An tSraith Shóisearach do Mhúinteoirí

Junior CYCLE for teachers

Learning Outcomes in Action

JCT Science Team

Chem Ed Conference 2017
University of Limerick

www.jct.ie

Ionad Oideachais Mhuineacháin

AN ROINN OIDEACHAIS AGUS SCILEANNA | DEPARTMENT OF EDUCATION AND SKILLS

In this workshop, we use a series of activities to show how learning outcomes translate into classroom practice. In particular, we wish to highlight how consideration of the action verb in the learning outcome brings clarity to the expectations for the learning outcome in the classroom.

The front page of each activity gives the context of learning and identifies both the learning outcomes in focus and the learning intention for the activity as well as the prior learning of the students for whom these activities were developed.

These activities are presented in paper form here but are available as word documents on our website www.jct.ie where you could adapt them to suit your student cohort. The purpose of the activities is not to exemplify how these learning outcomes must be taught but rather to highlight how the action verb was considered in interpreting the learning outcome and in developing learning experiences for this cohort of students.

Contents Page:

Learning Outcomes in Focus

Contextual Strand: CW3

Students should be able to describe and model the structure of the atom in terms of the nucleus, protons, neutrons and electrons; comparing mass and charge of protons, neutrons and electrons.

DESCRIBE: Develop a detailed picture or image of, for example, a structure or process; using words where appropriate; produce a plan, simulation or model.

Nature of science: NOS1

Students should be able to appreciate how scientists work and how scientific ideas are modified over time.

Learning Intentions

- Students will be able to describe where sub-atomic particles are located in the atom and how the mass and charge of the different particles compare.
- Students will begin to develop a practical understanding of the limitations of models.

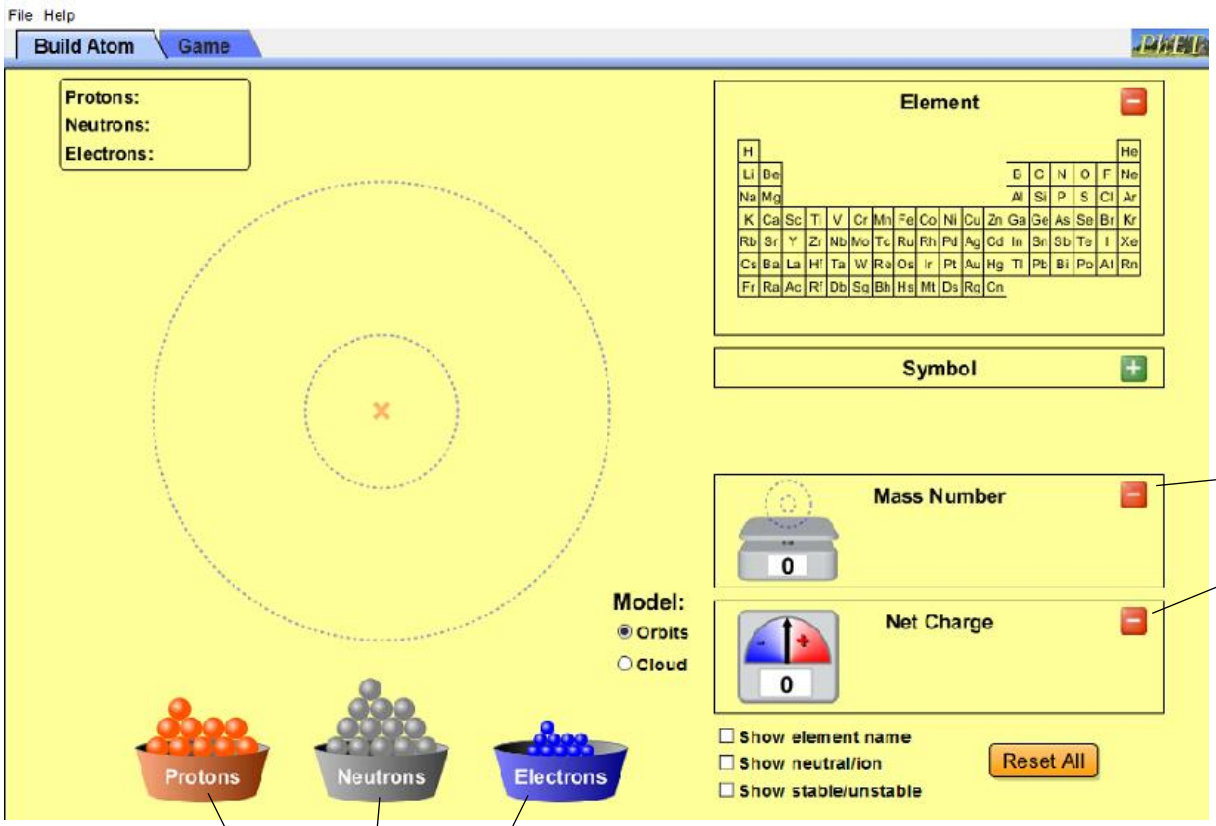
Prior Learning

Students have no prior knowledge of atomic structure but

- Understand that elements are made up of atoms
- Have explored the concept of mass

Student Activity Sheet.

Open the pHet "build an atom" simulation. Try the different buttons and then set up the simulation as shown in the diagram.



These should all be clicked so they are red.

These are the three things that are inside an atom. They are called SUB ATOMIC PARTICLES.

We are going to use the simulation to find out

- Where the different sub-atomic particles are found in the atom
- Whether the sub-atomic particles have a charge
- Whether the mass of the sub-atomic particles contribute significantly to the mass of the atom.

1. Using the simulation drag protons, neutrons and electrons into the atom. Use these words to complete the table:

PROTONS; NEUTRONS; ELECTRONS

	These particles are always found in rings around the outside of the atom.
	These particles are found in the centre (**the nucleus**) of the atom.

2. Press reset. Place the indicated number of *neutrons* in the atom and fill in the table after each addition. Mass is indicated on the electronic balance. Charge can be positive or negative.

Number of neutrons	Mass number reading	Net charge reading
1		
2		
3		
4		

Look at your results and discuss in your group the answer to the following questions:

- What happens to the *mass* number reading when you add a neutron? What do you think will happen when you add another neutron? Check your answer.
- What happens to the *charge* when you add a neutron? What do you think will happen to the charge when you add another neutron? Does a neutron have any effect on the charge?

3. Press reset. Place the indicated number of protons in the atom and fill in the table after each addition.

Number of protons	Mass number reading	Net charge reading
1		
2		
3		
4		

Look at your results and discuss in your group the answer to the following questions:

- What happens to the *mass* number reading when you add a proton? What do you think will be the mass number reading if you add another proton? Use the simulation to try.
- What happens to the *charge* when you add a proton? What do you think the charge will be if you add another proton? Does a proton have a charge?

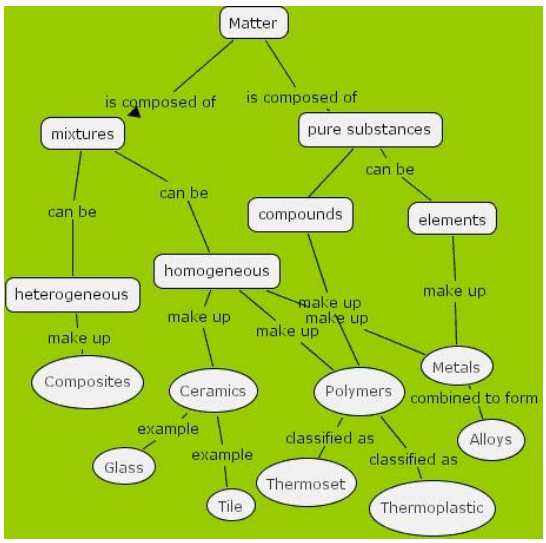
4. Press reset. Place the indicated number of electrons in the atom and fill in the table after each addition.

Number of electrons	Mass number reading	Net charge reading
1		
2		
3		
4		

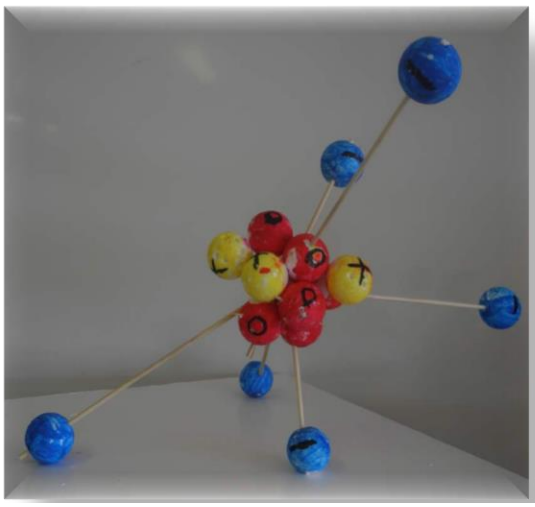
Look at your results and discuss in your group the answer to the following questions:

- What happens to the *mass* number reading when you add an electron? What do you think will happen to the mass number if you add another electron? Check using the simulation.
- What happens to the *charge* when you add an electron? What do you think will happen if you add another electron? Check your answer. Does an electron have a charge?

By working with the simulation, you should have found out about the mass, charge and location of the subatomic particles in an atom. Using the words **mass and charge** as well as the words in the envelope provided, develop a concept map on the large sheet provided showing what you have learned. Unsure what a concept map is? Two examples are shown below:



Extension activity: use your concept map to help you as you discuss the following question in your group.



A student was asked to develop a model of the atom and they presented the model shown in the picture. Discuss the following:

1. Does the model allow you to identify which colour represents each of the three sub atomic particles? Be prepared to justify your answer.

2. Can you identify ways that the model could be improved to better represent the mass of the sub-atomic particles?

Student Resources

Cut up the following and place in envelope for each group

SHELLS	**ELECTRONS**
NUCLEUS	**NEUTRONS**
PROTONS	**SUB-ATOMIC PARTICLES**
ATOM	

Learning Outcomes in Focus

Contextual strands: CW5

Students should be able to use the Periodic table to predict the ratio of atoms in compounds of two elements.

Use - Apply knowledge or rules to put theory into practice

Nature of science: NOS4

Students should be able to …critically analyse data to identify patterns.

Learning Intentions

- Recognise patterns in the periodic table
- Draw, name, and write formulas for some common molecules

Prior Learning

Students have identified patterns in the periodic table and are aware of the significance of the group numbers

Students have drawn models of a number of atoms

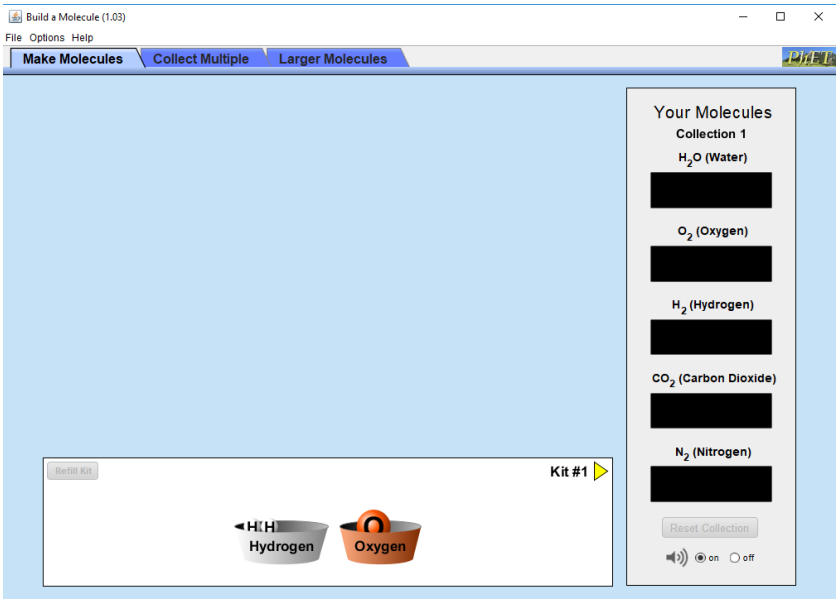
Students can classify substances as elements, compounds and mixtures

Student Activity Sheet.

We are going to use the simulation to find out

- The names and chemical formula of some common compounds and molecules
- The ratio of atoms in some common compounds
- Identify patterns in the naming of some compounds

Open the pHet "Build a molecule" simulation. Try the different buttons and then set up the simulation as shown in the diagram.



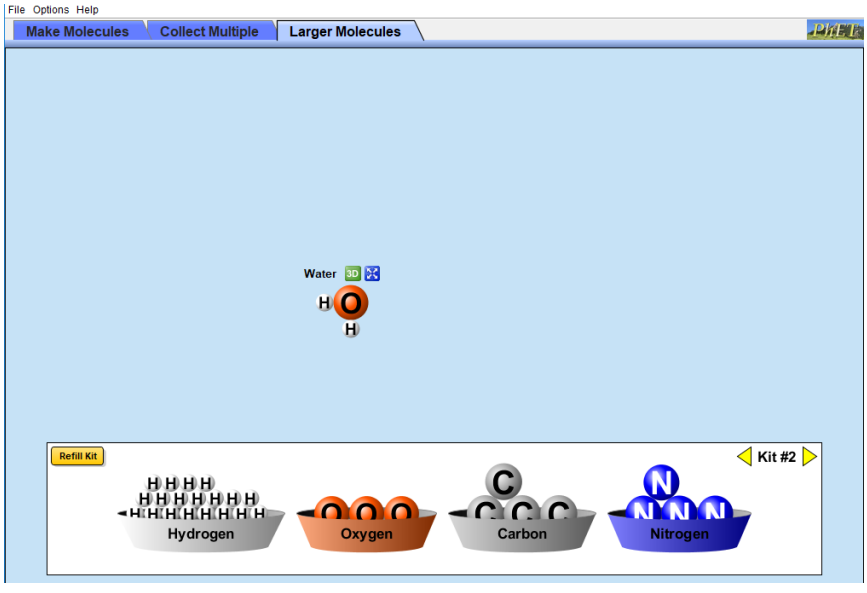
These are single atoms of the elements which you can use to make your molecules. When you have made a molecule, the name will appear and you can place it in the collection boxes.

1. Make a molecule:
How do you know you made a molecule?
_____

2. Discuss with your partner what the little number means.

3. Molecule Names and Chemical Formulas:
Compare the name and chemical formula for some molecules:

Use the 3D , Ball and Stick mode to see the number of bonds between the atoms/ions.



Once you have made the 1st collection of molecules and have had practice using the simulation move to the larger molecules tab

Make, name and draw molecules of the following elements and compounds.

Chemical Formula	Molecule Name	Drawing	How many bonds does each of these single atoms make in the molecule
H_2			H
CH_4			H
H_2O			H
NH_3			H
HCl			H
BH_3			H

How many bonds can a single Hydrogen make with any other atom? _____

What group is Hydrogen in the Periodic Table? _____

HCl			Cl
CCl_3			Cl
Cl_2			Cl

How many bonds does a Chlorine make in each of these molecules? _____

What group is Chlorine in the Periodic Table? _____

H_2O			O
CO_2			O

O_2			**O**

How many bonds does an Oxygen make in each of these molecules? _____

What group is Oxygen in the Periodic Table? _____

NH_3			**N**
PH_3			**P**

How many bonds does nitrogen or phosphorus make in the molecules above? _____

What group are these elements in in the Periodic Table? _____

CH_4			**C**
CO_2			**C**

How many bonds does Carbon make in the molecules above? _____

What group is Carbon in the Periodic Table? _____

BH_3			**B**

How many bonds does Boron make in the molecule above? _____

What group is Boron in the Periodic Table? _____

Complete the Summary:

Element	H	Mg	B	C	N	O	Cl
Number of bonds		2					
Group in periodic table		2					

Can you see a pattern in the number of bonds the atoms would like to make it the Periodic Table?

_____

Can you predict how many bonds the following atoms would make with hydrogen:

Fluorine: _____ Sulphur:_____ Bromine: _____ Silicone:_____

Can you using your periodic table predict how:

Lithium (group 1) would bond with Chlorine (group 7):

We could think of it like this:

	Li	Cl
Bonds needed	1	1
Atomic ratio	1	1
Formula	LiCl	

Another example:

Magnesium (group 2) would bond with Fluorine (group 7) :

	Mg	F
Bonds needed	2	1
Atomic ratio	1	2
Formula		

Now your turn to predict:

	Na	Cl
Bonds needed		
Atomic ratio		
Formula		

	Ca	Br
Bonds needed	2	1
Atomic ratio	1	2
Formula		

	P	Mg
Bonds needed	2	1
Atomic ratio	1	2
Formula		

Periodic Table Compound Game

Learning intentions: To USE the periodic table to practice deriving the chemical formulae for compounds

Materials: set of playing cards - 4 identical copies of each ion.

Instructions:

Aim: To collect as many cards as possible by producing compounds with the correct chemical formula using the periodic table and prior knowledge.

- In groups of 4
- Nominate a dealer
- The dealer shuffles the cards and evenly distributes the cards
- The dealer puts down 1 card and using their cards the rest must produce a chemical formula to include this card.
- The 1st person to come up with a correct chemical formula wins the hand and keeps the cards, putting them to 1 side- The dealer decides who wins.
- The person on the dealers left puts down 1 card and using their cards the rest must produce a chemical formula with this card.
- The 1st person to come up with a correct chemical formula wins the hand and keeps the cards, putting them to 1 side.
- The game continues until no one can produce a chemical formula.
- Write a list of the chemical formulas and name the compounds formed.

- How could you use this game as an assessment tool?
- Could you modify this game make it more accessible to all students?

Extension activity

Second Tab- Collect multipes

4. Make Many
   a. Fill all the collection boxes and then complete the questions for each Goal.

Goal: $4H_2$	
Draw it!	
What does the big '4' in $4H_2$ mean?	
What does the little '$_2$' in $4H_2$ mean?	

Goal: $2CO_2$	
Draw it!	
What does the big '2' in $2CO_2$ mean?	
What does the little '$_2$' in $2CO_2$ mean?	

Goal: $2O_2$	
Draw it!	
What does the big '2' in $2O_2$ mean?	
What does the little '$_2$' in $2O_2$ mean?	

Goal: $2NH_3$	
Draw it!	
What does the big '2' in $2NH_3$ mean?	
What does the little '$_3$' in $2NH_3$ mean?	

Learning Outcomes in Focus

Contextual Strand: CW10

Students should be able to evaluate how humans contribute to sustainability through the extraction, use, disposal, and recycling of materials

Evaluate (ethical judgement) - Collect and examine evidence to make judgments and appraisals**; describe how evidence supports or does not support a judgement;** identify the limitations of evidence in conclusions; make judgments about ideas, solutions or methods

Nature of science: NOS10

Students should be able to **appreciate the role of science in society**; and its personal, social and global importance; and how **society influences scientific research**

Appreciate - Recognise the meaning of; have a practical understanding of

Learning Intentions

- Students will be able to evaluate how humans contribute to sustainability through the extraction, use and recycling of Helium
- Students will evaluate information and explain the impact of the extraction and use of this element on society and the environment

Prior Learning

Students have used the periodic table and are familiar with the element Helium are aware that it is an inert gas

Students have possible encountered Helium in the use of part balloons.

STUDENT ACTIVITY SHEET

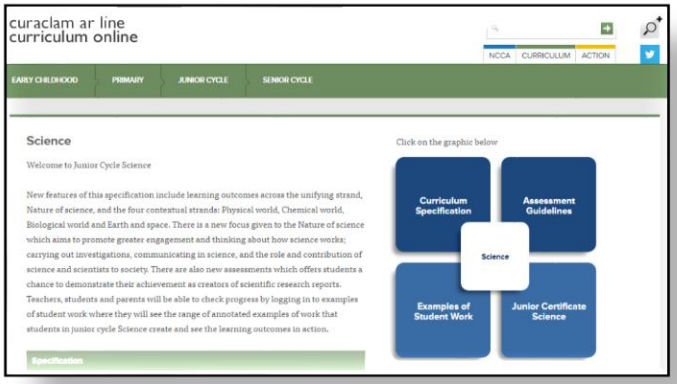
Should Helium party balloons be banned?

Using the articles supplied, can you with your group **examine the evidence to make a judgment** and decide how the **evidence supports or does not support your judgement.**

- In a group of 4 each person chooses a different **article to examine**.
- Make 3 or 4 main summary points on the article on an A4 sheet and **make a judgement on the question posed**, based on YOUR article justifying whether **the evidence supports /does not support your decision.**
- As a **group discuss** the summary points of each article and each judgement made with regards to question posed.
- Taking all information into consideration can the **group come to a consensus** on a judgement to the question posed giving justification.

Points for discussion

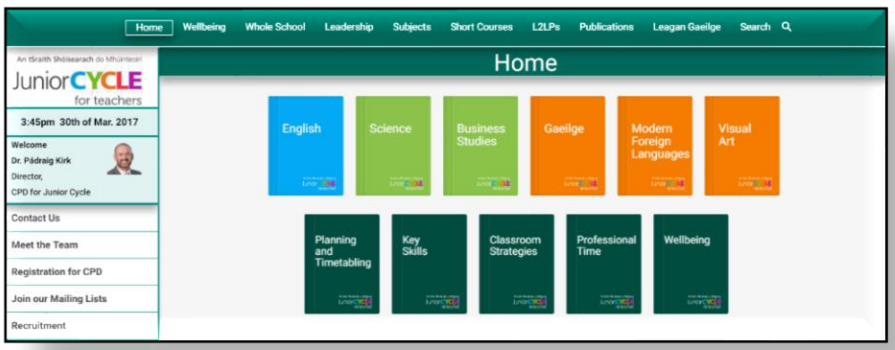
1. Why is it important to look at many sources before making a judgement?
2. Why is it important discuss with others your opinions and judgements?
3. What should society and scientists do now to help the sustainability of helium?



Visit www.curriculumomline.ie to view the curriculum specification for Junior Cycle Science and related material

Why not visit our newly designed website www.jct.ie where you can access among other things:

- Planning Resources
- Ideas for teaching strategies
- Information for teachers
- Videos for students
- Information leaflets for parents



You can also join our mailing list so that you can be notified about

- Elective CPD opportunities
- Webinars
- News and events
- Learning outcomes in focus

Thank you for participating in this workshop. We hope you enjoyed it!

Why not visit our website where you can

- Have your Junior Cycle Science questions answered
- Download resources which will assist you in planning for Junior Cycle Science
- Get advice from the full-time science team
- Find out more about what supports we can offer you – both online and onsite.

Contact details

For any queries, please contact us on one of the following:

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Phone number: 047 74008

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