Name of student:

Year 12 Geology Summer Work 2023

Below are the key areas of study for year 12. You must have some background before September!

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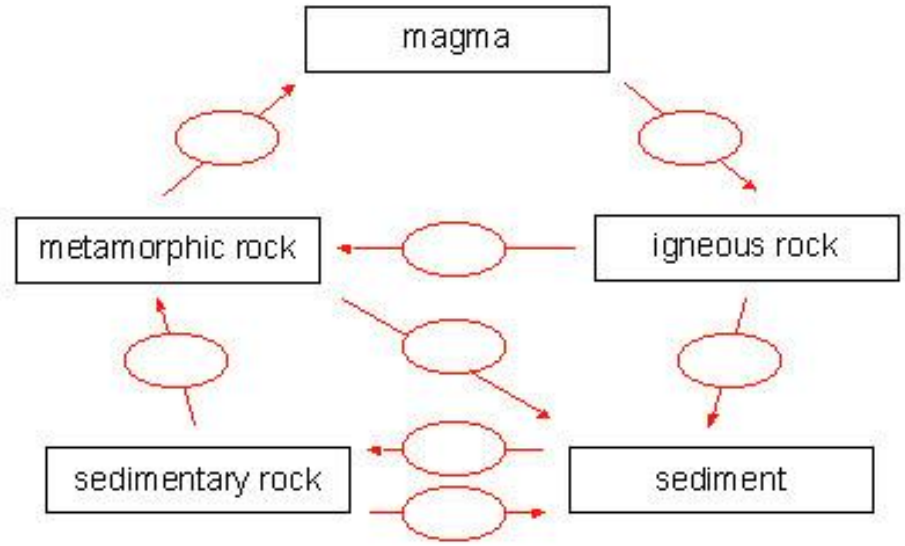
Rock Cycle

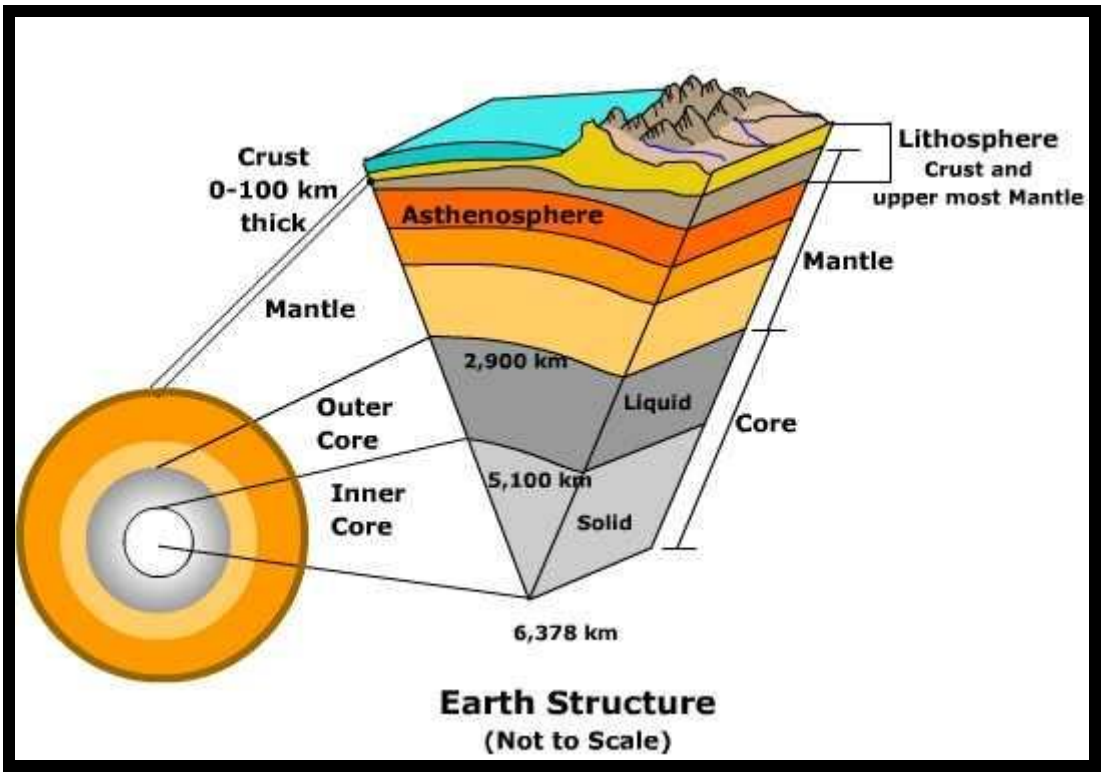
The following diagram illustrates the rock cycle. Match the letters below to the blank ovals on the diagram (note: some letters are used more than once). Example: If you believe that metamorphic rock is converted to magma by cementation and compaction then enter "a" in the top left oval.

a. Cementation and compaction (lithification)
b. Heat and Pressure
c. Weathering, transportation, deposition
d. Cooling and solidification
e. Melting



1.	Weathering and erosion both break down rocks. What is the difference?	
2.	At what temperature dues burial cease and metamorphism begin?	
3.	Which two common rock-forming minerals are resistant to chemical weathering.	
4.	Which mineral survives physical better than chemical weathering, and why.	
5.	What properties of this mineral make it more susceptible than quartz to erosion?	

Earth Structure



1.	What rock type is the continental crust?	
2.	What rock type is the oceanic crust?	
3.	Of what does the lithosphere comprise? What is its physical state?	
4.	What is the Moho, and what earthquake zone at destructive plate boundaries defines it?	
5.	What is the asthenosphere and what is its physical state?	
6.	What is the composition of the core?	
7.	Which part of the core is liquid?	

Britain Through Geological Time

Britain was originally south of the equator as Figure 12 below shows. How do we know this? Figure 13 is a log of two boreholes drilled into Carboniferous sediments: a swampy delta and a shallow tropical sea.

Figure 12 Graph showing northward drift of Britain

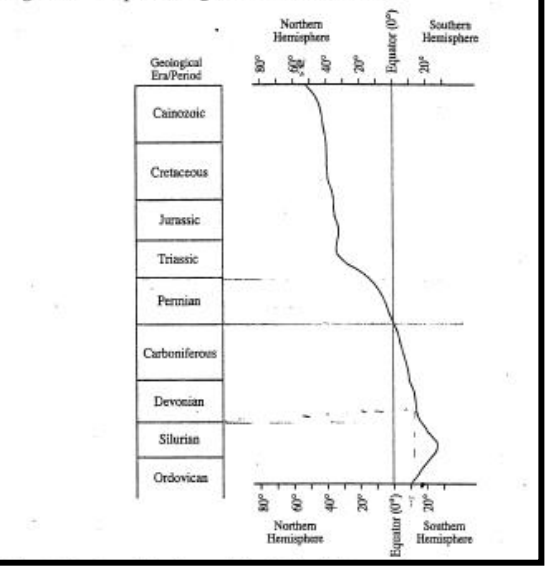
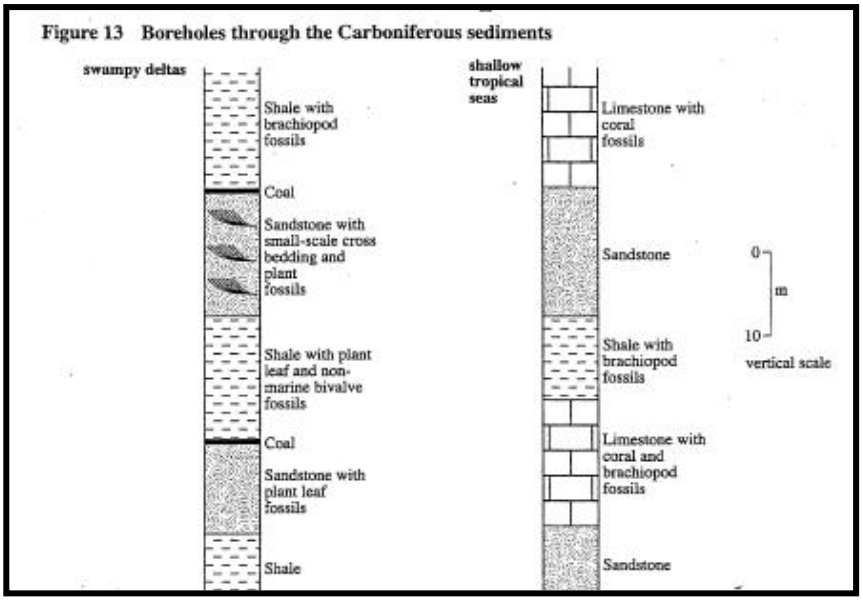


Figure 13 Boreholes through the Carboniferous sediments



a.	During which time periods was Britain south of the equator?	
b.	Which rocks are the oldest in each sequence (indicate where, ie. top, bottom, middle)?	
c.	How do you know (refer to the appropriate law)?	
d.	Explain how the logs provide evidence for Britain being covered in swampy deltas (give two pieces of evidence)	
e.	Swamps form in equatorial latitudes – name two other pieces of evidence that tell us Britain was at or near the equator	
f.	Explain how the logs provide evidence for Britain being covered in shallow tropical seas (give two pieces of evidence)	
g.	Give four conditions that favour coral to grow	

Rock and Mineral Identification

1.	What are the three rock types?	
2.	(a) What is porphyritic texture ?	
	(b) In an igneous rock, what are the larger and smaller grains called?	
	(c) In a metamorphic rock, what are the larger and smaller grains called?	
	(d) What does the presence of porphyritic texture indicate in igneous rocks?	
	(e) Sedimentary rocks which have several grain sizes are not called porphyritic. What do we say these rocks are?	
3.	A rock with a large percentage of dark minerals is known to be mafic. What three main minerals do these rocks contain?	
4.	We name igneous and metamorphic rocks based on grain size. Name the three mafic igneous rocks with a numerical value for their grain size.	
5.	What does grain size tell us about igneous and metamorphic rocks?	
6.	What does grain size tell us about sedimentary rocks?	
7.	Sedimentary rocks use different sizes for classification. Name their numeric value.	
8.	A rock with a large percentage of light minerals is known to be silicic. What four minerals do these rocks usually contain?	

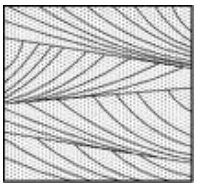
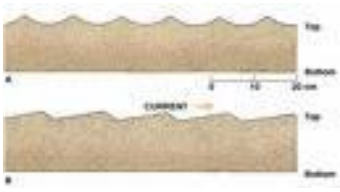
Rock and Mineral Identification

9.	What names do we use for coarse and fine grained silicic rocks?	
10.	What intermediate rock type has both mafic and silicic minerals? What is the main mafic mineral?	
11.	Interlocking texture is used to describe igneous and metamorphic rocks. Why do we not use this for sedimentary rocks.	
12.	What three properties are important to look for/test when identifying minerals?	
13.	Describe the term "lustre". Define: metallic, translucent and vitreous.	
14.	What is the term that describes how minerals fracture when they do not have a cleavage? Name such a mineral other than olivine.	

Sedimentary

1.	Define porosity. What texture of sedimentary rocks have a high porosity.	
2.	Define permeability. Which two sedimentary rocks are highly permeable?	
3.	What can change the character of either of the properties above? Give two	
4.	Define impermeable. Give two rock examples.	

Name the sedimentary structures below and describe how they formed. Draw the structure the wrong-way up.

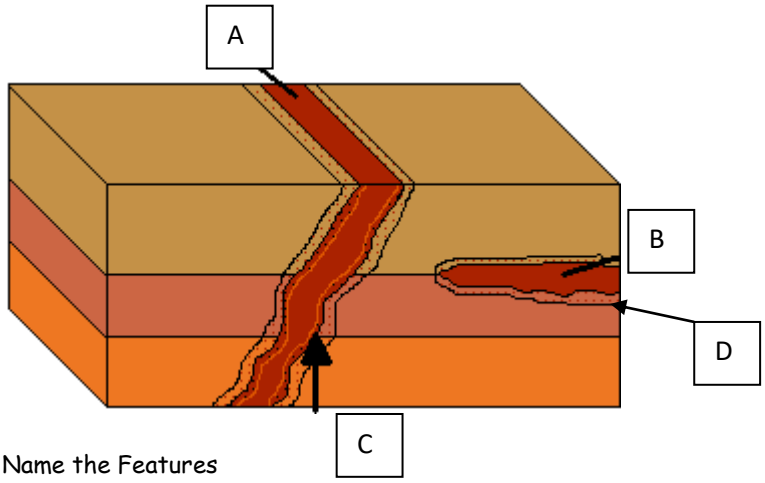
Diagram of structure	Description	Inverted diagram (upside down)
		
		
		
		

5.	Describe attrition. What happens to the grains?	
6.	Attrition occurs during wind transport. Describe the grains formed and the type of cementation that occurs in Aeolian (desert) sediments. Dunes form in Aeolian environments – what is the difference between these structures and those formed by marine processes or in rivers.	

Sedimentary - processes

7.	Describe abrasion. Which grain size is usually modified by abrasion rather than attrition and why.	
8.	What is bedload?	
9.	What is suspended load?	
10.	Which weathering process dominates colder climates?	
11.	Which weathering process dominates tropical/ equatorial climates?	
12.	The presence of what mineral tells you that a rock has not been in transport a long time?	
13.	What is the difference between conglomerate and breccias?	
14.	Describe how turbidity currents form and the resultant rock and sedimentary structure.	
15.	Name two rocks produced by sedimentary processes other than clastic.	
16.	Name three fine-grained rocks (include a limestone)	
17.	Name four medium-grained rocks and their defining feature (ie. colour)	
18.	Name two coarse-grained rocks.	
19.	What are the products of the chemical weathering of granite?	
20.	What is scree?	

Igneous



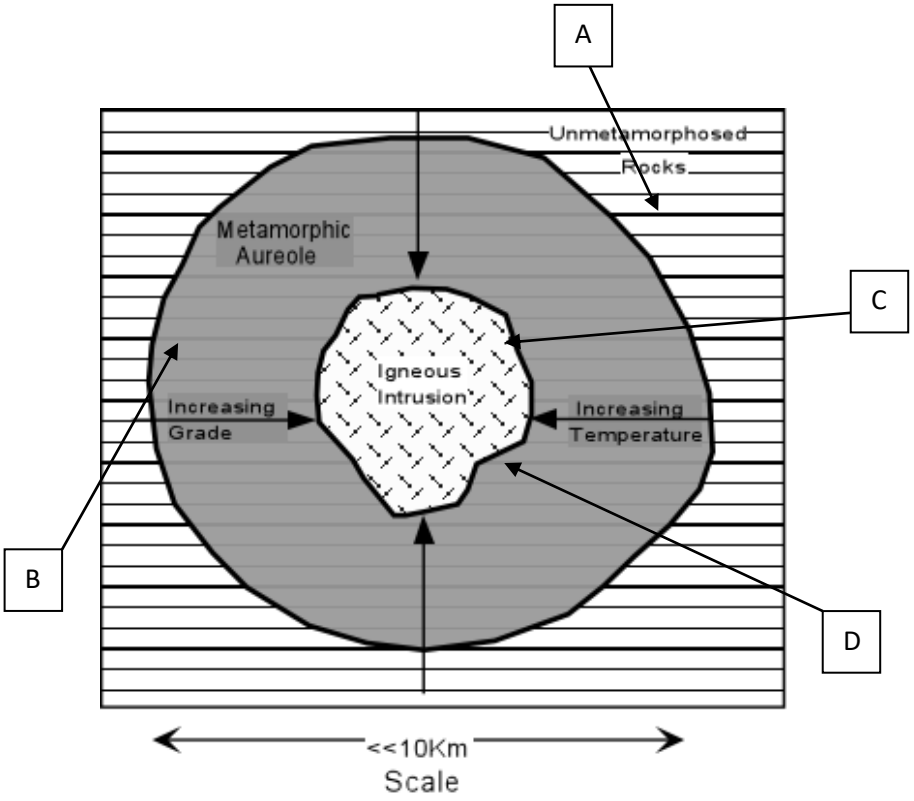
Name the Features

A.		B.	
C.		D.	

1.	Explain the difference between C and D above.	
2.	Feature B was intruded below the surface. How could you tell that Feature B was not in fact a lava flow?	
3.	Describe the grain size change across structure A above. If the composition of the magma was mafic, name the rocks that would form in the middle and on the outside.	
4.	What three structures form from lava flows?	

5.	What determines the shape of the above volcanoes? Name the rock type that forms.	
6.	Describe how pumice, vesicular and amygdaloidal lavas form.	

Metamorphism



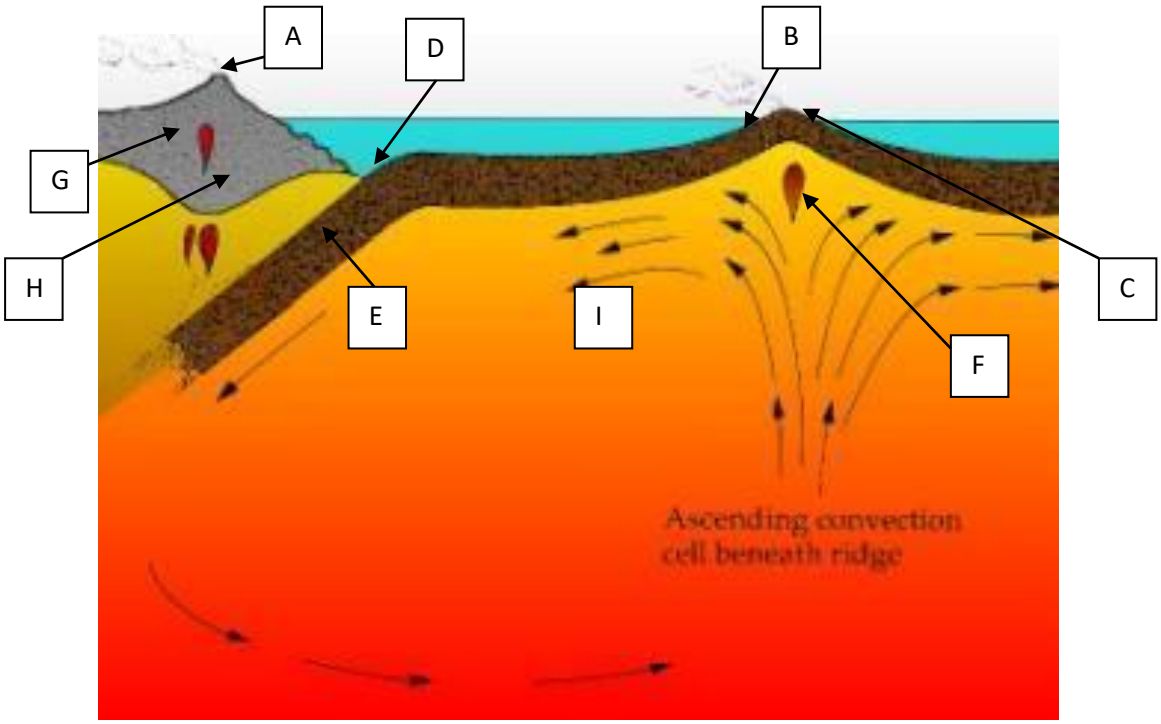
Name the Rock/Features (the country rocks are mudstones)

A.		B.	
C.		D.	

1.	What is this type of metamorphism and what is not seen in this type of metamorphism?	
2.	If the country rock had been marble or sandstone, how would the rocks differ at site B from Site D?	
3.	Regional metamorphism forms at destructive plate boundaries. What rocks form, from lowest to highest grade, if the original rock had been a mudstone or shale?	
4.	What do marble and sandstone NOT form during regional metamorphism that the rocks in (3) above do?	
5.	Regional rocks form during high pressures and temperatures. What is absent during contact metamorphism and why?	

Plate Tectonics

Ave Heat Flow →



Name the Rocks/Features

A.	(Rock)	B.	(Rock)
C.		D.	
E.	(Zone)	F.	(Process/Zone of)
G.		H.	(Igneous Rock)
I.		D/E	(Zone)

1.	Draw a heat flow diagram above the diagram using the middle line as the average. Draw arrows to show the direction of movement of the plates above the subduction zone and Mid-Ocean Ridge	
2.	What would the heat flow be at D above? Explain your answer.	
3.	What would the heat flow be above C ? Explain your answer.	
4.	Name the three different types of destructive plate margins.	

Plate Tectonics

5.	What type of destructive margin is depicted in the diagram above?	
6.	Island Arc systems have oceanic crust subducting beneath oceanic crust. Explain how this is possible?	
7.	What rock is produced at Island Arc settings?	
8.	What plate boundary is found at B above?	
9.	What key evidence is found here that the plates are moving away from each other?	
10.	What is the oldest oceanic crust?	
11.	What ceases to happen when continents collide? Why?	
12.	Convection currents continue to operate when continents collide. What is the consequence of this?	
13.	What three pieces of evidence did Wegener consider supported his theory of Continental Drift?	
14.	What main reason was his theory not accepted at the time?	

5.1 Geological Hazards

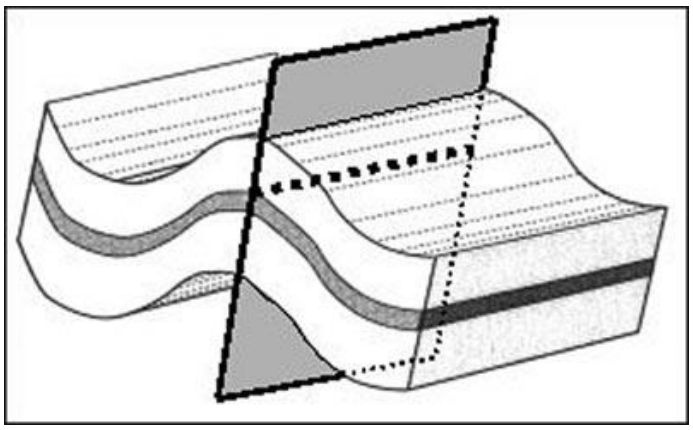
1.	What is the Mercelli Scale used to measure?	
2.	What is the Richter Scale used to measure?	
3.	Define epicentre.	
4.	Define focus.	
5.	What is liquefaction?	
6.	Briefly describe three effects of earthquakes.	
7.	Briefly describe four ways to predict earthquakes.	
8.	Briefly describe two ways in which earthquake hazards can be reduced.	
9.	Volcanic eruptions can be either effusive or explosive. Which is the more damaging? Why – give at least three reasons	
10.	Briefly describe three ways to predict volcanic hazards.	
11.	Briefly describe two ways in which earthquake hazards can be reduced.	
12.	What is a tsunami? How can it be triggered?	
13.	What geohazard factors contribute to major loss of life and damage.	

Geological Structures

Folding

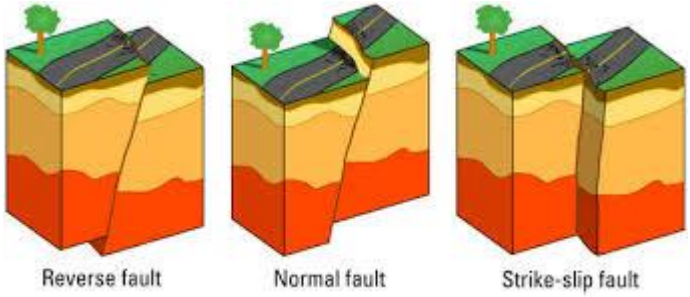
Sketch how a fold forms and use arrows to label the stress direction. Mark on the younging direction

Label below: anticline, syncline, a limb, axial plane trace, hinge, a bed, direction of dip, younging direction:



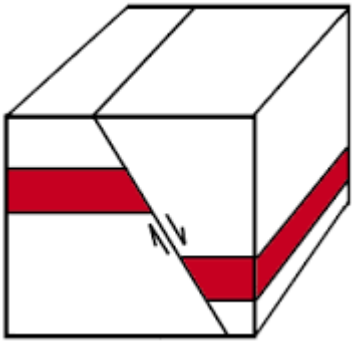
1.	What type of tectonic stress causes folding?	
2.	If an axial plane is vertical, the limbs dip at an equal amount. What do we call this type of fold?	
3.	What happens to the dip of the beds when the axial plane is dipping (ie. leaning from the vertical)?	
4.	Above is the cross section through a fold. Draw in the box how a fold would look in cross section where the hinge line is horizontal but the fold is asymmetrical. Mark on the dip of the beds with the symbol ├ and the dip value.	

Faults



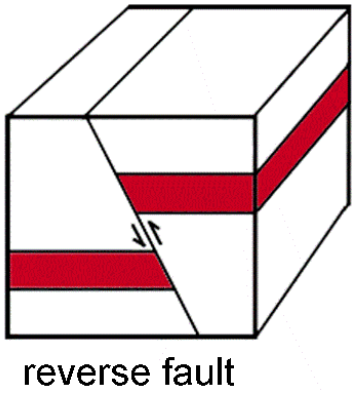
Normal Fault:

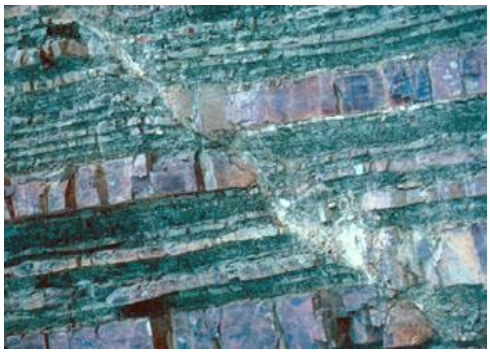
Redraw the above image for a normal fault, labelling: Hangingwall, Footwall, Movement Arrows. Measure the heave and throw (mark on your diagram what you have measured). Show the direction of dip of the fault plane with an arrow.



Reverse (Thrust) Faults:

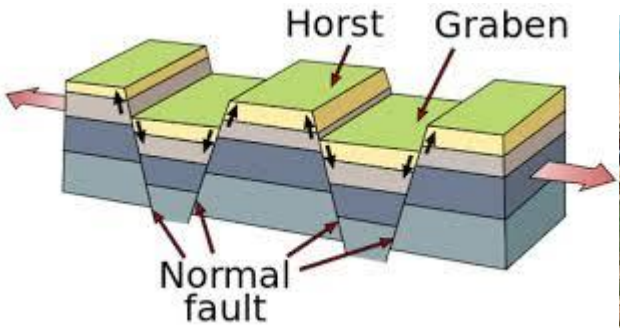
Redraw the above image for a reverse fault and another for a thrust fault, labelling: Hangingwall, Footwall, Movement Arrows, Angle of Dip. Show the direction of dip of the fault plane with an arrow.





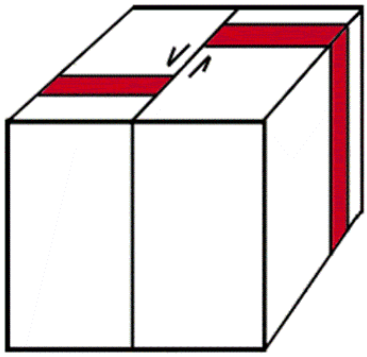
Horst and **Graben**

Refer to regions that lie between normal faults and are either higher or lower than the area beyond the faults. A Horst represents a block pushed upward by the faulting, and a Graben is a block that has dropped due to the faulting. Horst and Graben are formed when normal fault of opposite dip occur in pair with parallel strike lines . Horst and Graben are always formed together. Grabens are usually represented by low-lying areas such as rifts and river valleys whereas horsts represent the ridges standing between/on either side of these valleys.



Strike-Slip Faults

Draw a strike-slip fault, labelling movement arrows. Work out the amount of displacement on your fault (HINT: you will need a scale).



strike-slip fault

1.	What type of tectonic stress causes normal faulting?	Extensional / Compressional
2.	Define footwall and hangingwall	
3.	Describe a normal fault in terms of hangingwall and footwall.	
4.	Describe a reverse/thrust fault in terms of hangingwall and footwall.	
5.	For faults to happen, the rock needs to be cold. What term do we use for cold rocks?	
6.	Folds happen when rocks are warm. What term do we use for warm rocks?	

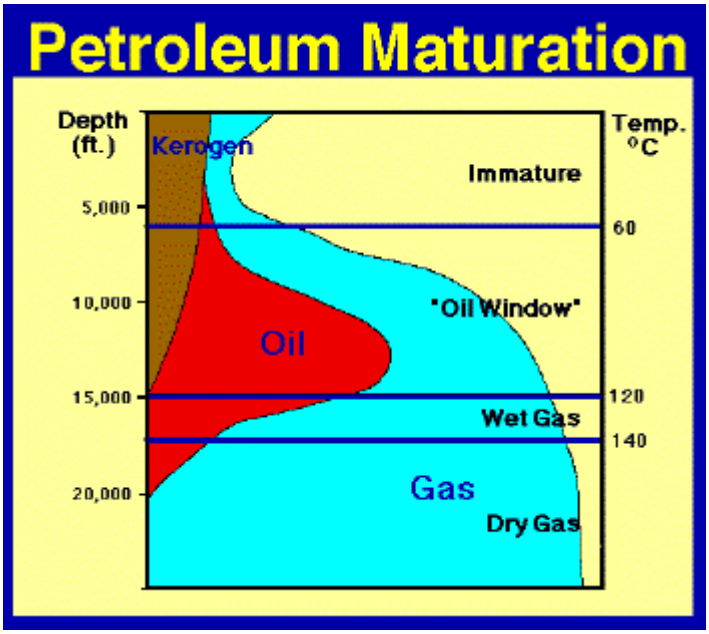
7.	At which plate boundary(s) do you find extensional faults?	
8.	At which plate boundary(s) do you find compressional faults?	
9.	Faults cause earthquakes. At which plate boundary(s) would you find shallow earthquakes?	
10.	At which plate boundary(s) would experience earthquakes up to 700km deep?	
11.	What do we call the zone of earthquakes along a subduction zone?	

EXTENSION TASKS

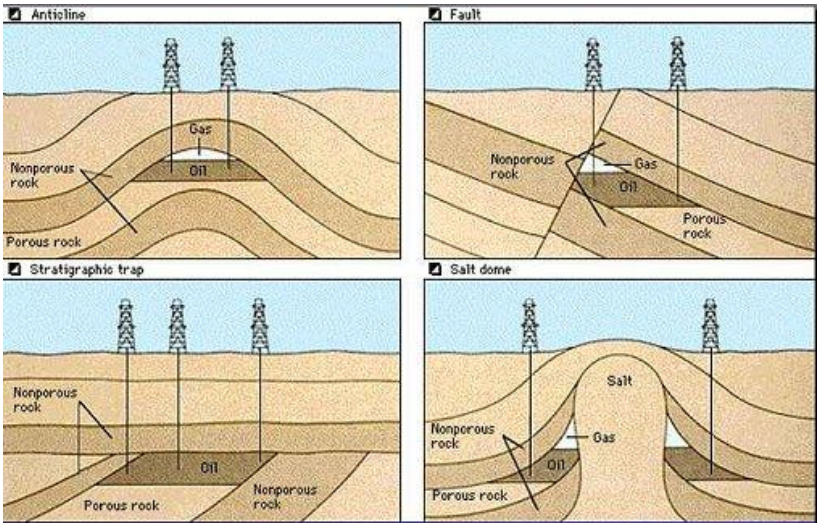
Oil

Source rock: Organic rich (Mudstone, Shale) containing abundant plankton.
Maturation: Plankton converted into petroleum by temperature and pressure during burial.
Migration: movement of Petroleum from source rock to reservoir.
Reservoir Rock: Porous and permeable rock which stores petroleum
Cap rock: Impermeable rock above the reservoir preventing petroleum migration

Formation of oil



Types of oil traps

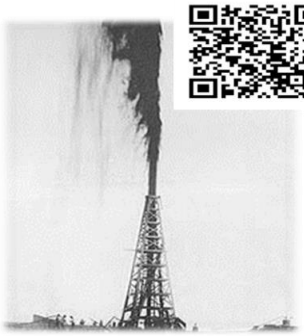


What are the main types of oil trap? How do they 'trap' oil?

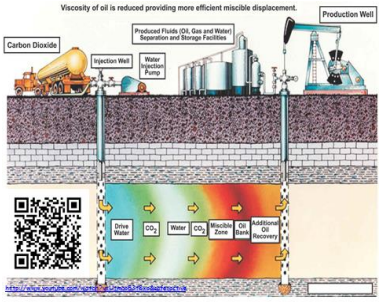
Recovering oil – Use QR codes to explain methods.

1. What, Where, Why, How?

2.



3.



Coal

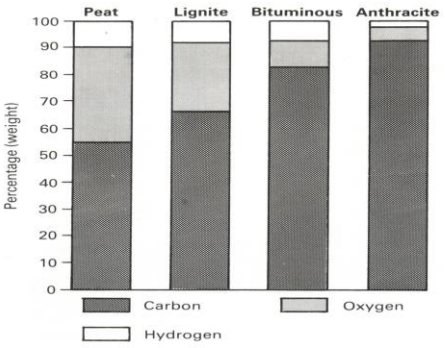
Answer the following:

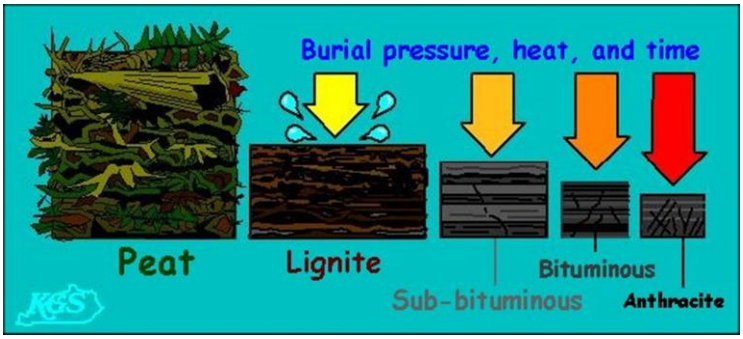
Formation:

Environment:

When:

Coalification and the coal series

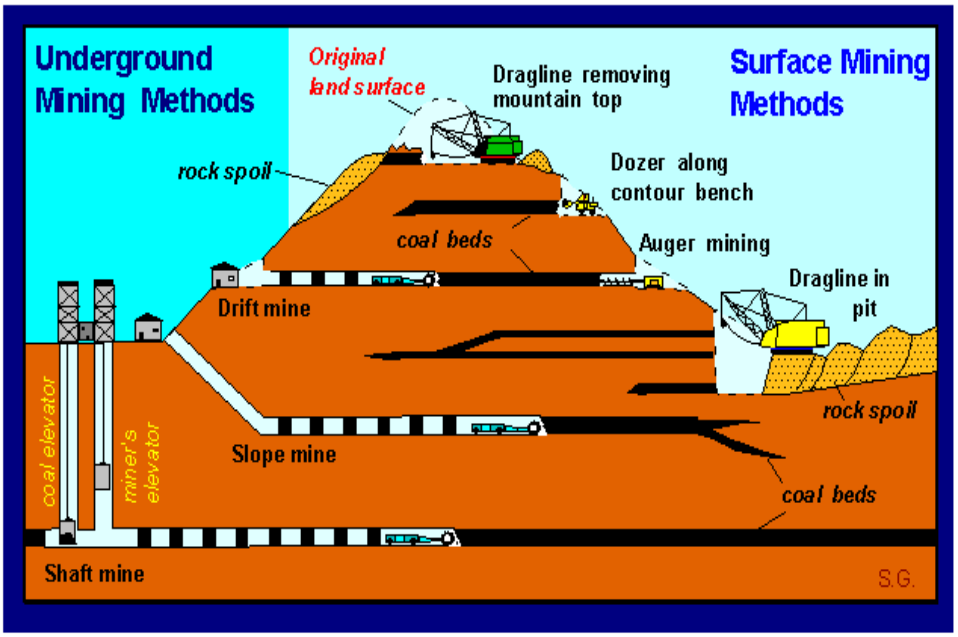




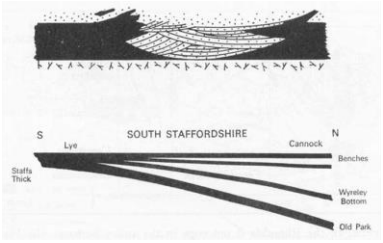
What is the link between Calorific value and carbon content?

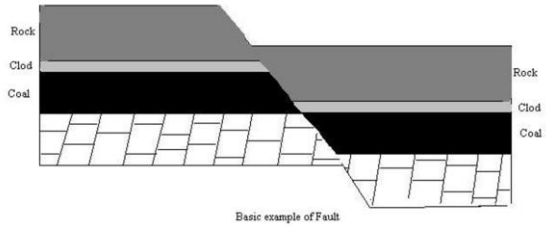
As the organic material becomes metamorphoses into coal, the carbon content increases and the impurities which include O and H reduce. The higher the Carbon content, the greater the calorific value which means that anthracite, which is the last to form, produces the most amount of energy.

Methods of Coal Mining



Difficult Mining – **Explain how river washout, Seam splitting and faulting can reduce the ability for miners to extract coal from mines.**





A – Washout

B – Seam Spliting

C - Faulting

Problems of Coal mining

List the problems ofsurface in the boxes below.

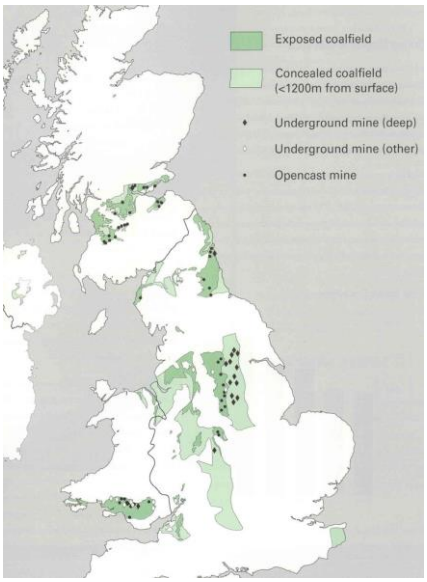
• **Human environment**	• **Natural Environment**

Or underground…..

1. Water
   - Changes in nature of groundwater and flow
   - Water table rebound
   - Contamination with Acid Mine Drainage (AMD)
2. Landscape
   - Dereliction of land
   - Dumps, spoil heaps, tailings (waste from processing)
3. Subsidence
4. Methane release – poisonous and flammable gases
5. Surface dumps, tips and heaps

UK Coal

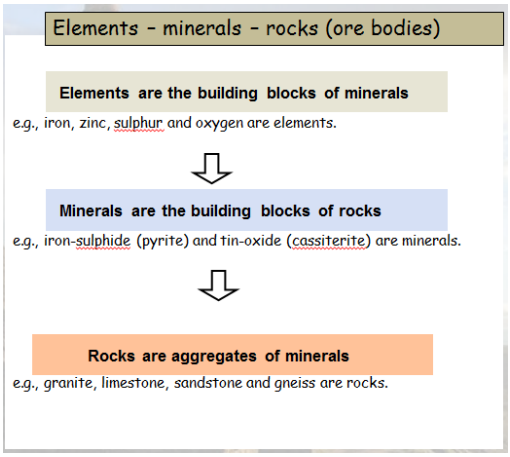
- Most U. K. coalfields are of Carboniferous age.
- However, there are some Tertiary coals in Devon (tend to be soft).
- S. Wales coalfield produces more than 50% anthracite, mainly open cast.
- Most U. K. coal is bituminous with only small areas of anthracite except S. Wales and Kent.



Metal Mining

Key Words

- Mineral – something that can be mined from the ground and is of economic/industrial value.
- Ore – the valuable material extracted comprises the Ore mineral and the Gangue
- Ore Mineral – the mineral from which the valuable component usually a metal will be derived
- Gangue – the unwanted part of the ore, comprises minerals such as calcite, quartz and iron pyrite
- Grade – Refers to the proportion of the ore that is the ore mineral or actual elemental metal content that can be extracted from it - expressed as a percentage



Native metals: A native metal is a metal found in its metallic form in nature. Only gold, silver, copper and platinum metals occur in nature in exploitable amounts.

Metal oxides: Are simple compounds with the element oxygen (O). Metals are relatively easily extracted from oxide minerals. Examples include: Hematite: Fe2O3

Metal sulphides: Are simple compounds with the element sulphur (S). Metals are less easily extracted from sulphide minerals, and are often oxidised first, as the initial stage in metal recovery. Examples include: Sphalerite: ZnS

Aggregate Mining

Type	Properties
Building Stone:	High load bearing strength, Attractive. No structural weaknesses. Resistant to mechanical and chemical weathering, Impermeable.
Aggregate:	Usually sand and gravel, heavily processed, remove impurities like clay, pyrite, organics, salts and sulphates, hard rocks such as granite, gneiss, greywacke, flint can be crushed.
Road stone:	Crushed aggregate mixed with bitumen, Strong high impact and bearing capacity., Resistant to abrasion and mechanical weathering, Impermeable to chemical corrosion., Angular Stones -Skid Resistant – does not polish (Polishing Stone Value (PSV)).

Landslides

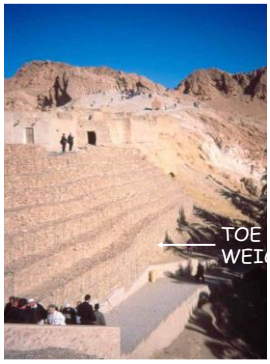
Angle of rest and slope stability

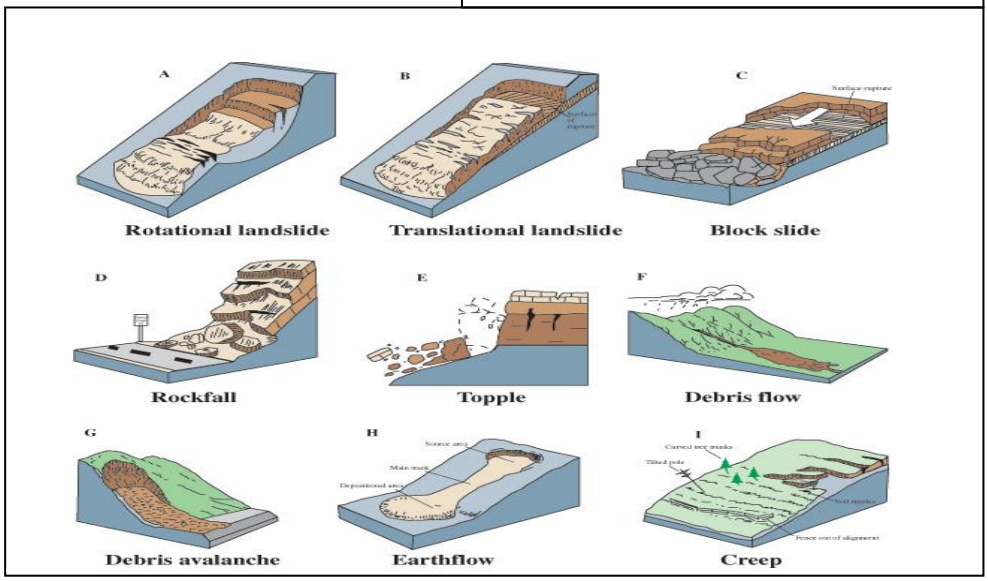
- This is the angle at which loose material remains stable.
- It is measured from the horizontal.
- It is greatest in fine-grained, angular material. Sugar is a good analogy.
- It is lowest in coarse-grained, rounded material. Rice is a good analogy.

Slope Stabilisation

Gabion Retaining Walls

Gabions holding up a very steep and unstable slope. The gabions are filled with local rocks.





Rock Bolting

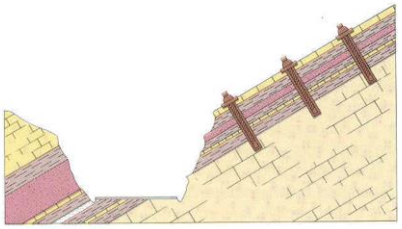


Figure 12–33 Rock bolts can be effective in preventing the slippage of bedrock along inclined planes of weakness. The system involves lowering a heavy cable into a drill hole and cementing it at the base within stable bedrock. A steel plate and nut are tightened onto the cable, thus anchoring the unstable beds above to the stable beds below.

Diagram to show benches on cuttings.