THE DUSTON SCHOOL
Knowledge itself is power
TDS 4-19

Year 9 Science Knowledge Booklet

Term 2

Name:	**Class:**
Homework 1 Due: 9th November	**Homework 2 Due: 7th December**
Homework 3 Due: 23rd November	

Science Homework 1

Read all of this knowledge organiser. The work covered will be in the first knowledge quiz of the term.

Big questions: How has our world developed?

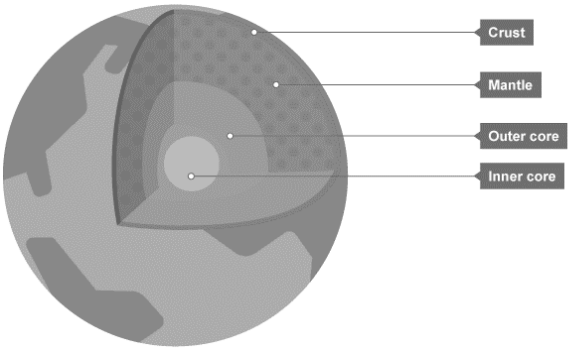
Why is the Earth like a scotch egg?
How has the Earth changed over time?
What is the difference between different rock types?
How are rocks recycled?
How does carbon move between different forms?
Why are scientists concerned about rising carbon dioxide levels?

Key vocabulary

Atmosphere	Layer of gases surrounding the Earth.
Carbon cycle	The series of processes where carbon compounds are interconverted in the environment.
Combustion	An exothermic chemical reaction where a fuel reacts with oxygen to release energy.
Compaction	Where a force is exerted on deposited material to force the deposited material into layers
Composition	The makeup of something e.g. the composition of air is 78% Nitrogen, 21% Oxygen and 1% other gases
Condensation	Physical change of substance for gas to liquid
Crust	The outer most layer of the Earth, it is solid.
Deposition	Process where material being transported by a river is deposited.
Erosion	Where bits of rock are moved away by wind or rain.
Hydrosphere	The liquid part of the Earth, including oceans, lakes, clouds rivers etc. It's the total amount of water on the planet
Igneous	Rock formed from solidified lava/magma
Inner core	The inner most layer, it's incredibly hot but is a solid due to the high pressure.
Lithosphere	Term used to describe the rocky part of the Earth, the crust and the upper mantle. Its where metals can be extracted from
Mantle	The second layer of the Earth, it's a solid but with some liquid properties (molten rock)
Metamorphic	Rock formed from another type of rock that is subjected to high pressure and temperature.
Outer core	The outer layer of the core, it's a liquid.
Photosynthesis	Endothermic chemical reaction where plants use sunlight to convert carbon dioxide and water into oxygen, glucose
Respiration	Exothermic chemical reaction where energy is released during the reaction between oxygen and glucose to form carbon dioxide and water.
Sedimentary	A rock that has formed from sediment (matter) deposited by water or air
Uplift	Where rocks underground are forced upwards due to pressure of the rocks forming underneath. .
Weathering	The breaking down of rocks, there are 3 types, (physical, chemical and biological

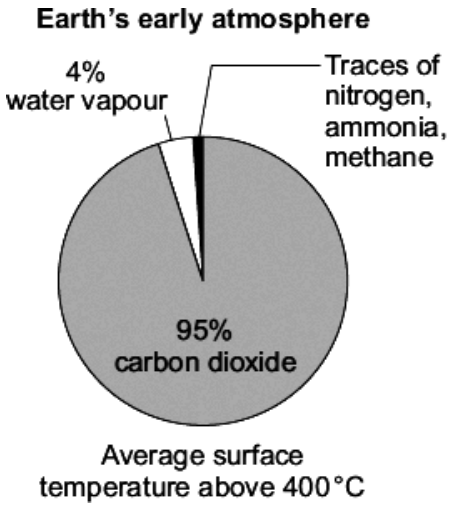
Why is the Earth like a scotch egg?

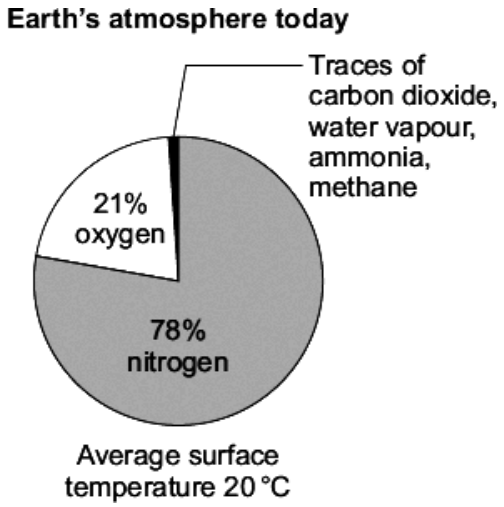
- The Earth is made up of different parts, the inner core, the outer core, the mantle and the crust.
- The crust is the thinnest layer and is made of rocks.
- The mantle is molten rock, it has solid properties except it can flow.
- The core in made of nickel and iron, because of this it exerts a very strong magnetic field. It is made of two parts, the inner core is solid, it is above the melting point of iron and nickel but the high pressures keep it as a solid.
- The outer core is liquid.



How has the Earth changed over time?

- Scientists believe that the Earth was formed about 4.5 billion years ago.
- Its early atmosphere was probably formed by the gases given out by volcanoes. It is believe that there was intense volcanic activity for the first billion years of the Earth's existence.
- The early atmosphere was probably mostly carbon dioxide, with little or no oxygen.
- There were smaller proportions of water vapour, ammonia and methane.
- As the Earth cooled down, most of the water vapour condensed and formed oceans.
- It is thought that the atmospheres of Mars and Venus today which contain mostly carbon dioxide, are similar to the early atmosphere of the Earth.

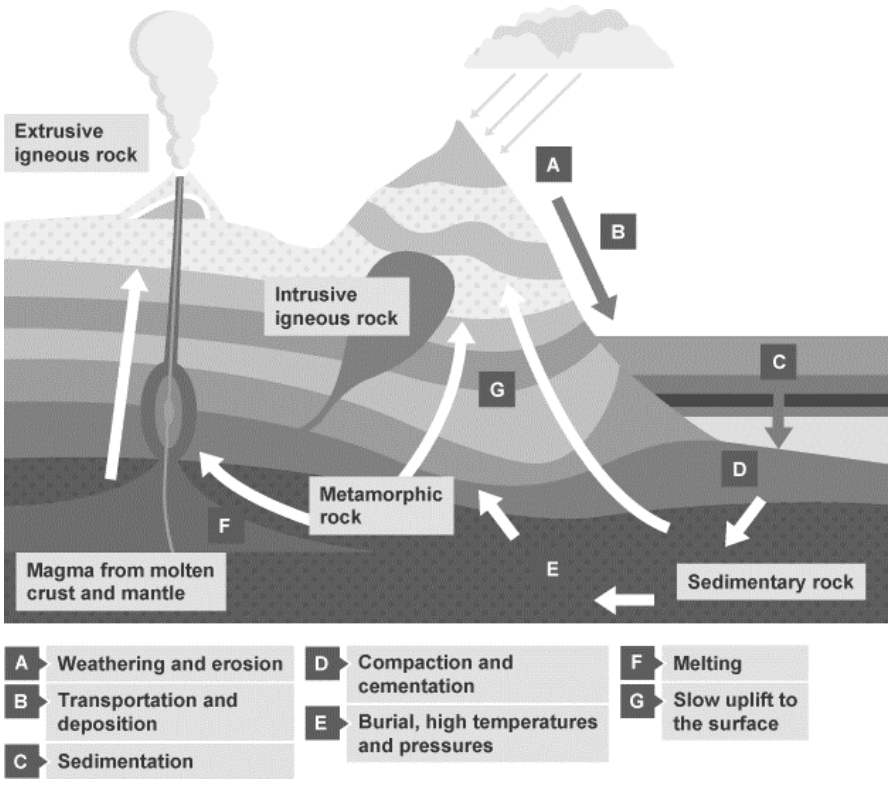




What is the difference between different rock types?

Type of rock	Examples	How it forms	Typical properties
Igneous	Obsidian, Basalt (extrusive) Granite (intrusive)	Formed when molten rock cools and solidifies, can do this quickly overground (extrusive, small crystals) or slowly underground (intrusive, large crystals),	Contain randomly arranged interlocking crystals, don't contain any fossils.
Sedimentary	Chalk, limestone, sandstone, shale	Formed when broken remains of other rocks are forced together, weathering, transportation, deposition, sedimentation, compaction and cementation	Can contain fossils, contain rounded grains in layers, oldest layers at bottom, youngest at top (takes millions of years)
Metamorphic	Marble (formed from limestone, Slate (formed from shale)	Formed from other rocks that are changed due to heat and / or pressure. The pressure comes from plate tectonic movement causing rocks to be buried or squeezed	Typically don't contain fossils as these are destroyed by the heat / pressure. Depending on the rock it formed from has a wide variety of properties.

How are rocks recycled?



Science Homework 2

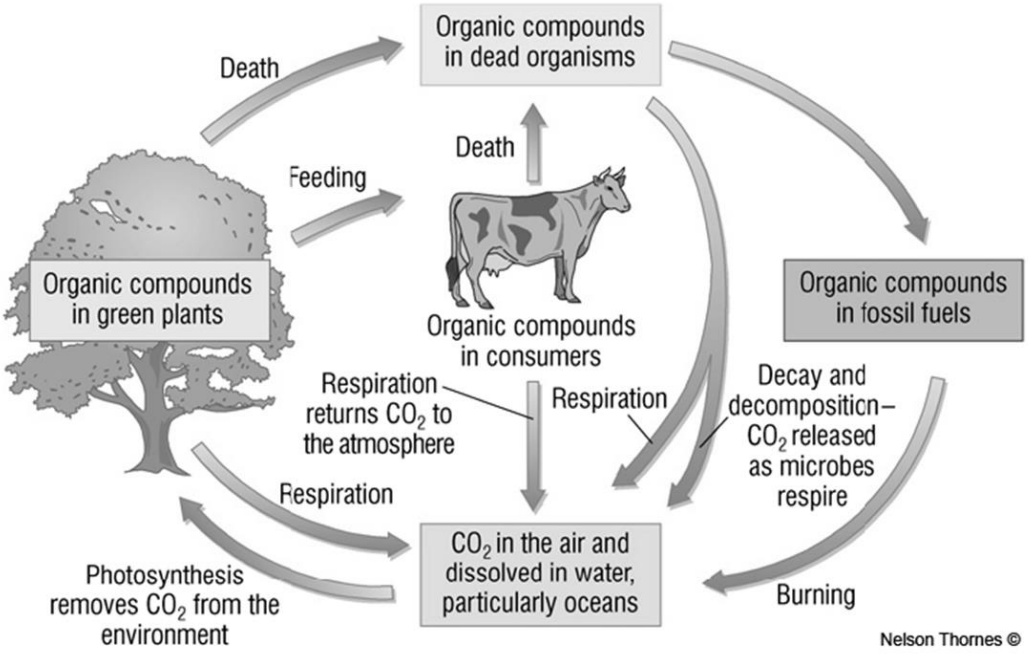
Try to answer all of these key knowledge questions. Then check your answers using the answer page. These are some of the questions that will be in the knowledge quizzes and the end of term Pillars tests.

Questions in *italics* are from older work.

Key knowledge question	**Your answer**
Rocks being broken up by changes in temperature is an example of?	
The Earths early atmosphere was made largely of which gas?	
What are the 4 layers that make up the Earth?	
What is the most common gas in our atmosphere now?	
What type of rock is formed by molten magma cooling?	
What type of rock is formed by rock fragments building up in layers?	
What type of rock is formed from existing rocks by heat and pressure?	
Why has the amount of carbon dioxide in the atmosphere increased more rapidly in the last few hundred years?	
Where has the O_2 in our atmosphere come from?	
Which biological process puts carbon dioxide into the atmosphere?	
Give two uses of glucose in plants.	
State the balanced symbol equation for photosynthesis.	
State the role of stomata in photosynthesis and respiration.	
State the word equation for anaerobic respiration in animals.	

How does carbon move between different forms?

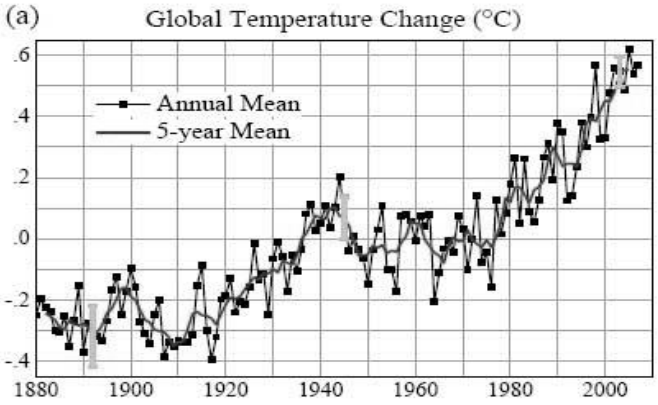
- Carbon exists in many forms in our environment.
- It moves between these in something known as the carbon cycle.



Why are scientists concerned about rising carbon dioxide levels?

What causes climate change?

- The climate on Earth has been changing since it formed 4.5 billion years ago.
- Natural factors used to cause these changes - volcanic eruptions, changes in Earth's orbit and shifts in the Earth's crust.
- Since the Industrial Revolution (1800s) global temperature has increased at a much faster rate.
- Burning fossil fuels, changing how we use the land and human activity have caused climate change.



Key knowledge question	**Answer**
Rocks being broken up by changes in temperature is an example of?	Weathering
The Earths early atmosphere was made largely of which gas?	Carbon dioxide
What are the 4 layers that make up the Earth?	Crust, mantle, outer core and inner core
What is the most common gas in our atmosphere now?	Nitrogen
What type of rock is formed by molten magma cooling?	Igneous
What type of rock is formed by rock fragments building up in layers?	Sedimentary
What type of rock is formed from existing rocks by heat and pressure?	Metamorphic
Why has the amount of carbon dioxide in the atmosphere increased more rapidly in the last few hundred years?	Burning fossil fuels
Where has the O_2 in our atmosphere come from?	Photosynthesis
Which biological process puts carbon dioxide into the atmosphere?	Respiration
Give two uses of glucose in plants.	*Respiration, combined with nitrates to make amino acids, cellulose for cell walls, lipids*
State the balanced symbol equation for photosynthesis.	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$
State the role of stomata in photosynthesis and respiration.	*Gas exchange*
State the word equation for anaerobic respiration in animals.	*glucose → Lactic acid + Energy*

Big questions: How do forces make objects act?

How do forces make things turn?

What do we have to do to get things to balance?

Where is the balancing point of an object?

Why are some things more stable than others?

How do gases exert pressure?

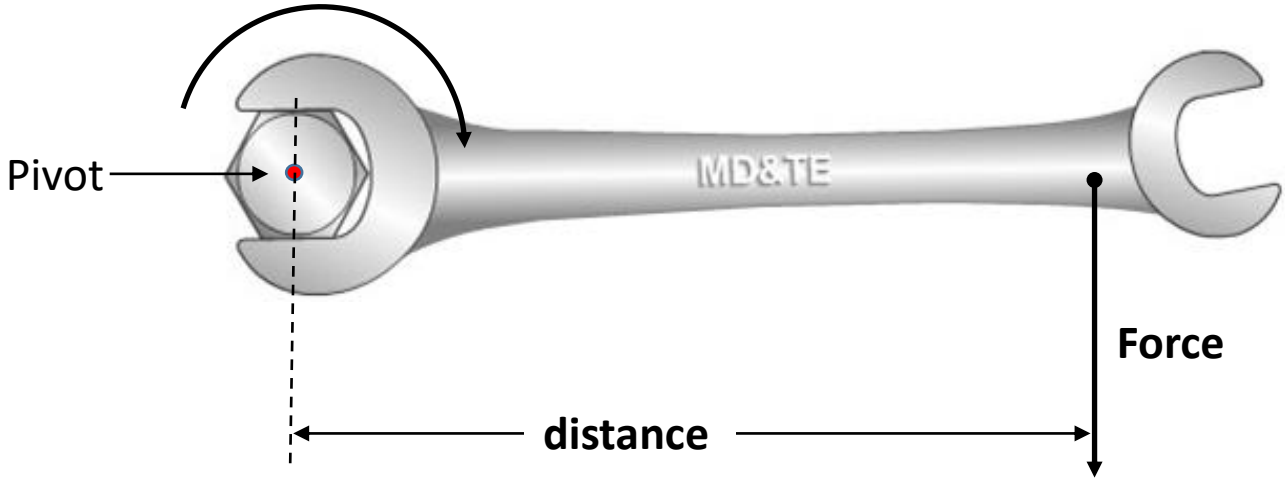
How does pressure change as we go deeper into a fluid?

Key vocabulary

Archimedes Principle	Archimedes principle states: the upthrust on an object is equal to the weight of the fluid displaced.
Centre of gravity	The centre of gravity is the point on an object where the force of gravity (weight) appears to act.
Density	The density of an object is its mass per unit volume.
Equilibrium	An object is in equilibrium is all of the forces and all of the moments are balanced. An object in equilibrium will not speed up or slow down or start or stop turning.
Gas pressure	The pressure exerted by a gas on the walls of its container.
Moment	A turning force is called a moment. When a force acts at a distance from a pivot a turning force or moment is created.
Pascal	One Pascal = one N/m2. The pascal is the unit of pressure.
Pressure	Pressure is the force per unit area exerted on a surface.
Stable / unstable	An object is stable if it is resistant to toppling over. A stable object will return to its original position if moved a small way,
The law of moments	The law of moments states: an object is in equilibrium if the sum of the clockwise moments is equal to the sum of the anticlockwise moments about any point.
Upthrust	An object that displaces a fluid (liquid or gas) experiences an upward force called upthrust.

How do forces make things turn?

- A force can have a turning effect on an object if it acts a distance from a pivot.
- The turning effect of a force is called its moment*.
- The moment of a force can turn clockwise or anti-clockwise if the force is reversed.
- The moment of the force is bigger if the force is bigger or the distance is bigger.



We can calculate the size of the moment of a force by:

$$moment\ of\ a\ force = force \quad \times \quad \begin{matrix} perpendicular\ distance\ from \\ the\ force\ to\ the\ pivot \end{matrix}$$

$$moment = F \times d$$

The **units:**

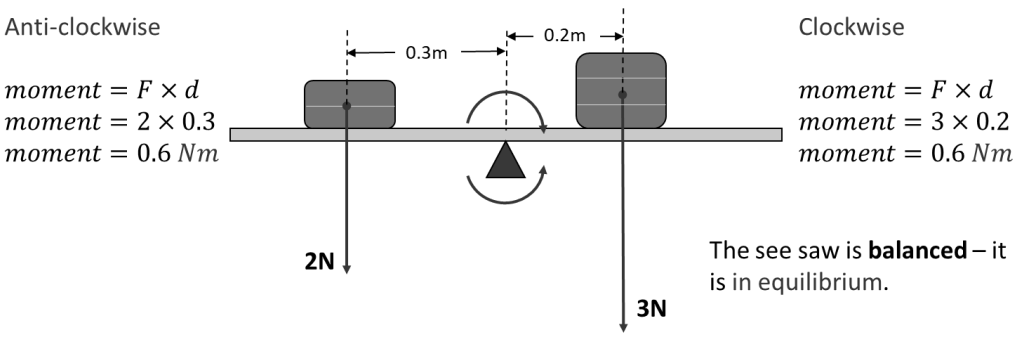
- of **force** are Newtons, N
- of **distance** are metres, m.
- of the **moment** are Newton metres, Nm.

What do we have to do to get things to balance?

The principle or law of moments says:

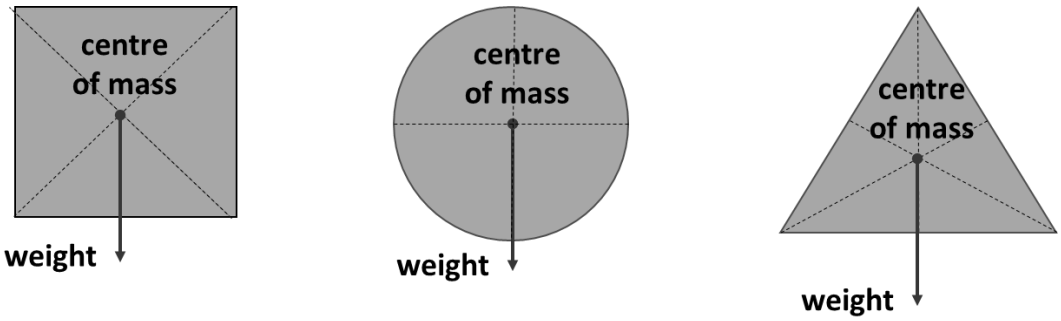
- An object is balanced if the sum of the clockwise moments is equal to the sum of the anticlockwise moments.
- When an object is balanced we say that it is in equilibrium.
-

Calculate the moments. Is this object in equilibrium?



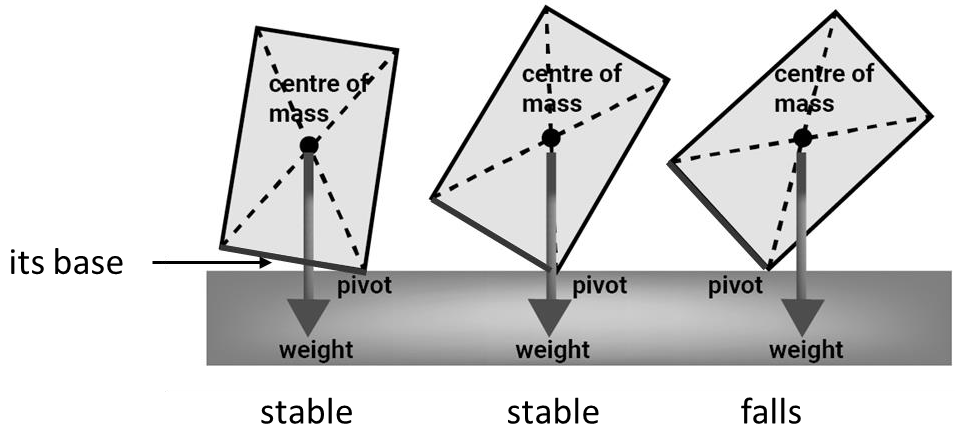
Where is the balancing point of an object?

- Weight is the force of gravity on an object.
- Gravity acts on all objects with mass and acts on every particle in the object:
- The many individual forces can be combined in to one single force called weight acting at the balancing point of the object.
- The single point at which the weight acts is called the centre of mass.
- For regular shaped objects the centre of mass is in the middle of the object.



Why are some things more stable than others?

- An object is stable if it is difficult to knock over. Stable objects can be tipped a long way before they fall over.
- An object falls over if the line of action of its weight fall outside of its base.
- Weight acts from the centre of mass straight downwards.
- An object falls over if the line of action of its weight fall outside of its base.



- An object is more stable if its base is wide.
- An object is more stable if its centre of mass is low down.

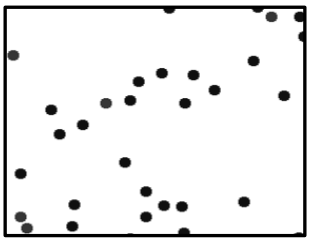
Science Homework 3

Try to answer all of these key knowledge questions. Then check your answers using the last page. These are some of the questions that will be in the knowledge quizzes and the end of term tests.

Questions in *italics* are from older work.

Key knowledge question	**Your answer**
What do turning forces cause movement around?	
What do we call a turning effect of a force?	
What equation links force, area and pressure?	
What equation links force, distance and moment?	
What happens to air pressure as you get higher in the atmosphere?	
What happens to the kinetic energy of gas particles as temperature increases?	
What is the unit of pressure?	
What unit do we use for moments?	
What word describes the movement of particles in a gas?	
Which would be the best tool to undo a very tight nut, a short or a long spanner?	
Define specific heat capacity of a substance.	
How can you tell from heating curve when state change occurs?	
In which state of matter do particles have the greatest energy?	
Name the change of state that happens when a solid becomes a liquid.	

How do gases exert pressure?



Gases have particles which are in constant motion. They move:

- **At random speeds**
- **In random directions**

They collide frequently with the walls of their container.

Every collision with the walls of the container exerts a force on the container.

This force over the area of the container exerts a pressure on the container*.

Remember: $\boldsymbol{pressure = \frac{Force}{Area}}$

This pressure is called the gas pressure.

- The pressure is measured in newtons per metre squared, N/m^2 or pascal, Pa.
- Pumping up a tyre puts more gas particles into the tyre.
- More gas particles collide more frequently with the walls of the tyre.
- More frequent collisions exert more force and exert more pressure.
- Heating a gas increases the speed of the particles.
- Faster gas particles collide more frequently with the walls of the tyre.
- More frequent collisions exert more force and exert more pressure.

How does pressure change as we go deeper into a fluid?

Objects deep under the ocean have a great weight of water above them. This weight exerts a great force on the surface area of the object.

$\boldsymbol{P = \frac{F}{A}}$ **so the water exerts a great pressure.**

This is called fluid pressure.

Fluid pressure increases with depth.

- The deeper you go the more fluid is above you.
- The more water above you the greater the force from the water and the greater the fluid pressure.
- A spouting can shows the effect of increasing fluid pressure at depth.

The pressure of a fluid can be calculated using:

$$\boldsymbol{Fluid\ pressure = depth \times \begin{matrix} density \\ of\ liquid \end{matrix} \times \begin{matrix} gravitational \\ field\ strength \end{matrix}}$$

$$\boldsymbol{P = h \rho g}$$

- P = the fluid pressure in N/m^2 or Pa
- h = the fluid depth in m.
- ρ = the density of the fluid.
- g = the gravitational field strength = 9.8 N/kg

AQA

The Periodic Table of Elements

1	2											3	4	5	6	7	0
							1 H hydrogen 1										4 He helium 2
7 Li lithium 3	9 Be beryllium 4											11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	20 Ne neon 10
23 Na sodium 11	24 Mg magnesium 12											27 Al aluminium 13	28 Si silicon 14	31 P phosphorus 15	32 S sulfur 16	35.5 Cl chlorine 17	40 Ar argon 18
39 K potassium 19	40 Ca calcium 20	45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26	59 Co cobalt 27	59 Ni nickel 28	63.5 Cu copper 29	65 Zn zinc 30	70 Ga gallium 31	73 Ge germanium 32	75 As arsenic 33	79 Se selenium 34	80 Br bromine 35	84 Kr krypton 36
85 Rb rubidium 37	88 Sr strontium 38	89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44	103 Rh rhodium 45	106 Pd palladium 46	108 Ag silver 47	112 Cd cadmium 48	115 In indium 49	119 Sn tin 50	122 Sb antimony 51	128 Te tellurium 52	127 I iodine 53	131 Xe xenon 54
133 Cs caesium 55	137 Ba barium 56	139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76	192 Ir iridium 77	195 Pt platinum 78	197 Au gold 79	201 Hg mercury 80	204 Tl thallium 81	207 Pb lead 82	209 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108	[268] Mt meitnerium 109	[271] Ds darmstadtium 110	[272] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.

Equation number	Word equation	Symbol equation
1	weight = mass × gravitational field strength (g)	$W = m\,g$
2	work done = force × distance (along the line of action of the force)	$W = F\,s$
3	force applied to a spring = spring constant × extension	$F = k\,e$
4	distance travelled = speed × time	$s = v\,t$
5	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{\Delta v}{t}$
6	resultant force = mass × acceleration	$F = m\,a$
7 HT	momentum = mass × velocity	$p = m\,v$
8	kinetic energy = 0.5 × mass × (speed)^2	$E_k = \frac{1}{2}m\,v^2$
9	gravitational potential energy = mass × gravitational field strength (g) × height	$E_p = m\,g\,h$
10	power = $\frac{\text{energy transferred}}{\text{time}}$	$P = \frac{E}{t}$
11	power = $\frac{\text{work done}}{\text{time}}$	$P = \frac{W}{t}$
12	efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
13	efficiency = $\frac{\text{useful power output}}{\text{total power input}}$	
14	wave speed = frequency × wavelength	$v = f\,\lambda$
15	charge flow = current × time	$Q = I\,t$
16	potential difference = current × resistance	$V = I\,R$
17	power = potential difference × current	$P = V\,I$
18	power = (current)^2 × resistance	$P = I^2\,R$
19	energy transferred = power × time	$E = P\,t$
20	energy transferred = charge flow × potential difference	$E = Q\,V$
21	density = $\frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$

How to get the most out of your knowledge organiser:

- To get the most use out of the knowledge organisers you should be learning sections and then self-testing.

- There are several different things you can do
  - Look, cover, write, check, correct
  - Read through the organisers
  - Mind maps
  - Key spellings
  - Make a glossary
  - Missing out key words
  - Questions/answers answers/questions
  - Flash cards
  - Revision clock learning
  - Mnemonics

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons
BBC Bitesize KS3 science
<u>You tube channels:</u>
Fuse school
Ted talks
Free science lessons
Primrose Kitten
<u>Shows on Netfilx</u>
Our planet
Tiny creatures
A life on our planet

Key knowledge question	**Answer**
What do turning forces cause movement around?	A pivot or fulcrum
What do we call a turning effect of a force?	A moment
What equation links force, area and pressure?	Pressure = force / area
What equation links force, distance and moment?	Moment = force x distance
What happens to air pressure as you get higher in the atmosphere?	It decreases
What happens to the kinetic energy of gas particles as temperature increases?	Kinetic energy increases
What is the unit of pressure?	Newtons per square metre (N/m^2)
What unit do we use for moments?	Newton metre Nm)
What word describes the movement of particles in a gas?	Random
Which would be the best tool to undo a very tight nut, a short or a long spanner?	A long one
Define specific heat capacity of a substance.	*The energy needed to raise the temperature of 1kg of substance by 1^oC*
How can you tell from heating curve when state change occurs?	*Time is continuing but there is no change in temperature*
In which state of matter do particles have the greatest energy?	*Gases*
Name the change of state that happens when a solid becomes a liquid.	*Melting*