


"Well, I guess we're the control group."

273 Investigating in Chemical Science

RESEARCHABLE QUESTION

- What happens to the distance the car travels when it is rolled onto different surfaces?



Surfaces	Distance Traveled (cm)			
	T1	T2	T3	Average
Carpet	7	8	17	
Concrete	22	24	25	
Grass	3	3	2	
Couch	13	14	13	

Distance rolled by a car on various surfaces

Independent variable		Dependent variable & units			
Surfaces	Distance Traveled (cm)				
	T1	T2	T3	Average	
Carpet	7	8	17	11	
Concrete	22	24	25	24	
Grass	3	3	2	3	
Couch	13	14	15	14	

Title to include IV and DV variables

Graphs

- 1) What type of graph will you plot? Discuss.
- 2) Draw a graph
- 3) Describe the shape of the graph and consequently record what you can say about the surfaces and the distance.
- 4) Use your science knowledge to explain your results?

Evaluating

- One way to evaluate an activity is to use a PMI
 - P** - Plus or positive aspect of the investigation
 - M** - Minus or negative aspects of the investigation
 - I** - Comments on Interesting aspects and Improvements or other Ideas about the investigation.
- Use the results of the PMI to discuss how you could improve the investigation. (What was not so good??)
- Use your findings to answer your question or determine whether your hypothesis was correct.

COWS MOO SOFTLY

The central feature of most investigations is that you change something and measure the effect it has on something else,

i.e. change the surface and measure the distance traveled

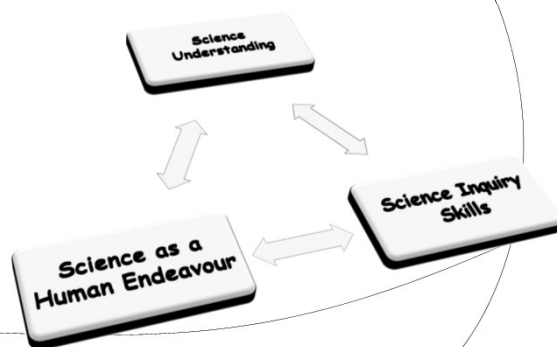
- Cows change something
- Moo measure something
- Softly keep everything else the same

This week

Focus

- ⊙ Observation
- ⊙ Kinetic theory
- ⊙ Atoms and molecules

National Australian Curriculum



NATIONAL CURRICULUM

Science Understanding

Science as a Human Endeavour

- Nature and development of science
- Use and influence of science

Science Inquiry Skills

- Planning and conducting
- Evaluating

Chemical Science Curriculum

General Outcomes

- ⊙ *The chemical and physical properties of substances are determined by their structure* (**Properties and structure**)
- ⊙ *Substances change and new substances are produced by rearranging atoms through atomic interactions and energy transfer* (**Interaction and change**)

Demonstration



Apply the Predict-Observe-Explain strategy to this question:

How many spoonfuls of icing sugar can be added to the bowl before the water overflows?

POE chart

PREDICTION	OBSERVATION	EXPLANATION

Predict-Observe-Explain

- ◎ This strategy encourages students to think more carefully and critically about science by challenging events that surprise them.
- ◎ Students are asked to predict what will happen when something is done to change a situation.
- ◎ The students make careful observations about what happens.
- ◎ By comparing their observations with their predictions they are encouraged to develop explanations about what is happening.

Are our observations infallible?

<http://www.youtube.com/watch?v=JG68812Moc>



Observation and Inference

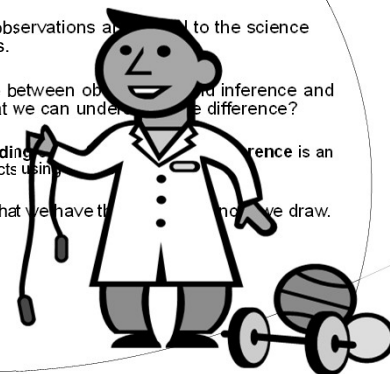
Careful and concise observations are essential to the science investigations process.

What is the difference between observation and inference and why is it important that we can understand the difference?

Observation is a recording of the facts using the senses. **Inference** is an interpretation of the facts using the mind.

The more knowledge that we have the more accurate our inferences will be. We do not have to draw. Look at the picture

list 3 observations
Now list 3 inferences



Why is this funny?

Observations



Inferences

"Oh, hey! I just love these things! ... Crunchy on the outside and a chewy center!"

Y Chart

slime

Feels like

Looks like

Smells like



Observing Slime

6 heaped teaspoons Psyllium seed husk
 100 ml of water
 1 disposable cup
 Teaspoon
 1-2 drops of food colouring
 kettle

- ⊙ Pour 100 ml of hot water into cup and add food colouring
- ⊙ Gradually add 6 heaped teaspoons Psyllium seed husk whilst stirring
- ⊙ Leave slime for 5 mins
- ⊙ Use the teaspoon to remove the slime and roll it into your hand

Observing and Feeling


- ⊙ 1. Play with the Slime.

How does it feel? List at least 4 descriptive words in the graphic organiser

A Y chart is graphic organiser, a simple way that students can collate their data under headings

Observing Oobleck

2 (measuring) cups (one for wet and one for dry)
 1/2 cup of corn flour (made from corn)
 1 container
 1-2 drops of food colouring
 Water



- ⊙ Measure 1/2 cup of cornflour into the container
- ⊙ Add a small amount of water (record the amount)
- ⊙ Add more water a little at a time, until you have Oobleck.

Observing and Feeling

- ⊙ 1. How much water did you add to the 1 cup of corn flour?
- ⊙ 2. Play with the Oobleck

How does it feel? List at least 4 descriptive words in the graphic organiser

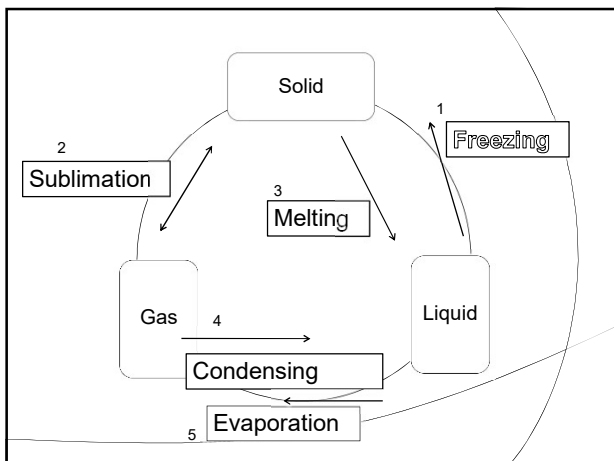
<https://www.youtube.com/watch?v=yHlAcASsf6U>



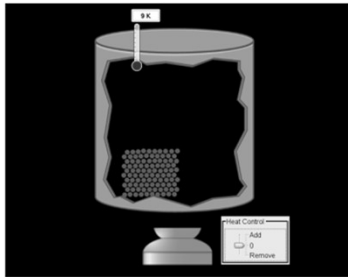
States or Phases of Matter

- ⊙ Most matter exists in one of three* forms
 - **Solid**
 - **Liquid**
 - **Gas**
- ⊙ Depending on environmental conditions such as pressure and temperature, the same material can be found in different forms.

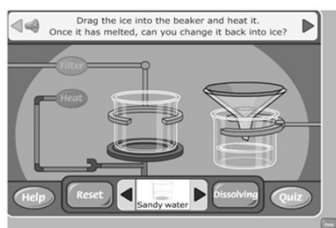
*There is a fourth state called a plasma which exists in extreme circumstances and some materials (non-Newtonian fluids) have both solid and liquid properties.



States of Matter



The Learning Federation and BBC sites



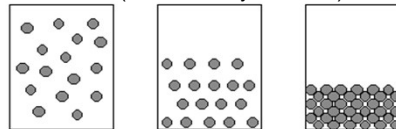
Activity on changes of state for water

<http://econtent.thelearningfederation.edu.au/ec/viewing/L9124/index.html>

Activity on sublimation of iodine

<http://econtent.thelearningfederation.edu.au/ec/viewing/L9126/index.html>

Molecular behaviour in different states of matter. (Kinetic theory of matter)



Takes the shape of
the container

Takes the shape of
part of the container

Keeps its own fixed shape

Volume not fixed

Volume fixed

Volume fixed

http://www.bbc.co.uk/schools/scienceclips/ages/9_10/changing_state.shtml

http://www.media.pearson.com.au/schools/cw/au_sch_whalley_sf1_1/int/2_slg.html

Atomic structure

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



Sub-atomic particles

- ☉ Protons have a mass of 1 unit and a charge of +1
- ☉ Neutrons have a mass of 1 unit and no charge
- ☉ Electrons have a mass of $1/1836$ u and a charge of -1

Atoms and molecules

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

Elements examples

can be metals or non-metals:

- oxygen (O_2),
- iron (Fe),
- sulphur (S)

In its normal state an atom has the same number of protons as electrons so the positive and negative charges are balanced.

The picture shows a helium atom with a nucleus made up of

*2 protons and
2 neutrons*

and

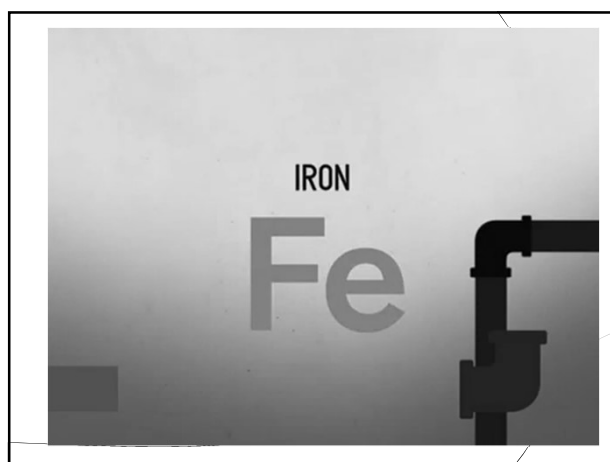
*2 electrons moving in
space or orbit.*



Periodic Table of the Elements																0													
IA												IIA				III A		IV A		VA		VIA		VII A		VIII		0	
1	H																	2	He										
2	Li	Be																	B	C	N	O	F	Ne					
3	Na	Mg	III B	IV B	V B	VI B	VII B	— VII —						IB	IIB	Al	Si	P	S	Cl	Ar								
4	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn	Ga	Ge	As	Se	Br	Kr											
5	Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe											
6	Cs	Ba	*La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn											
7	Fr	Ra	+Ac	Rf	Ha	106	107	108	109	110																			

<http://www.chemcool.com/>

* Lanthanide Series	58	Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
+ Actinide Series	90	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr



Compounds

◎ 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**.

◎ **Compounds** examples are:

- Water is H₂O i.e. two atoms of hydrogen with one atom of oxygen
- carbon dioxide,
- ammonia,
- copper sulphate
- hydrogen sulphide (rotten-egg gas)
- nitrous oxide (laughing gas)

Mixtures

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

Examples of **mixtures** are:

- Salt solution,
- the dry ingredients for a cake

Let's start from the start of the atom

And aim for the heart of the nucleus

Made up of neutrons and also protons

Positively charged

Protons all the same identical

Mass 1 amu and they're so small

Neutrons have no charge

Comparatively big

But only a smidge

In the nucleus

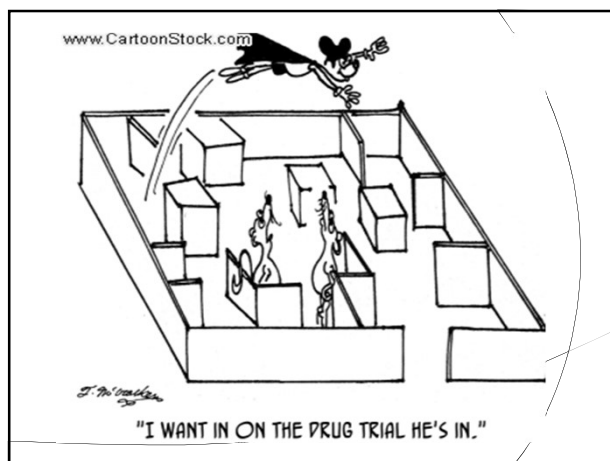
Carbon atom

6 protons + 6 neutrons

electron

proton

neutron



Assignment 2 (Total 40%): A child's ideas about a science concept:
Date Due: 17th April 2359 A, B, C, D & E

- ⦿ PART A Research 6%
- ⦿ **PART B Investigating 10%**
- ⦿ PART C Reporting 10%
- ⦿ PART D Activities 10%
- ⦿ Part E Reflection

Summary

- ⦿ Interview a child about their science knowledge with questions you create, record the interview, analyze the responses and then plan 2 activities to advance the child's understanding. Seek written consent from the parent (use letter & consent form on website) and interview ONE child (Years 3-6, ages 8-12).


Part B Preparing to Investigate a Child's Thinking 10% (suggested 300 words)

On the proforma:
 Create a minimum of **10 well considered interview questions**. You may want to refer to a concrete example (diagram, photograph or object etc.) that you plan to use in your interview.

In the Appendices:

- 1) **With written consent, interview ONE child** (Years 3-6) about their ideas around your chosen science concept. The consent letter **MUST** be included in the appendices as the assignment will **NOT** be marked otherwise.
- 2) Record evidence (an audio recording) of the interview with your child.

Interview Tips
 It is important to encourage the child to talk freely and draw upon their theories about this science concept. The purpose of the interview/ informal conversation is to find out what the child already knows and any misconceptions she/he has about the science concept.



Creating Questions

Consider the questions asked today

- 1) Identify open ended and closed Q
- 2) Identify those that asked for factual recall
- 3) Identify those Q that asked for explanation/analysis/understanding
- 4) What sort of Q's would you ask in your Assessment Part B?
- 5) Consider what prompts you could use to help engage and support the child

Use Blanks work in your activity book to create 10 questions discuss them with your partner

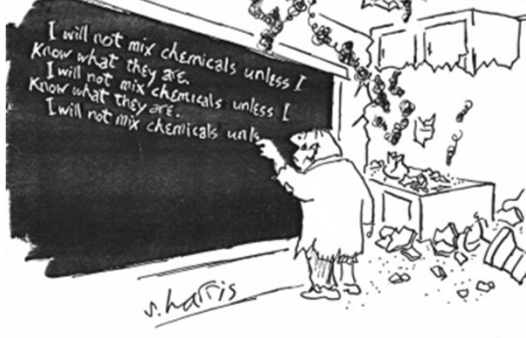
Assignment 2
Date Due: WEEK 17th April 2359
Part A Science Report (suggested 900 words)

Science References

Part B Preparing to Investigate a Child's Thinking (suggested 300 words)

Interview Date	Time	Place (at child's home, park etc)
Child's details	Year at school	Gender
Age	Questions	
1		
2 etc.		

<https://www.youtube.com/watch?v=LKfrg60ljh0>

v. Harris