

An Introduction to Chemistry and Biology

What are we doing today?

Chemistry! And the basics of reactions

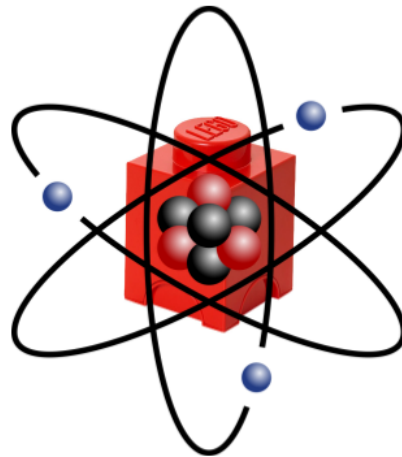
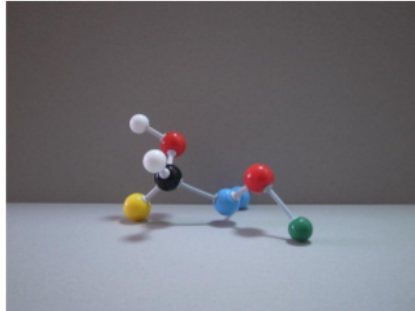
- Reactions with a catalyst
- Reactions from the sun

Biology

- Introduction into the scientific method
 - Angiosperm and gymnosperm plant classifications
-

What is an Atom?

- Incredibly small- $\sim 1/254,000,000$ of an inch
- Basic unit of matter - building blocks



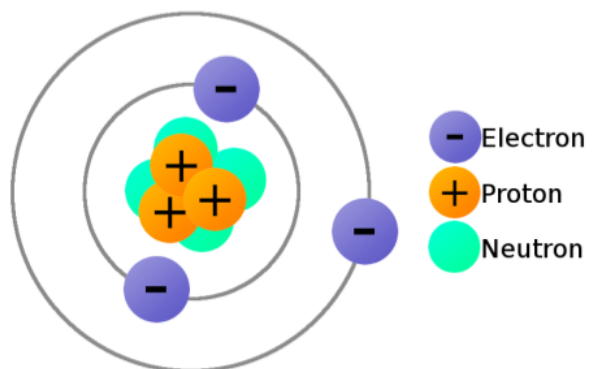
Slide 3

Image 1: Top right - a typical drawing of the atom, with red and black spheres in the middle, and small blue spheres moving around them, representing an atom.

Image 2: Bottom left - a couple of spheres with various colors connected together with gray sticks, representing a molecule.

Elements

- Atoms are made of protons, neutrons, electrons
- # of protons determines what we call the atom



Slide 4

Image 1: several coloured circles to represent an element. Blue is the electrons, orange the protons, and green neutrons.

PERIODIC TABLE OF ELEMENTS

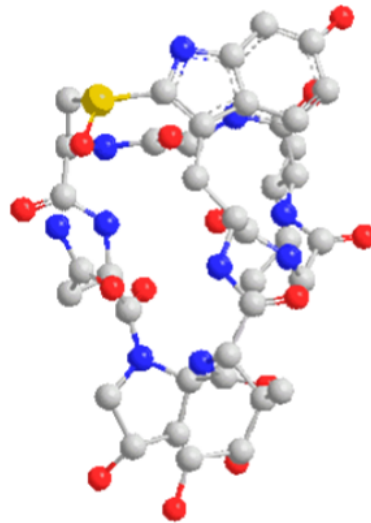
1 H Hydrogen																	2 He Helium
3 Li Lithium	4 Be Beryllium											5 B Boron	6 C Carbon	7 N Nitrogen	8 O Oxygen	9 F Fluorine	10 Ne Neon
11 Na Sodium	12 Mg Magnesium											13 Al Aluminium	14 Si Silicon	15 P Phosphorus	16 S Sulfur	17 Cl Chlorine	18 Ar Argon
19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
55 Cs Cesium	56 Ba Barium		72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
87 Fr Francium	88 Ra Radium		104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson
		57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium	
		89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium	

Slide 5:

Image 1: Periodic table with H, C, O, K, and Fe circled.

Molecules

- Atoms can bond to each other
- Molecules are two or more connected atoms



Slide 6:

Image 1: an example of a molecule using circles and lines. With differing colours representing different elements.

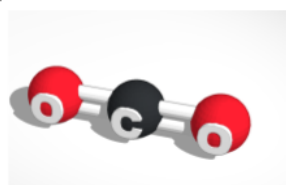
Can You Think of Any Molecules?

- Water

- Table Salt



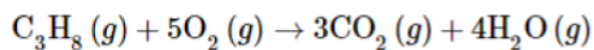
- Carbon Dioxide



Slide 7:

Images, drawings to represent the different molecules. Water (H₂O), Table salt (NaCl) and Carbon Dioxide (CO₂)

Chemical Reactions



Combustion of propane, to
make water

- When molecules break down into elements and recombine in different ways



Slide 8:

Image: picture of lego character to represent the multiple ways molecules can combine and change with a reaction.

Chemistry questions (Check-in)

GASEOUS REACTIONS **Elephant Toothpaste**

Elephant Toothpaste (Procedure)

- 1) Add $\frac{1}{2}$ Cup of Hydrogen Peroxide into empty water bottle
- 2) Add a big squirt of Dish Soap into Water Bottle
- 3) Put 3 Tablespoons of Warm Water into separate bowl
- 4) Add 1 Tablespoon of Yeast into the bowl and mix contents together
- 5) Pour the solution in the bowl into the Water Bottle and step back
- 6) Watch the Reaction!



Image of foam leaving the top of a beaker, representative of the reaction of hydrogen peroxide into constituents

Key Reaction

Main Point:

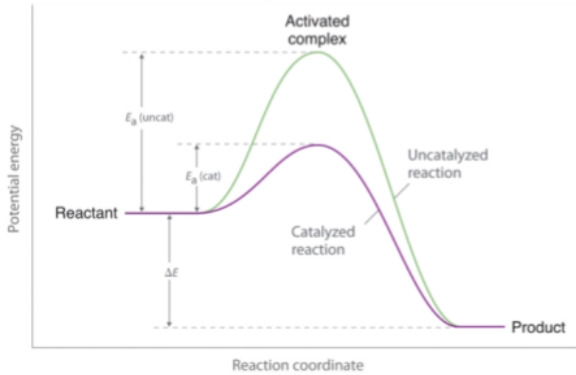
- Hydrogen Peroxide is broken down into water and oxygen
- But how is it able to break down so quickly?



Visual representation of decomposition of Hydrogen peroxide. Two moles of hydrogen peroxide break down into two moles of water and one mole of oxygen.

Catalyst

- Catalysts help increase the rate of the reaction
- Yeast contains an enzyme called Catalase, which acted as the Catalyst for the Reaction
- How is does the rate increase?
 - Catalysts help bring down the activation energy for the reactants to turn into the products



Visualization of the effect of a catalyst on the activation energy of a reaction. When a catalyst is added, the amount of energy required for the reaction to occur decreases.

Catalyst questions (Check-in)

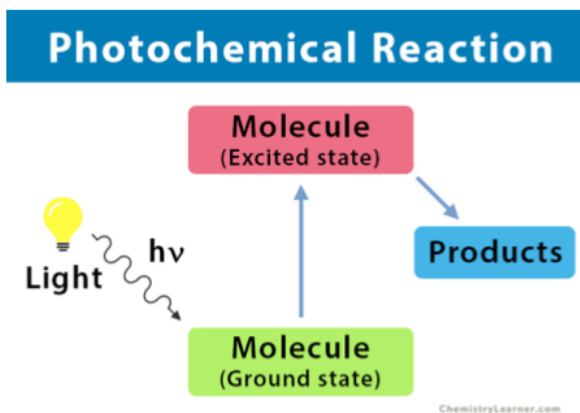
Photochemical Reactions

What it is: A reaction that receives the energy necessary for reaction from light sources

- UV (sunlight)
- Mercury Vapor Lamps
- X-ray

Examples:

- Photosynthesis
- Vitamin D
- Fireflies



CyanoType

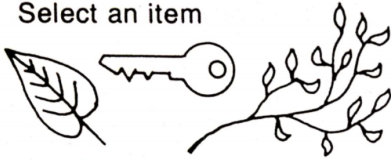
- A photographic printing process that produced early blueprints.
- Guess why they're called blueprints?
- Early low cost copying process now used for art.



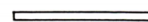



CyanoType Experiment

Today's experiment will model this phenomenon in a fun and easy way!

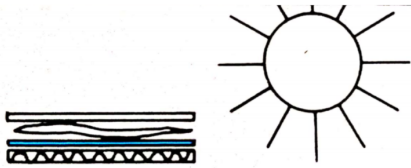
① Select an item



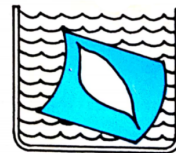
② Assemble in this order:

-  • Acrylic sheet
-  • Item
-  • Sunprint® paper
Blue side up
-  • A piece of cardboard

③



④



1. Image representation of item selection for cyanotype process
2. Image representation of cyanotype assembly: a piece of cardboard followed by its, sunprint paper, and finally the acrylic sheet.
3. Image representation of sun applied to cyanotype

Why collect plants?

3 EXPERIMENT

Make a plan & test your hypothesis.

Question: How are plants related to each other?

Hypothesis: (YOUR ideas here)

Experiment: Collecting plant samples

Data: Cyanotypes

Analyze: I think these plants are related because _____

Report: Tell the world! (or your parents)

THE SCIENTIFIC METHOD

1 QUESTION

Pick something you're curious about.

2 HYPOTHESIS

Make an educated guess at your question's answer.

3 EXPERIMENT

Make a plan & test your hypothesis.

4 DATA

Record your experiment's results and your observations.

5 ANALYZE

Review and draw conclusions.

6 REPORT

Explain your results and whether your hypothesis was correct.

Anna Atkins - Mid 1800's

- Chose cyanotype because complicated details are hard to draw
- First published a book photographing algae
- Moved to ferns and other land plants
- Focused more on art, using feathers, flowers, and such



Image description: Top right - Portrait of Anna Atkins in a traditional English dress
Image description: Bottom - Pictures of her cyanotypes, which are shown chronologically from left to right and are now held in art galleries.

Categorizing plants

Monocot vs Dicot

Vascular vs Non-vascular

Angiosperm vs Gymnosperm

Seed-producing vs Spore-producing

Trees vs Shrubs

Radially Symmetrical vs
Bilaterally Symmetrical

Introduction to Botany

	Angiosperms	Gymnosperms
Flowers	Flowers	No flowers
Seeds	Enclosed	Naked
Wood	Hardwood	Softwood
Life cycle	Seasonal	Evergreen (generally)
Leaves	Flat	Needle or scale-like
Population	80% of all green plants	Smaller, older group



Image description: Top right - Shows branches that end in little brown balls and needle-like, wintergreen leaves leading up to the end.

Image description: Bottom left - Depicts a short (maybe 6 feet tall) and conical tree

Image description: Bottom middle - A Christmas tree with ornaments and presents underneath.

Image description: Bottom right - Shows a pinecone attached to a few branches with round, green, needle-like leaves.



Image description: Top right, a large, mushroom-like tree with a central trunk and rounded clusters of leaves.

Image description: Bottom left - shows a branch which ends in a cluster of 3 round, green pom-pom like seeds. Large, flat single leaves sprout from the branch sporadically

Image description: Bottom right - The same flat leaves as in the left image, but with long, frilly extensions instead of seeds.



Image description: Top right - Shows needle-like leaves sprouting from sub-branches off of the main branch

Image description: Bottom left - Shows a massive tree about 4 or 5 times the height of all other surrounding trees

Image description: Bottom middle - Shows a tiny sprout about 5 inches tall, that is entirely green. Leaves are sprouting in an alternating pattern.

Image description: Bottom right - Shows two kids attempting to wrap their arms around the trunk of a massive tree, but failing spectacularly

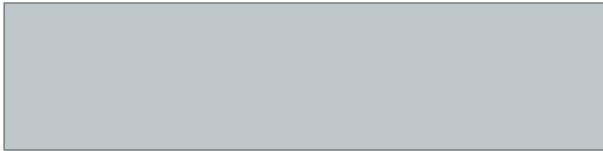


Image description: Top right - Depicts a white flower blooming next to a round dark red fruit

Image description: Bottom left - shows a seed growing slowly from a seed on the ground to a small sprout with flat leaves

Image description: Bottom right - Shows large clusters of spherical red fruit spread on a branch and large, flat, waxy leaves organized in an opposite pattern on the branch



Image description: Left - A field of round, short shrubs that are a mix of purple and green

Image description: Middle - a close up of the plant, showing the purple color is from the flowers sprouting at the top of the stem

Image description: Right - Shows the full anatomy of the plant, with thin roots at the bottom a main stem with thin branching leaves shooting of, and a collection of purple flowers at the top