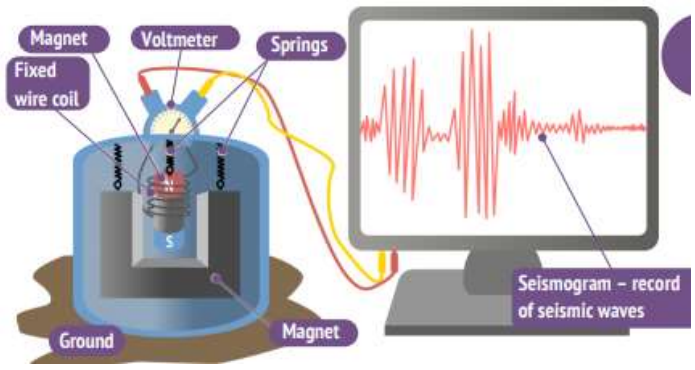
Earthquakes:



Like volcanoes, ***earthquakes occur primarily*** along the ***boundaries*** of ***tectonic plates***.
Earthquakes happen when two ***tectonic plates*** suddenly slip.
This causes ***shock waves*** to ***shake*** the ***surface*** of the Earth in the form of an ***earthquake***.
Earthquakes usually occur on the ***edges*** of large sections of the Earth's crust called tectonic plates.
These plates ***slowly move*** over a long period of time.
Sometimes the ***edges***, which are called ***fault lines***, can get ***stuck***, but the ***plates keep moving***.
Pressure slowly starts to ***build up*** where the edges are stuck and, once the ***pressure gets strong enough***, the plates will ***suddenly move*** causing an ***earthquake***.

Seismic Waves:

Shock waves from an ***earthquake*** that ***travel through the ground*** are called ***seismic waves***.
They are ***most powerful*** at the ***centre of the earthquake***, but they travel ***through*** much of the ***earth*** and ***back to the surface***.
They ***move*** quickly at ***20 times the speed of sound***.
Earthquake Scientists (***Seismologists***) use ***seismic waves*** to ***measure*** the ***size and destruction*** of an ***earthquake***.
They use a device called a ***seismograph*** to ***measure*** the ***size of the waves***.
The ***size of the waves*** is called the ***magnitude***.
To ***measure*** the ***strength*** of an earthquake, ***seismologists*** use a scale called the ***Moment Magnitude Scale*** (***MMS)***.
The ***larger*** the ***number*** on the MMS scale, the ***larger*** the ***earthquake***.
You usually ***will not*** even ***notice*** an earthquake that ***measures less than 3*** on the ***MMS scale***.



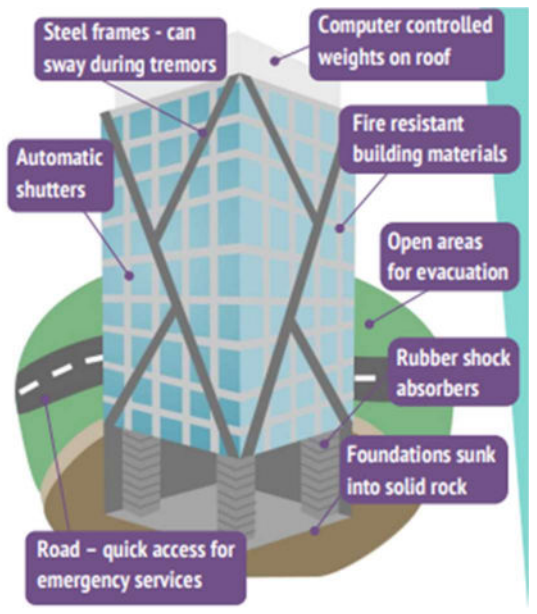
Here are some examples of what may happen depending on the scale:
4.0: Could shake your house as if a large truck were passing close by. Some people may not notice.
6.0: Stuff will fall off of shelves. Walls in some houses may crack and windows break. Pretty much everyone near the centre will feel this one.
7.0: Weaker buildings will collapse and cracks will occur in bridges and on the street.
8.0: Many buildings and bridges fall down. Large cracks in the earth.
9.0 and up: Whole cities flattened and large-scale damage.

Epicentre and Focus:

The place where the ***earthquake starts***, ***below the surface*** of the earth, is called the ***focus***.
The place ***directly above this*** on the ***surface*** is called the ***epicentre***.
The ***earthquake*** will be the ***strongest*** at ***this point*** on the ***surface***.

Earthquake hazards:

The location that an ***earthquake occurs affects*** the severity of the ***damage*** it can cause.
Earthquakes can cause ***buildings*** to ***collapse***, often killing or injuring the people trapped inside.
They can ***destroy roads***, ***railways*** and ***electricity cables*** which can delay communications and rescue attempts.
Earthquakes can also ***trigger*** other ***natural hazards*** including ***rock falls, landslides, tsunamis and even volcanic eruptions***.
Geologists know ***where earthquakes*** are ***likely to happen*** but it is ***impossible to predict when*** an earthquake will occur.
It is therefore important for ***earthquake-prone countries*** to be ***prepared*** at all times.
Engineering that allows ***buildings*** to '***wobble'*** instead of remaining stationary can ***help stop buildings collapsing*** and therefore potentially ***save thousands of lives*** during a large earthquake.
Educating the public is also very ***important*** so that people know what to do if they feel an earthquake.
Generally, ***staying indoors*** under a sturdy table or doorframe is the safest thing to do.



The San Andreas Fault Line, California:

The ***San Andreas Fault*** marks the ***boundary*** between ***two tectonic plates***: The ***Pacific*** plate and the ***North American*** plate.
This is a ***transform*** plate boundary: the ***Pacific*** plate (west) moves in a ***north-westerly*** direction, opposite to the ***North American plate*** (east).
This causes ***earthquakes*** along the ***fault line***. The entire ***San Andreas Fault*** is ***1,287 km*** long (***800 miles***) and reaches to ***depths*** of ***16 km (10 miles).***
In places, the Fault is ***1.5 km wide (1 mile)***.
The ***San Andreas Fault*** extends from ***northern California*** (on the west coast of USA) ***southwards*** to ***Cajon Pass*** near San Bernardino.
The ***plates move***, on average, ***6cm each year***.
If a person stood on one side of the Fault and looked across it, features on the opposite side would appear to have moved to the right.
Geologists believe that the total displacement (movement) along the Fault is at least 563 km (350 miles) since the San Andreas fault came into being about 15-20 million years ago.

The 1906 San Francisco earthquake:

Thousands of ***small earthquakes*** occur in ***California*** each year.
Large, highly destructive earthquakes, however, ***occur*** on average ***once every 100-150 years*** along the Fault.
The ***San Francisco*** earthquake of ***April 18, 1906*** was the ***most recent*** of these.
It is estimated to have had a ***magnitude of 8.3*** on the Richter scale and lasted for ***one minute***.
It resulted from a ***movement*** of the ***Fault by 6 metres***.
Damage was caused by both the ***earthquake*** and by the ***fire*** that swept through the city afterwards.
Nearly ***8 square kilometres*** and ***28,000 buildings*** were destroyed resulting in ***millions of dollars in damage***.
700 people were ***killed*** and ***thousands*** were ***left homeless***.

KEY ASSESSMENT QUESTIONS AND SCENARIOS:

EXS:	GDS:
How and why do earthquakes occur?	How do countries like the USA prepare for earthquakes and why is this so important?