Exploring Earthquakes: What do seismologists do?

Key Stage 4 Programme

Pupil Name	
Handbook Designed by	Dr Heckels

Timetable and Assignment Submission

Timetable – Tutorials

Tutorial	Date	Time	Location
1			
2			
3			
4			
5			
6 (Feedback)			

Timetable – Homework Assignments

Homework Assignment	Description	Due Date
Tutorial 1		
Tutorial 2		
Tutorial 3		
Tutorial 4		
Tutorial 5		

Assignment Submission – Lateness and Plagiarism

Lateness	
Submission after midnight on 9th August	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

The Brilliant Club KS4 Programme – Pupil Feedback Report

Grade	Marks	What this means
1st	70+	Performing to an excellent standard at A-level
2:1	60-69	Performing to a good standard at A-level
2:2	50-59	Performing to an excellent standard at GCSE level
3rd	40-49	Performing to a good standard at GCSE level
Working towards a pass	0-39	Performing below a good standard at GCSE level
Did not submit	DNS	No assignment received by The Brilliant Club

Lateness	
Any lateness	10 marks deducted
Plagiarism	
Some plagiarism	10 marks deducted
Moderate plagiarism	20 marks deducted
Extreme plagiarism	Automatic fail

Name of PhD Tutor			
Title of Assignment			
Name of Pupil			
Name of School			
ORIGINAL MARK / 100		FINAL MARK / 100	
DEDUCTED MARKS		FINAL GRADE	

If marks have been deducted (e.g. late submission, plagiarism) the PhD tutor should give an explanation in this section:

Learning Feedback Comment 1 - *Enter Key Learning Priority Here*	
What you did in relation to this Key Learning Priority *Enter feedback here*	How you could improve in the future *Enter feedback here*
Learning Feedback Comment 2 – *Enter Key Learning Priority Here*	
What you did in relation to this Key Learning Priority *Enter feedback here*	How you could improve in the future *Enter feedback here*
Learning Feedback Comment 3 – *Enter Key Learning Priority Here*	
What you did in relation to this Key Learning Priority *Enter feedback here*	How you could improve in the future *Enter feedback here*
Resilience Comment	
How you showed learning resilience during the course *Enter feedback here*	How you could build learning resilience in the future *Enter feedback here*

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Course Rationale

Earthquakes are one of the Earth's major natural hazards that effect humans across the globe. They cause the earth to move and create mountains and oceans. Seismologists study earthquakes and the physics and processes within the earth and on it's surface.

This course provides an introduction to the huge field of seismology and some of the methods used by the earth science community to understand the physical processes of earthquakes, or seismic events.

We will learn exactly what an earthquake is and how and why they occur, recognising patterns and plate tectonics across the globe. The major hazards to communities will be investigated, including why structures sink or fall down after large events.

We will discover how earthquakes are recorded, by building our own seismometer. After recording earthquakes, we will look into the physics behind seismic waves and how we identify different waves on seismograms.

The course will culminate in a project to analyse an earthquake, calculating it's magnitude and determining it's precise epicentre. We will let loose our creativity by making poster presentations of our case study and results.

In addition to learning about the field of seismology, students will gain an understanding of the scientific research method, including data collection and manipulation, and presenting science through reports and poster presentations.

Mark Scheme Table

	Skills	1st (70-100)	2:1 (60-69)	2:2 (50-59)
Subject knowledge	Knowledge and Understanding	○ All content included is relevant to the general topic and to the specific question/title ○ Good understanding of all the relevant topics. ○ Scientific terms are defined and used accurately throughout ○ Clear justification on how the content included is related to the specific issues that are the focus of the assignment	○ Most of the content included is relevant to the general topic and to the specific question/title ○ Good understanding of most the relevant topics ○ Scientific terms are used accurately but not always clearly defined. ○ Adequate justification on how the content included is related to the specific issues that are the focus of the assignment	○ Some of the content included is relevant to the general topic and to the specific question/title ○ Good understanding on some of the relevant topics but occasional confusion on others. ○ Scientific terms are used mostly accurately with occasional confusion and often not defined. ○ Some justification on how the content included is related to the specific issues that are the focus of the assignment
Critical thinking	Research and Evidence	○ Inclusion of rich sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas ○ Use evidence/calculations to support claims/assertions /ideas, consistently clearly and convincingly ○ Evidence of further reading beyond materials provided which were used in an appropriate context ○ Data is effectively analysed and appropriate assumptions/conclusions are reached	○ Inclusion of adequate sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas ○ Use evidence/calculations to support claims/assertions/ideas, mostly clearly and convincingly ○ Evidence of further reading beyond materials provided ○ Data is analysed and the assumptions/conclusions that are reached are mostly appropriate	○ Inclusion of some sources of research findings, data, quotations or other sourced material as evidence for the claims/ ideas ○ Use evidence/calculations to support claims/assertions/ideas, at times clearly and convincingly ○ Limited evidence of further reading beyond materials provided ○ There is an attempt to analyse data is and draw assumptions/conclusions

	Critical Evaluation	○ Moved beyond description to an assessment of the value or significance of what is described ○ Evaluative points are consistently explicit/systematic/reasoned/justified ○ Effective critiques on the reliability of sources provided	○ Mostly description but some assessment of the value or significance of what is described ○ Evaluative points are mostly explicit/systematic/reasoned/justified ○ Some evidence of critiques on the reliability of sources provided	○ Only description with minimal assessment of the value or significance of what is described ○ Evaluative points are at times explicit/systematic/reasoned/justified ○ Limited evidence of critiques on the reliability of sources provided
Written communication	Structure and Presentation	○ Ideas are presented in paragraphs and arranged in a logical structure that is appropriate for the assignment ○ The introduction clearly outlines how the essay/report will deal with the issues ○ The conclusion summarises all the main points clearly and concisely ○ All calculations, formulas and methods are clearly structured, clear to follow and correct ○ Tables and graphs are effectively constructed including appropriate headings, units and scales. ○ All sources are referenced correctly in an agreed format	○ Ideas are presented in paragraphs and arranged in a structure that is mostly appropriate for the assignment ○ The introduction adequately describes how the essay/report will deal with the issues ○ The conclusion summarises most of the main points clearly ○ Calculations, formulas and methods are mostly structured, clear to follow and correct ○ Most tables and graphs are well constructed ○ Most sources are referenced correctly in an agreed format	○ Ideas are presented in paragraphs and arranged in a structure ○ The introduction mentions how the essay/report will deal with the issues ○ The conclusion summarises some of the main points clearly ○ Calculations, formulas and methods are not always structured, clear to follow and correct. ○ Some tables and graphs are well constructed but contains some errors ○ Some sources are referenced correctly in the agreed format with occasional errors

	Language and Style	○ No spelling, grammar or punctuation errors ○ Units and significant figures are presented accurately throughout ○ Writing style consistently clear, appropriate for scientific documents and easy to follow ○ Accurate and consistent use of technical language and vocabulary	○ Minimal spelling, grammar or punctuation errors ○ Units and significant figures are presented accurately throughout ○ Writing style mostly clear, appropriate for scientific documents and easy to follow ○ Some attempts of using technical language and vocab alary, but not always accurate	○ Some spelling, grammar or punctuation errors ○ Units and significant figures are presented accurately throughout with occasional errors ○ Writing style moderately clear, appropriate for scientific documents and easy to follow ○ Use of simple language and vocabulary effectively but struggles to use technical language

Glossary of Keywords

Word	Definition
Aftershocks	Shocks or tremors that occur after an earthquake. Aftershocks can cause as much or more damage than the earthquake itself.
Body waves	Waves that travel out underground from the focus of an earthquake. Includes P waves and S waves.
Epicentre	The point on the Earth's surface directly above the focus or origin of the earthquake.
Fault	A crack in the rock, caused by movement of the Earth's crust.
Focus	The point under the surface of the Earth where an earthquake begins.
Magma	Molten or melted rock from the Earth's mantle.
Megathrust	An earthquake that occurs when one tectonic plate subducts beneath another. Megathrust earthquakes often generate large tsunamis that cause damage over a much wider area than is directly affected by ground shaking near the earthquake's rupture.
Mercalli scale	An earthquake that occurs when one tectonic plate subducts beneath another. Megathrust earthquakes often generate large tsunamis that cause damage over a much wider area than is directly affected by ground shaking near the earthquake's rupture.
P or Primary waves	Primary body waves, which travel from the focus of an earthquake. These are compression waves.
Richter scale	A scale from 1 to 9 that measures the strength of an earthquake.
Ring of Fire	The area around the Pacific Plate where many earthquakes and volcanic eruptions occur.
S or secondary waves	The slower secondary body waves that cause side-to-side movement.
Seismogram	A zig-zag line created by vibrations read from a seismograph caused by body waves.

Seismograph	An instrument that measures how much the ground shakes or vibrates in an earthquake.
Surface waves	Waves that emanate from the epicenter of an earthquake which cause little damage.
Tectonic plate	Section of the Earth's crust.
Tsunami	A series of ocean waves generated by any rapid large-scale disturbance of the sea water. Most tsunamis are generated by earthquakes, but they may also be caused by volcanic eruptions, landslides, undersea slumps or meteor impacts.

Tutorial 1 – Let's shake, rattle and roll!
Introduction to Earthquakes

From ancient Japanese legends, Namazu was a giant catfish that lived underground and caused earthquakes when angered or woken.

What is the Purpose of Tutorial 1?

- To learn what exactly is an earthquake and what the different fault types are
- To introduce the topic of Plate Tectonics and discover where and earthquakes occur
- To investigate the major types of earthquake hazards

What is an earthquake?

Write in the following lines your idea of an earthquake after the group discussion.

Historically, there were many different theories and explanations to try and understand earthquakes and what caused them.

In ancient Japan, people thought monsters lived underground and caused tremors when they were woken or angry. Ancient Greek philosophers suggested that earthquakes were caused by gases trying to escape from underground.

The field of seismology, from the Greek word 'seismos' meaning earthquakes, has only developed in the last 100-150 years. Previously western scientists thought earthquakes were caused by explosions deep underground.

In 1755 Lisbon suffered a major earthquake and tsunami, which together caused massive destruction. This had a huge effect on contemporary European scientific and philosophical development. It was at this time that the first versions of current theories of earthquakes were suggested: in 1760, the British engineer John Mitchell suggested that earthquakes were caused by rock movements deep underground, and related the shaking to the propagation of seismic waves within the earth.

Studies based on another major earthquake – the 1906 San Francisco earthquake – led to further developments: Henry Fielding Reid, Professor of Geology at Johns Hopkins University, examined the displacement of the ground surface in the area around San Francisco before and after the 1906 earthquake. These observations led him to suggest that the earthquake must have involved an 'elastic rebound' of previously stored elastic stress.

Elastic rebound theory:

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-
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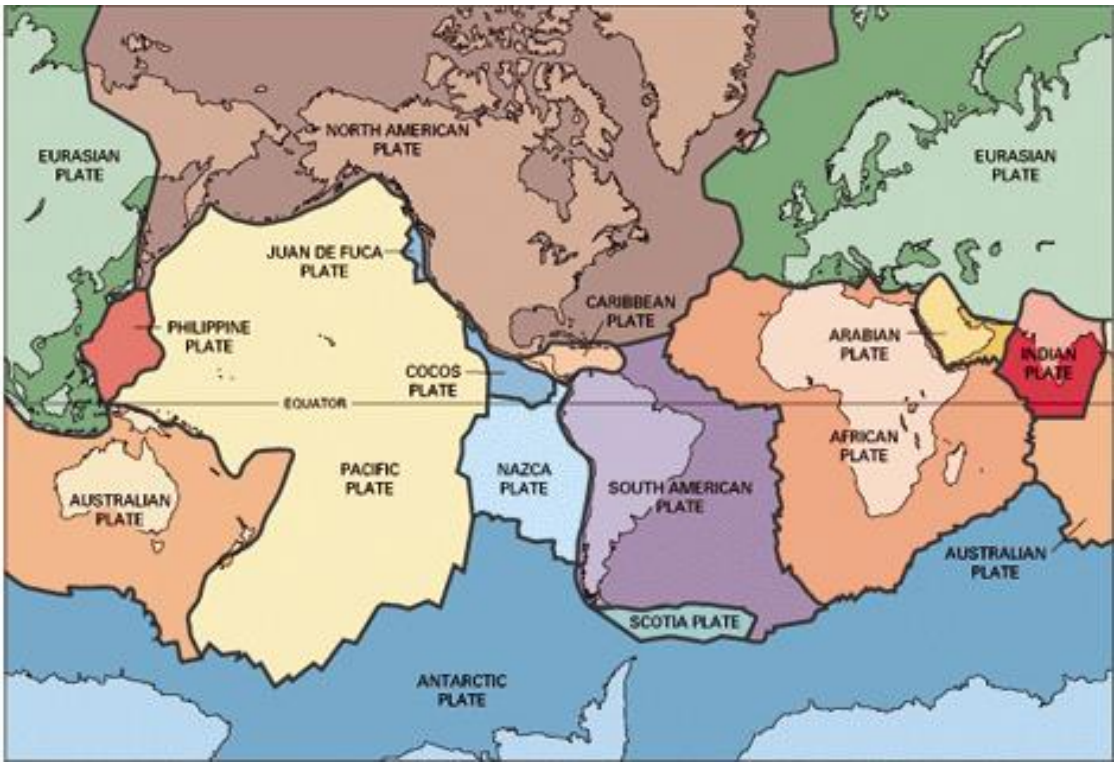
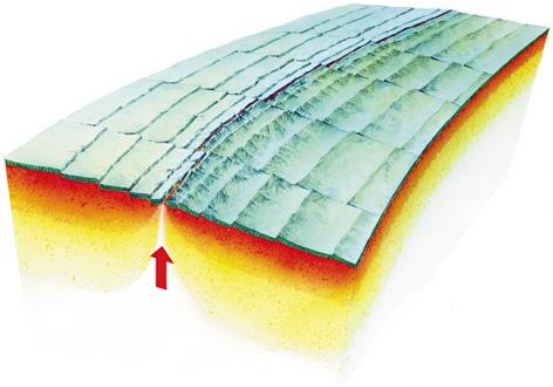
Tectonic Plate Theory



Tectonic Plates are the large pieces of the earth's crust, that make up the continents and oceans. They move slowly, a few centimetres a year, relative to one another. Along the *plate boundaries* different processes take place, causing earthquakes and volcanoes. There are several different types of plate boundaries:

1. *DIVERGENT OR CONSTRUCTIVE BOUNDARIES*



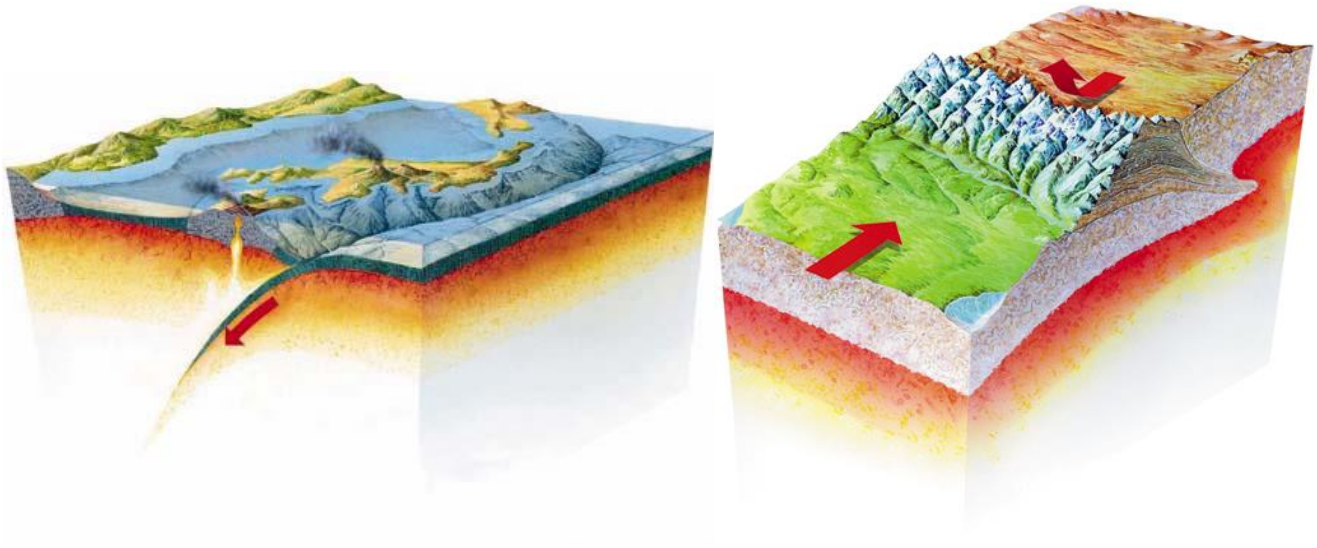
At divergent boundaries, tectonic plates are **moving apart** and are often associates with **volcanoes** as new material is produced at the surface. Earthquakes at these boundaries are small but frequent.

Where in the world?

2. *CONVERGENT OR DESTRUCTIVE BOUNDARIES*

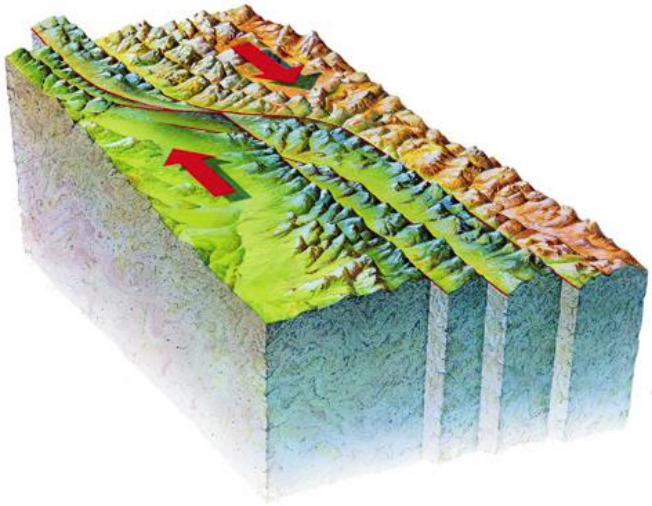
When the boundary is between an oceanic and a continental plate, it is a **destructive** boundary. The oceanic plate it pushed underneath the continental plate, at a **subduction zone**. These boundaries tend to produce earthquakes that have magnitudes over 6.0, and the deepest quakes.

Where the boundary is between **two continental plates**, one plate crumples upwards over the other to produce mountain ranges.



Where in the world?

3. *TRANSFORM BOUNDARIES*

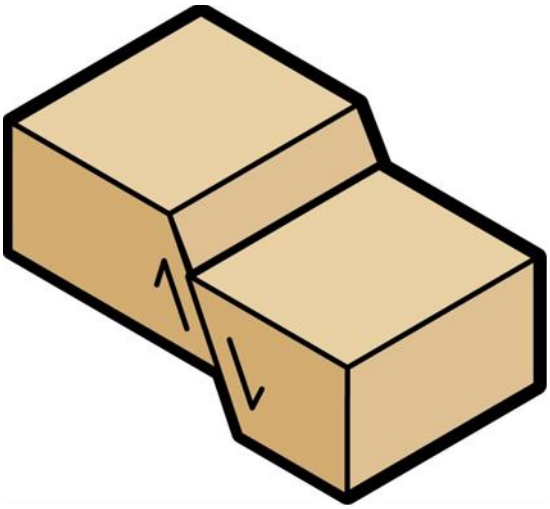


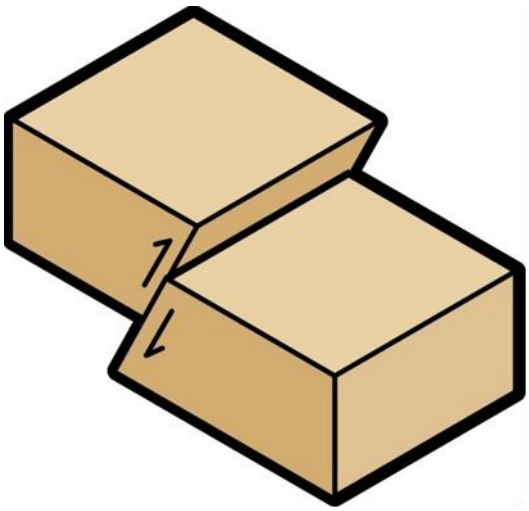
This type of boundary involves no loss or creation of material. The plates **slide past** each other. Transform boundaries typically produce shallow earthquakes.

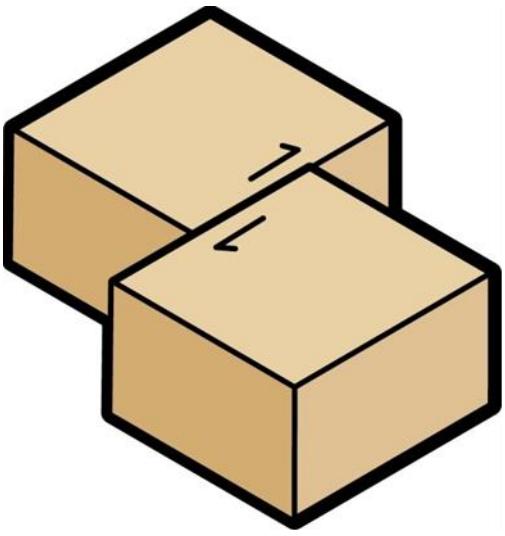
Where in the world?

Faults at plate boundaries

TASK: Label the 3 types of faults on the figures below.







Practical – Seismic hazards simulations – Bye bye Barbie!

During the demonstrations, make notes in the space below about what hazards we are modelling and what happens.

The key hazards we will try and examine are:

- *LIQUEFACTION*
- *TSUNAMI*
- *RESONANCE*

Homework Assignment – Monitoring global earthquakes

Using the USGS (United States Geological Service) and IRIS (International Research In Seismology) earthquake monitoring websites, monitor all earthquakes with magnitude greater than 4.5 occurring over the next week.

https://earthquake.usgs.gov/earthquakes/map/

http://geoserver.iris.edu/events

On the large world map provided, mark the locations of the earthquakes you find. Try to colour code your earthquakes according to magnitude and in the space below list some observations of patterns in the locations. We will begin the next session with a group discussion into your results.

Tutorial 2 – Recording Earthquakes and Prediction; Why Labyrinth got it so wrong!

Collapsed highway in San Francisco after the 1989 Loma Prieta earthquake, USA.

What is the Purpose of Tutorial 2?

- To learn how earthquakes are monitored globally and why.
- To understand seismograms are and what they show.
- To think about why earthquakes can't yet be predicted.
- To investigate what a seismometer is and understand how it works.

Predicting earthquakes

What is the difference between predicting and forecasting earthquakes?
Why can't earthquakes be predicted?

-
-
-

Why should we monitor earthquakes globally?

Shouldn't we just be worried about where we live?

Practical – Building a seismometer and recording signals

For this week's practical we are going to assemble and set up our own seismometer in school, to record some real seismic signals.

What is a seismometer?

What signals can they record?

-
-
-

Seismometers can tell us not only *when* an earthquake happens, but we can use the signals, or *seismic traces*, we record to work out *where* and *how large* an event is. We'll look at this in more detail in later tutorials, and in this practical we'll get used to the equipment used by scientists and government agencies to monitor seismic activity.

Use this space to make some notes on your seismometer and the signals you record.
See who in your group can generate the largest 'earthquake'.

Homework Assignment – Earthquake case study

The final assignment for this course will be to create an academic poster presenting an earthquake. This weeks' homework and those over the next couple of weeks will help with preparation and can be used in your poster.

Your tutor has a list of earthquakes that you can choose from. The earthquake you choose will be your case study for the rest of the course and the final assignment.

After you've chosen your case study, your homework is to research the background of your event and write a paragraph or two (500 words **maximum**), in the form of a punchy news bulletin. This will form the introduction of your final assignment.

Try to answer the following questions:

- WHAT happened and WHEN?
- WHERE did the earthquake occur? Describe the tectonic setting (hint: we defined this in tutorial 1)
- WHO was affected?
- HOW BIG was the earthquake?

For your research, use the internet (Wikipedia can be used ONLY as a starting point) and the extracts of scientific papers provided. The websites suggested in Homework 1 will also provide lots of great information.

Tutorial 3 – I'm talking 'bout Good Vibrations; Discovering seismic waves

Destroyed temples and buildings in Basantapur Durbar Square, Kathmandu following the 2015 Gorkha earthquake, Nepal.

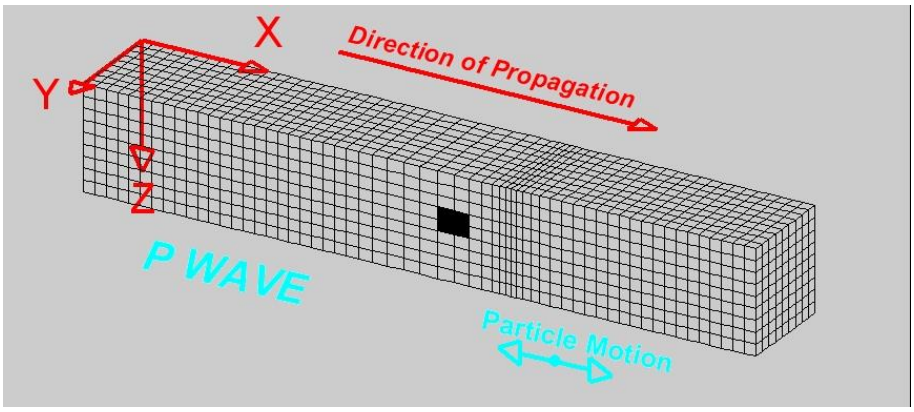
What is the Purpose of Tutorial 3?

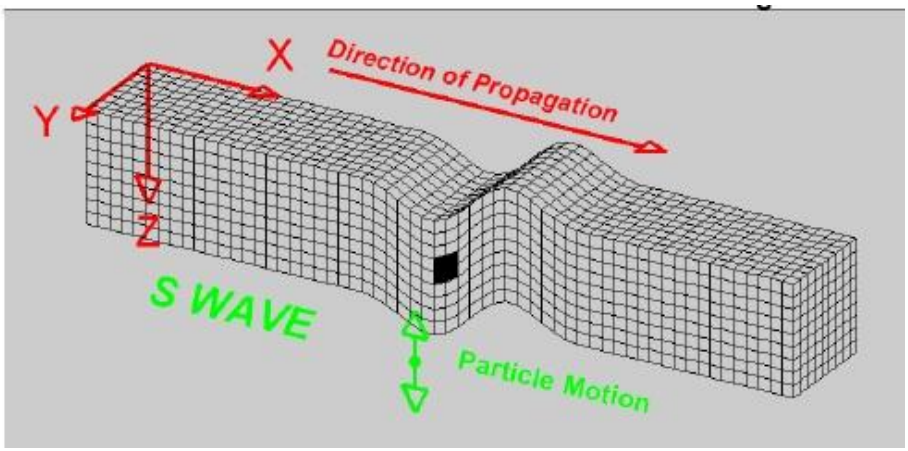
- To learn about the types of seismic waves.
- To investigate how they travel through the earth.
- To identify different wave types on a seismic record.

Seismic Waves

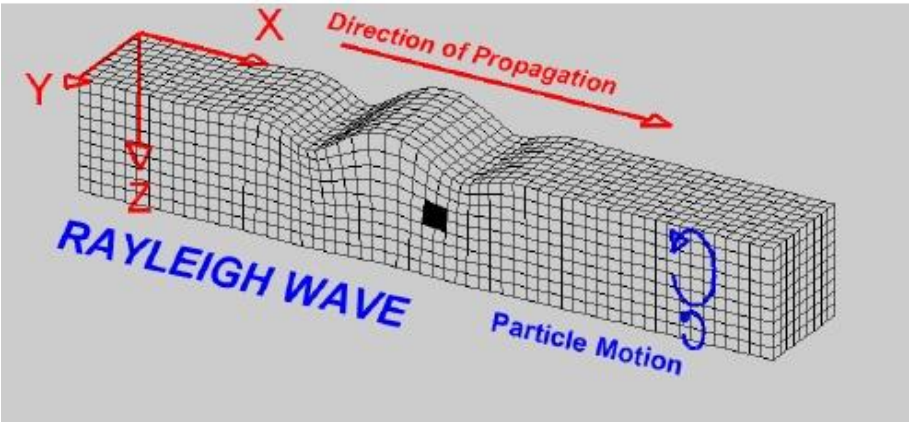
When an earthquake occurs, the energy is released through the Earth as *SEISMIC WAVES*. They travel either through the inside of the Earth (***body waves***) or along the ground surface (***body waves***). There are two kinds of body waves; ***P-waves*** (primary) and ***S-waves*** (secondary). There are also two kinds of surface waves; ***Rayleigh*** and ***Love*** (both named after the scientists that discovered them). Unless the earthquakes are extremely deep, it is the surface waves that are largest in amplitude and cause the greatest damage to buildings and other structures.

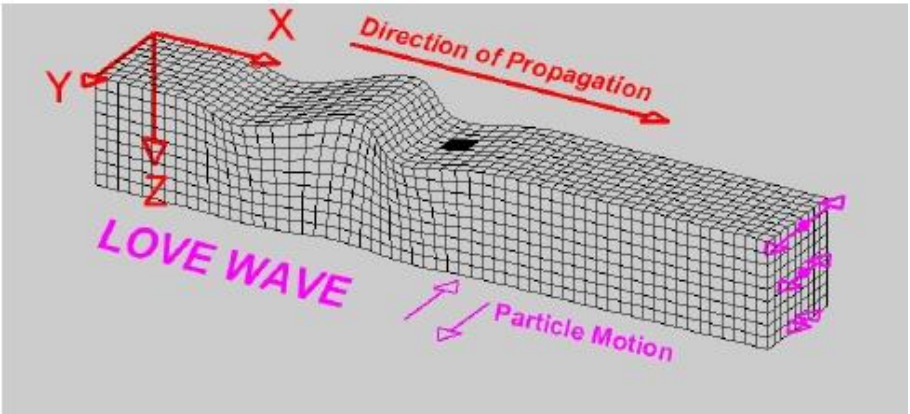
Body waves – P and S





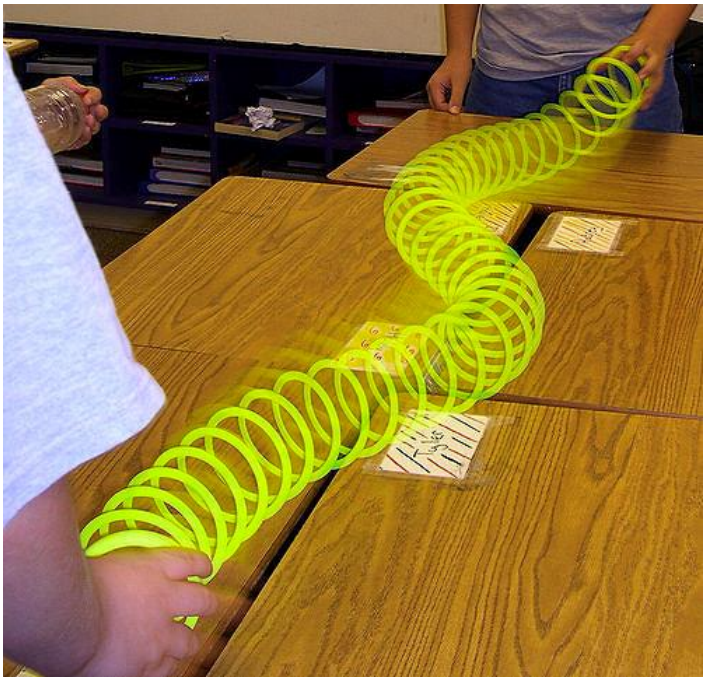
Surface waves – Rayleigh and Love





Practical – Slinky seismic waves

Have a go at creating all 4 types of seismic waves with Slinkys.



Identifying wave types on a seismogram

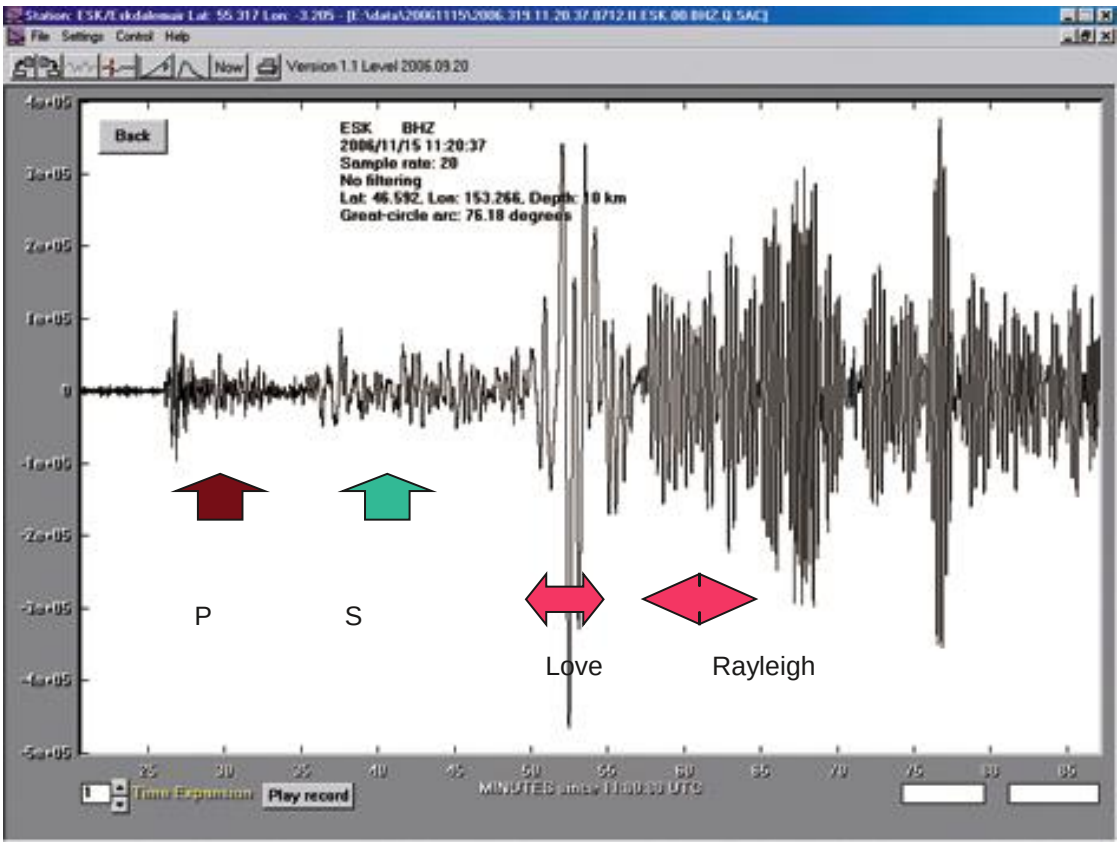
Seismologists use seismograms to help them learn more about earthquakes: if you know what wave phases you are looking at on a seismogram and the properties of these waves, you can work out how far away the earthquake was.

The four different types of wave, P, S, Love and Rayleigh, have different characteristics, which will affect the times at which different waves arrive at seismic stations around the world. The speed the waves travel at also depends on the material through which they are travelling.

- P-waves travel the fastest, typically at about 5 to 7 km/s in the Earth's crust; and 8 km/s or more in Earth's mantle and core (the denser the material, the faster they travel); they travel more slowly through water (about 1.5 km/s). P-waves can also travel through air, and can sometimes be heard as a low rumble.

- S-waves travel more slowly than P-waves, typically at 3 to 4 km/s in the Earth's crust, at around 4.5 km/s in the mantle and 2.5 km/s in the (solid) inner core. They cannot travel through fluids, so they cannot pass through water, magma or the Earth's liquid outer core.

- Surface waves travel more slowly than body waves, typically between 2 and 4 km/s, with Love waves slightly faster than Rayleigh waves. The speed and depth of these surface waves depends on the frequency: lower frequencies generally travel faster and at greater depth.



TASK: Your tutor has lots of examples of seismograms. Have a go at identifying the different wave types and annotate them on the figures.

For 2 different earthquakes recorded at the same station, look at the differences between the waves appear on the seismograms. Then look at their magnitudes, can you spot any correlations (patterns) between magnitude and the seismic signals?

Now look at a single earthquakes recorded at many stations, look again at the differences between the waves appear on the seismograms. This time look at the location of the epicentre, can you spot any correlations (patterns) now between location and the seismic signals?

Seismographs can record waves travelling in different directions. Typically, scientists use 3 component seismometers, that record waves travelling vertically (up and down) and horizontally (north to south and east to west).

The seismometer you worked with last week could only record seismic waves travelling vertically.

STRETCH TASK: Have a look at the different vertical and horizontal seismograms and try again to identify the different wave types. Can you spot any similarities or differences? Why might it be useful of scientists to look at different component recordings?

Homework Assignment – Collecting seismic data

For your case study earthquake find data from 3 local stations (nearby to the earthquake epicentre) and 3 global stations (anywhere else on the globe).

Try to identify the different wave types on each trace.

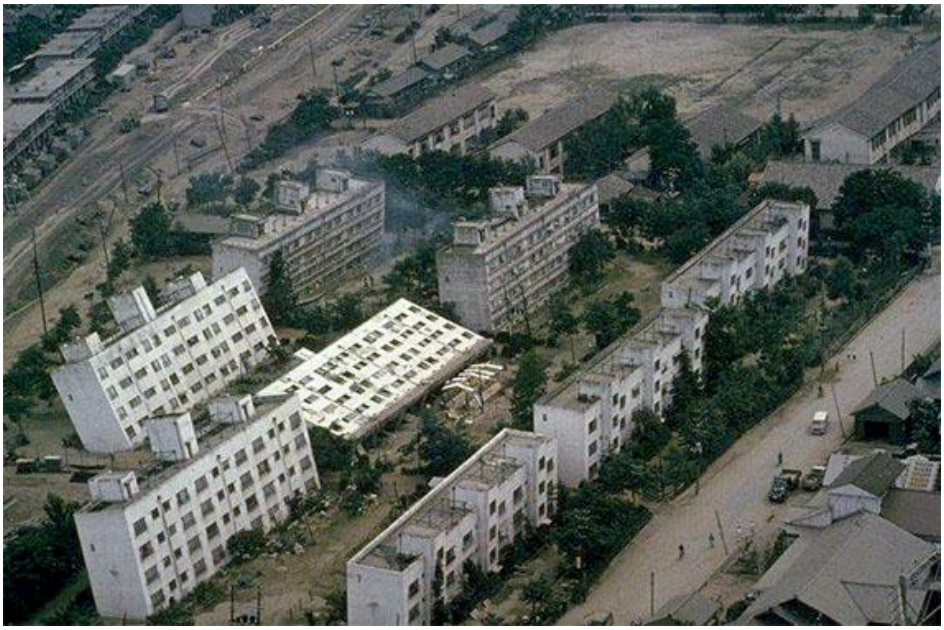
You can find the data on the following website:

http://ds.iris.edu/wilber3/find_event

Your tutor will show you how to use the site. Select your case study and choose some example stations. Print out examples of horizontal (BHN or BHE) and vertical (BHZ) seismogram records and annotate.

Write a short paragraph explaining the method for finding the data (200 words maximum) and note down some observations about your data (300 words maximum.

Tutorial 4 – I'm all shook up!
Analysing Earthquakes



Sunken and toppled buildings after the 1964 Niigata earthquake, Japan.

What is the Purpose of Tutorial 4?

- To gain an insight into some of the information that can be obtained from seismograms.
- To learn how to calculate the magnitude of an earthquake.
- To use the triangulation method to locate the epicentre of an earthquake.

What is the meant by magnitude?

The magnitude of an earthquake is a number that relates to the size of the ground movement caused by the earthquake. Earthquake magnitude scales are logarithmic (i.e. a 1 unit increase in magnitude corresponds to a 10 fold increase in ground movement).

There are several measures of earthquake magnitude, the two most well known being *Richter Magnitude* and *Moment Magnitude*. UK earthquake magnitudes are usually given as Richter Magnitude (ML, or Local Magnitude) and you might have heard of the Richter scale before.
Nowadays, most seismologists use the Moment Magnitude scale (Mw) for describing the magnitude of large earthquakes. With this scale, the magnitude of the earthquake is related to the area of the tectonic plate that ruptured (moved).

Scientists cannot actually measure the magnitude of an earthquake - they estimate the magnitude by measuring its effects, but also on other factors such as the types of rocks in a particular area. This leads to earthquakes appearing to have different magnitudes depending on what method is used for estimating the magnitude and which datasets have been used to make this estimate, and the reported magnitude of events can change as more data gets analysed: the magnitude of the 26 December 2004 earthquake in Sumatra was originally calculated as Mw 9.0, but was later recalculated to Mw 9.3, for example.

Intensity

Another measure of the size of an earthquake is the *Intensity*. This is a comparison of the effects on people and structures, which decrease with distance from the epicentre of the earthquake. The *Mercalli Intensity Scale (MMI)* has 12 levels of intensity, increasing from I to XII (which would be total destruction).

CIIM Intensity	People's Reaction	Furnishings	Built Environment	Natural Environment
I	Not felt			Changes in level and clarity of well water are occasionally associated with great earthquakes at distances beyond which the earthquakes felt by people.
II	Felt by a few.	Delicately suspended objects may swing.		
III	Felt by several; vibration like passing of truck.	Hanging objects may swing appreciably.		
IV	Felt by many; sensation like heavy body striking building.	Dishes rattle.	Walls creak; window rattle.	
V	Felt by nearly all; frightens a few.	Pictures swing out of place; small objects move; a few objects fall from shelves within the community.	A few instances of cracked plaster and cracked windows with the community.	Trees and bushes shaken noticeably.
VI	Frightens many; people move unsteadily.	Many objects fall from shelves.	A few instances of fallen plaster, broken windows, and damaged chimneys within the community.	Some fall of tree limbs and tops, isolated rockfalls and landslides, and isolated liquefaction.
VII	Frightens most; some lose balance.	Heavy furniture overturned.	Damage negligible in buildings of good design and construction, but considerable in some poorly built or badly designed structures; weak chimneys broken at roof line, fall of unbraced parapets.	Tree damage, rockfalls, landslides, and liquefaction are more severe and widespread wiht increasing intensity.
VIII	Many find it difficult to stand.	Very heavy furniture moves conspicuously.	Damage slight in buildings designed to be earthquake resistant, but severe in some poorly built structures. Widespread fall of chimneys and monuments.	
IX	Some forcibly thrown to the ground.		Damage considerable in some buildings designed to be earthquake resistant; buildings shift off foundations if not bolted to them.	
X			Most ordinary masonry structures collapse; damage moderate to severe in many buildings designed to be earthquake resistant.	

The intensity of an earthquake depends not only on the earthquake magnitude but also on how far away the observation is made from the earthquake's epicentre. For example, the Hector Mine earthquake in California in 1999 had a magnitude of 7.1, but intensity values ranging from I (not felt) to IX (violent shaking).

Locating earthquakes – Triangulation

Seismologists compare seismograms from several seismograph stations and use the difference in arrival times of the waves (P-waves) at each station to work out the different distances the seismic wave must have travelled to each of the stations. They also know how quickly each kind of seismic wave travels through the Earth.

They can then 'triangulate' from these values to work out where the earthquake was. Draw a circle round each station with radius the same as the distance you calculated it must be from the earthquake source. Where the circles intersect is the earthquake source. In practice this initial calculation of the earthquake's location is just a preliminary estimate.

TASK: Watch the video and write your own method for locating an earthquake. Try to include any equations that are used.

Assumptions

There are several assumptions made when the triangulation method is used. After the group discussion, list a few of them:

-
-
-

Practical – Locating an earthquake

Using the seismograms provided for your case study and the instructions presented above, have a go at locating your event.

You will be provided with a large version of the Traveltime to Distance conversion graph you saw in the video.

Maps of the whole Earth will be provided as well as maps zoomed in to your study region.
Try to get 2 locations:

1. Using your 3 local stations
2. Using your 3 global stations

You will compare these results later.

Don't worry if you don't finish, it's your homework too.

Homework Assignment - Analysing earthquakes

Write a minimum of 400 words on the method for locating an earthquake and how magnitudes are estimated, using what you learnt in today's tutorial. This will form the methods section of your final assignment.

Finish the practical work from today and be prepared to present a location for your case study at the beginning of the next tutorial. How do your results compare to what you researched for your background in week 2?

Tutorial 5 – You rock my world!
Presenting our scientific research

Stranded cows, as a result of landslides during the 2016 Kaikoura earthquake, New Zealand. The cows were rescued after 2 days when the mound they were on collapsed.

What is the Purpose of Tutorial 5?

- To find out about our final assignment.
- To discover what a scientific poster is and how best to make one.
- To learn how to reference correctly.
- To get started and get creative!

Scientific posters

Look at the examples of posters shown to you by your tutor. In the space below and on the next page, write down some thoughts on what makes a scientific poster. What do you like and think looks good? How might you include this in your poster?

Final Assignment

Your task is to create a scientific poster on your case study earthquake.

Use your previous homework assignments and what you have learnt in tutorials to help and guide you.

Make sure you have sections on:

- Title (and your name!)
- Introduction (Describe the background to your earthquake, and what your poster is presenting)
- Data (What you used and where you got it from)
- Methods (How did you locate and calculate magnitudes?)
- Results
- Discussion (How accurate do you think your results are?)
- Concluding statement
- References

Make sure you have answered the questions below and included:

- Tectonic setting – What kind of fault is it? What are the plate tectonics
- What were the main hazards to the public? What happened?
- How was it monitored? – What was the response to the earthquake?
- For your discussion, look at scientific literature – how do your answers vary? HINT: compare to USGS and GeoNet.

Presentation is important. Figures and lots of colour is encouraged – we want to display your posters for the school to see!

Refer to the mark scheme at the front of this handbook to see what you will be marked on.

Tutorial 6 – Feedback tutorial

What is the Purpose of Tutorial 6?

- To receive feedback on final assignments.
- To share examples of best practice with the other pupils in your group.
- To write targets for improvement in school lessons.
- To reflect on the programme including what was enjoyed and what was challenging.

Final assignment feedback

What I did well…	What I could have improved on…
•	•
•	•
•	•

My target for future work is…

Reflecting on Uni Pathways

What did you most enjoy about Uni Pathways?
•   •   •

What did you find challenging about the programme?	How did you overcome these challenges?
• • •	• • •

Appendix 1 – Referencing correctly

When you get to university, you will need to include references in the assignments that you write, so we would like you to start getting into the habit of referencing in your Brilliant Club assignment. This is really important, because it will help you to avoid plagiarism. Plagiarism is when you take someone else's work or ideas and pass them off as your own. Whether plagiarism is deliberate or accidental, the consequences can be severe. In order to avoid losing marks in your final assignment, or even failing, you must be careful to reference your sources correctly.

What is a reference?

A reference is just a note in your assignment which says if you have referred to or been influenced by another source such as book, website or article. For example, if you use the internet to research a particular subject, and you want to include a specific piece of information from this website, you will need to reference it.

Why should I reference?

Referencing is important in your work for the following reasons:

- It gives credit to the authors of any sources you have referred to or been influenced by.
- It supports the arguments you make in your assignments.
- It demonstrates the variety of sources you have used.
- It helps to prevent you losing marks, or failing, due to plagiarism.

When should I use a reference?

You should use a reference when you:

- Quote directly from another source.
- Summarise or rephrase another piece of work.
- Include a specific statistic or fact from a source.

How do I reference?

There are a number of different ways of referencing, and these often vary depending on what subject you are studying. The most important to thing is to be consistent. This means that you need to stick to the same system throughout your whole assignment. Here is a basic system of referencing that you can use, which consists of the following two parts:

1. **A marker in your assignment**: After you have used a reference in your assignment (you have read something and included it in your work as a quote, or re-written it your own words) you should mark this is in your text with a number, e.g. [1]. The next time you use a reference you should use the next number, e.g. [2].
2. **Bibliography**: This is just a list of the references you have used in your assignment. In the bibliography, you list your references by the numbers you have used, and include as much information as you have about the reference. The list below gives what should be included for different sources.

    a. **Websites** – Author (if possible), title of the web page, website address, [date you accessed it, in square brackets].

    E.g. Dan Snow, 'How did so many soldiers survive the trenches?', http://www.bbc.co.uk/guides/z3kgjxs#zg2dtfr [11 July 2014].

    b. **Books** – Author, date published, title of book (in italics), pages where the information came from.

    E.g. S. Dubner and S. Levitt, (2006) *Freakonomics*, 7-9.

    c. **Articles** – Author, 'title of the article' (with quotation marks), *where the article comes from* (newspaper, journal etc.), date of the article.

    E.g. Maev Kennedy, 'The lights to go out across the UK to mark First World War's centenary', Guardian, 10 July 2014.

Appendix 2 – Using the VLE

VLE username	
VLE password	

Please remember the following key details…

- You are able log into the VLE either through the link on our website (www.thebrilliantclub.org) or going directly to the VLE site at (https://portal.thebrilliantclub.org/sign-in).
- Please update your profile with your full name and email address- this will allow you to retrieve forgotten passwords or usernames
- If you forget your log-in details you can request them to be emailed to you by clicking the link on the VLE home page. (If you are still having problems you can email: schools@thebrilliantclub.org)

What is the VLE?

The VLE is a virtual learning environment for all pupils on Uni Pathways it is used for:

- messaging your tutor
- submitting homework
- submitting your final assignment
- accessing resources for your tutorials
- finding out more information about university and careers

How should I use the VLE?

The VLE is a professional academic environment in which pupils are able to message their PhD Tutor. Here are a few things to consider:

- Ensure you keep a professional tone in the messages you send to your tutors.
- Ensure you always reply to your tutors in a timely manner.
- Thank your tutor for the effort they are putting in to give you your feedback etc.
- Submit all homework to your tutor on time.

IMPORTANT: Final assignment

- When you submit your final assignment, please remember that you need to do so through the 'My Activities' tab and not as an attachment to a message.

Notes

Notes

Notes

Exploring Earthquakes

Key Stage 4 Programme

researchersinschools.org