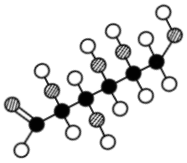
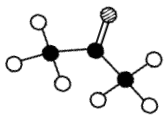
Science4All



Crazy Chemicals!

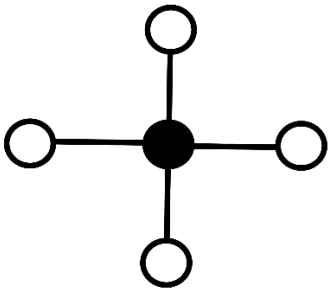


In this exercise, we will identify and count atoms in some important chemicals we use daily.

Count up the different atom types using the atom key and chemical structures to help you.

For example:

Name:	Methane	**Found in:**	Natural gas and emissions from farming and industry.
Greenhouse gas?	Yes	**Use:**	Heating, cooking, light and producing electricity.

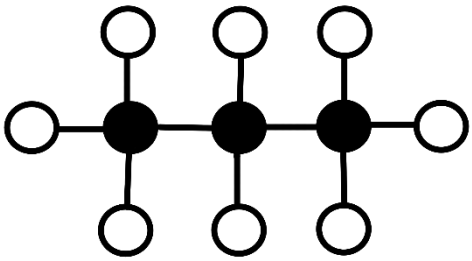


Atom count:

Hydrogen:	○	4
Carbon:	●	1
Oxygen:	▨	0

1.

Name:	Propane	**Found in:**	Natural gas and crude oil.
Greenhouse gas?	No	**Uses:**	Heating, cooking, vehicle fuel and refrigeration.

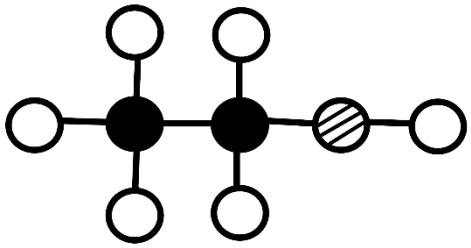


Atom count:

Hydrogen:	○	8
Carbon:	●	3
Oxygen:	▨	0

2.

Name: Ethanol
Greenhouse gas? No
Made by: Fermenting sugars.
Uses: Alcoholic drinks, manufacturing, medicines, and biofuel.

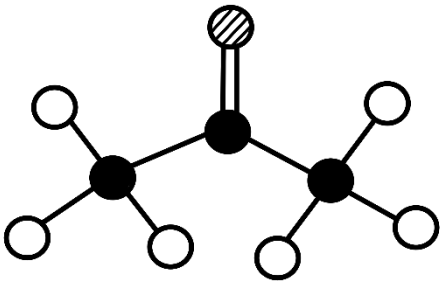


Atom count:

Hydrogen:	○	6
Carbon:	●	2
Oxygen:	▨	1

3.

Name: Acetone
Greenhouse gas? No
Found in: Plants, volcanic gases, car emissions and tobacco smoke.
Uses: Nail polish remover, making plastics and paint thinner.

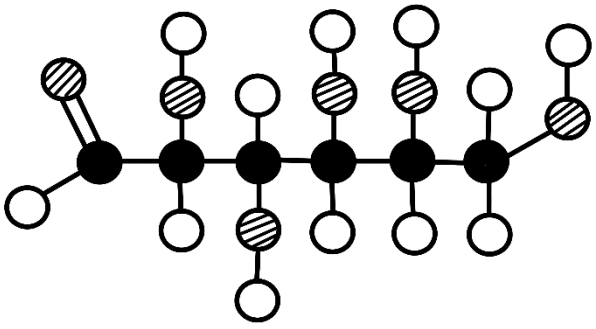


Atom count:

Hydrogen:	○	6
Carbon:	●	3
Oxygen:	▨	1

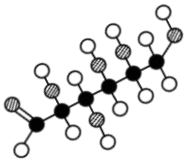
4.

Name: Glucose
Greenhouse gas? No
Found in: Fruits, honey, sweetcorn, desserts, and fizzy drinks.
Uses: Main source of energy for plants and animals (including humans).

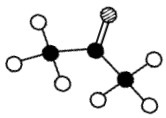


Atom count:

Hydrogen:	○	12
Carbon:	●	6
Oxygen:	▨	6



Crazy Chemicals!



Teaching resource

This worksheet is designed to help students understand what we mean by molecules and chemicals. Structures are shown to give a basic idea of what chemicals look like on the atomic level. This guide can help further explain the different chemicals to the students.

Atoms	Atoms make up everything that we know in our world. They are so small that we can only see them with very powerful microscopes. The periodic table tells us about the different types of atoms scientists have found. In the exercise, we focus on organic compounds (chemicals that contain carbon).
Greenhouse gas	Greenhouse gases are gases released into the atmosphere that enhance the earth's natural greenhouse effect. They do this by trapping the sun's heat inside our atmosphere and causing the global temperature to rise. This climate change has devastating effects on wildlife and humans alike. Greenhouse gases can occur from natural resources, like methane from cows, or from industrial processes such as the release of carbon dioxide from burning fossil fuels.
Methane	Methane is the simplest hydrocarbon (compounds made up of hydrogen and carbon). It makes up 85-90% of natural gas and is essential to heating homes and electricity production[1]. As a greenhouse gas, it is relatively short-lived compared to carbon dioxide[2]. However, methane can trap heat more effectively than many other greenhouse gases, so its emission is very dangerous[2]. The most common source of methane emissions comes from livestock, especially cows, sheep and goats, leaks at gas and oil drilling sites and microbes in landfill and sewage treatment centres[2]
Propane	Propane is found as a component in natural gas[1], oil-refinery gases and crude oil[3]. Like methane, propane is also used in heating homes and cooking[4]. Propane is also used as a vehicle fuel (commonly known as liquid petroleum gas (LPG)[3]). It is considered a clean fuel due to its lower production of carbon emissions upon combustion[4]. As well as being environmentally friendly, it is also a highly efficient refrigerant and is used widely in our fridges[4] and has been proposed an alternative to using hydrofluorocarbons (which are climate damaging) in air conditioning units[5].
Ethanol	Ethanol is one of the most widely known chemicals as one of the primary components of alcoholic drinks. It can be made in various ways, most commonly by the fermentation of fruit, vegetables, or plants by yeast. Some of its less commonly known uses include acting as a solvent in drug manufacture[6] and as a raw material in making plastics[7]. Ethanol as a biofuel is another environmentally friendly solution for running vehicles which has had huge success in Brazil where 73% of the country's total cars in 2018 could use ethanol as fuel[8].
Acetone	Acetone is one of the most common chemical solvents used. A solvent is something that is used to dissolve things. You can see acetone at work when it breaks down nail polish by turning it back into its liquid form, which can then be wiped away[9]. It is commonly used as a solvent during the chemical reactions in industrial plastic production[10]. Acetone is one of the simplest compounds that we know, so it is found widely in nature. As well as being found in plants and volcanic gases, it is also found in our bodies as a by-product when we break down fats[11].
Glucose	Glucose is arguably the most important organic chemical that there is. Glucose is the fuel that gives plants and animals energy. During cellular respiration, glucose is combined with oxygen to form adenosine triphosphate (ATP). The ATP is then used as energy by the cell. As you can imagine, it is very important for us to have enough glucose in our diet to ensure that our bodies have the energy to run properly. However, a diet that is too high in glucose (sugar) can lead to life-threatening illnesses such as diabetes[12]. We find glucose in most of our foods, especially those that are sweet. Foods that contain carbohydrates are later broken down into glucose by our bodies[12].

Additional Resources:

Atoms:

Tuition in has a short video that explains all about atoms, what is inside atoms and the different types of atoms that we can have: https://www.youtube.com/watch?v=CvkmVRS61SI

Let's talk science has a webpage that provides an introduction to atoms, here you can read further about what is inside an atom and a brief history of the different atomic models: https://letstalkscience.ca/educational-resources/backgrounders/introduction-atom

The Royal Society of Chemistry has an interactive periodic table which gives lots information on the different elements such as atomic data, how they were discovered and the origins of their names: https://www.rsc.org/periodic-table

Greenhouse gases:

MinuteEarth has a short video that explains how greenhouse gases work in more detail and explains methane and carbon dioxide specifically: https://www.youtube.com/watch?v=sTvqIijqvTg

LiveScience has a really helpful webpage that explains the greenhouse effect, how greenhouse gases cause global warming and the sources of greenhouse gas emissions. Each section has both a text explanation and a video explanation: https://www.livescience.com/37821-greenhouse-gases.html

Methane:

National Geographic has an in-depth article all about methane, where it comes from and its effects on the environment: https://www.nationalgeographic.com/environment/article/methane

NASA has an interesting video that shows how the sources of methane fluctuate globally by location and season. It also explains the main sources of methane by location: https://www.youtube.com/watch?v=GpLbd2fe3h4

Student Energy has a video explaining all about natural gas and how we extract it from the Earth: https://www.youtube.com/watch?v=-njmj0diWu8

Propane:

ELGAS has a blog explaining all things propane. It has simple answers to almost all propane related questions and explains how and why we use it, where it comes from and its chemical properties: https://www.elgas.com.au/blog/1689-what-is-propane-gas/#:~:text=Propane%20is%20a%20flammable%20hydrocarbon,liquid%20at%20relatively%20low%20pressures.

EarthScience Western Australia has a video explaining how oil and gas are formed: https://www.youtube.com/watch?v=8YHsxXEVB1M

Emerson has a short video that explains the benefits of propane over HFC's for refrigeration in more detail: https://www.youtube.com/watch?v=MLqbuIDvbbM

Ethanol:

The University of Illinois has a helpful webpage that summarises where ethanol comes from and how it is used and produced: https://web.extension.illinois.edu/ethanol/

FuseSchool has a helpful video on how biofuels are made and explains both biomethane (a natural gas substitute) and bioethanol: https://www.youtube.com/watch?v=OJw6WFkTPZo

Earth.org has an interesting article detailing the success of bioethanol in Brazil and explores whether it is a viable wider replacement for fossil fuels: https://earth.org/bioethanol-in-brazil/

Acetone:

MedicalNewsToday has a webpage that explains in more detail about how acetone is produced naturally in the body and some of the risks it can pose: https://www.medicalnewstoday.com/articles/what-is-acetone

Shell has a short summary of some further industrial uses of acetone: https://www.shell.com/business-customers/chemicals/our-products/acetone.html

Glucose:

3-Minute Explanation has a video explaining how glucose provides energy to the cells in the human body: https://www.youtube.com/watch?v=zcEUs4y1v60

Ms Dunphy has a helpful video that explains the different ways that plants use glucose: https://www.youtube.com/watch?v=sMOG7JWFguc

Harvard School of Public Health has a good resource that explains how our bodies process sugars and goes into detail about how we measure the release of sugars in our foods using glycaemic index: https://www.hsph.harvard.edu/nutritionsource/carbohydrates/carbohydrates-and-blood-sugar/

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