

## Building a Molecule

### Learning Outcomes in Focus

#### Contextual strands: CW 5

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: NoS 4

Students should be able to produce and select data (qualitatively/quantitatively), critically analyse data to identify patterns and relationships, identify anomalous observations, draw and justify conclusions

### Learning Intentions

Students will learn to:

1. Recognise patterns in the Periodic Table.
2. Draw, name, and write formulas for some common molecules of 2 elements.
3. Use the Periodic Table to practice deriving the chemical formulae for compounds.

### Prior Learning

Students can classify substances as elements, compounds and mixtures. Students have described and modelled the structure of the atoms. Students have been introduced to the Periodic Table and are aware of the significance of the group numbers.

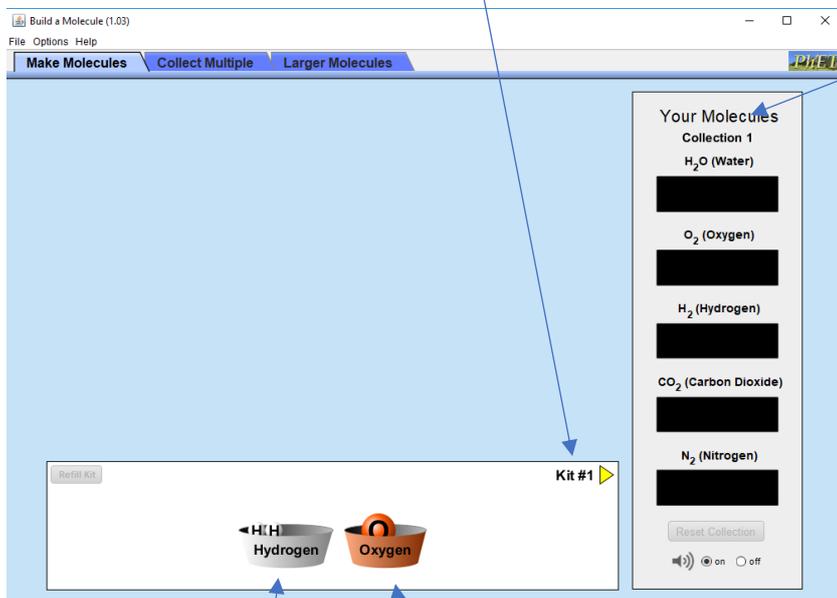
### Teacher Information

You will find the simulation needed for the following activity at

<https://phet.colorado.edu/en/simulation/legacy/build-a-molecule>

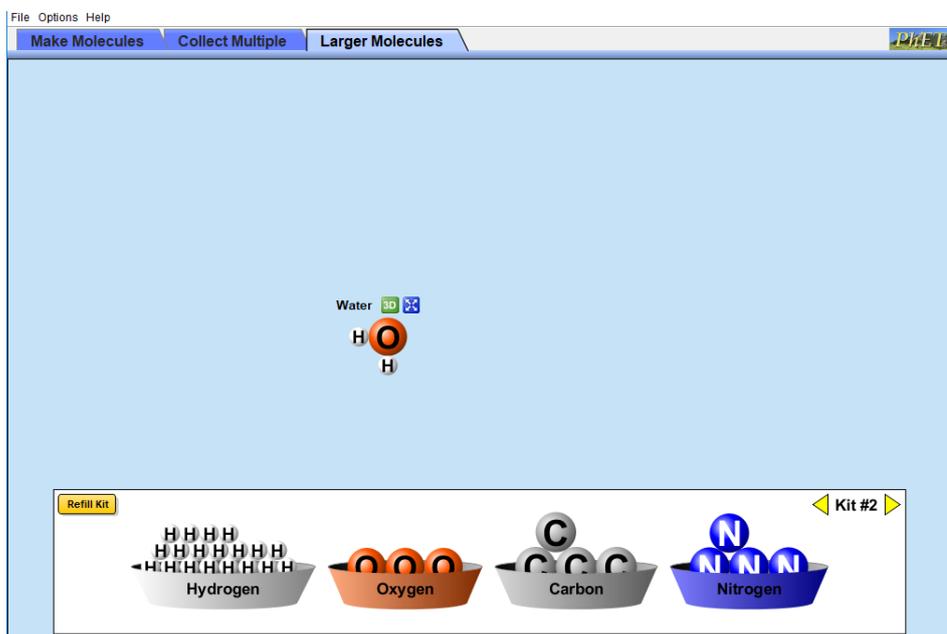
## Student Activity Sheet

Open the pHet “[Build a molecule](#)” simulation. Make a molecule. How do you know you made a molecule? Using the different Kits available, build all the molecules required for Collection 1. For each molecule, do the following:



1. Use the **3D** , **Ball and Stick** mode to see the number of bonds between the atoms.
2. Drag the molecule over to the matching collection box.
3. Discuss with your partner what the little number means.
4. Compare the name and chemical formula.

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 examine the molecule in 3D



Once you have made the 1<sup>st</sup> 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 do each of the H atoms make in the molecule?
$H_2$			
$CH_4$			
$H_2O$			
$NH_3$			
$HCl$			
$BH_3$			

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

What group is Hydrogen in the Periodic Table? \_\_\_\_\_

Chemical Formula	Molecule Name	Drawing	How many bonds do each of the Cl atoms make in the molecule?
$HCl$			
$CCl_3$			
$Cl_2$			

How many bonds does a Chlorine atom make in each of these molecules? \_\_\_\_\_

What group is Chlorine in the Periodic Table? \_\_\_\_\_

Chemical Formula	Molecule Name	Drawing	How many bonds do each of the O atoms make in the molecule?
$H_2O$			
$CO_2$			
$O_2$			

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

What group is Oxygen in the Periodic Table? \_\_\_\_\_

Chemical Formula	Molecule Name	Drawing	How many bonds do each of these atoms make in the molecule?
$NH_3$			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? \_\_\_\_\_

Chemical Formula	Molecule Name	Drawing	How many bonds do each of the C atoms make in the molecule?
$CH_4$			
$CO_2$			

How many bonds does Carbon make in the molecules above? \_\_\_\_\_

What group is Carbon in the Periodic Table? \_\_\_\_\_

Chemical Formula	Molecule Name	Drawing	How many bonds do each of the B atoms make in the molecule?
$BH_3$			

How many bonds does Boron make in the above molecule? \_\_\_\_\_

What group is Boron in the Periodic Table? \_\_\_\_\_

**Complete the Summary:**

Element	<i>H</i>	<i>Mg</i>	<i>B</i>	<i>C</i>	<i>N</i>	<i>O</i>	<i>Cl</i>	<i>P</i>
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 in the Periodic Table?

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Can you predict how many bonds the following atoms would make with Hydrogen?

Fluorine: \_\_\_\_\_ Sulphur: \_\_\_\_\_ Bromine: \_\_\_\_\_ Silicone: \_\_\_\_\_

Can you use your Periodic Table to follow how Lithium (group 1) would bond with Chlorine (group 7)?

We could think of it like this:

	<u>Li</u>	<u>Cl</u>
<u>Bonds needed</u>	<u>1</u>	<u>1</u>
<u>Atomic ratio</u>	<u>1</u>	<u>1</u>
<u>Formula</u>	<u>LiCl</u>	

Another example:

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

	<u>Mg</u>	<u>F</u>
<u>Bonds needed</u>	<u>2</u>	<u>1</u>
<u>Atomic ratio</u>	<u>1</u>	<u>2</u>
<u>Formula</u>		

**Now your turn to predict:**

	<u>Na</u>	<u>Cl</u>
<u>Bonds needed</u>		
<u>Atomic ratio</u>		
<u>Formula</u>		

	<u>Ca</u>	<u>Br</u>
<u>Bonds needed</u>	<u>2</u>	<u>1</u>
<u>Atomic ratio</u>	<u>1</u>	<u>2</u>
<u>Formula</u>		

	<u>P</u>	<u>Mg</u>
<u>Bonds needed</u>	<u>2</u>	<u>1</u>
<u>Atomic ratio</u>	<u>1</u>	<u>2</u>
<u>Formula</u>		

## 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 atom.

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

Instructions:

- In groups of 4, nominate a dealer
- The dealer shuffles the cards and evenly distributes the cards between all 4 players
- The dealer puts down 1 card and using their cards the rest must produce a chemical formula to include this card.
- The 1<sup>st</sup> 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 1<sup>st</sup> 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.

*Li*

*H*

*Al*

*Na*

*Br*

*S*

*K*

*Mg*

*Be*

*F*

*Ca*

*O*

**Cl**

*N*

*P*

*O*

*C*

*C*

*H*

*H*

*H*

*H*

*H*

*H*

*Cl*

*Cl*

*Cl*

Valency or charges can be added if you wish.

## Possible Extension Activity

### Second Tab - Collect Multiple

Fill all the collection boxes and then complete the questions for each 'goal'.

Goal: $2\text{CO}_2$	
Draw it!	
What does the big '2' in $2\text{CO}_2$ mean?	
What does the little '2' in $2\text{CO}_2$ mean?	

Goal: $2\text{O}_2$	
Draw it!	
What does the big '2' in $2\text{O}_2$ mean?	
What does the little '2' in $2\text{O}_2$ mean?	

Goal: $4\text{H}_2$	
Draw it!	
What does the big '4' in $4\text{H}_2$ mean?	
What does the little '2' in $4\text{H}_2$ mean?	

Goal: $2\text{NH}_3$	
Draw it!	
What does the big '2' in $2\text{NH}_3$ mean?	
What does the little '3' in $2\text{NH}_3$ mean?	