

Year 7 Science Knowledge Booklet

Term 4

Name:

Class:

Homework 1 Due: 28th February

Homework 2 Due: 14th March

Homework 3 Due: 28th March





Science Homework 1

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

Big questions

What are waves?
 What are the properties of waves?
 How do sound waves travel?
 How does light travel?
 What are the differences between light and sound?
 What happens when light hits a surface?
 How can we use reflection?
 What happens when light goes through an object?
 How do lenses work?
 What is the electromagnetic spectrum?

Key vocabulary

Amplitude	The maximum displacement of a point on the wave. (measured from the undisturbed position)
Electromagnetic spectrum	The range of radiations in the same family as visible light. All electromagnetic radiations are transverse waves and travel at the speed of light.
Frequency	The number of complete waves passing every second. Measured in Hertz (Hz)
Longitudinal wave	A wave whose vibrations are along the direction of wave travel. Sound waves are longitudinal waves.
Normal	A line drawn at right angles to a boundary where the wave crosses the boundary. All angles of waves are measured from the normal.
Reflection	When a wave bounces off a surface.
Refraction	The change of direction of a wave when it crosses a boundary. Caused by a change in wave speed.
Specular reflection	Reflection from a smooth surface like a mirror. All waves coming from the same direction are reflected at the same angle.
Transverse wave	A wave whose vibrations are at right angles to the wave direction. Light and all electromagnetic radiations are transverse waves.
Wave	Ways of transferring energy and information through a medium without overall movement of the medium.
Wave speed	The speed that wave crests travel. In metres per second.
Wavelength	The length of one complete wave. Measured in metres.

What are waves?

A wave is an oscillation or vibration that transfers energy, not matter

Waves can transfer energy and information without a net motion of the medium through which they travel. They involve vibrations (oscillations) of some sort.

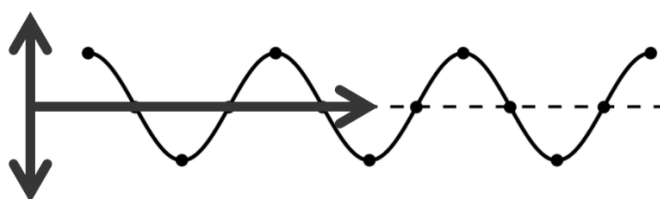
The 2 types of waves are:

Longitudinal waves

Particles vibrate parallel to the direction the wave travels e.g. sound waves

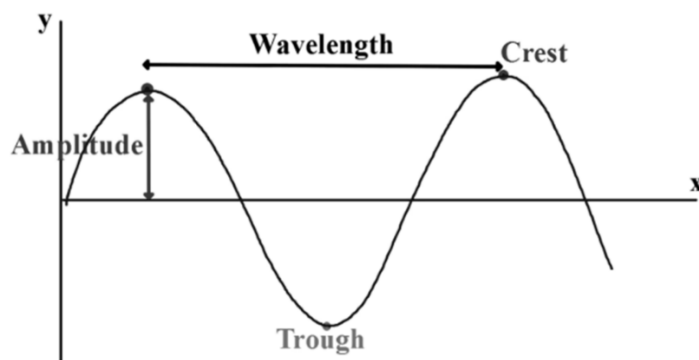
Transverse waves

Particles vibrate at right angles to the direction the wave travels e.g. light



What are the properties of waves?

Amplitude (A) is the maximum displacement of a wave. (Distance from the middle to the top or bottom of a wave)



Wavelength (λ) is the distance between two peaks (or any two equivalent adjacent points).

Frequency (f) is the number of waves that passes a point each second.

The unit of frequency is **Hertz (Hz)**.

1 Hz = 1 wave per second

Time Period (T) is the time for one oscillation.

$$\text{Time period} = \frac{1}{\text{frequency}} \quad T = \frac{1}{f}$$

T is measured in seconds

Reflection involves a change in direction of waves when they bounce off a barrier.

Wave speed, frequency and wavelength all stay the same.

Diffraction is the spreading out of a wave after passing around an obstacle or through a gap.

Wave speed, frequency and wavelength all stay the same.

Refraction is when a wave changes direction and occurs at a boundary/ surface when a wave moves from one material to another.

Wave speed and wavelength change but frequency stays the same. There may also be a change in direction.

When two waves meet they add together.

This is called **superposing**.

How do sound waves travel?

- Sound waves are caused by vibrations.
- The vibrations cause air particles to vibrate and the vibrations are passed on by the particles in the air to your ear and cause your ear drum to vibrate.
- Sound travels through solids and liquids as well as gases.
- Sound travels faster in solids and slowest in gases.
- This is because the particles are closer together in a solid so the vibrations are passed on quicker.
- Sound cannot travel in a vacuum because there are no particles to vibrate.

Substance	Speed of sound
Air	343 m/s
Water	1493 m/s
Steel	5130 m/s

How does light travel?

- Light is a transfer of energy.
- Light is emitted by a luminous source like the Sun, a light bulb and fire.
- Light travels in straight lines.
- Light travels as a wave.
- Light can travel through a vacuum. (Sound cannot travel through a vacuum).
- Light travels at the speed of light = 300,000,000 m/s (3×10^8 m/s).
- Light can be reflected, transmitted or absorbed.
- A transparent object transmits most light (some can be reflected or absorbed)
- An opaque object does not transmit light – light is reflected or absorbed
- A translucent object transmit some light

What are the differences between light and sound?

Light is a transverse wave, sound is a longitudinal wave.

The speed of light is 300,000,000 m/s. That is almost 1 million times faster than the speed of sound.

Light can travel through a vacuum, it does not need particles.



Science Homework 2

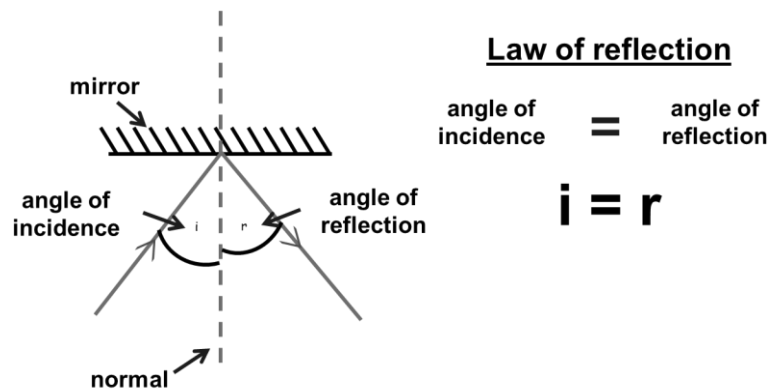
Try to answer all of these key knowledge questions. Then check your answers using the answer page.

Questions in *italics* are from older work.

Key knowledge question	Your answer
Waves can be divided into 2 types, one is transverse, what is the other?	
What do we call a wave bouncing off a surface?	
What is the unit of frequency?	
What equation links frequency, wavelength and wave speed?	
At what angle to wave direction are the vibrations in transverse waves?	
Light, X-rays and radio waves are all part of what?	
The length of one complete wave measured in metres is its?	
The maximum displacement of a point on a wave is called its?	
What do we call a wave changing direction as it moves from one material to another?	
What do we mean by a waves frequency?	
<i>Which, out of solids, liquids and gases can the particles only vibrate?</i>	
<i>How can you tell from a heating curve when state change occurs?</i>	
<i>In which state of matter do particles have the greatest energy?</i>	
<i>Which out of solids, liquids, and gases can easily be compressed?</i>	

What happens when light hits a surface?

The Law of Reflection states that $i = r$



Shiny smooth surfaces reflect regularly. This is called specular reflection. Other surfaces also reflect light but if the surface is rough the light is reflected in all directions. We call this diffuse reflection.

How can we use reflection?

Mirrors inside cars reflect light to help drivers see objects behind them.

Reflective strips on clothing and bikes help cyclists to be extra visible at night.

'Cat's eyes' on the road reflect light from car headlamps to help the driver see the road at night.

Peri a prefix meaning "about" or "around".

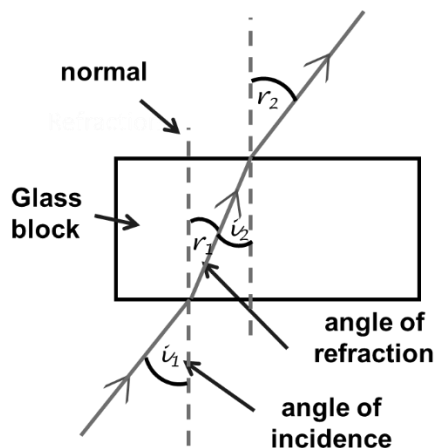
A word that originated from the Greek language as a preposition.

Scope- indicating an instrument for observing, viewing, or detecting: *microscope*, *stethoscope*.

What happens when light goes through an object?

When light travels from one medium to another (e.g. air to water) it changes direction at the boundary between the two mediums. This is called refraction.

The wave slows down as it goes into a denser medium so changes direction.

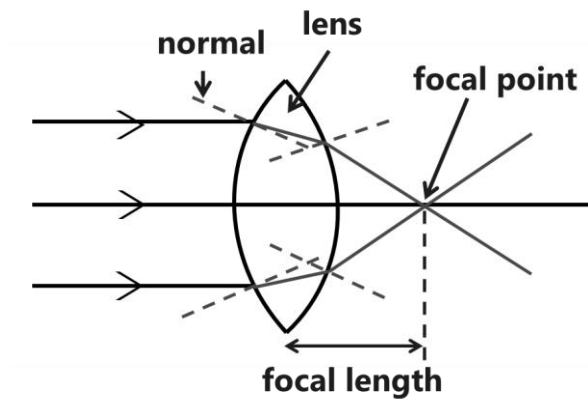


The angle of incidence is greater than the angle of refraction for light entering a glass block
Light bends towards the normal.

The angle of incidence is less than the angle of refraction for light emerging from a glass block
Light bends away from the normal

How do lenses work?

Lenses use refraction to change the direction of light rays, they cause images to be enlarged or reduced.

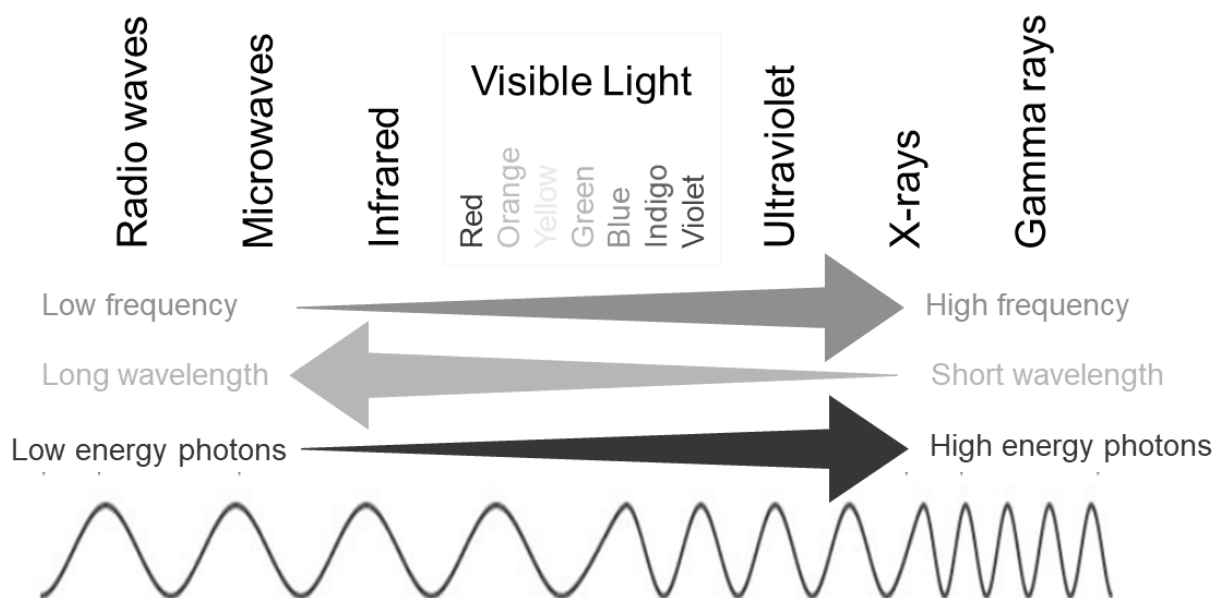


What is the electromagnetic spectrum?

Electromagnetic waves carry energy. The waves are transverse vibrations in electrical and magnetic fields, not vibrating particles.

Electromagnetic waves do not need matter to travel through - they can travel through empty space (a vacuum).

In a vacuum, all electromagnetic waves travel at $3 \times 10^8 \text{ ms}^{-1}$ - the fastest speed possible. They slow down a bit when travelling through matter (e.g. light travelling through glass)



Wider reading

Real-life tractor beam levitates objects using sound waves

It may seem straight out of "Star Trek," but it's real: Scientists have created a sonic "tractor beam" that can pull, push and pirouette objects that levitate in thin air.

The sonic tractor beam relies on a precisely timed sequence of sound waves that create a region of low pressure that traps tiny objects that can then be manipulated solely by sound waves, the scientists said in a new study.

Read more and watch a video at - <https://www.cbsnews.com/news/real-life-tractor-beam-levitates-objects-using-sound-waves/>

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

Look at the separate booklet you have been given about self-testing to help you

Science Learning Tools and wider study:

The Oak Academy – Online Science lessons

BBC Bitesize KS3 science

You tube channels:

Fuse school

Ted talks

Free science lessons

Primrose Kitten

Shows on Netflix

Our planet

Tiny creatures

A life on our planet

Key knowledge question	Answer
Waves can be divided into 2 types, one is transverse, what is the other?	Longitudinal
What do we call a wave bouncing off a surface?	Reflection
What is the unit of frequency?	Hertz (Hz)
What equation links frequency, wavelength and wave speed?	$\text{wave speed (m/s)} = \text{frequency (Hz)} \times \text{wavelength (m)}$
At what angle to wave direction are the vibrations in transverse waves?	Right angles/ 90 degrees
Light, X-rays and radio waves are all part of what?	The electromagnetic spectrum
The length of one complete wave measured in metres is its?	Wavelength
The maximum displacement of a point on a wave is called its?	Amplitude
What do we call a wave changing direction as it moves from one material to another?	Refraction
What do we mean by a waves frequency?	The number of complete waves passing per second
<i>Which, out of solids, liquids and gases can the particles only vibrate?</i>	<i>Solids</i>
<i>How can you tell from a heating curve when state change occurs?</i>	<i>Heating continues but temperature does not change (a flat line)</i>
<i>In which state of matter do particles have the greatest energy?</i>	<i>Gas</i>
<i>Which out of solids, liquids, and gases can easily be compressed?</i>	<i>Gases</i>

Big questions: What are acids and alkalis?

What household items are acids?

How do metals react with acids?

What household items are alkalis?

What natural substances can be used as indicators?

Would bee and wasp stings be treated the same?

What is a salt?

How can we make a salt?

Key vocabulary

Acids	Acids are substances that neutralise bases/alkalis. They release at least one H^+ ion
Alkalis	Alkalis are substances that neutralise acids. They are soluble bases, which release OH^- ions.
Bases	Substance that neutralise acids
Evaporation	Separation technique used to separate dissolved substances from solutions
Filtration	Separation techniques used to remove solids from liquids / solutions
Neutralisation	A reaction when an acid and a base/alkali react together to form a salt and water
pH scale	A scale used to determine the acidity or alkalinity of a solution. 7 is neutral. Less than 7 is acidic, More than 7 is alkaline
Salt	Salts are compounds formed from the reaction between acids and bases. It is an ionic compound

What household items are acids?

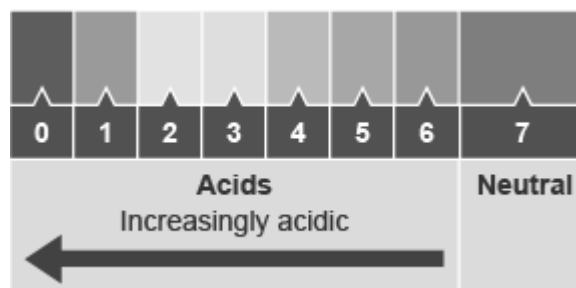
Acids are compounds which are very often found in a lab, but are also found in many homes.

Acids can have their strength measured on a scale called the pH scale.

(It has to be written with a lowercase p and a capital H!)

Using the pH scale, an acid would be a substance with a pH lower than 7.

The stronger the acid, the lower the pH.



Strong Acids

Strong acids are those with the lowest pH. There are three common strong acids we need to be able to remember.

1. Hydrochloric acid has the formula HCl
2. Sulfuric acid has the formula H_2SO_4
3. Nitric acid has the formula HNO_3

How do metals react with acids?

Acids can be a reactant in many different chemical reactions.

Commonly, acids can be reacted with metals to make new compounds.

When reacting, the hydrogen will be pushed out of the acid, and the metal will take its place.

This new product is called a **salt**.

Example: hydrochloric acid will react with sodium.

Hydrogen is released as a new product, and the other product is the **salt sodium chloride**.



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 pH would show something was an acid?	
What pH would show something was an alkali?	
What pH would pure water have?	
What do we call chemicals that change colour at different pH values?	
What colour is universal indicator in an acid?	
What colour is universal indicator in an alkali?	
What colour is universal indicator in pure water?	
When a metal reacts with an acid what two products do we get?	
When an alkali reacts with an acid what two products do we get?	
What name do we give to a reaction between an acid and an alkali?	
<i>Describe what is meant by "contact forces"</i>	
<i>Describe what is meant by the term "non-contact forces"</i>	
<i>In which direction does friction act?</i>	
<i>Name the apparatus used to measure force.</i>	

What natural substances can be used as indicators?

There are many substances which can be used as an indicator; not just universal indicator. However, the colours are different.

We could use two natural substances to act as an indicator with different substances.

- **Red cabbage**
- **Turmeric**

	Acid	Alkali	Water
Universal indicator	Red	Purple	Green
Red Cabbage	Red	Green	Blue/purple
Turmeric	Yellow	Red	Yellow

Would bee and wasp stings be treated the same?



Both bee and wasp stings hurt. But should they be treated the same?

The venom in bee stings are acidic, and the venom in wasp stings are alkaline.

When an acid and an alkali (or base) react, water will always be formed, along with another product. So you can treat a bee sting with an alkaline or base (like hydrogen sodium bicarbonate) and wasps with an acid (like vinegar).

Both water and the other product will be neutral. The reaction is called **neutralization**.

This other product is called a salt; and it will be dissolved in the water that is also produced.

What is a salt?

A salt is a compound formed when some or all the hydrogen ions in an acid are replaced by metal ions. They can be formed when acids react with alkalis or bases in neutralisation reactions.

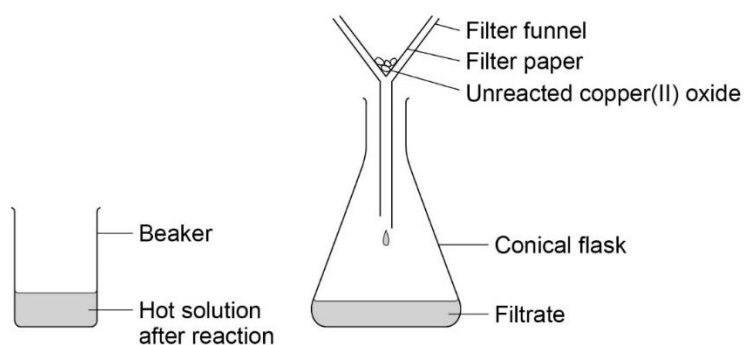
The general reaction for this chemical reaction is:



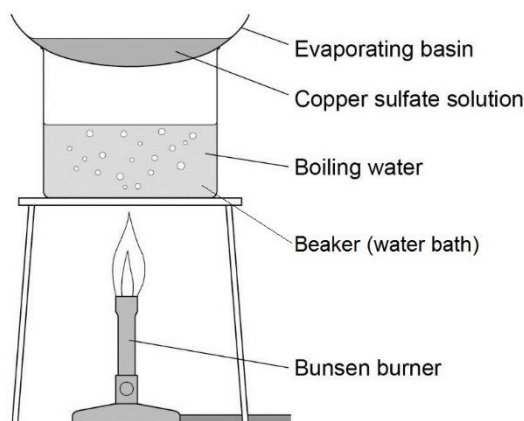
How can we make a salt?

We can use this method to make a salt:

1. Measure 10cm³ of warmed acid using a measuring cylinder.
2. Add the acid to a beaker.
3. Add excess base, one small spatula at a time, and stir. Continue until the solid does not disappear.
4. Filter solution (to remove the leftover solid) and use evaporating dish to collect solution.



5. Set up the Bunsen burner.
6. Turn on the Bunsen burner and wait heat the solution until some crystals start to form.



7. Turn off the Bunsen burner and wait for it to cool.

Key knowledge question	Answer
What pH would show something was an acid?	A number below 7
What pH would show something was an alkali?	A number above 7
What pH would pure water have?	7
What do we call chemicals that change colour at different pH values?	Indicators
What colour is universal indicator in an acid?	Red
What colour is universal indicator in an alkali?	Purple
What colour is universal indicator in pure water?	Green
When a metal reacts with an acid what two products do we get?	A salt and hydrogen
When an alkali reacts with an acid what two products do we get?	A salt and water
What name do we give to a reaction between an acid and an alkali?	Neutralisation
<i>Describe what is meant by “contact forces”</i>	<i>A force produced by something that is touching something else</i>
<i>Describe what is meant by the term “non-contact forces”</i>	<i>A force produced by something that is not touching something else</i>
<i>In which direction does friction act?</i>	<i>In the opposite direction to movement</i>
<i>Name the apparatus used to measure force.</i>	<i>Newton meter</i>

1	2		3	4	5	6	7	0	
7 Li lithium 3	9 Be beryllium 4	<div>Key</div> <div>relative atomic mass atomic symbol name atomic (proton) number</div>	11 B boron 5	12 C carbon 6	14 N nitrogen 7	16 O oxygen 8	19 F fluorine 9	4 He helium 2	
23 Na sodium 11	24 Mg magnesium 12		27 Al aluminum 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		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		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 cesium 55	137 Ba barium 56		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		[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118	
			65 Zn zinc 30	63.5 Cu copper 29	59 Ni nickel 28	59 Co cobalt 27	56 Fe iron 26	55 Mn manganese 25	
			112 Cd cadmium 48	108 Ag silver 47	106 Pd palladium 46	103 Rh rhodium 45	101 Ru ruthenium 44	[98] Tc technetium 43	
		201 Hg mercury 80	197 Au gold 79	195 Pt platinum 78	192 Ir iridium 77	190 Os osmium 76	186 Re rhenium 75		
		[285] Cn copernicium 112	[272] Rg roentgenium 111	[271] Ds darmstadtium 110	[268] Mt meitnerium 109	[277] Hs hassium 108	[264] Bh bohrium 107		
		45 Sc scandium 21	48 Ti titanium 22	51 V vanadium 23	52 Cr chromium 24	55 Mn manganese 25	56 Fe iron 26		
		89 Y yttrium 39	91 Zr zirconium 40	93 Nb niobium 41	96 Mo molybdenum 42	[98] Tc technetium 43	101 Ru ruthenium 44		
		139 La* lanthanum 57	178 Hf hafnium 72	181 Ta tantalum 73	184 W tungsten 74	186 Re rhenium 75	190 Os osmium 76		
		[227] Ac* actinium 89	[261] Rf rutherfordium 104	[262] Db dubnium 105	[266] Sg seaborgium 106	[264] Bh bohrium 107	[277] Hs hassium 108		

Insert for GCSE Chemistry (8462), Combined Science: Trilogy (8464), and Combined Science: Synergy (8465) papers v1