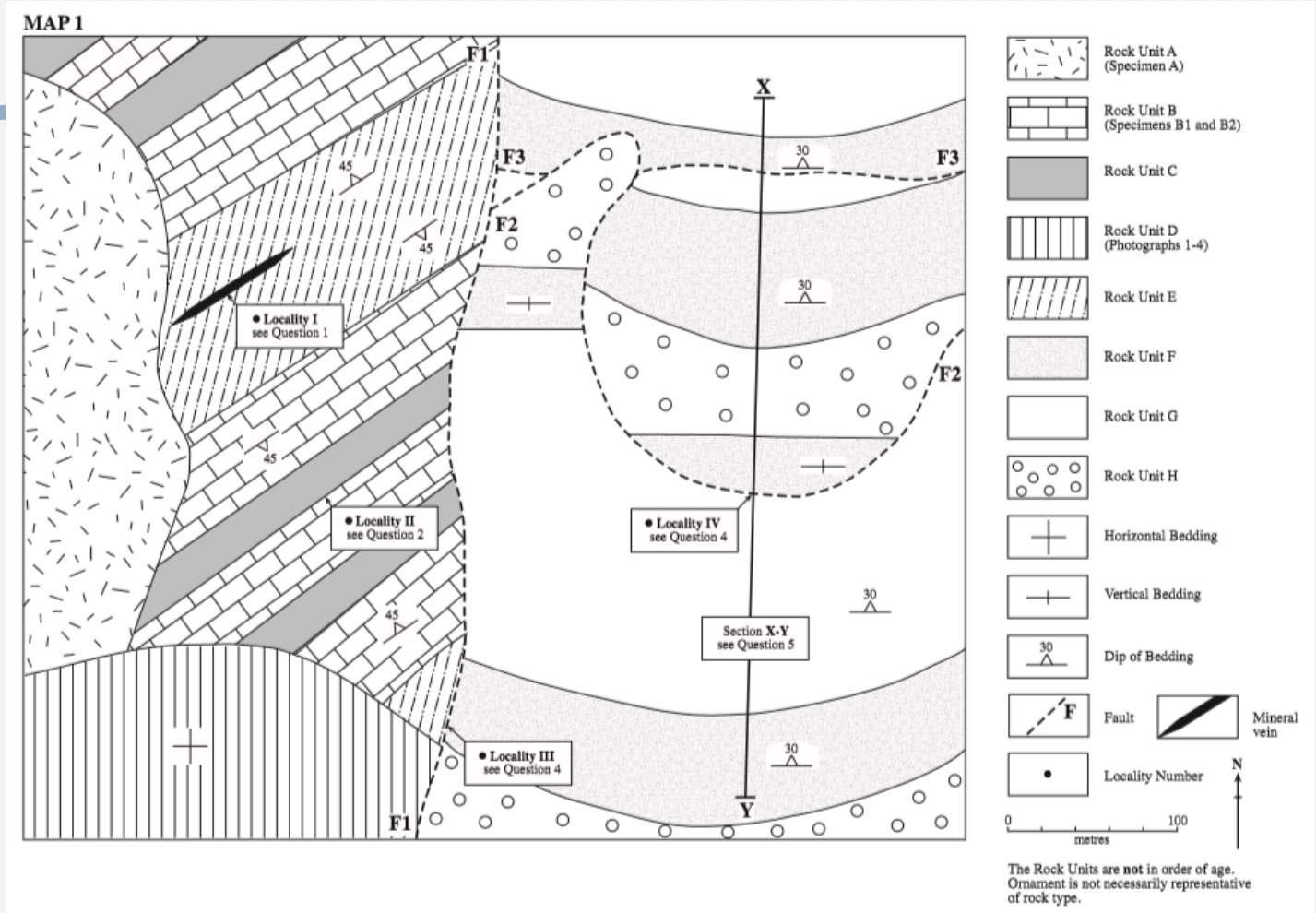
AS Geology - Investigations

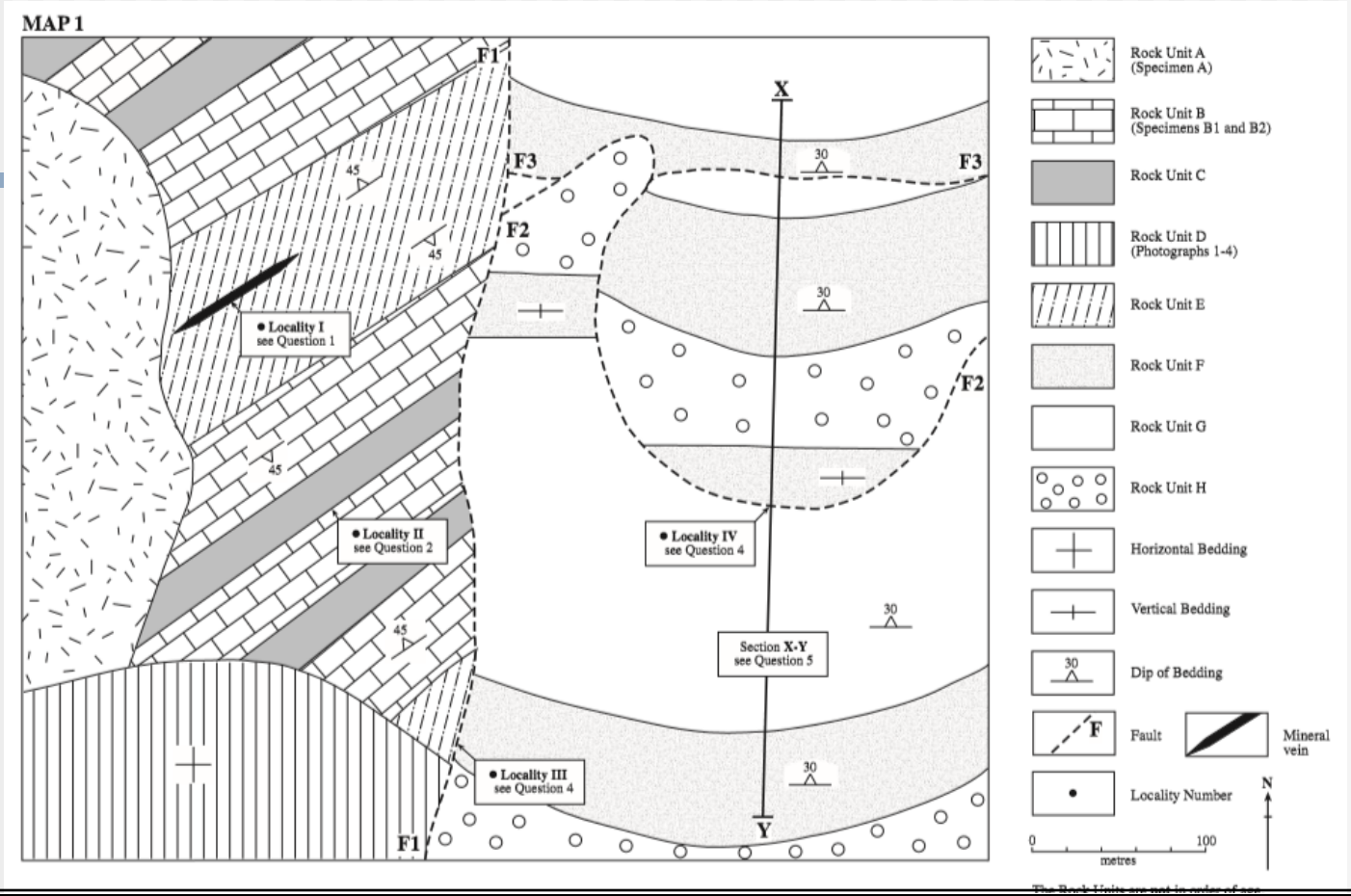
Paper 1 – Practical $1^1/_2$ hours



A test of your range of interpretation skills based around a simplified geological map

Map Interpretation

What features can you interpret from a map



Main principles

* Superposition – younger rocks on top of older ones * Rock layers dip towards younger ones

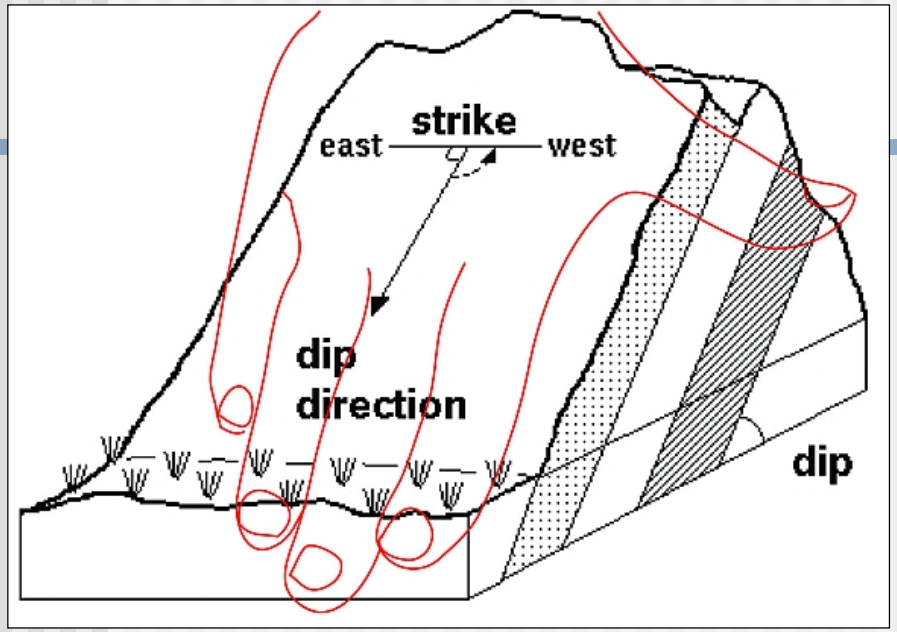
* Cross cutting – a feature cross cutting another must be younger * Strike is bi-directional

* Faults downthrow towards younger rocks * Antiforms/Anticlines have oldest rocks in middle

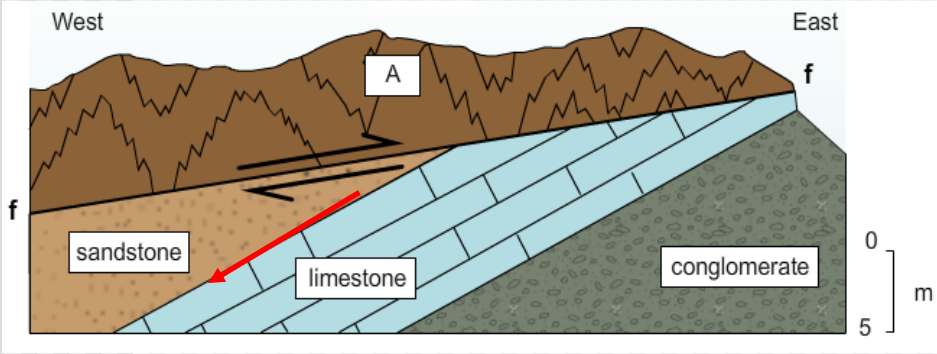
* Synforms/Synclines have youngest rocks in the middle * Unconformities hide the older rocks

Don’t forget Dip and Strike

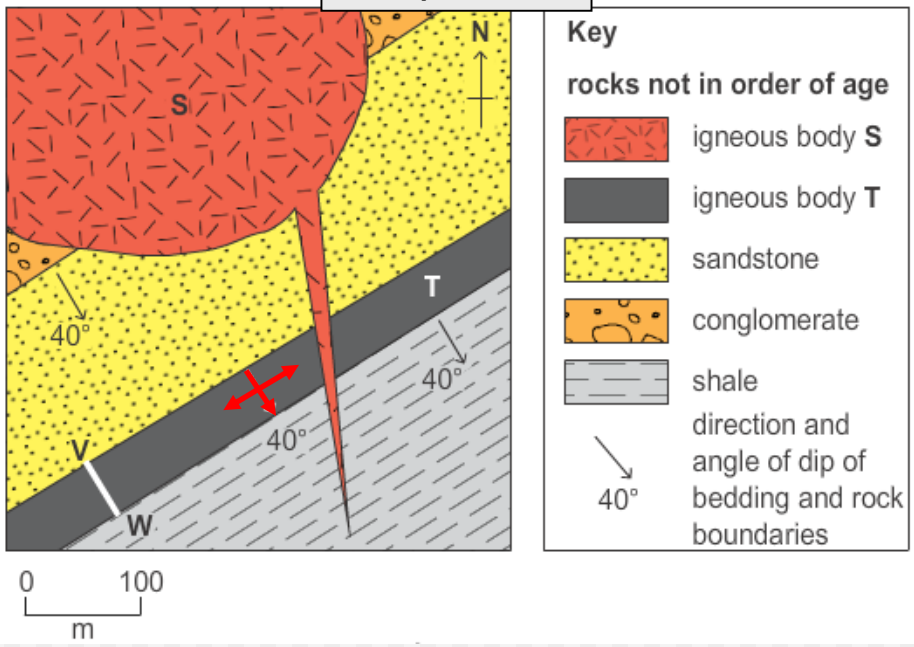
Rock layers are tilted by compression and show both dip and strike



Cross-section view



Map view



The sedimentary beds on the map:

- Dip to the South East at 40º
- Strike NE to SW

The sedimentary beds on the cross-section:

- Dip to the West at 30º
- Strike N to S (into the board)

Rock Texture

You will be given three or four rock/fossil specimens along with photos of key locations or features in the exam. You may be asked to:

* Describe the texture (**size**, **shape**, **sorting** of particles)

Very small, random crystals (under 1mm) with rounded gas vesicles.

* Name the rock

Basalt

* Recognise minerals

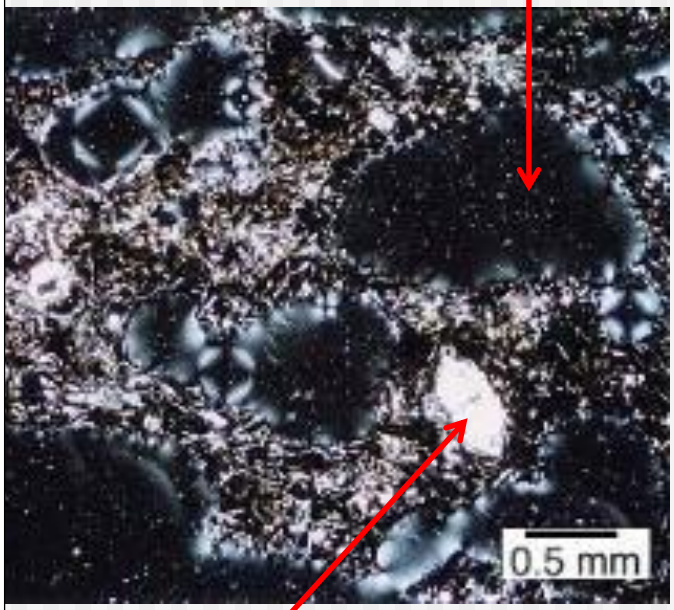
Feldspar

* Explain its formation

Probably formed as a lava flow due to small crystal size (rapid cooling). Gas trapped as it tried to escape during cooling.

Key textural words:

Crystalline
Foliated
Well-sorted
Random
Angular
Rounded
Equigranular
Non-foliated
Layered

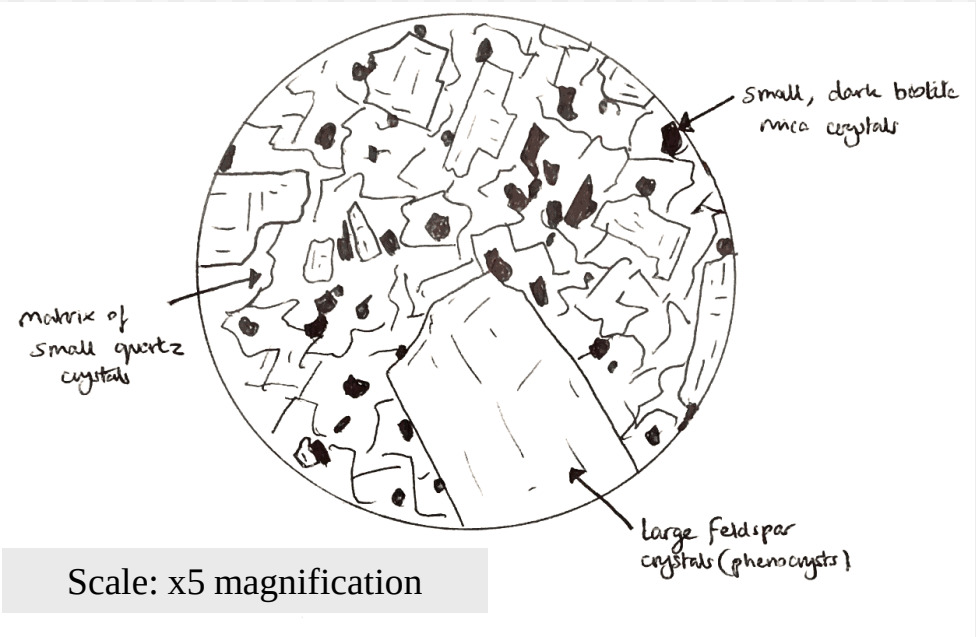


White mineral with 2 good cleavage planes

*** Remember to use the mineral data sheet if necessary ***

Sketching Specimens

You will almost certainly be asked to draw a sketch of a rock/fossil either from hand specimen or from a photo.



Scale: x5 magnification

To calculate the magnification you simply use:

$$\text{Magnification} = \frac{\text{size of image/sketch}}{\text{size of real object}}$$

Above example

$$\text{Magnification} = \frac{5\text{cm}}{1\text{cm}} = 5 \text{ times}$$

*** Remember to use the mineral data sheet if necessary ***

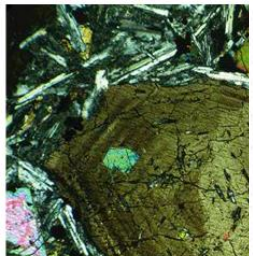
Mineral Identification

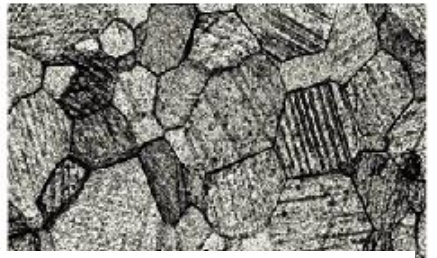
You may be given photos of mineral samples related to the map. You may be asked to:

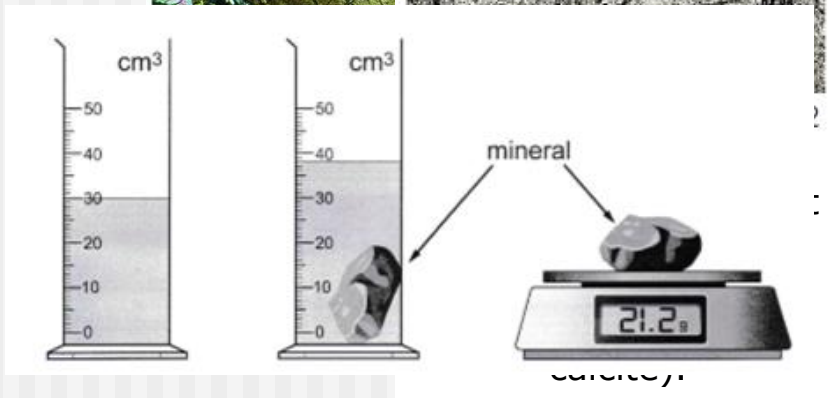
* Identify them from their given properties.

* Describe tests that you would undertake to ider

* Interpret their formation.







Name		Cleavage/Fracture	Hardness	Density (gcm^{-3})	Streak	Lustre	Colour	Other diagnostic properties
Quartz	RF	*none/conchoidal	7	2.65	scratches streak plate	vitreous	colourless, milky but variable	hexagonal prisms terminated by pyramids
Orthoclase Feldspar	RF	*2 good, 90	*6	2.6	scratches streak plate	vitreous	flesh, pink, white	*simple twin
Plagioclase Feldspar	RF	*2 good, 90	*6	2.7	scratches streak plate	vitreous	creamy-white, grey, colourless	*repeated multiple twin
Muscovite Mica	RF	*1 perfect (basal)	*2.5	2.7-3.1	white	pearly	colourless or pale yellow, green or brown	*flaky
Biotite Mica	RF	*1 perfect (basal)	*2.5-3	2.7-3.1	white	pearly	brown/black	*flaky
Hornblende	RF	*2 good, 60/120	*5-6	3.0-3.5	scratches streak plate	vitreous	black, dark green	prismatic crystals
Augite	RF	*2 good, 90	*5-6	3.2-3.5	scratches streak plate	vitreous	greenish black	prismatic crystals
Olivine	RF	none/conchoidal	*6-7	3.2-4.3	scratches streak plate	vitreous	*olive green	
Chiastolite/ Andalusite		poor 1/ uneven fracture	7.5	3.1-3.3	scratches streak plate	vitreous	pearly grey/pink	needle crystals with square x-sections, black centre
Garnet		none	*6.5-7.5	3.5-4.3	scratches streak plate	vitreous	red/brown	*12 sided crystals - each face rhomb shaped
Calcite	RF	*3 good, not at 90, perfect rhombs	*3	2.71	white	vitreous	colourless, white, tints	*effervesces with 0.5M HCl, rhombic shape
Fluorite		*4 good, parallel to octahedron	*4	3.0-3.2	white	vitreous	colourless purple/green/yellow	fluoresces in uv light, cubic or octahedral crystals
Halite		3 good, 90 cubic	*2.5	2.2	white	vitreous	colourless, white, often stained	*salty taste cubic crystals, often stained
Gypsum		1 good (basal)	*1.5-2	2.3	white	silky, pearly	colourless, white, often stained	fibrous or twinned crystals
Barites		2 good, 90	*3-3.5	*4.5	white	vitreous, resinous	white, pink	bladed crystals
Chalcopyrite		poor/conchoidal	4	4.2	*black	metallic	bronze yellow	*tarnished to peacock colours
Pyrite		none/conchoidal	*6	5.0	*greenish black	metallic	brass yellow	crystals often striated cubes
Galena		*3 good, 90 cubic	*2.5	*7.5	*lead grey	metallic	lead grey	cubic crystals
Haematite		poor/subconchoidal	*5.5-6.5	4.9-5.3	*cherry red	metallic-dull	red/black skin/steel grey	kidney shaped masses, fibrous

* - Useful property for diagnosis RF - Common rock-forming mineral

This table should not be memorised.

Marks in the examinations will be awarded for description of the outcomes of tests on minerals and, on some occasions, identification from test results.

To calculate the density of a mineral:
1) Weigh it on a balance.
2) Place it into a set volume of water and see how much it displaces.

Finally: Density (g/cm^3):

$$= \frac{\text{weight}}{\text{volume displaced}}$$

*** Remember to use the mineral data sheet if necessary ***

Evidence Questions

These will ask you to use evidence from a specific map location, specimen or photograph

(a) Complete **Table 3a** using evidence from **Specimen C** and **Figure 3**. For **Specimen C** you must refer to a diagnostic test using the equipment provided by the supervisor. [6]

	Evidence from **Specimen C** **Locality I**	Evidence from **Figure 3** **Locality II**
Crystalline texture (yes/no)	• No	•
Mean size of grains/crystals (mm)	•	•
Composition	Test and result • Conclusion/composition •	Composed of calcium carbonate
Name of rock	•	Marble

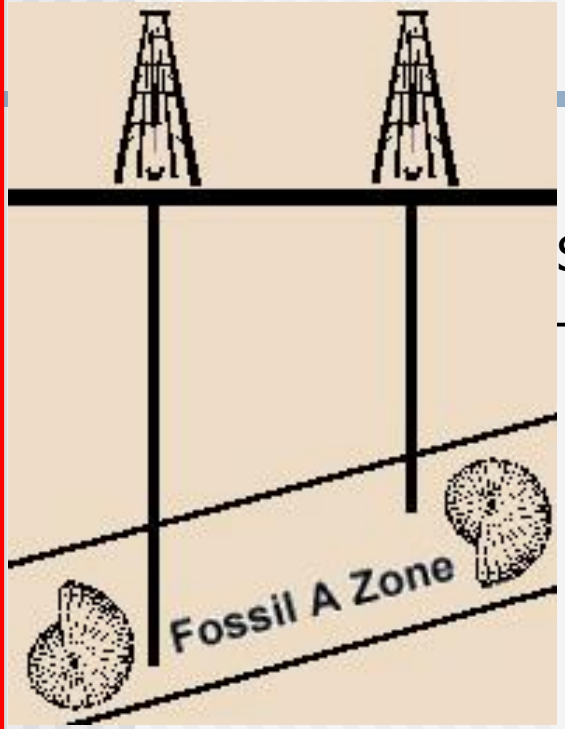
Table 3a

- Use the correct thing to provide your evidence e.g. map, photo or specimen
- Make use of the equipment provided if required
- Use the mineral data sheet if it will help
- Refer to evidence – what proof is there? Don't speculate

Key Fossils

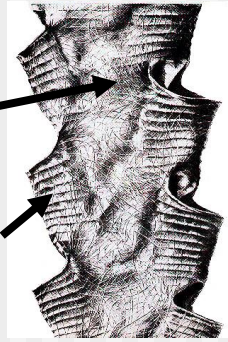
Zone fossils can be used on a map to:

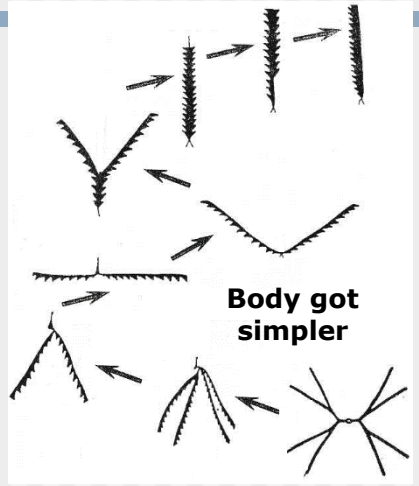
Match up (correlate) rocks of the same age, or put rock units in age order.



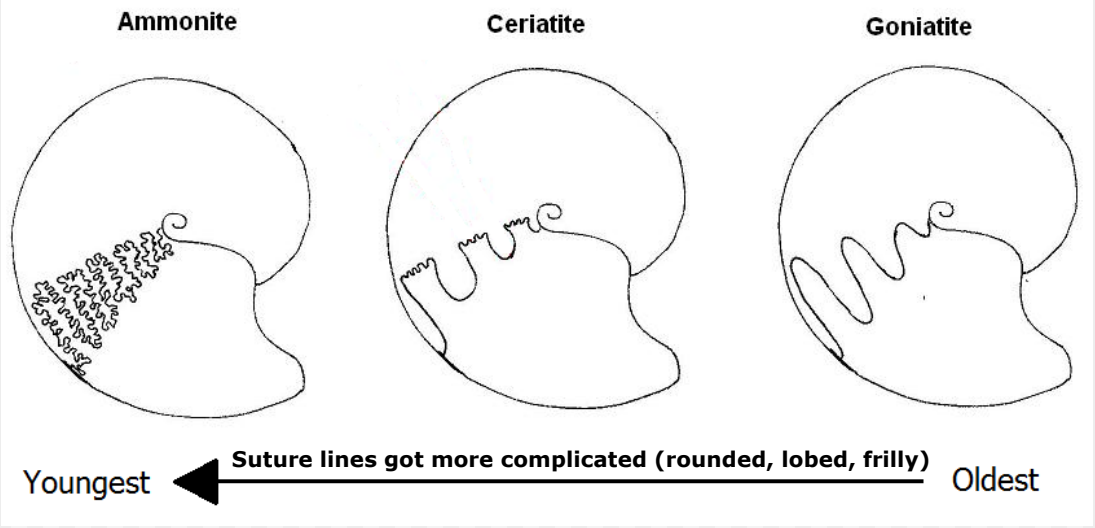
Zone Fossils

Graptolites





Cephalopods



Good zone fossils:

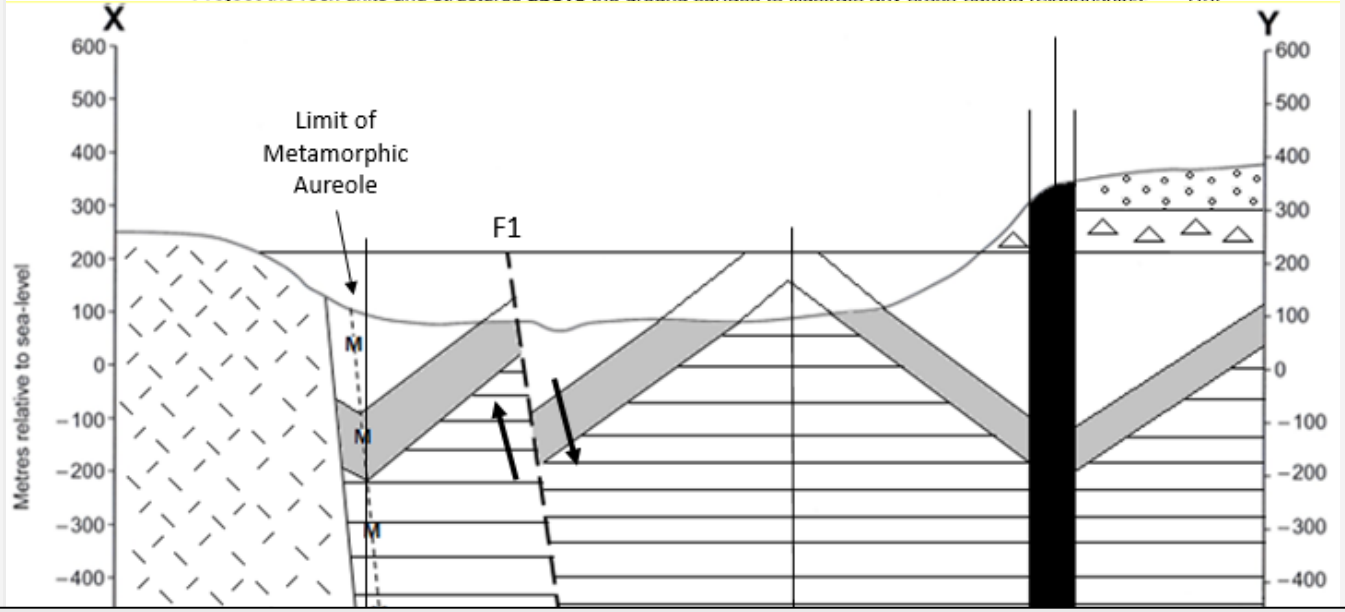
- Evolved quickly
- Widespread
- Lived in the sea
- Numerous
- Easy to recognise features

The Cross Section!

You will need to draw an accurate and detailed cross-section showing the geology along the line shown on the map.

Complete the sketch of the geological cross-section along this line using **Map 1**.

- Draw the rock units. Use similar ornament, or letters, for those as on **Map 1**.
- Draw and label any **fold axes**, with the correct symbol.
- Draw **arrows** to show the movement of any faults.
- Mark on the extent of any metamorphic aureoles.
- **Project** the rock units and structures **above** the ground surface to illustrate any cross-cutting relationships. [13]



Key tips

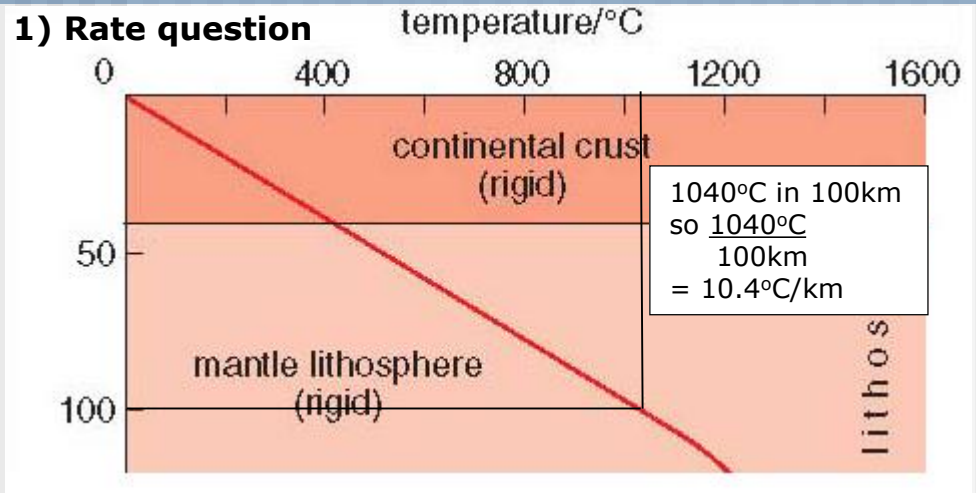
- Make sure your piece of paper is neat, accurate and includes all relevant information
- Add in the horizontal layers first (youngest), followed by vertical/igneous features
- Then complete the older, dipping beds and layers
- Finally do what you are asked to e.g. project above surface, label features etc.

Science (therefore some maths!)

Therefore there will be some elements of data analysis or realtively simple mathematical questions.

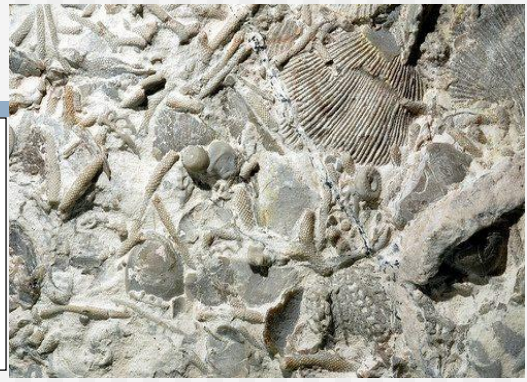
Three common types:

1) Rate question



1040°C in 100km
so $\frac{1040°C}{100km}$
= 10.4°C/km

2) Ratio question



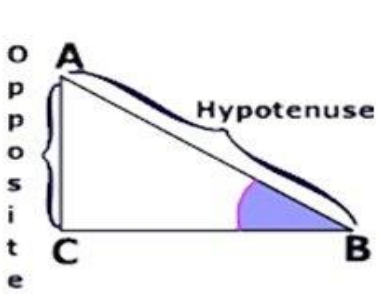
100 fossils counted in a bed of limestone. 30 are bivalves and 70 are corals. What is the ratio of bivalves to corals?

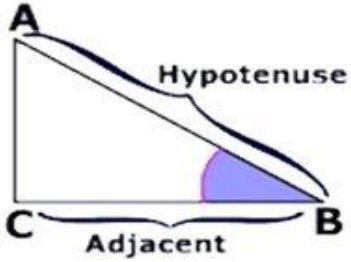
30 bivalves 70 corals: $\frac{70}{30} = 2.3$

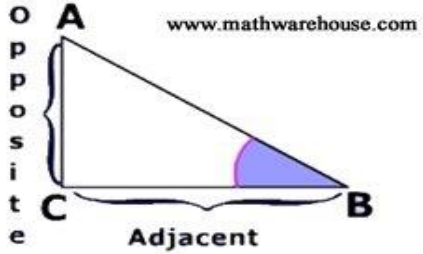
So the ratio is 1 : 2.3

3) Trigonometry questions

$$\sin(B) = \frac{opposite}{hypotenuse} \qquad \cos(B) = \frac{adjacent}{hypotenuse} \qquad \tan(B) = \frac{opposite}{adjacent}$$





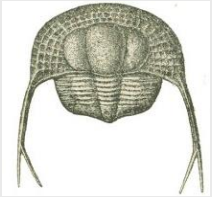


Remember – Command Words

- Describe = Say what you see (from a graph, map or picture).
- Explain = State how something has happened (give facts in order).

* Large crystals formed first
* Smaller crystals all cooled quickly later on

- Label = Add to a map or picture (easy to miss).
- Annotate = Put explanation on a map, cross section or diagram.
- Compare / Contrast = Say how things are similar / different.
- Interpret = Use evidence to suggest way of life or rock formation.



*LONG SPINES SUGGEST BURROWING
*NO EYES SO LIVED IN DEEP WATER
*SMALL TAIL – NON SWIMMER

- Evaluate = Give the good and bad points, come to a decision – maybe about quarrying, landfill sites, dams etc.

Read, read and read the data and the questions: RTFQ and ATFQ