

## Knowledge & Understanding

Explaining Science

Classification

## Working Scientifically

Designing Experiments

Data, Tables & Graphs

Making Conclusions

EYFS -----> KS1 -----> Secure

LKS2 -----> Secure

UKS2 -----> Secure ----->

EYFS

Year 1

Year 2

Year 3

Year 4

Year 5

Year 6

Year 6+

Explaining Science

I remember simple science facts within an activity

I remember simple science facts within a topic

I remember a range of **science facts** within a topic

I am using pre-learning to build connected knowledge

I **connect** knowledge within a topic & from **pre-learning**

I connect knowledge between topics & from pre-learning

I **connect** knowledge across science & the **wider curriculum**

I connect knowledge fluently across science & curriculum

I use science words during an activity

I use & remember relevant science words during activity

I use & **remember** science words over time (short term)

I remember science words I have used before (longer term)

I **remember & use** science words correctly (apply)

I begin to use complex science words correctly

I use **complex** science words correctly (**fluency**)

I use complex science words accurately & fluently

I describe what is happening using words & actions

I describe what is happening using science

I use **science** to describe & **recall** what I have seen

I begin to use science models to describe (sequence)

I use **science models** to **describe** (what, where)

I use science models to describe & begin to explain (why, how)

I use **science models** to describe & **explain** (why, how, logical)

I begin to apply science models to explain new events

I match appropriate pictures & words to label diagrams

I add science word labels to diagrams

I **add science labels** & information (help) to diagrams

I add science labels & information to diagrams

I **annotate** diagrams to help describe & explain

I begin to create & annotate my own 2D/3D diagrams

I create & annotate my **own 2D/3D diagrams**

I create & annotate my own complex 2D/3D diagrams

I begin to use science facts to explain my answer

I select science facts to use in an answer

I **select** relevant science facts to use in an answer

I link relevant facts together in an answer

I **'cluster'** related facts together into points (recalled)

I select & prioritise facts to create an argument/answer

I present a **clear & logical** argument / answer

I present an extended & logical argument / answer

Classification

I sort using pictures or instructions

I sort using simple yes/no statements

I use simple spider keys with **obvious differences**

I use large spider keys with obvious differences

I use a range of spider keys with **fine differences**

I construct spider & use number keys

I **construct** both spider & number keys

I construct both spider & number keys (complex)

I group by familiar features (size, colour, shape, etc)

I group by difference or similarity

I **group** by difference, similarity or change

I create groups for sorting (create criteria)

I **create** appropriate groups for sorting (create criteria)

I group & sub-group by easily observation (create criteria)

I group & **sub-group** by fine observation (create criteria)

I group & re-group using combinations of criteria

I use my senses to identify properties of materials

I link properties of materials to an application (help)

I **link properties** of materials to an application

I combine properties required for an application (help)

I **describe combined properties** required for an application

I explain how properties suit an application

I **explain the science** behind a range of properties

I describe how material properties can change



Prediction	Observed Variables Categoric Data (words) - Charts					Design			Measured Variables Continuous Data (numbers) - Graphs		
		I use experience to suggest what might happen next	I suggest what might happen in an investigation	I suggest what might happen ( <b>simple prediction</b> )	I predict cause & effect (science prediction)	I predict a trend ( <b>relationship prediction</b> )	I use K&U to explain my relationship	I reason K&U to make a <b>hypothesis</b> (relationship)	I reason K&U to generate a testable hypothesis		
Equipment	I use a range of everyday items to investigate	I use a limited range of science equipment correctly (help)	I use a range of science equipment correctly	I select suitable equipment for the task	I <b>select &amp; use</b> suitable equipment for the task	I select equipment with the right scale for the task (help)	I <b>select &amp; use</b> equipment with <b>right scale</b> for the task	I select & use equipment for increased precision			
	I begin to know what it means to investigate safely	I notice risk (help) & can list some common dangers	I <b>notice risk</b> in my investigation & know common dangers	I predict obvious risk & act on safety suggestions	I predict obvious risk & <b>work safely</b> (mostly)	I begin to plan to minimise risk & work safely (consistently)	I plan to <b>minimise risk</b> & describe safe use of equipment	I predict & control a range of risks independently			
Design	I use experience to suggest an idea to investigate	I suggest an idea to investigate & ask questions	I <b>suggest</b> an idea to investigate from observations	I identify cause & effect in my investigation	I <b>plan</b> investigations by selecting variables to change	I plan investigations & ensure controlled variables kept same	I <b>plan reliable</b> investigations (use of variable terminology)	I plan a reliable investigations with increased precision			
	I'm aware that variables change in an investigation	I begin to identify the cause variable in an investigation	I <b>identify the cause variable</b> correctly (label & range)	I suggest a suitable data range for a cause variable	I suggest a data <b>range &amp; interval</b> for a cause variable	I suggest a data range, interval & sufficient readings	I plan to collect <b>repeat readings</b> (>3) & calculate mean	I plan to reduce error by care of measurement			
	I follow short demo & spoken instruction with multiple parts	I follow short demo, spoken & picture instructions	I <b>follow</b> short spoken & written instructions in order	I follow written instructions & write a simple method	I <b>design &amp; write</b> a simple <b>ordered</b> method (from plan)	I design & write an ordered method (controls variables)	I <b>design &amp; write</b> an <b>ordered reliable</b> method (repeats)	I design & write a reliable method (repeats; precision)			



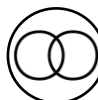
**Researching & communicating:**  
Use secondary sources to find & organise relevant information



**Observing & measuring over time:**  
Over short (seconds / minutes) or long (days / months) periods of time



**Comparative & Fair testing:**  
One variable changed; others are kept the same. Use words or numbers



**Identification & classification:**  
Sorting into groups based upon criteria

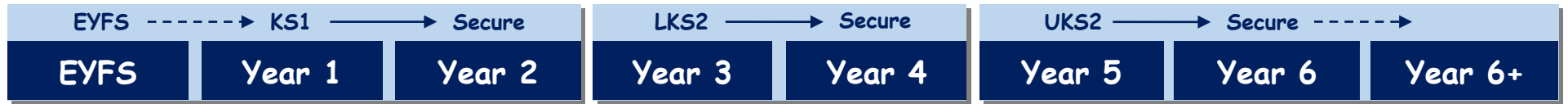


**Finding patterns:**  
Patterns emerge from observation



**Problem solving:**  
Applying science knowledge to find answers

WS Skills are taught & practiced **through** a range of Enquiry Type investigation



**Data**

I position numbers on a number track to 10 & beyond	I position numbers on a number track to 20 & beyond	I measure <b>labelled</b> divisions on a number line (inc. in steps)	I measure unlabelled divisions on a number line (+ve values)	I measure <b>unmarked</b> divisions on a number line (+ve values)	I measure divisions on a number line past zero (-ve values)	I <b>scale up/down</b> a number line (axis) & decide on limits	I scale up/down a number line (axis) confidently
I use non-standard units to measure & compare	I measure in non-standard & compare e.g. heavier/lighter	I measure <b>standard units</b> (inc. length, mass, capacity)	I measure/compare values in standard units	I <b>measure/convert</b> values in standard units (inc. time)	I measure/convert values in standard units (inc. area)	I <b>measure/calculate</b> with standard units (inc. area & volume)	I calculate compound units (e.g. acceleration)

**Tables**

I use a simple table by recording in pictures & words	I use a simple table by recording in words and numbers	I <b>use</b> a simple table recording in words & numbers (inc. tally)	I use a frame to construct a simple table of results	I <b>construct</b> a simple table to compare cause & effect	I use a frame to construct a complex table of results	I <b>construct</b> a complex table to show repeated data	I construct complex tables to include calculations																								
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Cause	Effect																														

**Graphs**

I add to pictograms with help	I use a frame to add to pictograms & block charts	I <b>construct</b> simple pictograms & <b>block charts</b>	I use a frame to construct a bar chart (help)	I <b>construct bar charts</b> correctly (inc. numerical axis)	I use a frame to construct a graph & can scale axes (help)	I <b>construct graphs</b> & can scale at least one axis independently	I construct graphs & can scale each axis confidently
I represent groups using resources, marks & numbers	I add to block charts by counting up	I <b>use scale</b> on block chart (coordinate) to add correct blocks	I draw bars on a bar chart (one axis coordinate)	I <b>plot coordinates</b> on a graph in the first quadrant	I join plotted coordinates with straight lines	I plot mean values & draw a <b>trend line</b> for linear data	I plot mean values & draw a trend line for non-linear data
I compare groups using comparative language							

**Data, Tables & Graphs**

	EYFS -----> KS1 -----> Secure			LKS2 -----> Secure		UKS2 -----> Secure ----->		
	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 6+
Patterns	I recognise, create & describe simple patterns (e.g. size)	I recognise, create & describe simple number patterns	I describe simple features & patterns in data & charts	I describe simple patterns in data, charts & graphs	I describe simple patterns, trends & relationships in data	I describe patterns, trends & relationships in data	I describe changing patterns, trends & relationships	I compare changing patterns, trends & relationships
	I begin to use 'more or less' to compare observations	I use 'more or less' to compare numbers	I see obvious differences in sets of numbers	I see subtle differences in sets of numbers	I see differences (error) in repeated data	I spot anomalous data that doesn't fit the pattern	I spot anomalous data & explain from the method	I deal with anomalous data to increase reliability
Conclusions	I talk about changes through my senses during activities	I describe the changes that are happening	I describe the changes that have happened	I describe my results by linking cause & effect	I describe trends & begin to use science models to explain	I use data in my conclusion & science models to explain	I use primary & secondary data in my conclusions	I use a range of data in conclusions to support validity
	I explore 'what if ..' questions through talk & play	I explore different ways to do things through play	I suggest a different way to do things with help	I suggest improvements to my method	I suggest sensible improvements to my method	I identify strengths & weaknesses & improvements	I suggest limitations (data) & practical improvements	I suggest limitations (use data) & justify improvements

## Working Scientifically - word lists

### KS1

**Axis** = reference line drawn on a graph to show the range of data for each variable (shows values)

**Block chart** = visual tool to show data/counts as bars built up by adding component blocks. Used to compare data visually

**Cause** = the variable we chose to change in an investigation

**Data** = a measured or counted outcome for a variable (numbers)

**Effect** = the variable that changes when we change the cause

**Experiment** = investigation that looks for a link between variables (fair or comparative test)

**Observation** = sensed outcome for a variable (described in words)

**Pictogram** = chart that uses pictures to represent data

**Prediction** = suggests what might happen based upon prior knowledge or experience (not a guess)

**Results table** = way of presenting data from an investigation

**Risk** = dangers when doing an investigation, using equipment or working in an area

**Standard units** = a quantity of a variable that is used as a standard measure (e.g. litre, meter, gram, etc)

**Variable** = a factor that can change

### LKS2 (plus KS1)

**Bar chart/graph** = visual tool that uses bars to compare discrete data

**Comparative test** = fair test comparing discrete differences

**Conclusion** = the answer you give to a question (based upon data)

**Continuous data** = values are numbers (result from counting/measuring)

**Coordinate** = used to plot data (x/y) on a graph

**Data interval** = numerical gap between data points for a variable

**Data point** = a coordinate for a variable

**Data range** = maximum & minimum values for a variable

**Discrete data** = values are distinct/separate (e.g. male/female; counts)

**Fair test** = an investigation where only one variable is changed (cause); all others are kept the same and at their best value

**Line graph** = visual tool that shows a relationship trend between two continuous variables (it is essentially a scatter graph)

**Method** = ordered sequence of steps taken during an investigation. It can be written or in diagram form

**Prediction (correlation/relationship)** = describes the expected trend for two variables (cause & effect) that are linked

**Prediction (scientific/causal)** = suggestion as to what might happen based upon prior knowledge, experience or observation. Links the cause with the predicted effect. Does not have to describe the trend

**Spider key** = branching classification key where each branch has a yes/no choice (dichotomous key) leading to further choices

**Trend** = the outcome when two variables (cause & effect) are linked

### UKS2 (plus KS1/LKS2)

**Anomalous data** = data that does not fit a pattern

**Controlled variable** = variables kept at the same value so they do not influence the dependent variable in a fair test

## Making Conclusions

**Data set** = values for repeated data

**Data spread** = variation of the data away from a mean (often due to imprecise measuring or when the controlled variable have not been kept the same)

**Dependent variable** = changed (effect) as a result of changing another. This is observed or measured and demonstrates a relationship in a fair test

**Hypothesis** = a reasoned prediction based upon theory, experience or direct observation

**Independent variable** = chosen variable (cause) changed in a fair test.

**Mean** = 'average' value from a data set

**Number key** = classification key that is a written, condensed version of a spider key

**Precision** = how similar your repeated data is (good technique & equipment choice)

**Primary data** = your experimental data or observations from an investigation

**Reliability** = if your data can be repeated (i.e. no error). Can be improved through collecting repeated values and calculating a mean

**Results table (complex)** = Table that contains multiple columns to show repeated data, calculations or a variety of features of a variable

**Risk assessment** = formal assessment of risk leading to improved safety recommendations or change in practice

**Secondary data** = researched data or observations. It can also be data gathered from others doing a similar experiment. Used to compare/support

**Trend line** = line drawn roughly between coordinates to show the trend (does not have to go through all data points)

**Valid data** = reliable, accurate & no bias or error (we are measuring what is expected)