Topic 3

Not to get technical...but according to chemistry, alcohol is a solution.

CHEMICAL SCIENCE YEAR LEVEL STATEMENTS

Foundation - Objects are made of materials that have observable properties (ACSSU003)

Year 1 -Everyday materials can be physically changed in a variety of ways (ACSSU018)

Year 2 - Different materials can be combined for a particular purpose (ACSSU031)

Year 3- A change of state between solid and liquid can be caused by adding or removing heat (ACSSU046)

Year 4 -Natural and processed materials have a range of physical properties that can influence their use (ACSSU074)

Year 5 - Solids, liquids and gases have different observable properties and behave in different ways (ACSSU077)

Year 6 - Changes to materials can be reversible or irreversible (ACSSU095)

Year 7 - Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU113)

CONTENT AND ACTIVITIES

- Rockets POE
- Conceptual change and prior knowledge
- White Powders: Are they the same?
- Physical and chemical changes
- Atoms and molecules review

ROCKETS

POE

Which rocket will go the highest?

Rockets

PRIOR KNOWLEDGE

- ❑ What is the purpose of performing this POE.
- ❑ What other methods could we use to determine students' prior knowledge.
- ❑ Why is PRIOR KNOWLEDGE important?

TEACHING AND LEARNING

"The most important single factor influencing learning is what the learner already knows.

Ascertain this and teach...accordingly"

(Ausubel, 1968, p. v)

CONSTRUCTING KNOWLEDGE

Constructivist theory is based on the premise that

1. Learners must actively construct their own knowledge
2. Learners prior knowledge is influential in how learners construct new knowledge

CONSTRUCTING THEIR OWN KNOWLEDGE

- Knowledge is an active process
- Students must engage and interact with their environment
- Social and physical interaction are important
- Students developmental level set limits on their learning at that given point in time

DEVELOPMENTAL LEVELS

- Stage 1- Sensorimotor (birth - 2yrs)
- Stage 2- Pre-operational (2yrs- 6yrs)
- Stage 3- Concrete operational (6- teen)

Reversibility, Seriation Classification (number i.e. 6 objects) Addition, subtraction, division and multiplication, Conservation

- Stage 4- Formal operational (12 up but!)

Combinational reasoning (consider and test all variables in systematic way) Proportional reasoning. Identification and control of variables Hypothetical and deductive reasoning (move to possibility/imagined scenarios)

CHILDREN'S' SCIENCE

Evaporation

Alex's mum says Alex is fascinated by the way water evaporates. At the centre, Alex leads a discussion on evaporation with a group of children in the outdoor area. Alex says to Peter, 'If you look at this water, it will be gone soon.' Peter asks, 'How do you know that, Alex?' Alex replies, 'Because the sun warms it up and then it just goes.' (field notes, October).

PRIOR KNOWLEDGE

- Children come to school with preformed ideas that help them explain the world around them
- These idea make sense and are logical to the child and are usually strongly held
- These ideas are referred to as misconceptions, preconceptions, alternative conceptions, alternative frameworks, pre- instructional conceptions

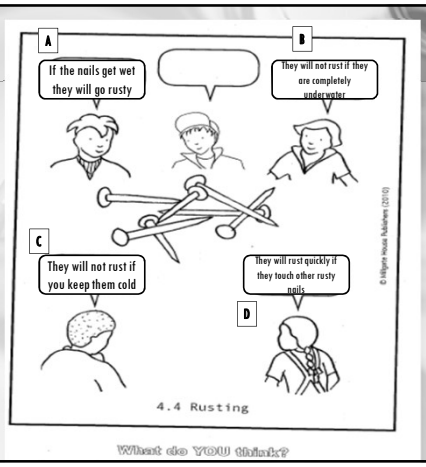
CREATING CONCEPTUAL CHANGE

1) Identify

Using Diagnostic Tasks

Questioning

- POE
- Brain storm
- Concept Cartoon



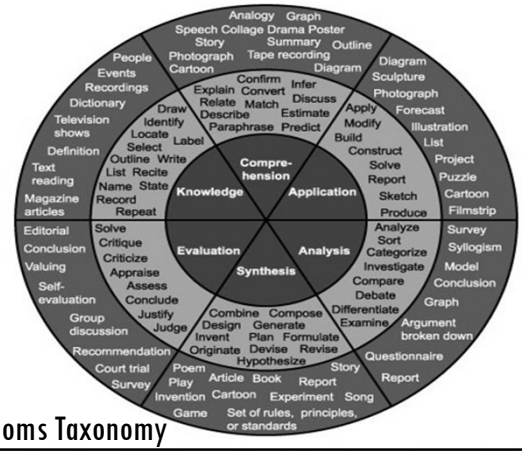
ASSESSMENT 2 QUESTIONS

- Explain the oxidation of iron
- Explain the chemistry of rusting

What sorts of objects have you seen rust?

Where were these objects?

What happens to an object when it rusts?



Blooms Taxonomy

CHILDREN'S IDEA OF RUST

- Children use their everyday experience of rust on cars and gates to conclude that rust is already there under the surface so there is no need for an explanation.
- For example an 8 year old wrote, ***"Screws are made of metal. Rust comes out of metal."*** (Harlen 2000 A. p44)

TEACHERS CHALLENGE

Teachers then need to set up discrepant event to challenge students ideas

- 1) Engage. Problem that is contextualized, relevant and meaningful to student
- 2) Support. Supportive environment to enable students to share and explores different ideas
- 3) Conflict. Set tasks that lead to student dissatisfaction with current conceptions
- 4) Help. Empower students to craft their own KNOWLEDGE

LEANERS CHALLENGE

1) **Accepts** responsibility for their own learning
2) **Trusts** their own thinking and justifies their conclusions using sensible arguments
3) **Negotiates** meaning
4) **Change**. Be prepared to change their view when they have found one that suits their new experiences

Classroom Climate for Conceptual Change

1) Teachers and students respect each others ideas
2) Supportive climate in which students can express their ideas and be able to disagree with others without fear
3) Common acceptance of goal of classroom activity
4) Negotiated meaning must be adopted because student sees it as plausible not because teacher says so

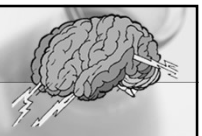
INVESTIGATING WHITE POWDERS

- You have been given 5 samples of white powders.
- 1) Start by using your senses and find out as much as you can about the similarities and differences between the samples. Use OBSERVATIONS
- Use as many senses as you can EXCEPT TASTE

Property	Powder A	Powder B	Powder C	Powder D	Powder E	Powder F
Smells like						
Feels like						
Sounds like						
Looks like						

Property	Powder A	Powder B	Powder C	Powder D	Powder E	Powder F
Size of particles						
Whiteness						

BRAIN STORM



Now you have used your senses, in your group brain storm other ways you can test the powders

- Solubility
- Reaction with chemicals (acid)
- Burn/Heat
- Freeze

WHAT HAPPENS IF . . . . .

- Put a small sample of each of the powders on the paper provided. Make sure you remember which is which!
- Add 2 or 3 drops of vinegar to each sample and observe the results.
- Report your findings and discuss what you think happened.
- Do you think any chemical changes occurred? Why? Which powder?

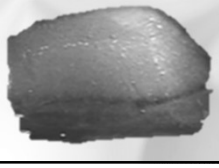
PHYSICAL AND CHEMICAL CHANGE

Processes where new substances are formed and which cannot be reversed to regain the original substances are called **chemical changes**

To decide if a change is a physical or chemical change you need to ask 2 questions:

Have any new substances been formed?

Is it possible to reverse the change and get the same substances back again?



CHANGING STATE

- An example of a physical change is what happens when we increase the temperature of a solid.
- This next activity requires a high degree of self control.
- You are going to be given chocolate drops to investigate whether different kinds of chocolate melt at different rates.

MAKING CHANGES

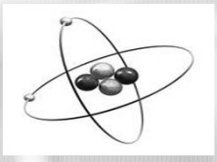
- There are lots of ways in which we can change substances.
  - Heating
  - Cooling
  - Applying pressure
  - Mixing different substances together
  - . . . . . .
- The final product may look like the original substance but may also be very different.

DISSOLVING

- Liquid is called a
- Solid is called a
- The mixture is called is a

ATOMIC STRUCTURE

- All atoms consist of a small central nucleus made up of protons and neutrons, surrounded by smaller particles called electrons



ELEMENTS, COMPOUNDS AND MIXTURES

A) If material is made up of only one kind of atom it is called an **element**.

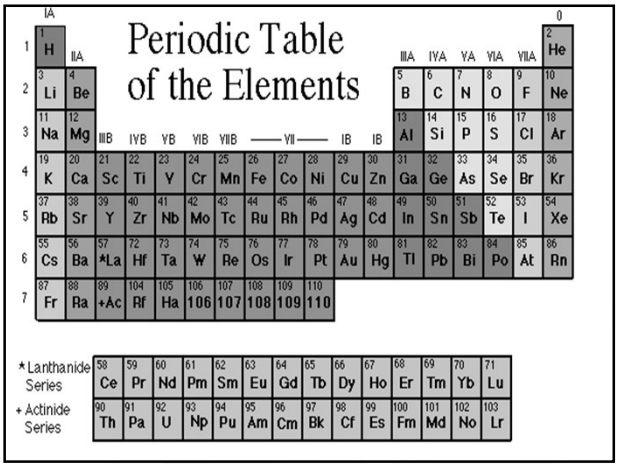
examples can be metals or non-metals: Fe, Gold, Helium

B) Several atoms can join together to form a molecule and material with more than one kind of atom in its molecules is called a **compound**.

examples are: Water is H_2O, carbon dioxide

C) Material made up of different elements or compounds which are not chemically combined is called a **mixture**.

Examples are: Salt solution, the dry ingredients for a cake



CHEMICAL EQUATIONS

- You are not expected to be able to write chemical equations yourself but the reaction you have just observed can be used to illustrate how the atoms are conserved but rearranged.
- In words the reaction is:

  Sodium bicarbonate + acetic acid -> sodium acetate + carbon dioxide + water
- The reaction is shown in symbols below. Count the C, H, O and Na atoms on each side the equation. What do you notice?

$$NaHCO_3 + CH_3COOH \rightarrow CH_3COONa + CO_2 + H_2O$$

CHEMICAL REACTIONS & CHEMICAL CHANGES

- In a chemical reaction the atoms in the molecules can separate and join other atoms to make new substances.
- There are always the same number of atoms of each type at the end as there were at the beginning but the combinations are different.

E.g. $2Na + 2HCl \rightarrow 2NaCl + H2$

2 atoms Na 2 atoms H 2 atoms Cl → 2 atoms Na 2 atoms H 2 atoms Cl

MISCONCEPTIONS

1. Temperature is a property of a particular material or object—— metal is naturally cooler than plastic.
2. The temperature of an object depends on its size.
3. Heat and cold are different, rather than being opposite ends of a continuum.
4. When temperature at boiling remains constant, something is "wrong."
5. Boiling is the maximum temperature a substance can reach.

6. Ice cannot change temperature.

7. Objects of different temperature that are in contact with each other, or in contact with air at different temperature, do not necessarily move toward the same temperature.

8. The kinetic theory does not really explain heat transfer. (It is recited but not believed).

9. Objects that readily become warm, are good conductors of heat, do not readily become cold.

10. The bubbles in boiling water contain "air," "oxygen," or "nothing," rather than water vapour.

11. Gases are not matter because most are invisible.

12. Gases do not have mass.

CHILDREN'S SCIENCE CONDENSATION

An educator and an eight-year-old child are looking at a clear, uncovered casserole dish, half-filled with water, on top of the (switched-off) stove. They watch the water bubble and the steam rise. The child exclaims, 'Oh look, it looks like lemonade!' Other children run over and talk about the 'lemonade' and discuss the steam rising and collecting on the top of the exhaust cupboard above the stove (observation notes).

Condensation of water vapour is something that children see in many everyday contexts – such as in their kitchen, in the bathroom, and on windows (in the house and in the car or school bus). With condensation, children must be able to imagine that an invisible gas is changing to a liquid. Very few children are able to think that water condenses from water vapour in the air. Many believe that the cold changes into water or that (for older children) the cold causes hydrogen and oxygen to change into water. Knowing that the cool surface the water vapour hits is cooling the vapour (changing it from a gas to a liquid) helps children understand condensation.