



Hands-On SCIENCE

LEVEL 1

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A large, light blue illustration of a person climbing a staircase. The person is at the top of the stairs, reaching up to a large checkmark. The staircase is composed of several steps, and the person is shown in a dynamic, upward-moving pose. The checkmark is positioned above the person's head, indicating a goal or achievement. The entire illustration is rendered in a light blue color.

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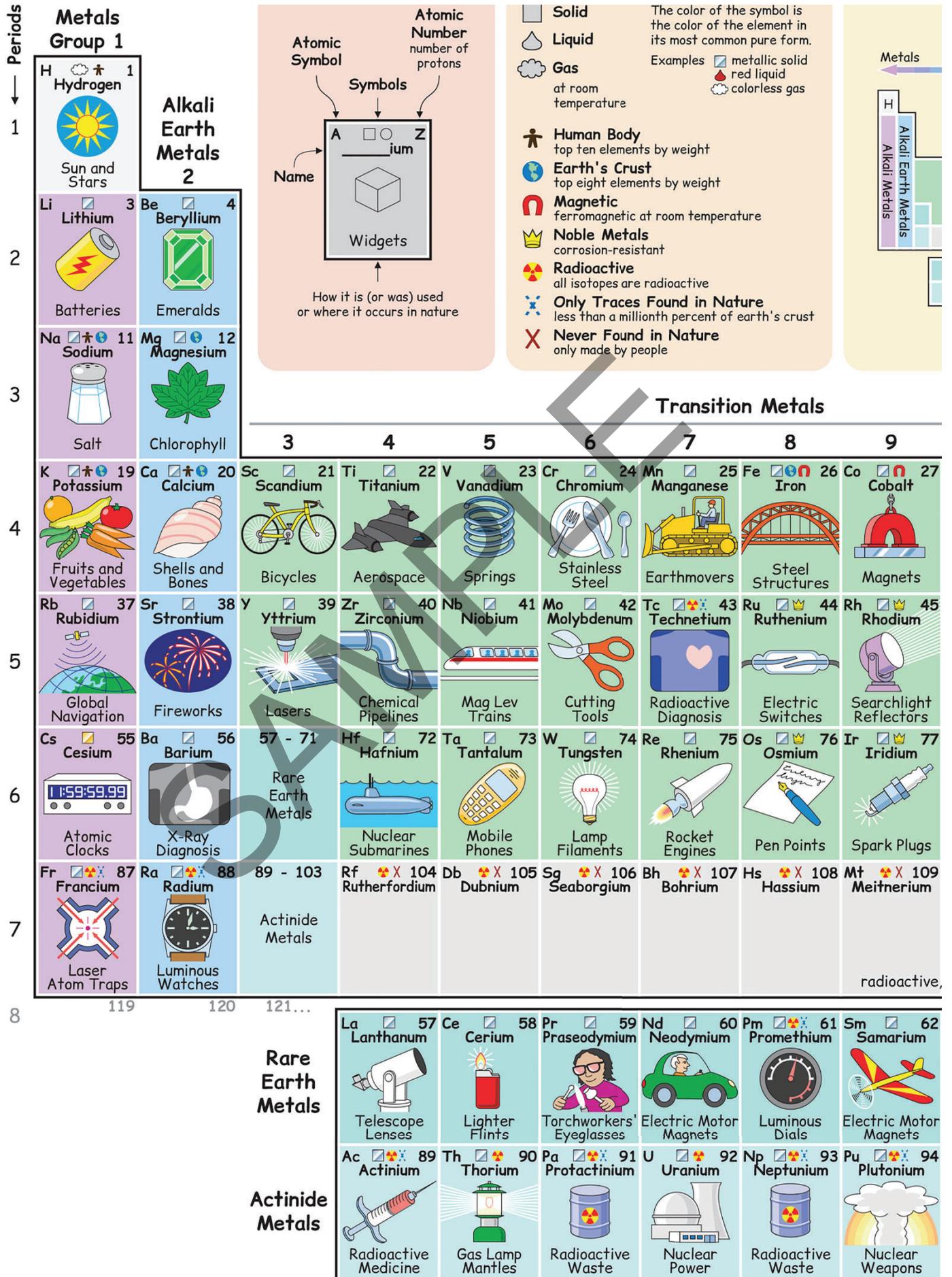
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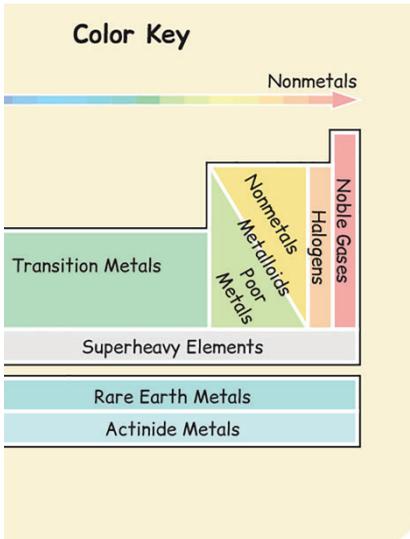
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The Periodic Table of



the Elements, in Pictures



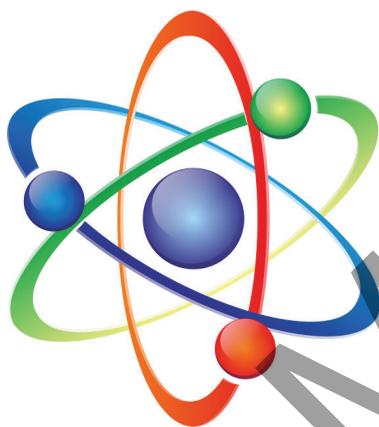
			Boron Group 13		Carbon Group 14		Nitrogen Group 15		Oxygen Group 16		Halogens 17		Noble Gases 18	
			B 5 Boron Sports Equipment	C 6 Carbon Basis of Life's Molecules	N 7 Nitrogen Protein	O 8 Oxygen Air	F 9 Fluorine Toothpaste	He 2 Helium Balloons						
			Al 13 Aluminum Airplanes	Si 14 Silicon Stone, Sand, and Soil	P 15 Phosphorus Bones	S 16 Sulfur Eggs	Cl 17 Chlorine Swimming Pools	Ne 10 Neon Advertising Signs						
			Zn 30 Zinc Brass Instruments	Ga 31 Gallium Light-Emitting Diodes (LEDs)	Ge 32 Germanium Semiconductor Electronics	As 33 Arsenic Poison	Se 34 Selenium Copiers	Br 35 Bromine Photography Film	Ar 18 Argon Light Bulbs					
Ni 28 Nickel Coins	Cu 29 Copper Electric Wires	Pd 46 Palladium Pollution Control	Ag 47 Silver Jewelry	In 49 Indium Liquid Crystal Displays (LCDs)	Sn 50 Tin Plated Food Cans	Sb 51 Antimony Car Batteries	Te 52 Tellurium Thermoelectric Coolers	I 53 Iodine Disinfectant	Kr 36 Krypton Flashlights					
Pt 78 Platinum Labware	Au 79 Gold Jewelry	Cd 48 Cadmium Paint	Hg 80 Mercury Thermometers	Tl 81 Thallium Low-Temperature Thermometers	Pb 82 Lead Weights	Bi 83 Bismuth Fire Sprinklers	Po 84 Polonium Anti-Static Brushes	At 85 Astatine Radioactive Medicine	Xe 54 Xenon High-Intensity Lamps					
Ds 110 Darmstadtium never found in nature, no uses except atomic research	Rg 111 Roentgenium never found in nature, no uses except atomic research	Cn 112 Copernicium never found in nature, no uses except atomic research	Nh 113 Nihonium never found in nature, no uses except atomic research	Fl 114 Flerovium never found in nature, no uses except atomic research	Mc 115 Moscovium never found in nature, no uses except atomic research	Lv 116 Livermorium never found in nature, no uses except atomic research	Ts 117 Tennessine never found in nature, no uses except atomic research	Og 118 Oganesson never found in nature, no uses except atomic research						

Eu 63 Europium Color Televisions	Gd 64 Gadolinium MRI Diagnosis	Tb 65 Terbium Fluorescent Lamps	Dy 66 Dysprosium Smart Material Actuators	Ho 67 Holmium Laser Surgery	Er 68 Erbium Optical Fiber Communications	Tm 69 Thulium Laser Surgery	Yb 70 Ytterbium Scientific Fiber Lasers	Lu 71 Lutetium Photodynamic Medicine						
Am 95 Americium Smoke Detectors	Cm 96 Curium Mineral Analyzers	Bk 97 Berkelium Radioactive Waste	Cf 98 Californium Mineral Analyzers	Es 99 Einsteinium radioactive, never found in nature, no uses except atomic research	Fm 100 Fermium radioactive, never found in nature, no uses except atomic research	Md 101 Mendelevium radioactive, never found in nature, no uses except atomic research	No 102 Nobelium radioactive, never found in nature, no uses except atomic research	Lr 103 Lawrencium radioactive, never found in nature, no uses except atomic research						

1. ELEPHANTS TOOTHPASTE

WHAT IT'S ABOUT

Atoms — Atoms are the building blocks of everything in the universe. They are the smallest particles in the universe that can't be further divided. One grain of salt contains a *billion billion* atoms! They are so small, they can't be seen even with the most powerful microscope. So how do we know atoms exist and that they make up everything? The answer is, by seeing how different substances behave and how they react to other substances. This is the study of science, and it helps us understand atoms and how they interact with each other.

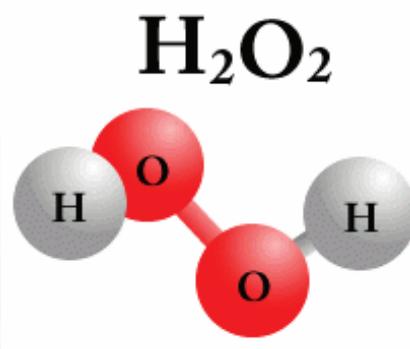


The **Periodic Table of Elements** names all the atoms that we know, as well as their basic properties.

Molecules — Atoms combine with

each other to form molecules. A molecule is the smallest particle that causes the substance to have its unique qualities and properties. For example, water is H_2O , which stands for 2 hydrogen atoms and 1 oxygen atom. Each molecule in the water is made up of the same 3 atoms. A cup of water contains many billions of this molecule. When there are different types of atoms in the molecule, it is called a **compound**. When there is only one type of atom in the molecule, it is called an **element**. Oxygen is an example of an element. The oxygen gas that we breathe is made up of molecules that contain only oxygen atoms. The molecule is O_2 , which means 2 oxygen atoms bonded together into one molecule.

Hydrogen Peroxide is written as H_2O_2 . This means that each molecule has 2 hydrogen atoms and 2 oxygen atoms.



A container of hydrogen peroxide left open cannot remain in its current form, and slowly separates into water and oxygen.

Decomposition – When a molecule separates and the substance breaks down into two (or more) other substances, this is called decomposition.



HOW IT WORKS

With hydrogen peroxide, decomposition happens naturally even without adding any yeast. However, it would happen very slowly. Yeast contains an enzyme called catalase, which is a catalyst. This means that it causes the decomposition to happen at a quicker pace. The oxygen that is formed gets trapped in the soap and makes bubbles, creating all the foam that comes piling out of the bottle.

SCIENCE WORDS



- ___ atom
- ___ periodic table of elements
- ___ molecules
- ___ hydrogen
- ___ oxygen
- ___ compound
- ___ element
- ___ hydrogen peroxide
- ___ decomposition
- ___ enzyme
- ___ catalyst

- A. atoms bonded together
- B. H_2O_2
- C. an atom found in air
- D. acts as a catalyst
- E. smallest particle
- F. molecules with same atoms
- G. molecule separating
- H. speeds up the chemical reaction
- I. list of all the atoms
- J. molecules with different atoms
- K. an atom found in water



LESSON REVIEW QUESTIONS

1. How are atoms and molecules similar? How are they different?

2. Is hydrogen peroxide a compound or an element? Why?

3. What does hydrogen peroxide separate into?

IN YOUR OWN WORDS



What is the topic of this experiment? _____

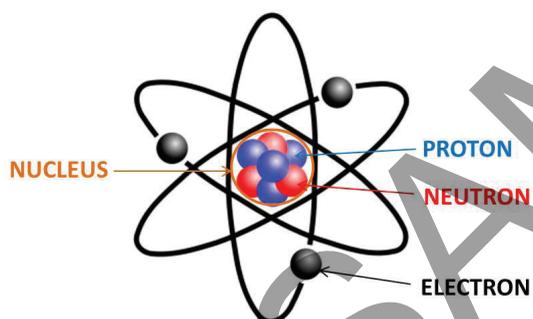
PROCEDURE - How did the teacher perform the experiment?

OUTCOME - Describe what happened during the experiment, and why.
Use the words you learned in the lesson.

2. ELECTROMAGNETIC NAIL

WHAT IT'S ABOUT

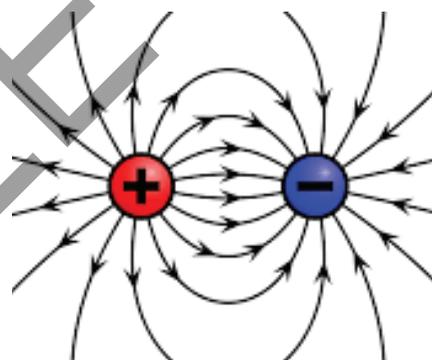
Atoms – Atoms are the smallest particles in the world that can't be further divided. But what is an atom made up of? Scientists have discovered that atoms have three parts: **electrons**, **protons** and **neutrons**. Each atom has a unique number of these particles in them. The **Periodic Table** of Elements lists the names and characteristics of each type of atom.



Atoms look like a mini solar system: the protons and neutrons are in the middle, called the **nucleus**, and the electrons circle around the nucleus. Electrons and protons have an electric **charge** – electrons have a negative charge, and protons have a positive charge. Neutrons are **neutral** – they have no charge. Charges make atoms act like magnets, because a negative pulls

a positive closer (**attracts**), but pushes away another negative (**repels**). Similarly, a positive pulls a negative closer, but pushes away another positive.

In short, opposite charges attract, and similar charges repel. An atom that has the same amount of



protons as electrons will be neutral, because the two cancel out. Most atoms are like this, and do not have any charge. If in total an atom has more electrons it will have a negative charge, and if it has more protons it will have a positive charge.

Another outcome of electric charge is, as you can guess, **electricity**. An electron can leave its atom and attach to a nearby atom that is positive (missing an electron). In this way, electrons can race through a long string of atoms, creating a **current** of electricity moving close to the speed of light! This is exactly what happens when you complete the **circuit** (pronounced sir-kit) of a battery and wires, for example in a flashlight.

A circuit is a complete pathway that connects the negative and positive sides of a battery. The negative side of a battery has more electrons, which are attracted like a magnet to the positive side of the battery, which has more protons. As a result, a cycle of electrons race through the metal wire by jumping one atom at a time toward the positive side, creating a steady stream of electricity.



HOW IT WORKS

As electricity flows, it also creates a **magnetic field**. This teaches scientists that there is a connection between electricity and magnetism. In fact, scientists view them as two aspects of one force, called the **electromagnetic** force. Using electricity, you can make your own magnet. When electrons stream through the metal wire and surround the iron nail, it creates a magnetic field around the nail. The more you wind the wire around the nail, the greater the magnetic field. Once the nail is magnetic, it will attract other metals, such as paper clips or safety pins.

SCIENCE WORDS

A^a

- ___ atom
- ___ electron
- ___ proton
- ___ neutron
- ___ periodic table of elements
- ___ nucleus
- ___ electric charge
- ___ neutral
- ___ electricity
- ___ electric current
- ___ circuit
- ___ magnetic field
- A. complete electric cycle
- B. list of atoms
- C. smallest particle
- D. caused by electric current
- E. no charge
- F. center of atom
- G. circles the nucleus
- H. negative or positive
- I. has a positive charge
- J. stays near protons
- K. build-up of electrons
- L. flow of electrons



LESSON REVIEW QUESTIONS

1. If an atom has the same number of electrons and protons, what type of electric charge does it have? What if there are more protons than electrons?

2. Can an atom lose some electrons? How does this create electricity?

3. In this experiment, what happens to the nail when electricity flows through the wire?

IN YOUR OWN WORDS



What is the topic of this experiment? _____

PROCEDURE - How did the teacher perform the experiment?

OUTCOME - Describe what happened during the experiment, and why.
Use the words you learned in the lesson.

SAMPLE