Uplift - Student Activity

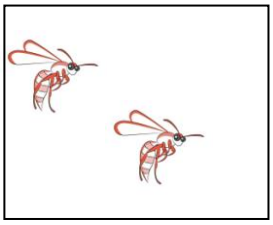
Tectonic movements uplift and down-warp the crust of our planet. Tectonic movements raise mountains and create sedimentary basins. In Western Australia the Yilgarn and Pilbara cratons are slowly moving upwards and being eroded whilst the major sedimentary basins such as the Perth Basin, Canning Basin and Eucla Basins are slowly moving downward and being filled with sediment.

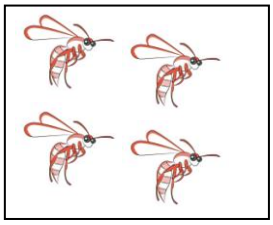
Uplift is the result of two forces working in concert, temperature and density:

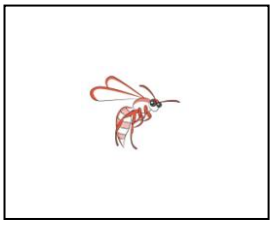
1. Temperature causes expansion or contraction creating density changes and the formation of convection currents within the asthenosphere (crust/mantle interface zone)
2. Density changes permit the vertical movement of rock masses

Density

Density is a measure of mass (amount of matter) per unit volume (space taken up).







If each of these pictures represent a 1 cubic centimetre ($1cm^3$) box, what is the wasp density in each box?

_____

If each wasp had a mass of 1 gram (1g) what would the density of each cube be?

_____

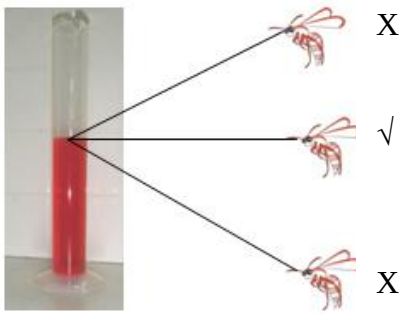
MASS

VOLUME X DENSITY

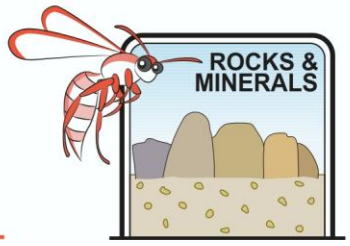
To find what happens when liquids of different densities are placed in the same container.

Materials per student or group

- 1 test tube
- Equal volumes of water and vegetable oil (20mL)
- Test tube rack or beaker to hold it upright
- A measuring cylinder



Measure out 20mL of oil and 20ml of water. HINT it is easier if you measure the water first. Remember to take your eye down to the level of the liquid and measure from



the bottom of the meniscus.
Place your thumb over the mouth of the test tube to seal it and give the liquids a good shake.
Leave the test tube upright and note what happens to the oil and water.
Repeat three times.

Test	Observation
1	
2	
3	

Why did you repeat the experiment? _____

Your teacher will demonstrate how to measure the densities of oil and water.

What was the density of water? _____

What was the density of oil? _____

Do we now have scientific data to explain why oil "floats" on water? Explain your answer.

_____

_____

Density of rocks
Igneous rocks are rich in iron which has a density of 7.87g/cm^3. Sedimentary rocks are rich in silicon which has a density of 2.33g/cm^3. Core rocks are much denser than crustal rocks due to gravitational pull.
Which rocks are more common on our Earth's crust? _____

Which rocks must have risen up from deeper in the Earth? _____

The volume of non-geometrically shaped rocks can be estimated by water displacement.

To estimate the volume, mass and density of a rock
Materials per student or group

- String
- Different rocks
- A large beaker
- A measuring cylinder
- Triple beam balance
- Water

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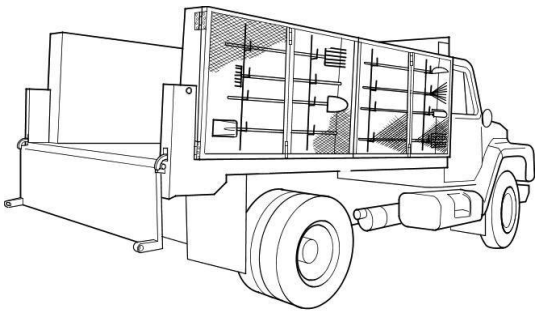
1. Using the triple beam balance measure the mass of the rock. Remember to move the heaviest weights first.
2. Fill the beaker with water and place it somewhere any overflow can be collected by the measuring cylinder, perhaps placing it on the edge of the sink draining board?
3. Tie the rock with string.
4. Lower the rock into the water and collect the volume of water it displaces into the measuring cylinder.
5. Use the mass and volume data to estimate the density of each rock.

Rock	Mass (g)	Volume (cm^3)	Density (g/cm^3)

Extra for experts

A contractor has to carry twenty 1 metre cubes of granite and twenty of sandstone to a new building site. His truck is only licensed to carry 10.5 tonnes (1,050,000g). Granite has a density of 2.64g/cm3 and this sandstone has a density of 2.32g/cm3. What is the most efficient way for them to load their truck?



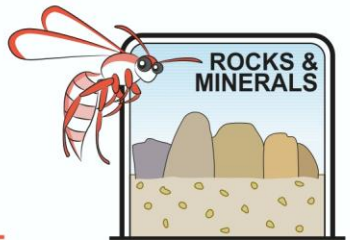
As sediments are covered by more and more sediments in a basin they will compact losing water and increasing their density.

Density and mineral ores

Mineral ores have their origins in different rocks at different depths within the Earth .The greater the density the greater the depth. Tectonic forces bring them to the surface for our use.

Please use the data provided to range the minerals from deepest source to least deep.

Manganite (magnesium Mg)	$4.32g/cm^3$	Gold (Au)	$19.32g/cm^3$
Bauxite (aluminium Al)	$2.45g/cm^3$	Siderite (tin Sn)	$3.85g/cm^3$
Galena (lead Pb)	$7.5g/cm^3$	Magnetite (iron Fe)	$5.12g/cm^3$



MASS
VOLUME X DENSITY

CALCULATIONS
If a rock has a mass of 9g and a volume of $3cm^3$ then its density will be $3g/cm^{3.}$

Trial estimations

1. If the igneous rock gabbro has a mass of 12g and a density of $3.03g/cm^3$, what is its volume?

_____

_____

2. If the sedimentary rock sandstone has a volume of $36cm^3$ and a density of $2.50g/cm^3$, what is its mass?

_____

_____

3. What is the density of a gold nugget which has a mass of 3g and a volume of $0.16cm^3$?

_____

Extension
Archimedes "Eureka" moment happened when he solved the problem of whether a crown was made of solid gold after he had been having a bath! What did he do to prove the crown was not pure gold? Interrogate your library and the internet.

_____

_____

_____

_____

_____

Uplift - Student Activity

Heat and density **Convection currents**

Away from tectonic boundaries (hot spots) temperature increases by 25^{o}C for every kilometre of depth. Miners often have to be provided with air conditioning to work in deep mines. As heat increases kinetic energy increases. Molecules become more mobile and bounce off each other pushing each other farther and farther apart. This decreases the density of rocks with depth. Less dense rocks can rise. Within the sticky partially melted zone of the asthenosphere which lies at the boundary of the crust and mantle, these rising masses of hot rocks create very slow moving convection currents. When the rocks rise, they cool, become denser and create downward currents. There are many convection currents currently at work moving rocks around. Australia is slowly moving northwards at the same rate as your fingernails grow driven by such a convection current.