GRAPHICAL ORGANIZERS FOR PROCESSING SCIENTIFIC KNOWLEDGE

DEPARTMENT OF PHYSICAL SCIENCE

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Title	:	**GRAPHICAL ORGANIZERS FOR PROCESSING SCIENTIFIC KNOWLEDGE**
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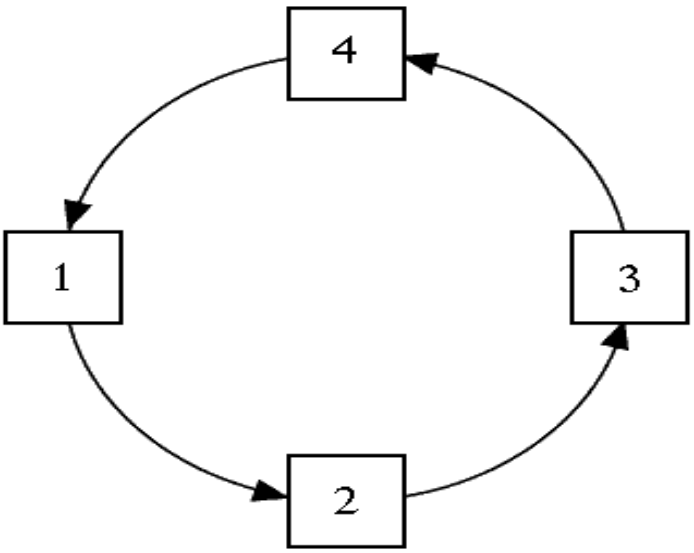
CYCLE DIAGRAM

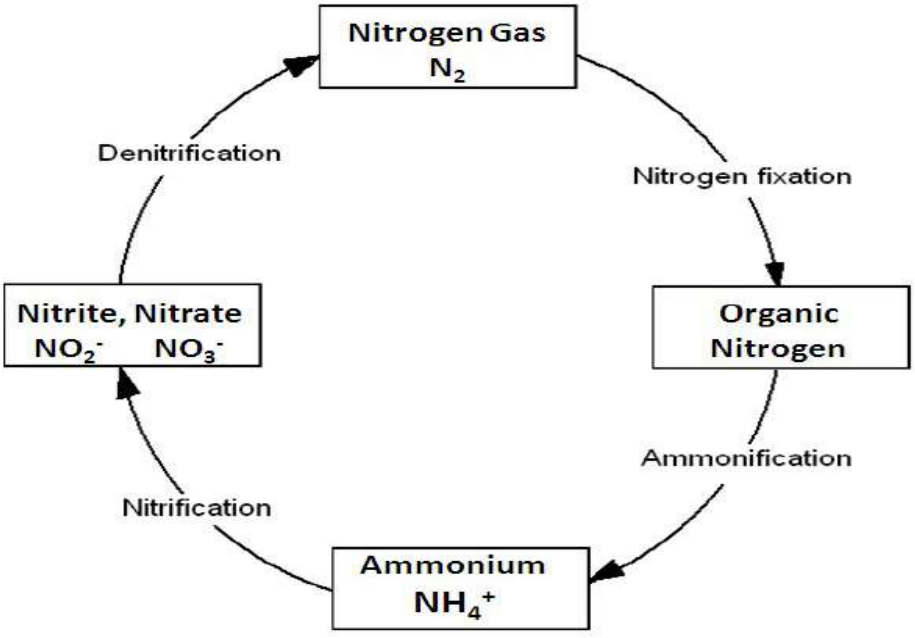


Purpose : To show how items are related to one another in a repeating cycle.

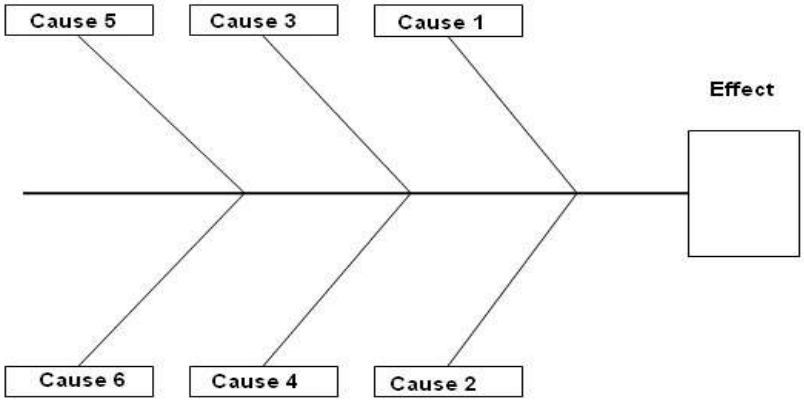
When to use : Use when there is no beginning and no end to a repeating process.

How to draw : Identify the main events in the cycle, how they interact, and how the cycle repeats. Using these details draw the diagram.

Example : Nitrogen cycle



FISHBONE DIAGRAM

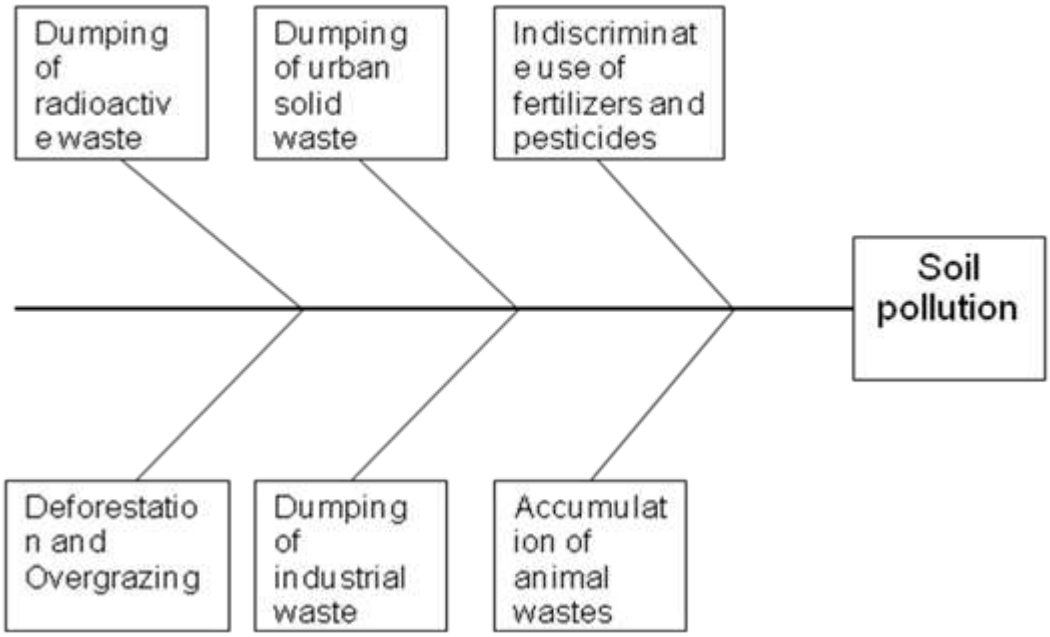


Purpose : Used to explore the many aspects or effects of a complex topic.

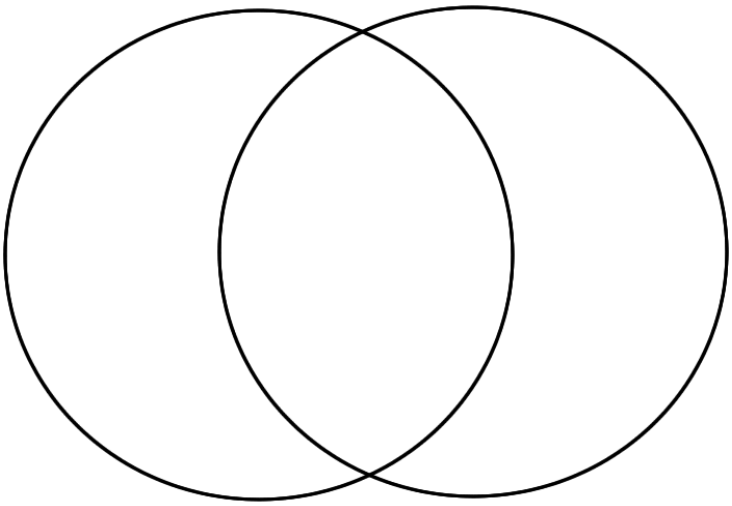
When to use : Use when a cause-effect relationship is complex and non-redundant.

How to draw : A main idea statement or category is written on the single box on the right. Supporting facts, examples, or subcategories are written on the lines to the left. A third set of lines can be generated and attached to the subcategories with additional information or facts.

Example : Major causes of Soil pollution



VENN DIAGRAM

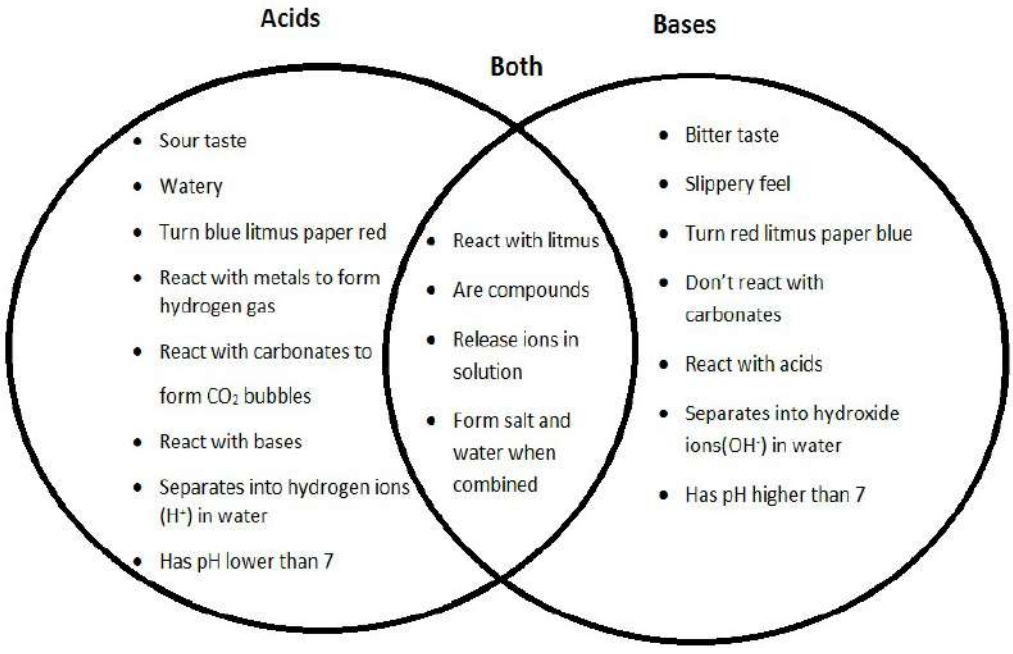


Purpose : Venn diagrams are used to compare and contrast groups of things.

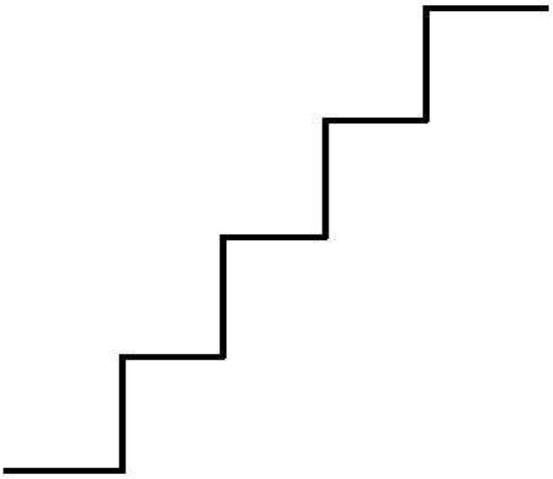
When to use : Use to illustrate the relationship between sets of data or groups of objects that share something in common.

How to draw : A Venn diagram uses intersecting circles to illustrate the similarities between groups. Similarities between groups are represented in the intersecting portion of the circles, while differences are represented in the non-intersecting portion of circles.

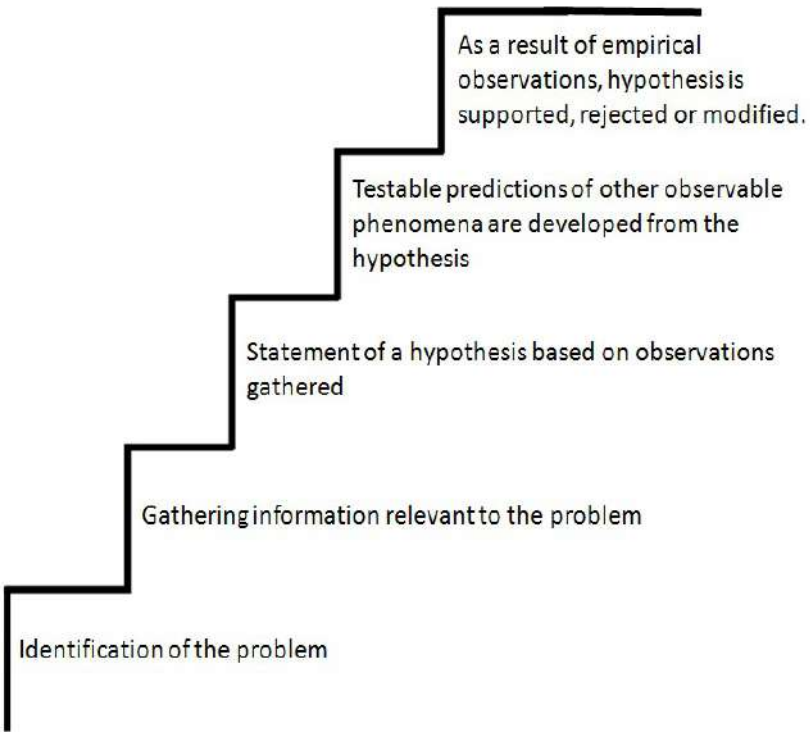
Example : Comparing acids and bases



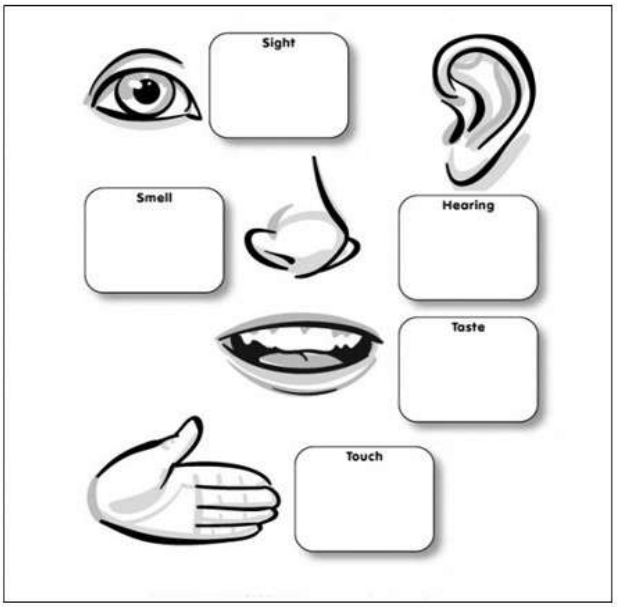
STAIR STEPS



Purpose : For plotting a course of action.
When to use : Use when a topic involves a step by step process.
How to draw : Write the first step of the process at the bottom level of the stair steps diagram. Then the steps of the process are written in their order from bottom to top level. Final step should be at the top level of the diagram.
Example : Steps in scientific method.



SENSORY OBSERVATIONS

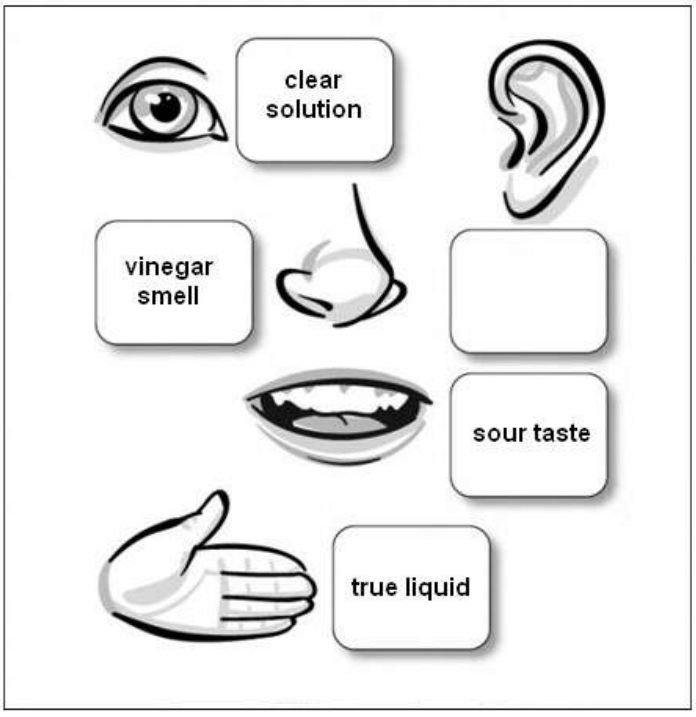


Purpose : Record what you observe with your different senses.

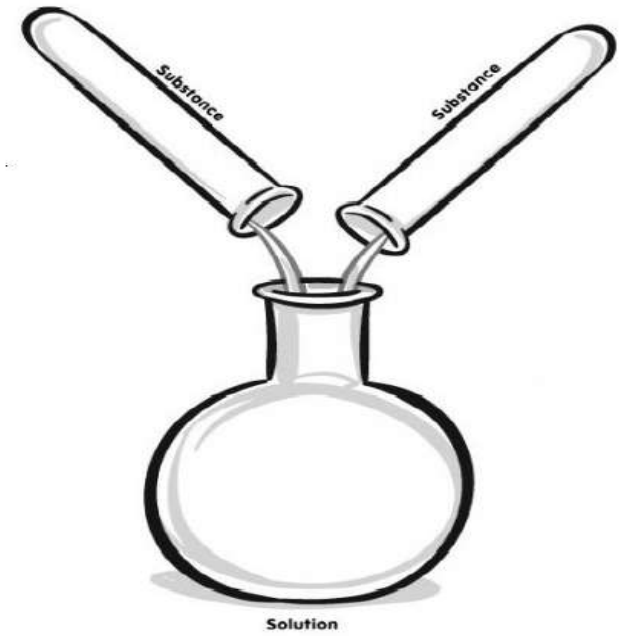
When to Use : During an experiment/nature walk where observation using sense organ plays major role.

How to Draw : Write what you see near the picture of eye, what you hear near the picture of ear, what smell near the picture of nose, etc.

Example : Students are given acetic acid solution and asked them to identify the solution; they can use this graphical organizer as

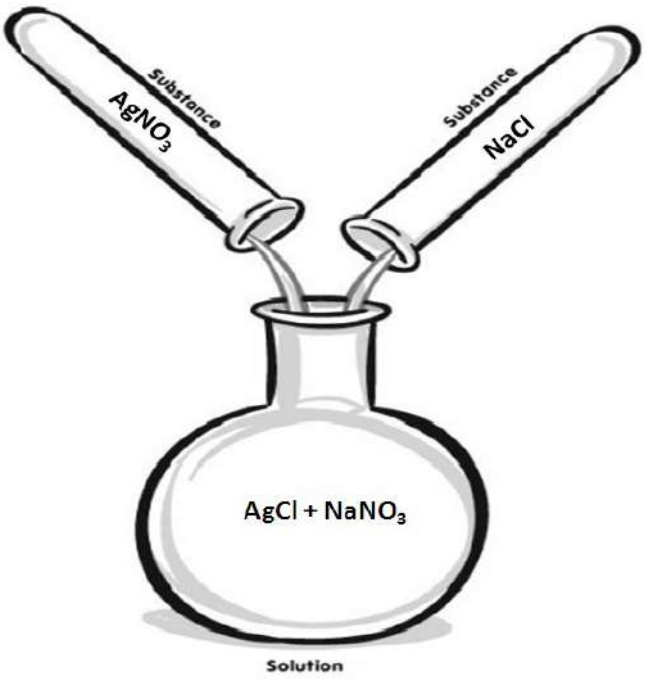


WHAT IS THE SOLUTION

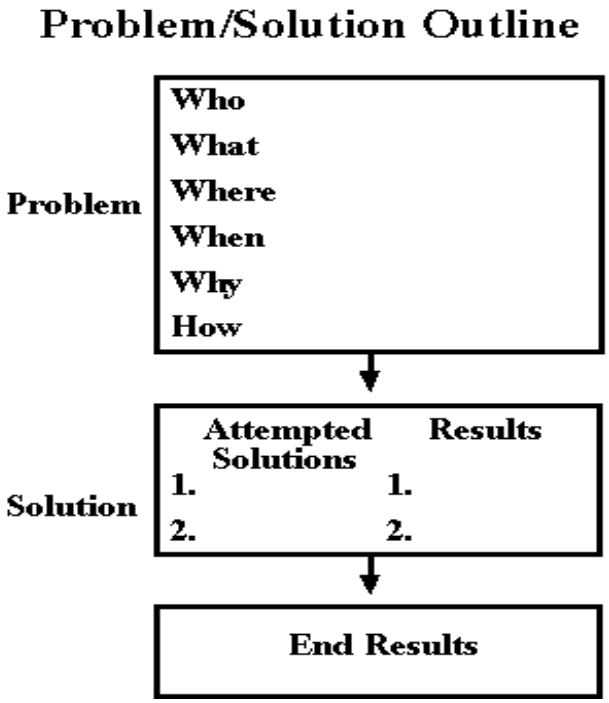


Purpose **:** To record what happens when two (or more) substance combine.
When to Use **:** When teaching a chemical reaction/equation
How to draw **:** Write the reactants/terms on the test tubes and the product on the bottle given in the figure.
Example : On teaching the reaction

$$NaCl + AgNo_3 \longrightarrow AgCl + NaNo_3$$



PROBLEM SOLUTION CHART

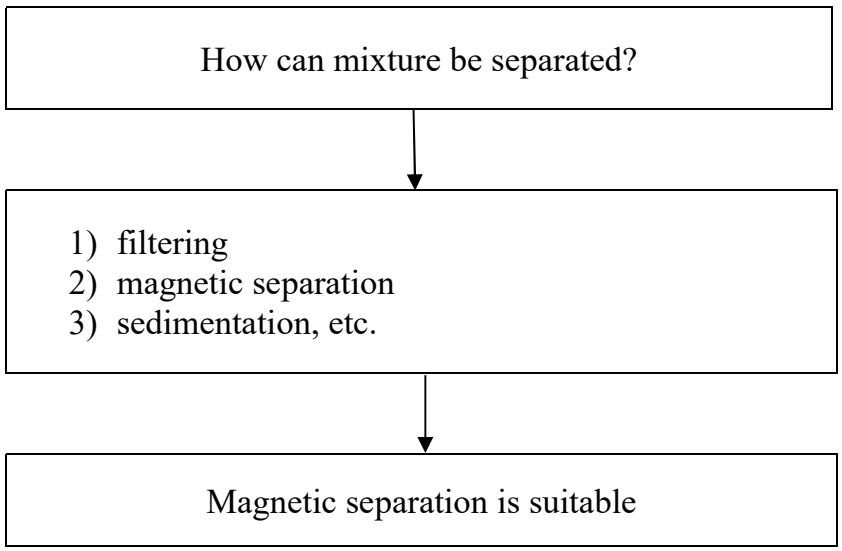


Purpose **:** Help students streamline the steps involved in recognizing a problem and utilizing problem-solving skills.

When to use : Use in group discussion after the teacher has explained an event or action.

How to draw : There are 3 boxes. W/H type problems are written on the top box. Solutions are written on the middle box. End result of those solutions is written in the bottom box.

Example : How can magnet-soil mixture be separated?



KWHL CHART

What I **K**now	What I **W**ant to know	**H**ow I learn	What I**L**earned

Purpose : Using this graphic organizer will help students monitor and take responsibility for their own learning.
Used in construction and organization of knowledge.

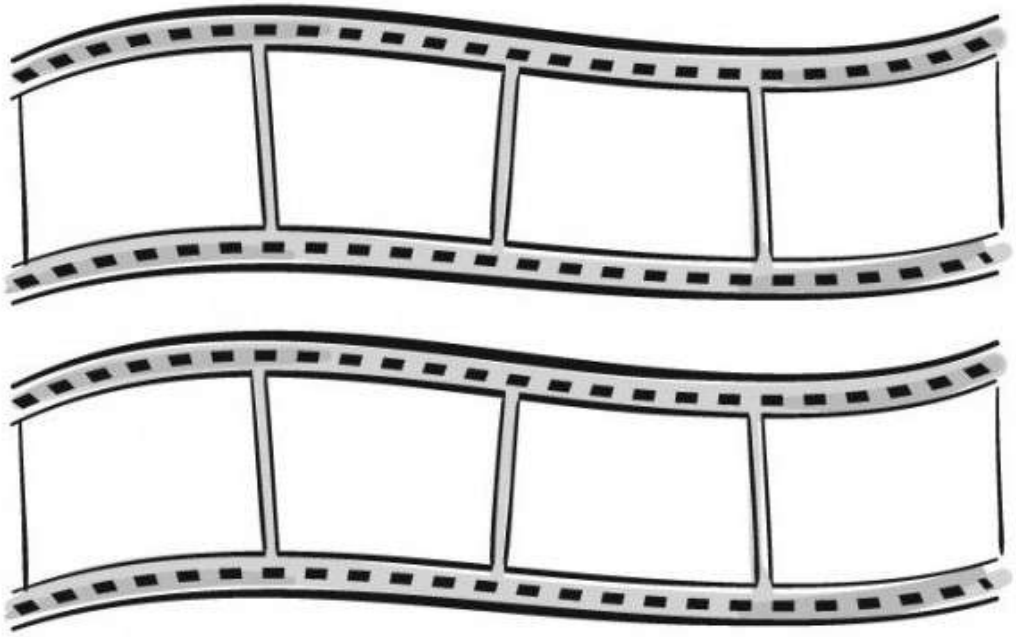
When to use : Use to activate student's prior knowledge about the topic and generate questions to guide their search for more information.

How to draw : Draw a 4×2 table. Prior knowledge is written in the first column. What he wants to know about the topic is written in the second column. How will he learn is written in the third column. What he learned is written in the fourth column.

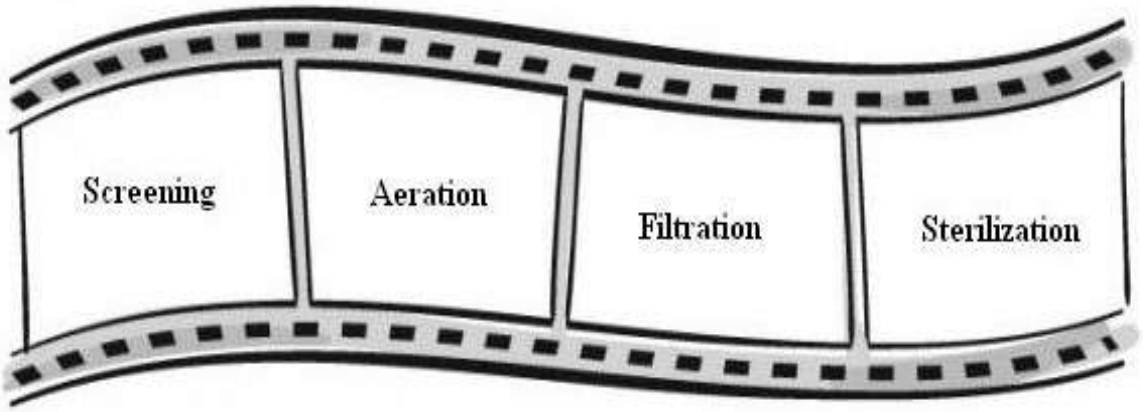
Example : Topic – Metals and its physical properties?

What I **K**now	What I **W**ant to know	**H**ow I learn	What I **L**earned
Iron, Aluminium, Copper, Gold, etc are metals	What are the physical properties of metals?	Through observation, From books.	Metals are hard, lustrous, malleable, ductile, sonorous and good conductors of heat and electricity.

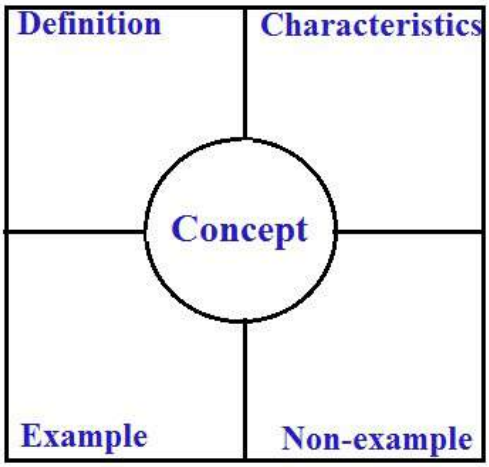
SERIES OF EVENTS



Purpose : To arrange events which are not cyclic but linear & sequential.
When to Use : To draw the series of events those make up a science process.
How to draw : Each event is can be written in the box sequentially from left to right.
Example : While teaching stages of water purification each box can be written orderly as- Screening, Aeration, filtration, Sterilization.



FRAYER DIAGRAM

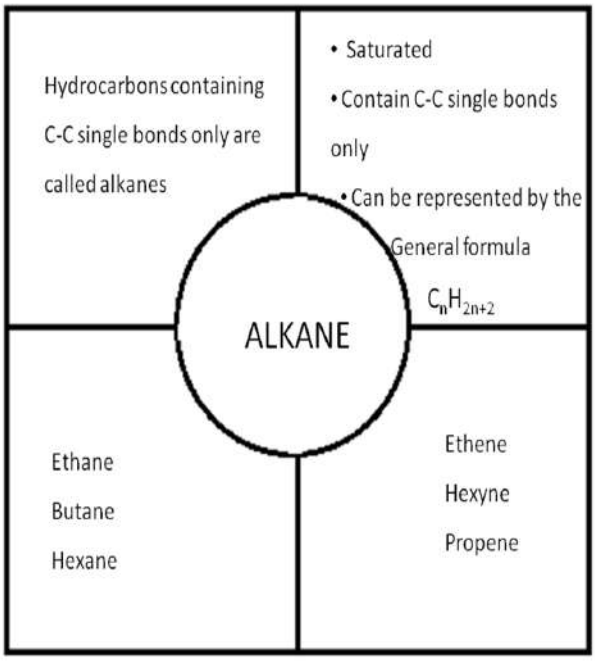


Purpose : Use to represent the elements of a concept. Helps to develop a better understanding of complex concepts by having students identify not just what something is, but what something is not.

When to Use : Use at the review phase or while teaching a complex concept.

How to draw : Name of the concept is written at the centre of the diagram and its definition, characteristics, examples and non-examples are written in the quadrants around.

Example : The concept Alkane, its definition, characteristics, examples and non-examples can be represented by the Frayer diagram as shown below



T CHART

TOPIC	
Advantage	Disadvantage

Purpose : Used for listing two separate viewpoints of a topic, for analyzing or comparing two aspects of a topic.

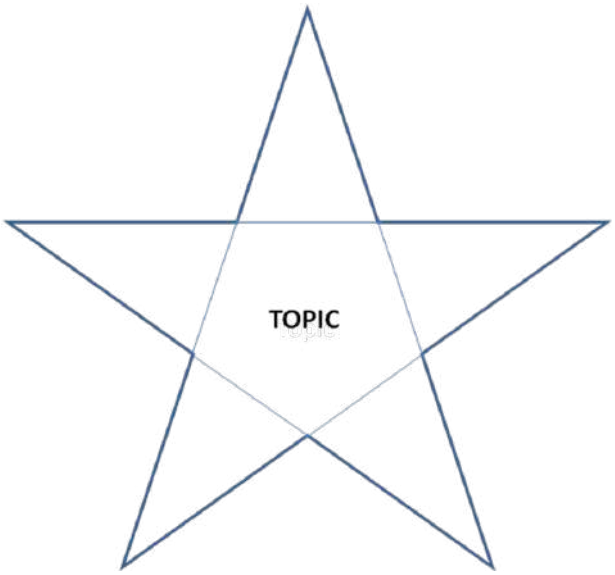
When to Use : Use when a topic includes anything that can be cleanly divided into two opposing views, i.e., while evaluating the pros and cons of a major decision, recording facts vs. opinions, presenting advantages and disadvantages or strengths and weaknesses, etc.

How to draw : The area is divided into two columns and a small raw is drawn at the top of the column. The main aspects of the topic are written on the top columns. The viewpoints related to the topic are written below.

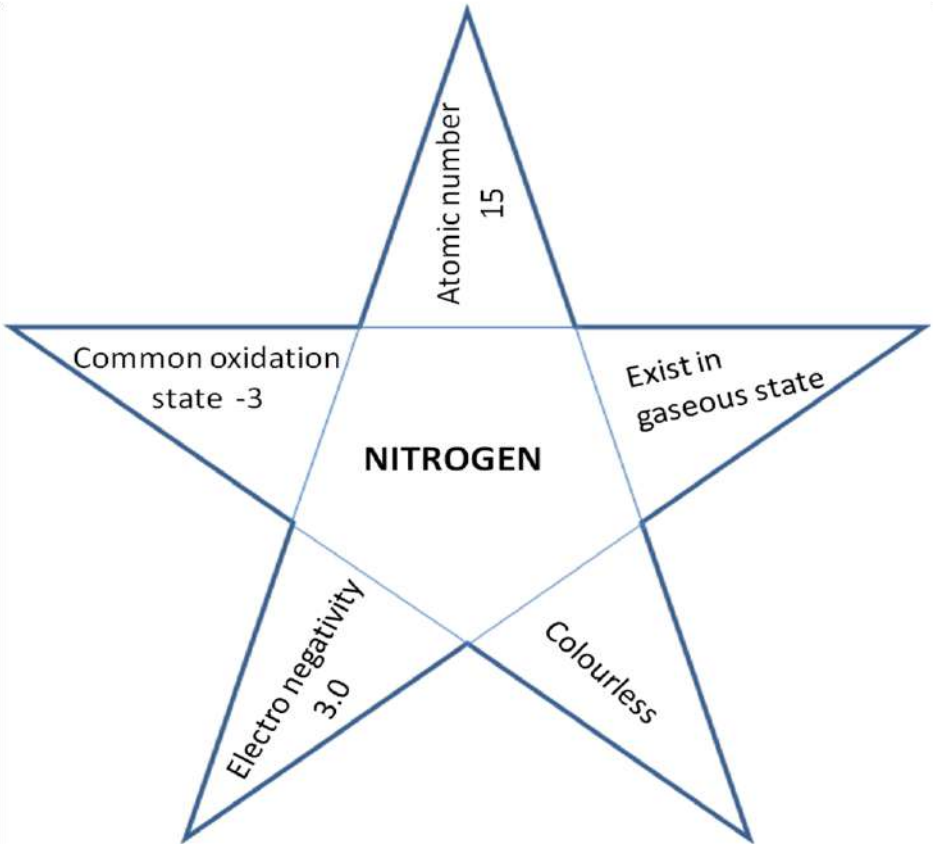
Example : Merits and demerits of Bohr model of atom

BOHR MODEL OF ATOM	
Merits	**Demerits**
• It could explain the stability of atom • It could explain the atomic spectrum of hydrogen • It could account for the simultaneous appearance of a large number of lines in the spectrum of hydrogen • It helped in calculating energy of an electron in a particular orbit of hydrogen atom	• It could not explain the line spectra of multielectron atoms • It could not explain Zeeman effect • It could not explain de Broglie concept of dual character of matter • It could not explain Heisenberg's uncertainty principle

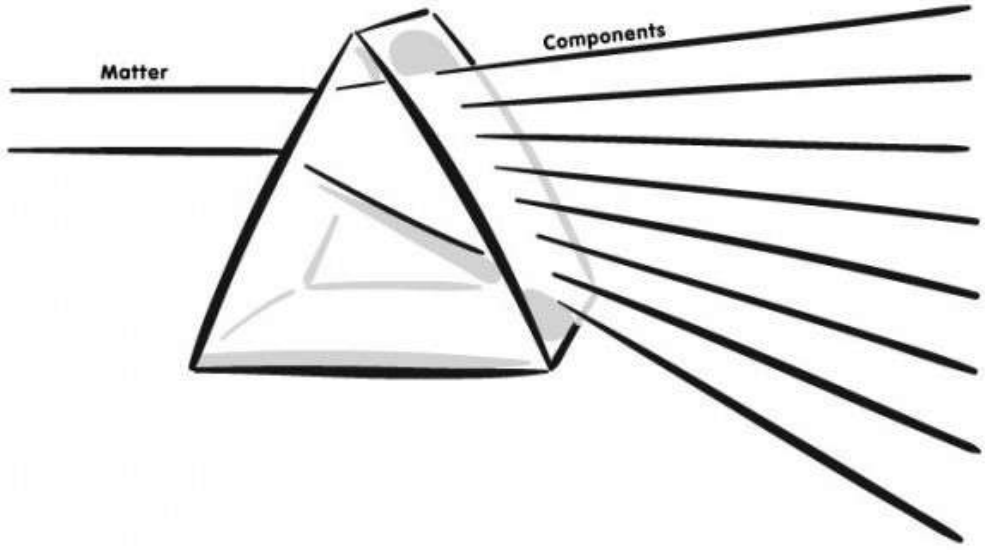
STAR DIAGRAM



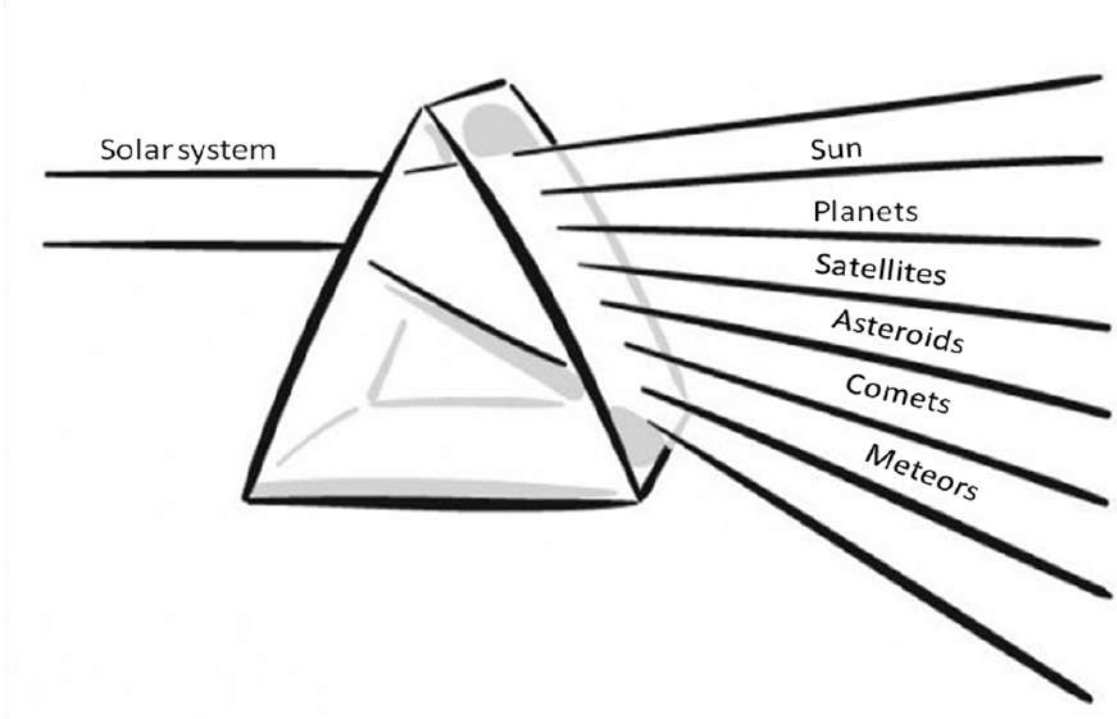
Purpose : Used for organizing the characteristics of a single topic.
When to Use :
How to draw : A central space is used for displaying the topic. Facts, attributes, or traits about the topic are written at each "point" of the star.
Example : Properties of Nitrogen.



PARTS OF A WHOLE



Purpose **:** To identify the composition of different types of matter
When to Use **:** Choosing a type of matter and break it down to its components
How to Draw : draw the main concept in the left side of the prism and it's components on the right side.
Example : Components of Solar system



SEQUENCE CHART

Topic
First
Next
Next
Next
Next
Next
Last

Purpose : To show the sequential events in a process

When to Use : Use when a topic involves a sequence of events. Useful when multiple or sequential factors need to be put in order and remembered.

How to draw : Draw a table as shown in figure. Name of the topic or process is written in the top row in the diagram. The first event in the process is written in the row below it. Then the sequential events are written in order in the following rows.

Example : Soap making process

Soap Making
Take 3.5 ml of water in a beaker
Add 10g Castaic Soda. And mix it.
Let the solution to cool down.
Add 60g Coconut Oil and slowly mix it.
After a long time put this precipitate in small vessels.
After it became solid use it.

MATRIX

	Attribute 1	Attribute 2	Attribute 3
Item 1			
Item 2			
Item 3			
Item 4			

Purpose **:** to organize or categorize information or to make comparisons among categories.

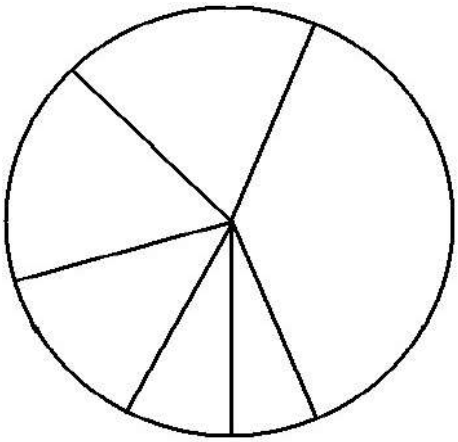
When to use **:** use when multiple items are to be compared.

How to draw **:** The items to be compared are listed along the left side of the table's rows, and the general features are listed across the top of the table before filling in the cells with facts or supporting information.

Example **:** Comparing Electron, Proton and Neutron

	Mass	Charge	Location	Discoverer
Electron	9.108×10^{-31} kg	1.602×10^{-19} C	Outside the nucleus	J.J.Thomson
Proton	1.672×10^{-27} kg	1.602×10^{-19} C	In the nucleus	Goldstein
Neutron	1.675×10^{-27} kg	0	In the nucleus	Chadwick

PIE CHART

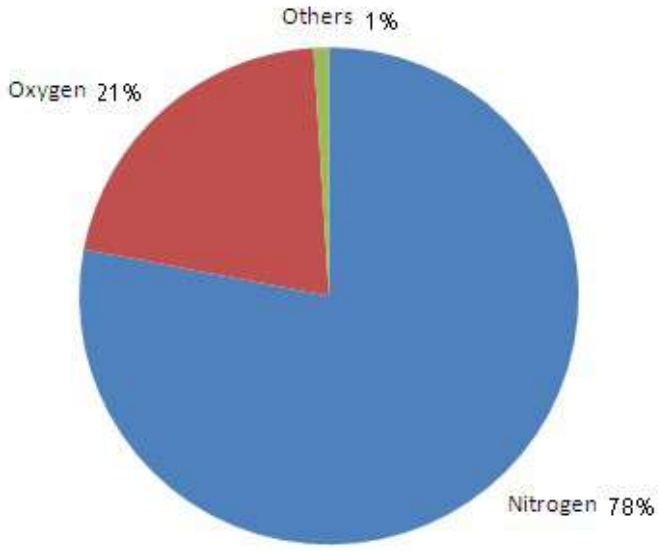


Purpose : Used to visually represent the percentage of whole one portion of data taken up. To show how a set is a composite of many differently sized parts.

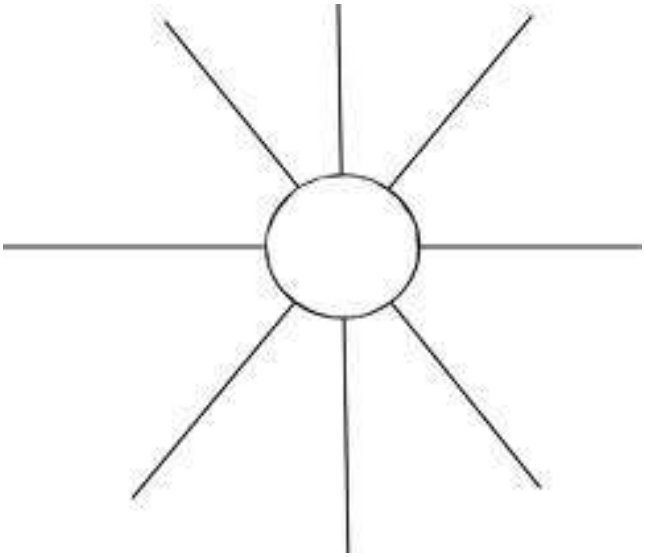
When to Use : Use to visually represent data that may be given in the form of a small table. The data might be classified into nominal or ordinal categories.

How to draw : Draw a circle. Divide the circle into sectors according to numerical proportions of different categories. Write the category and percentage on each slice of pie.

Example : Proportion of different gases in air



SPIDER CHART

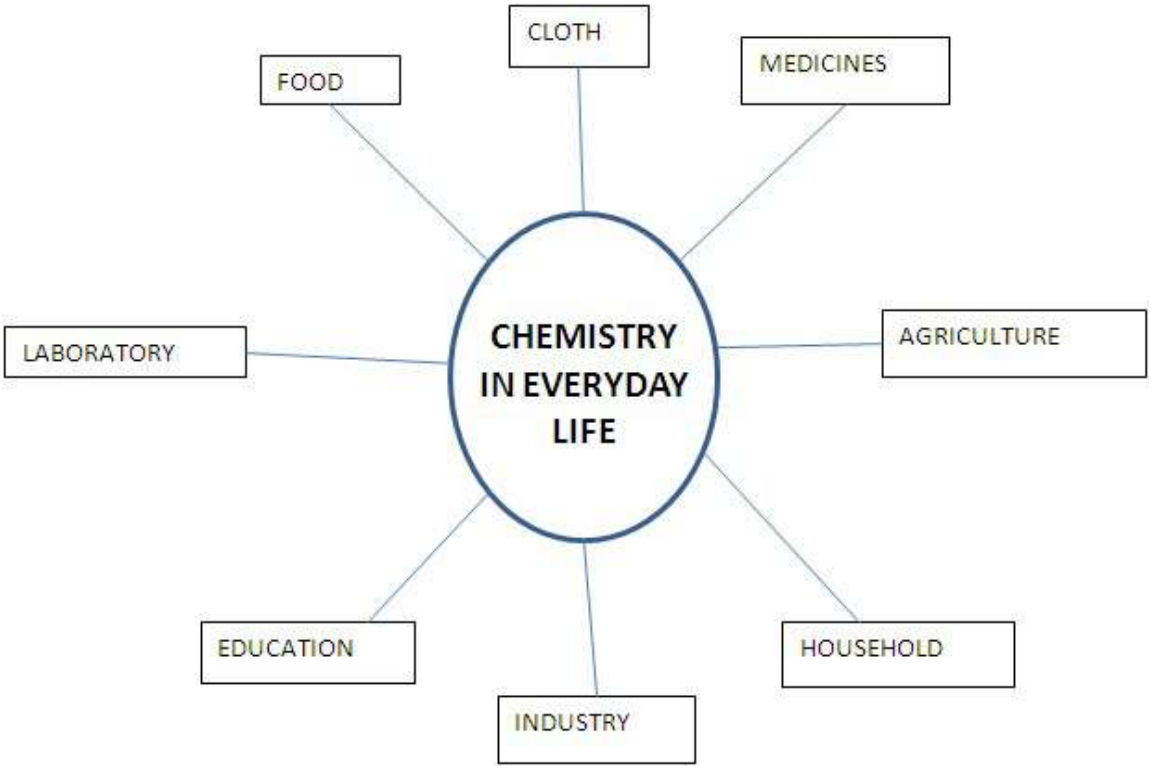


Purpose : Used for focus main topic and supporting ideas and for comparing multiple entities based on different characteristics.

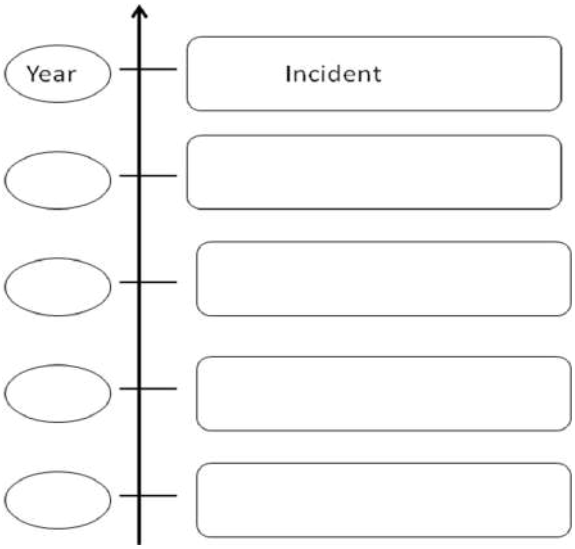
When to Use : If the topic involves investigating attributes associated with single topic. Use when the data is divergent in nature

How to draw : The main idea written on the single circle at the center .The supporting ideas spreads from the center.

Example : Chemistry in everyday life



TIME LINE

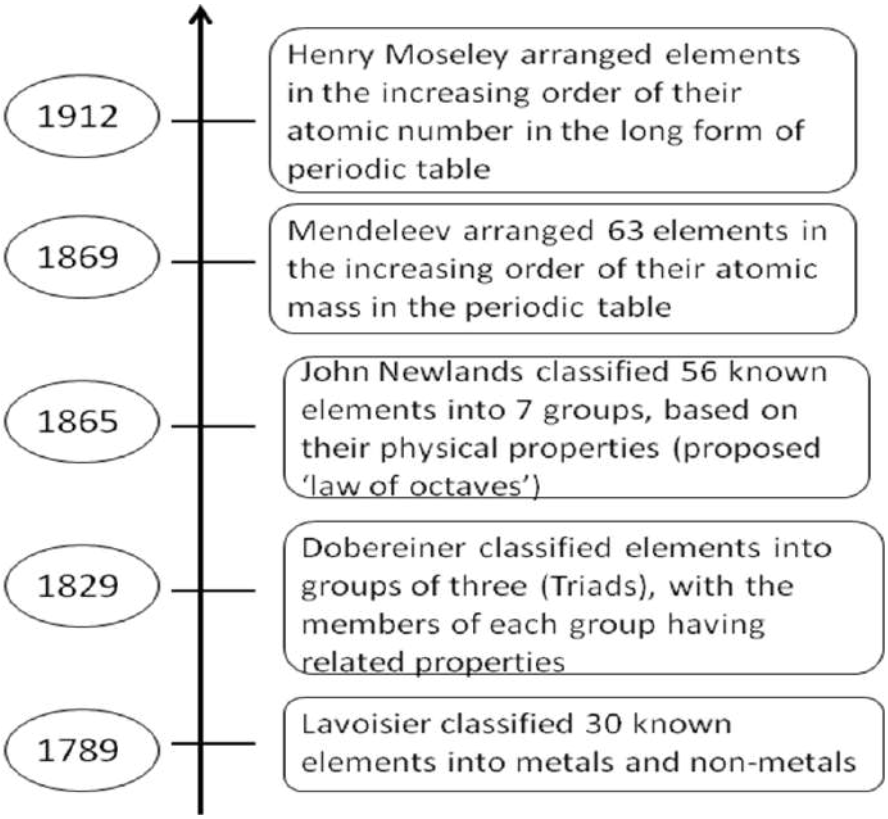


Purpose : For arranging the data in the basis of year (chronological order)

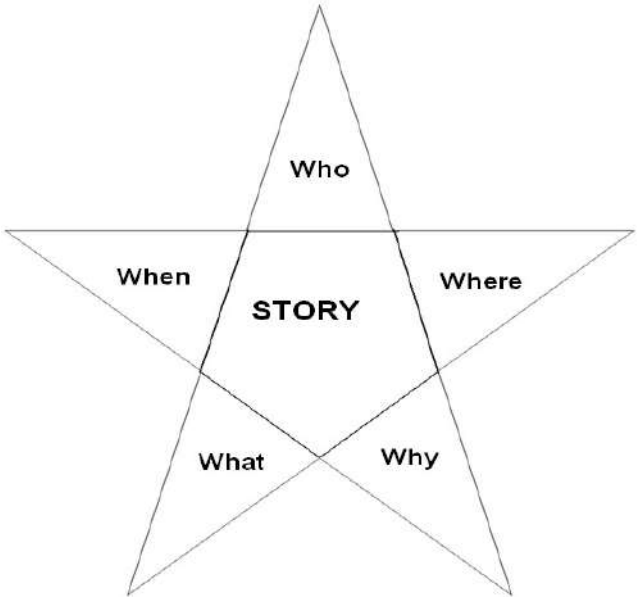
When to Use : Use when there is a series of incidents related to a topic occurred in different years.

How to draw : First draw a vertical line. On one side of the line years are arranged in the ascending or descending order. Then the corresponding incidents are written on the other side of the line.

Example : Classification of Elements



FIVE W 'S CHART

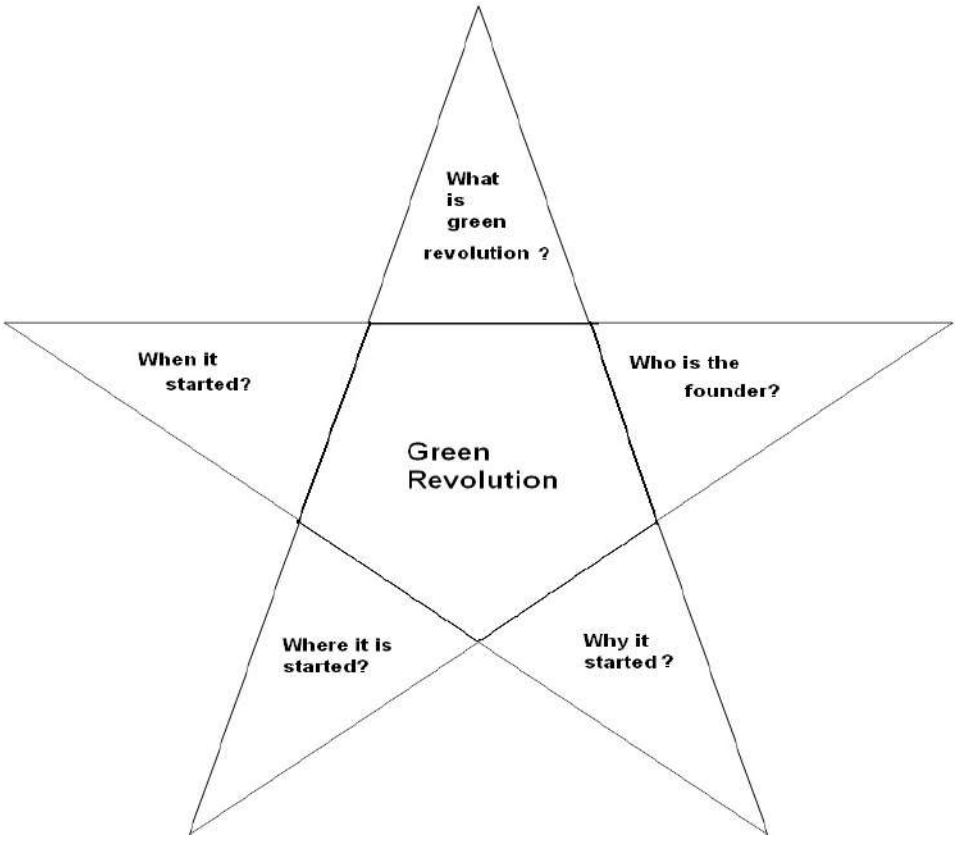


Purpose : For showing who, when, where, what, and why of a story or event in a simple visual way.

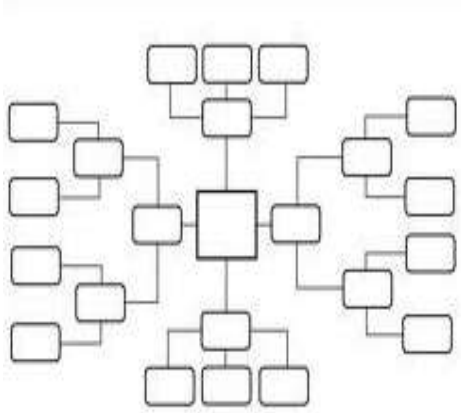
When to use : Use while examining the key points of a story or event.

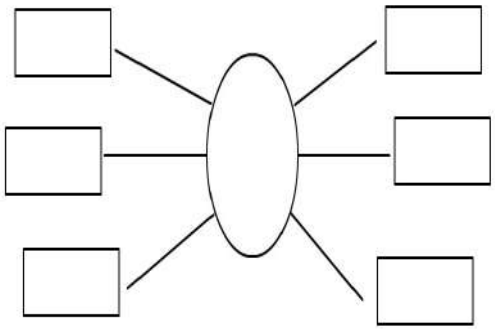
How to draw : Draw a star write the main idea on the centre and the questions like what, when, who, why, where on the dividing portions.

Example **:** Green Revolution



CONCEPT MAP



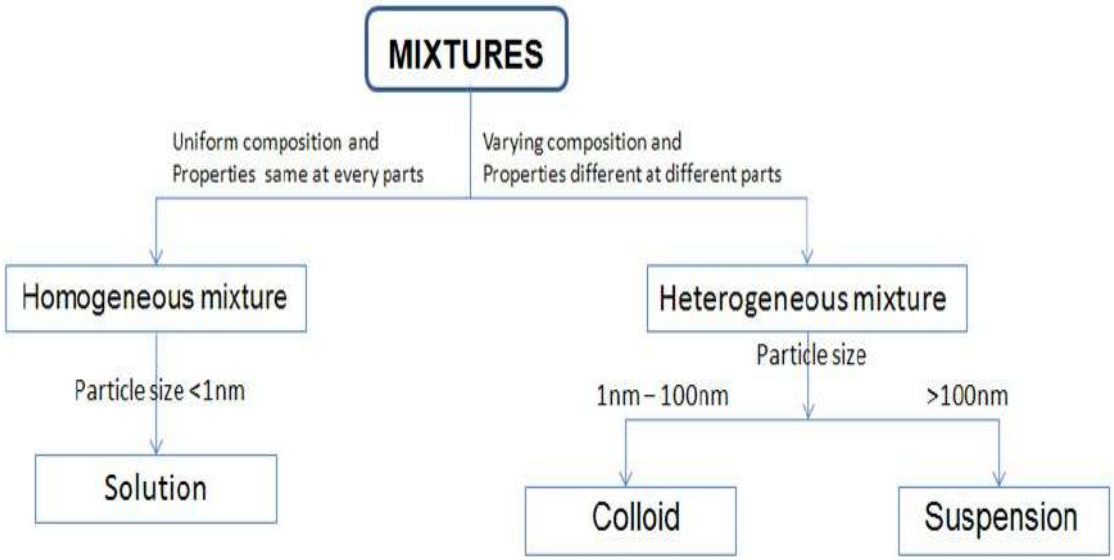


Purpose : Depicts suggested relationship between concepts. It helps meaningful learning of science concepts.

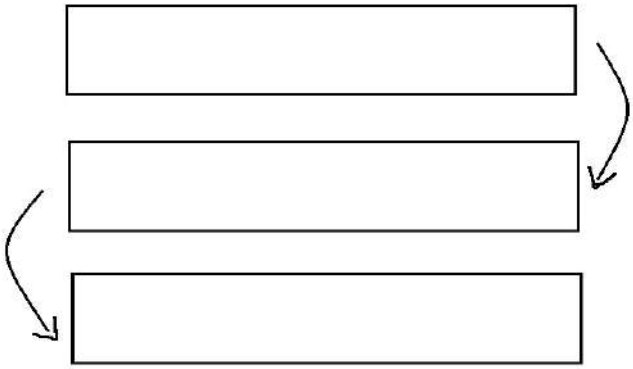
When to Use : Use to show relationship between concepts in a unit or more than one unit in a subject area.

How to draw : Concepts or ideas are written in boxes or circles, which are connected with labeled arrows. Concept maps may be divergent type, convergent type or hierarchical type.

Example : Concept map of Mixtures



STEP BY STEP CHART

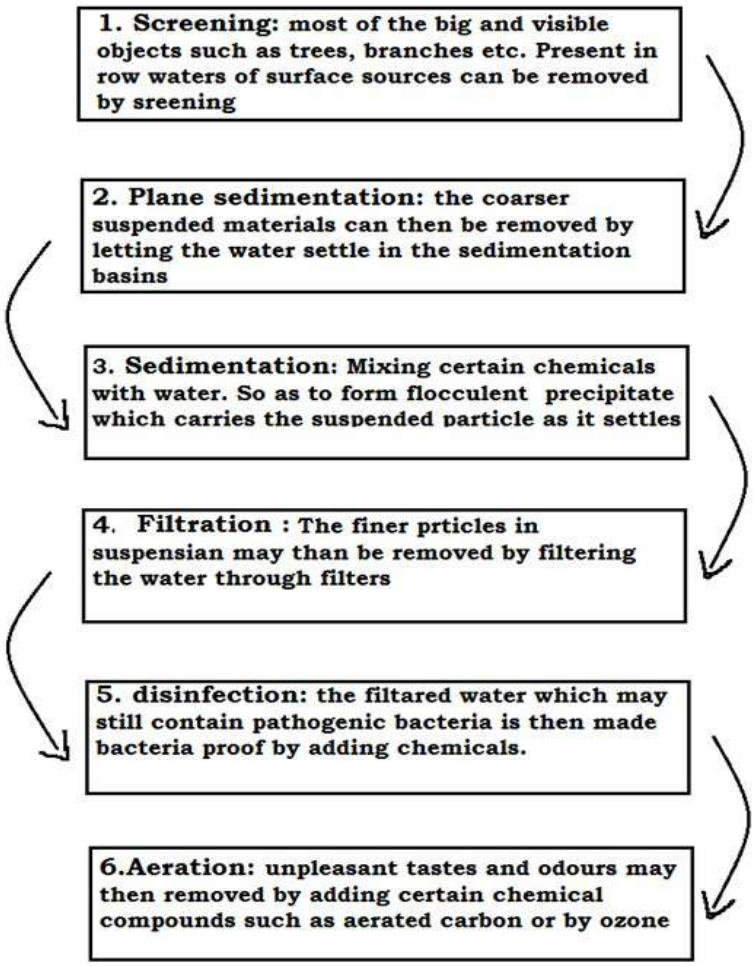


Purpose : To show the sequential steps/events in a process

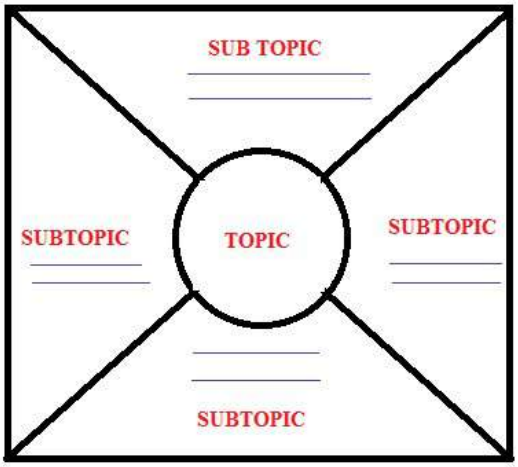
When to Use : Use when a topic involves a process with sequence of events/steps.

How to draw : Steps in the process are written in boxes in sequential order from top to bottom.

Example : various methods or the steps which may be adopted for purifying the public water supplies



ONE AND ALL ORGANIZER

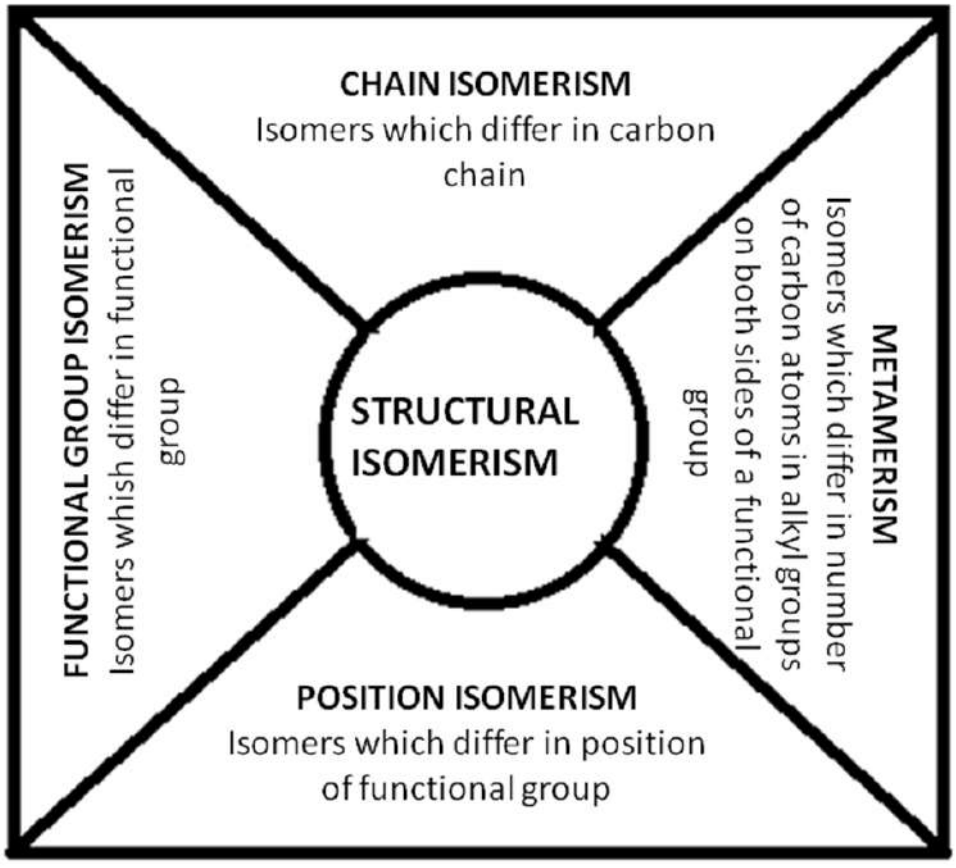


Purpose : For structuring scientific knowledge.

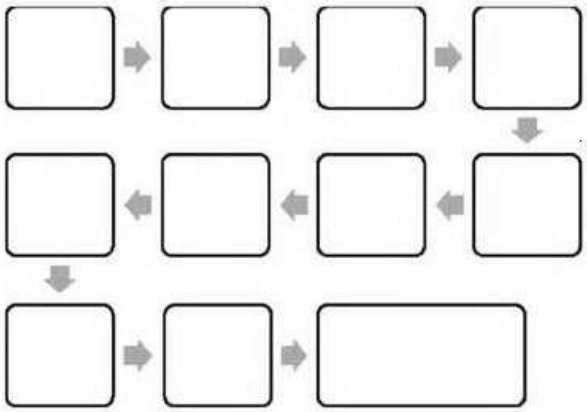
When to Use : Use to uncover similarities and differences among various subtopics of a main topic.

How to draw : The main topic is written in the central circle in the diagram. Subtopics are written around and illustrations may be given.

Example : Structural isomerism in organic compounds



FLOW CHART

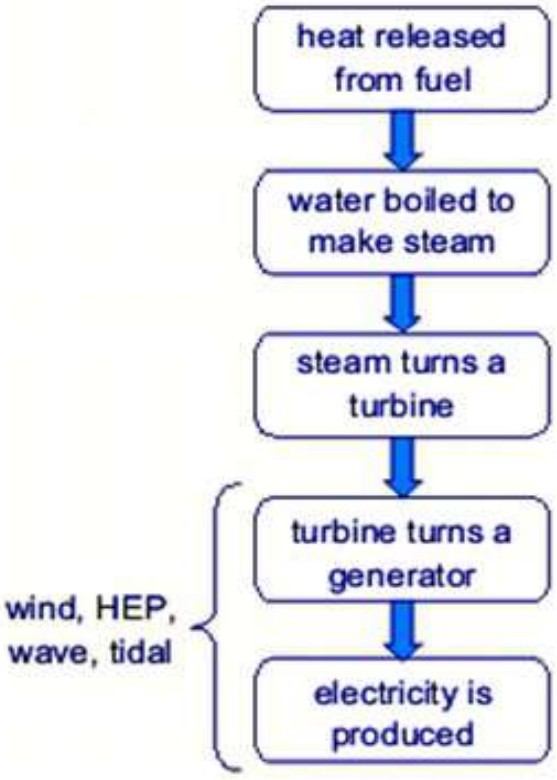


Purpose **:** To show the sequential events in a process. Helps to clarify how things are currently working and how they could be improved.

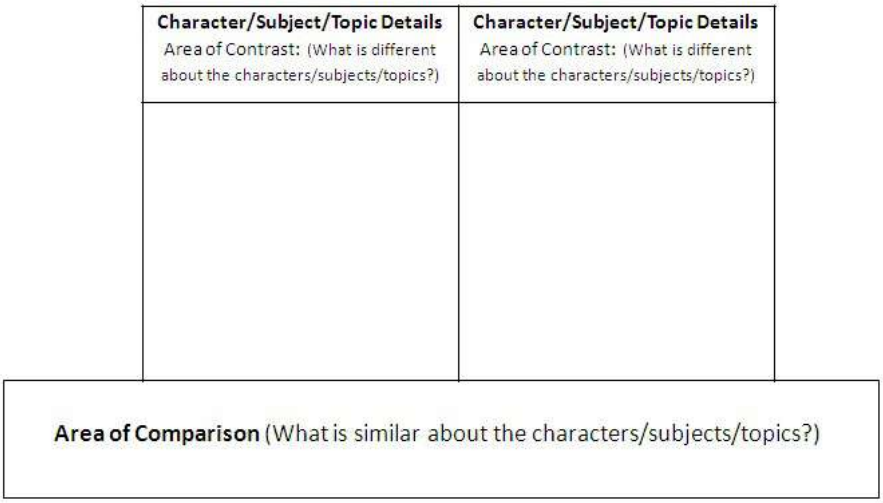
When to use **:** Use when a process involves series of steps/events in sequential order.

How to draw **:** Steps/events are written in boxes, which are connected with arrows showing the sequential order.

Example **:** electricity production in a power station



TOP HAT ORGANIZER



Purpose : For the easy learning of similarities and dissimilarities.

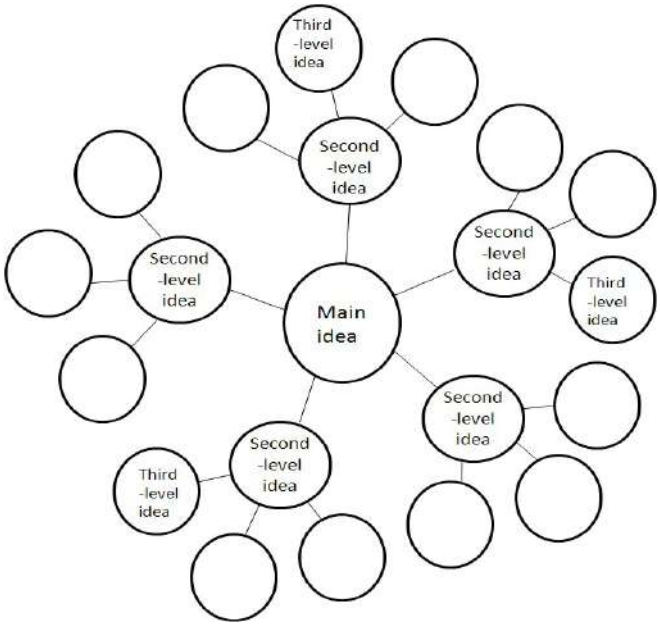
When to Use : Use when comparison study is required. Use to record the similarities and differences between two concepts, theories, topics, etc.

How to draw : Indicate names of the items to be compared on top row. List the differences between the two in columns below it. Similarities between the two are listed in the bottom row of the diagram.

Example : Comparison between n-type and p-type semiconductors.

N type	P type
larger electron concentration than hole concentration	larger hole concentration than electron concentration
electrons are the majority carriers	holes are the majority carriers
holes are the minority carriers	electrons are the minority carriers
created by doping an intrinsic semiconductor with donor impurities	created by doping an intrinsic semiconductor with acceptor impurities
Both are extrinsic semiconductor	
Used for making diode and transistors	

CLOUD

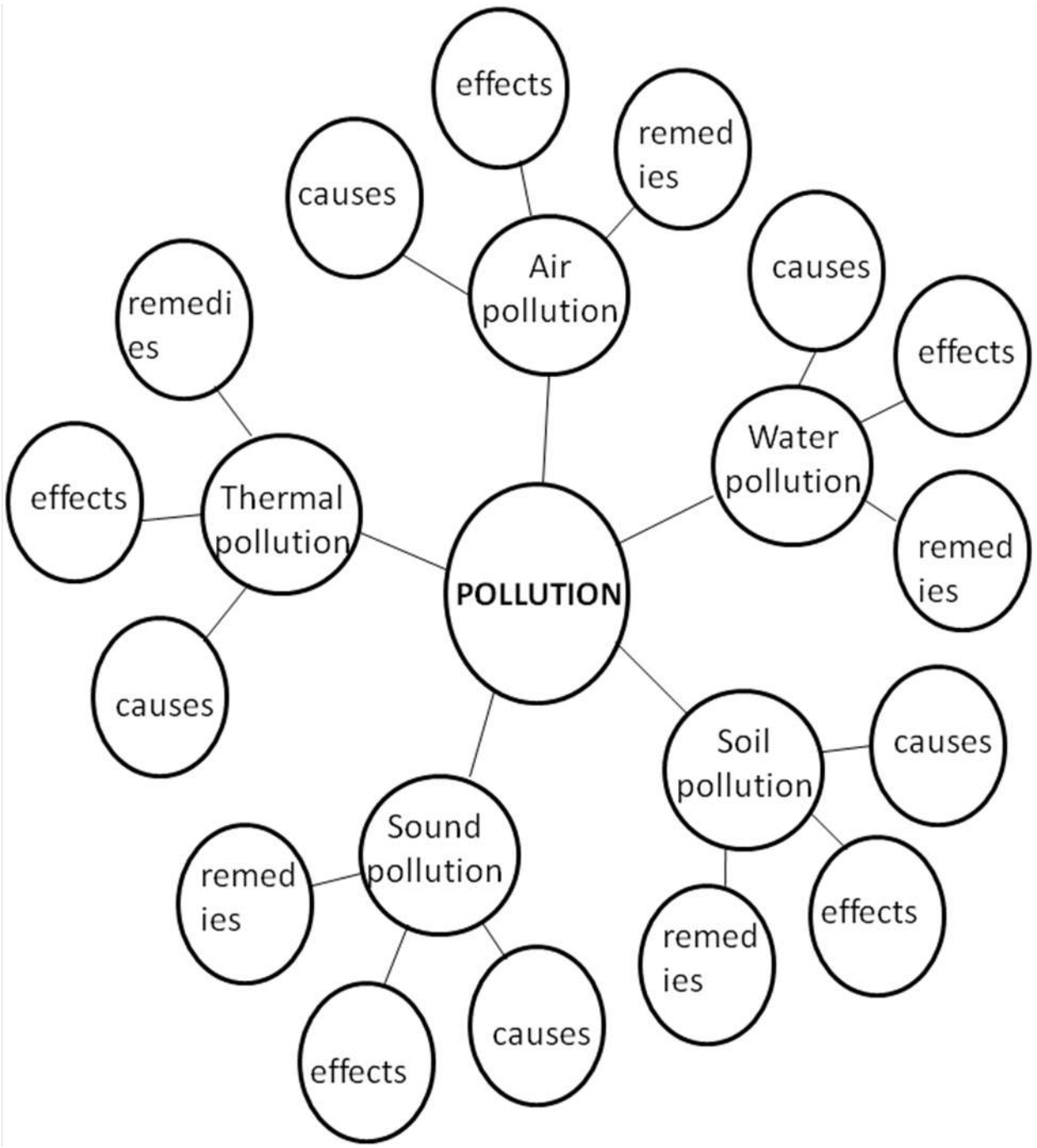


Purpose **:** To systematize the generation of ideas based upon a central topic

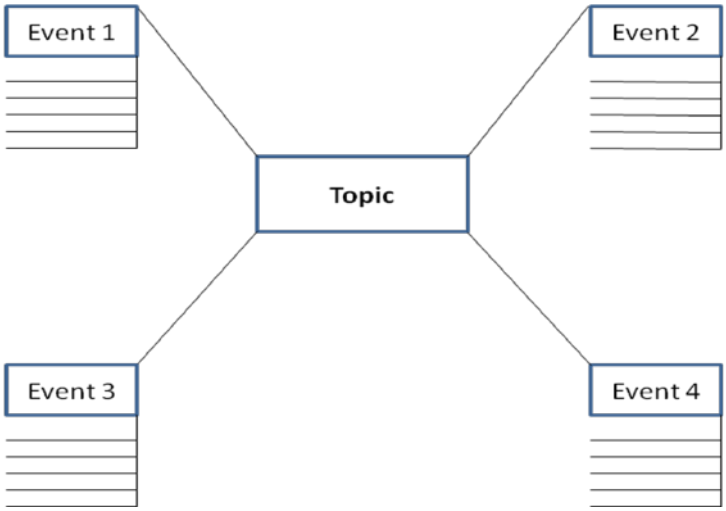
When to use **:** Use while brain storming a theme, associate about an idea, or when exploring a new subject.

How to draw **:** To create a cloud diagram, the student first thinks of as many terms or ideas relating to the stimulus topic as possible (and then writes the second-level ideas in circles attached to the main topic). Then the student explores each of these new second-level ideas in turn, and for each, finds as many related ideas as possible (and adds these third-level terms to the diagram around the idea). If more detail is desired, the previous step can be repeated for each of the third-level ideas (or more).

Example **:** Different types of pollution and their sources


POLLUTION
Air pollution
effects
remedies
causes
Water pollution
causes
effects
remedies
Thermal pollution
remedies
effects
causes
Soil pollution
causes
effects
remedies
Sound pollution
remedies
effects
causes

TIME-0RDER CHART

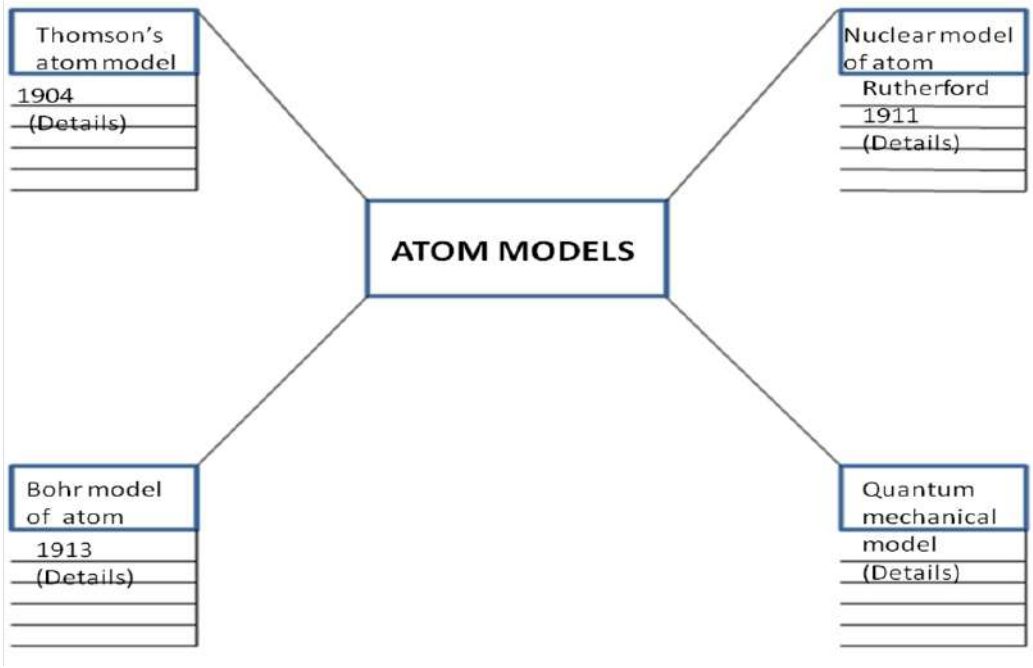


Purpose : To display a list of events in the chronological order

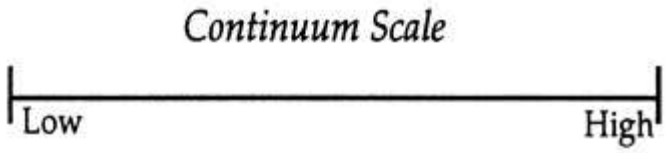
When to Use : When there is number of events related to a topic occurred at different time.

How to draw : Topic is written at the central square. Write events in time order in the boxes and details on the branching lines.

Example : Atom models

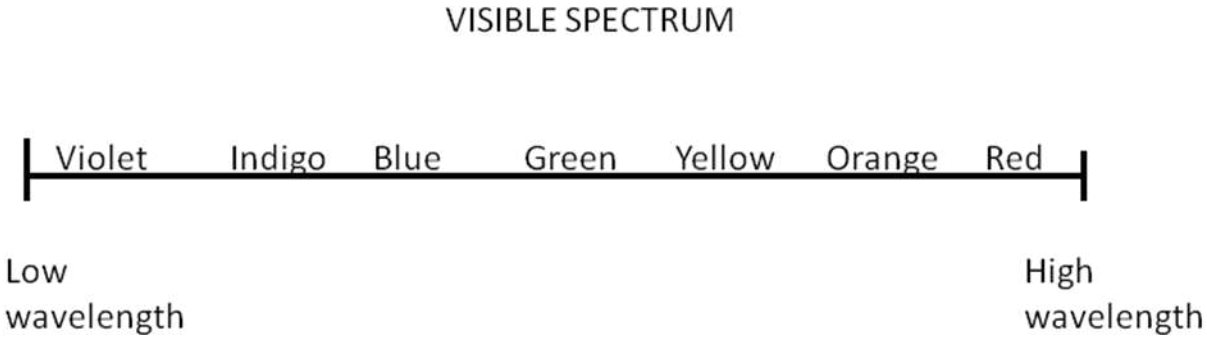


CONTINUUM SCALE

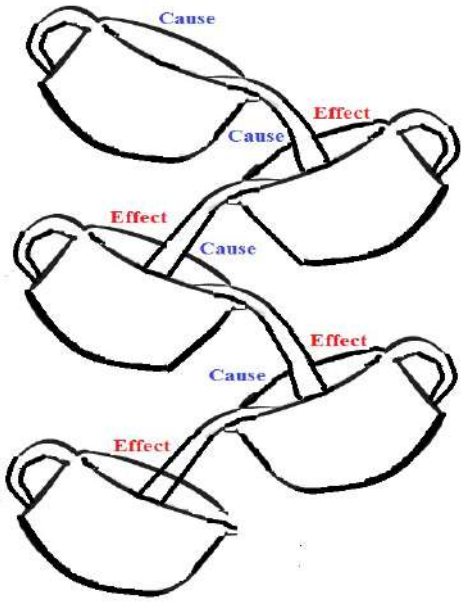


Purpose : For organizing information along a dimension such as less to more, low to high, and few to many.

Example : Visible spectrum



CAUSE AND EFFECT FLOW CHART

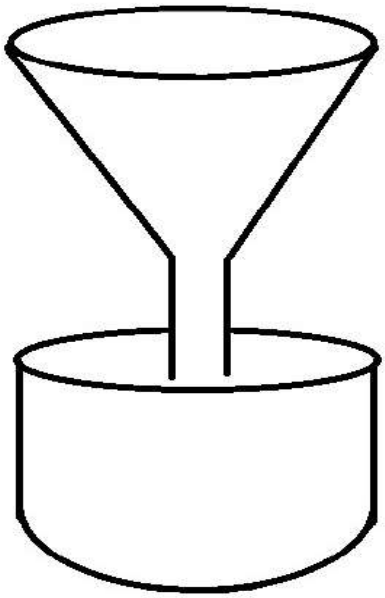


Purpose : Used to show cause-effect relationship. It helps students recognize that everything happens for a reason and has consequences.

When to Use : Use when the effect itself becomes a cause for something else and this new "effect," in turn, becomes the cause for something else again and hence results in a chain reaction, with one event triggering another event, which triggers another, and so on. This can be used during classroom discussion.

How to draw : Identify the cause-effect relationship in a chain of events and write them in order in the cups.

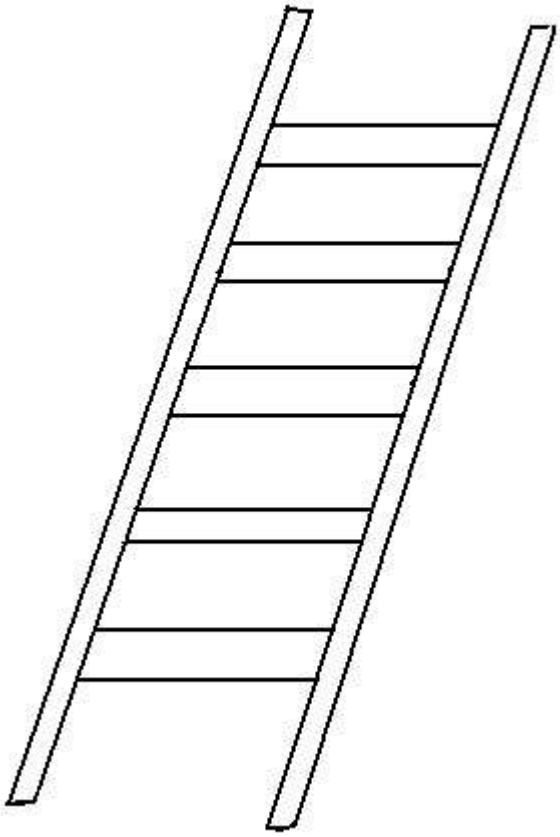
FUNNEL



Purpose : For synthesizing ideas, drawing conclusions, reducing a body of information to it's core e.g. creating a definition, this model is useful. It can also be used to challenge or test pupils e.g. find the elements that are missing from the funnel.

How to draw : All details, components or parts of the information or picture are placed inside the funnel. They emerge as a conclusion, definition or synthesis.

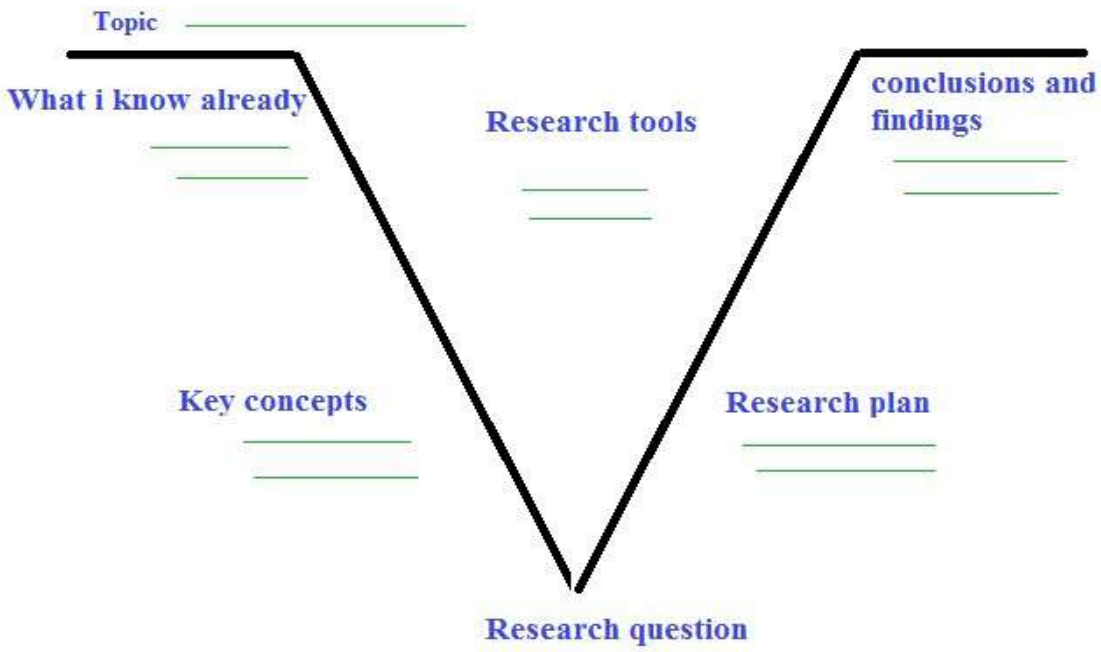
LADDER CHART



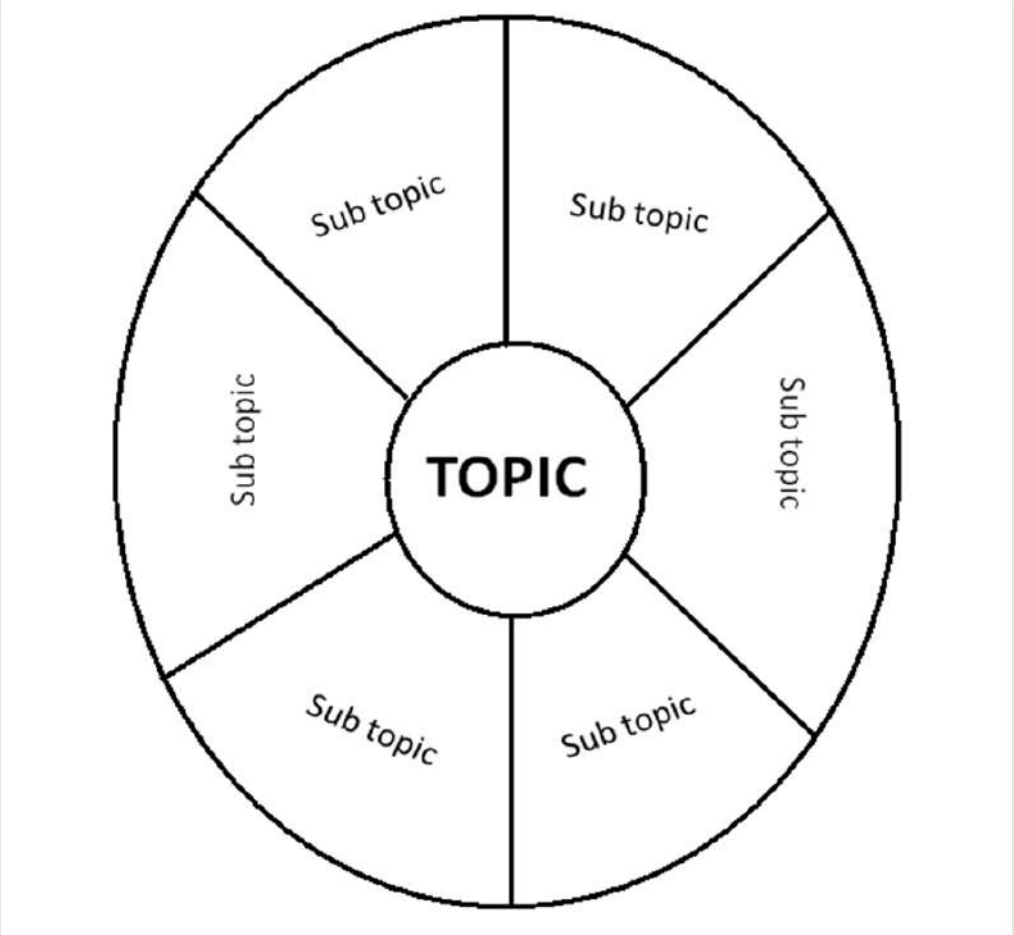
Purpose **:** This can be used to prioritize or rank ideas and/or information.

When to use **:** It can also be used for topics with a series of stages or steps. It is suitable for topics with a definite beginning and end. At the pre-teaching stage the teacher can have pairs/triads of students fill in any information they know about the topic on the correct step. Teacher can monitor the results and then focus the teaching more accurately on the needs of the class. Active learning can be facilitated if the teacher then provides the information in jumbled form. Students work together to rank the information correctly.

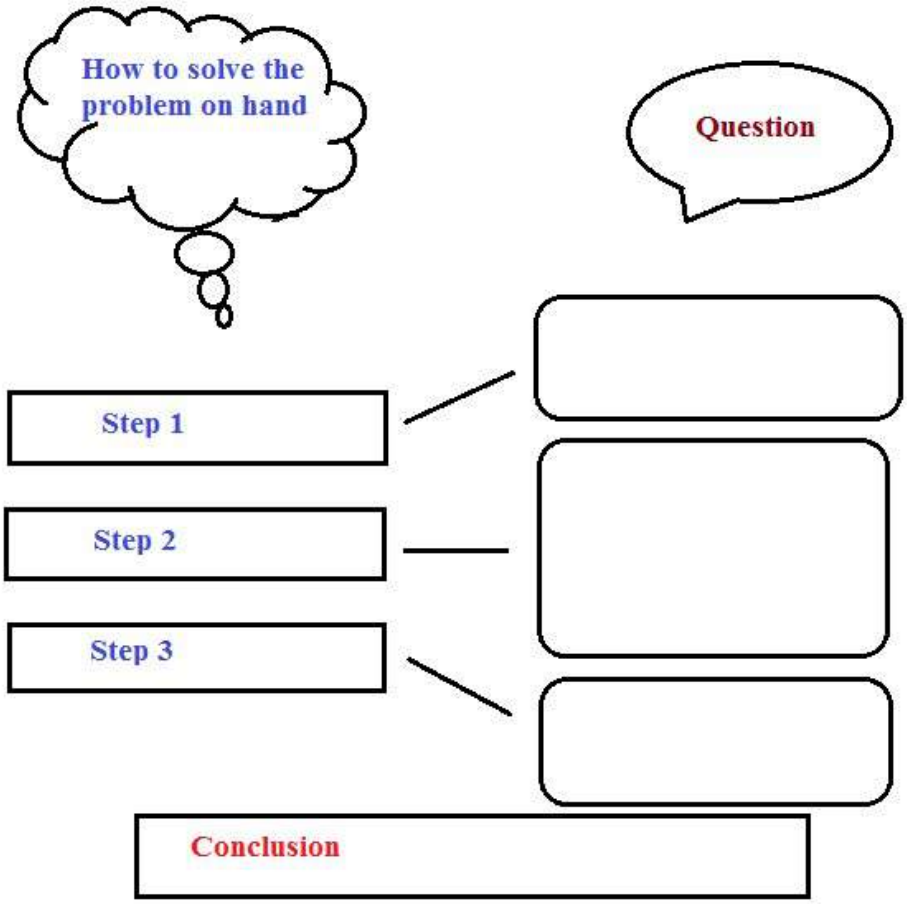
V-MAP


Topic
What i know already
Research tools
conclusions and findings
Key concepts
Research plan
Research question

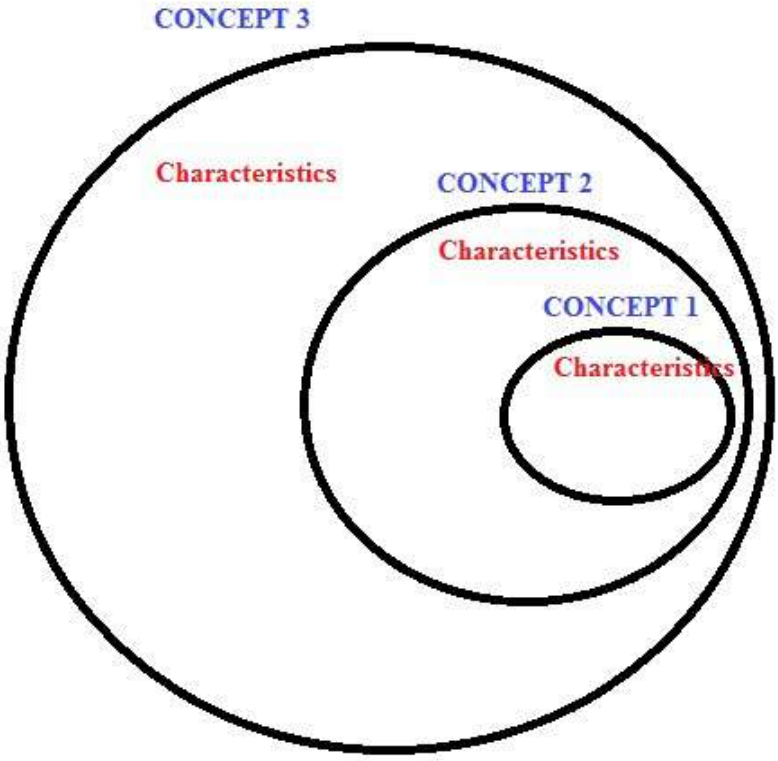
WHEEL DIAGRAM



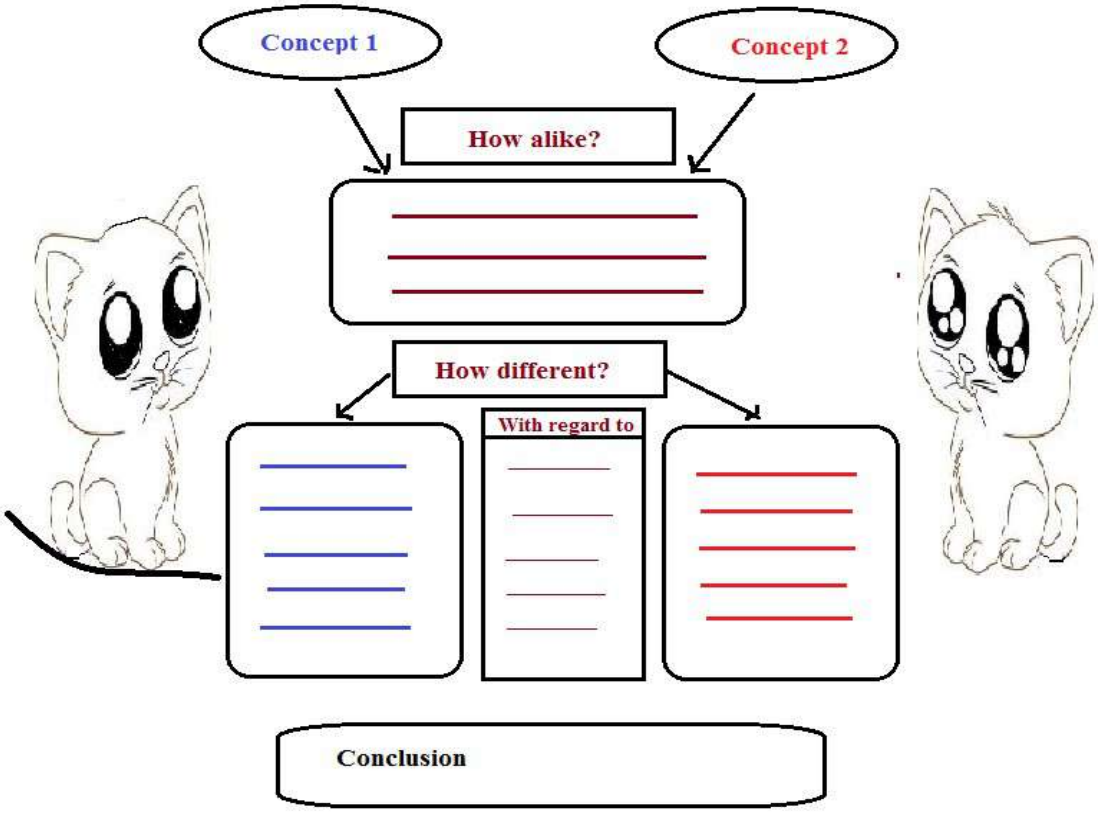
PROBLEM-SOLVING STEPS



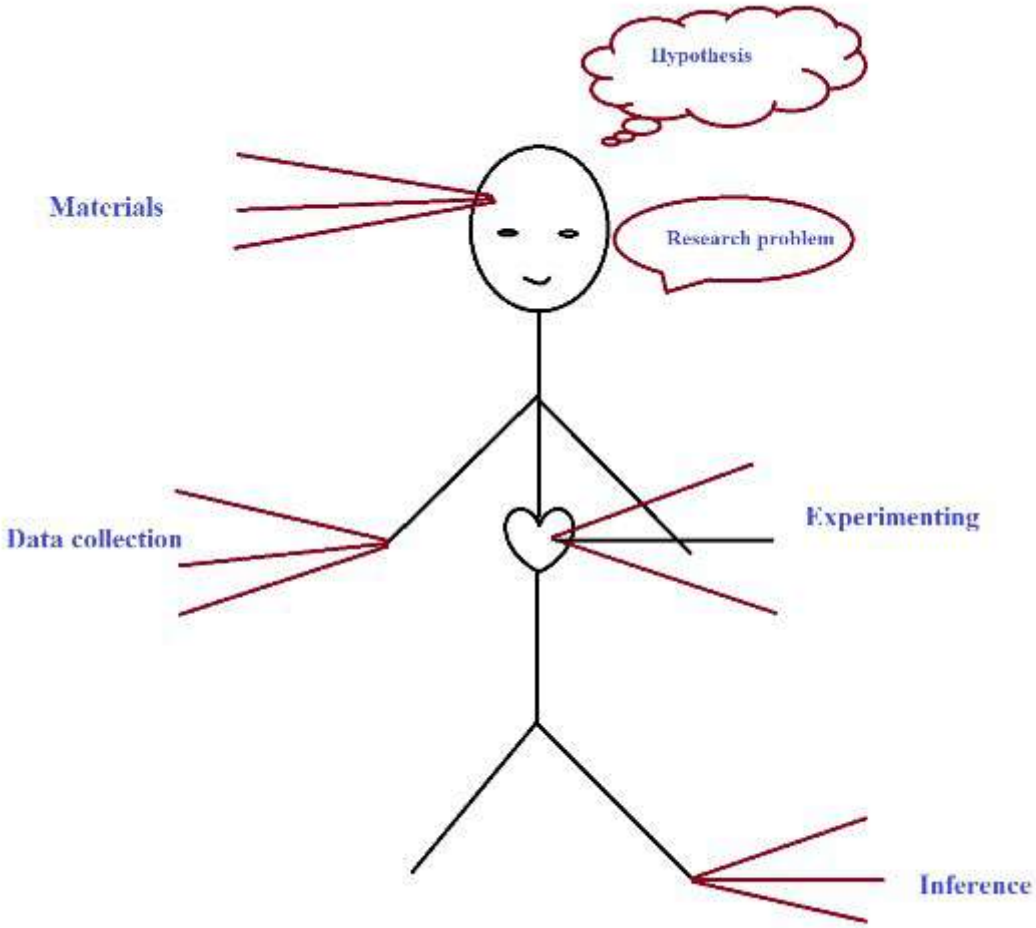
GENERAL TO SPECIFIC



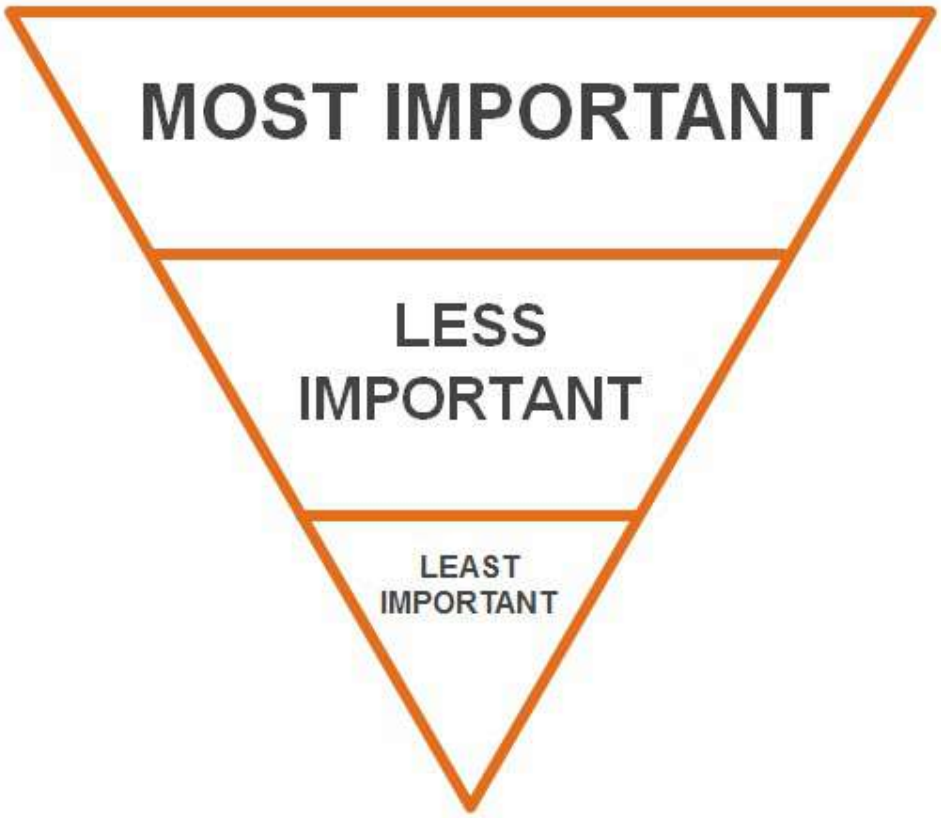
COMPARE/CONTRAST WITH SUMMARY



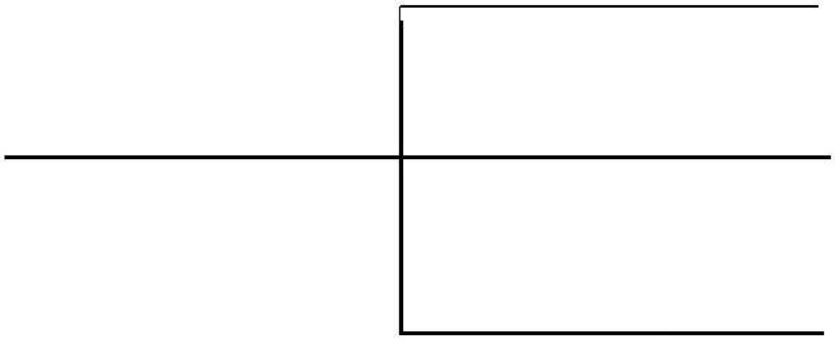
STICK-MAN DIAGRAM



INVERTED TRIANGLE



E-CHART



PMI CHART

Plusses	Minuses	Interesting things

GRAPHICAL ORGANIZERS FOR PROCESSING SCIENTIFIC KNOWLEDGE

DEPARTMENT OF PHYSICAL SCIENCE

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