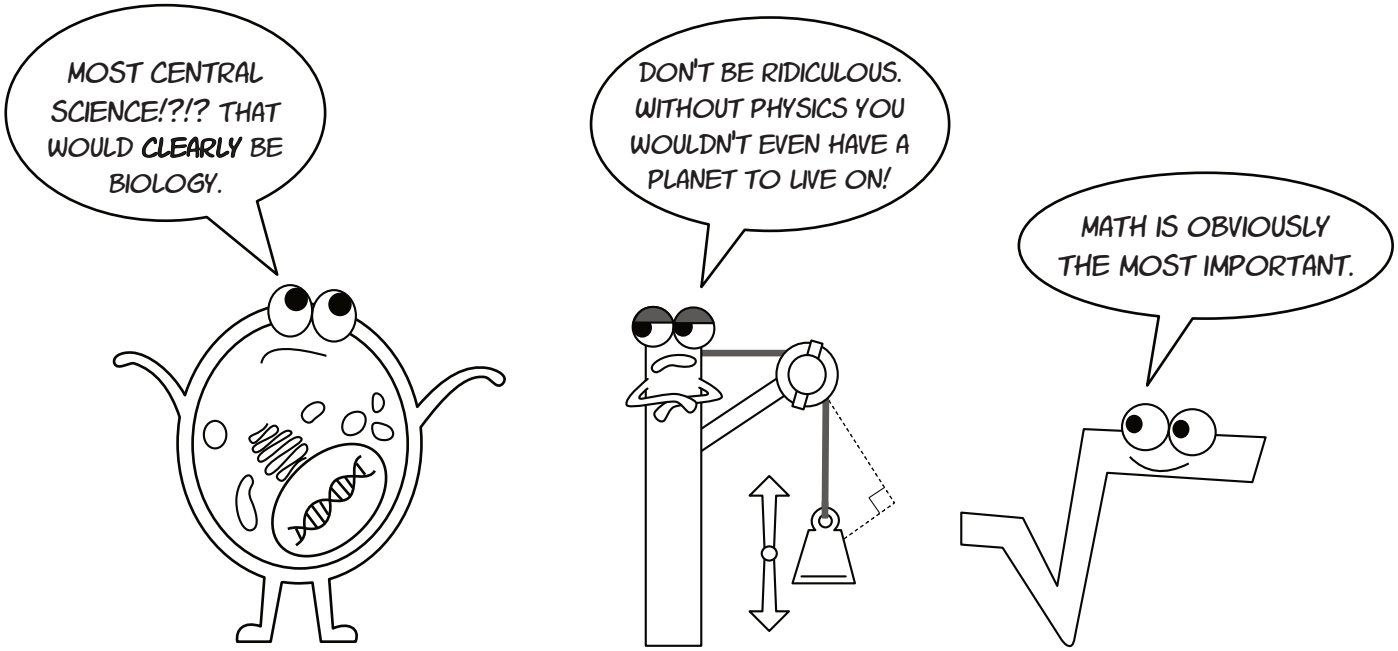
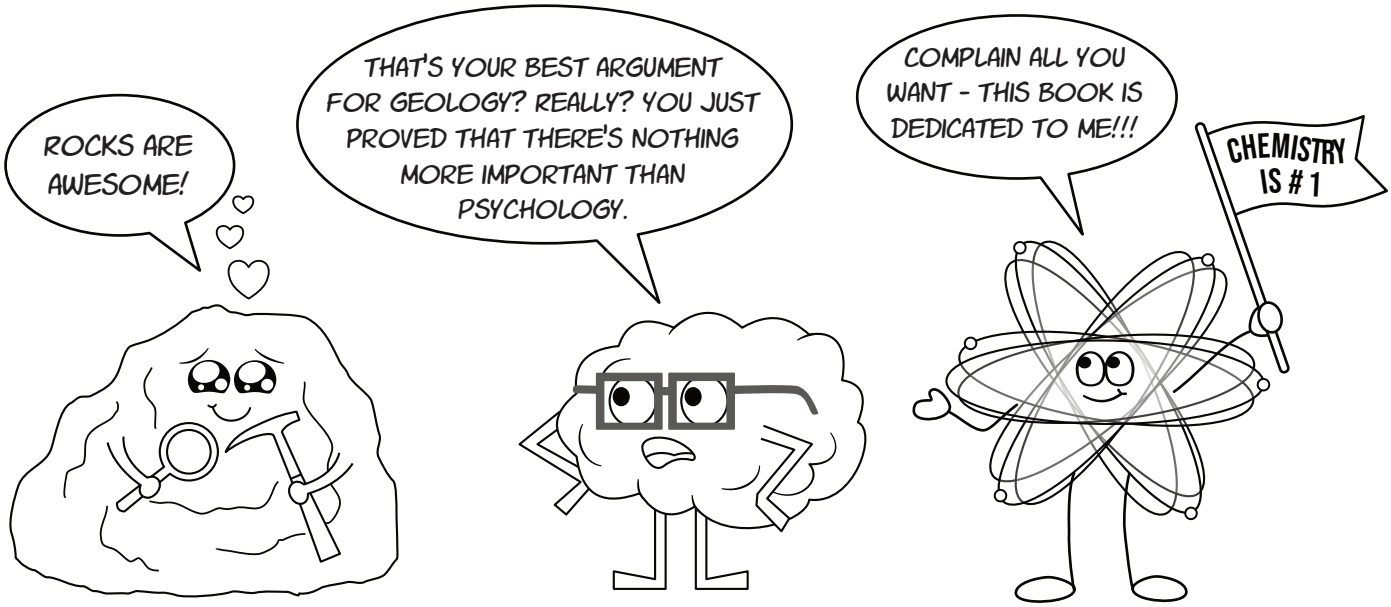
CHEMISTRY

The central and most important branch of science





A course by Science Mom & Math Dad

Fall 2020 schedule:

	Date	Topic	NGSS (if applicable)
Week 1	Tuesday, Sept 1	The story of the atom	5-PS1-1
	Thursday, Sept 3	Elemental, dear Watson!	
	Friday, Sept 4	***Hands-on Activity: Modeling Clay Orbitals***	
Week 2	Tuesday, Sept 8	A noble quest	
	Thursday, Sept 10	Element vs mixture vs compound	5-PS1-3
	Friday, Sept 11	***Hands-on Activity: Edible Experiments***	
Week 3	Tuesday, Sept 15	Why is it radioactive?	
	Thursday, Sept 17	Conservation of matter	5-PS1-2
	Friday, Sept 18	***Gameshow review***	
Week 4	Tuesday, Sept 22	Chemical reactions part 1	5-PS1-4
	Thursday, Sept 24	Chemical reactions part 2	5-PS1-4
	Friday, Sept 25	***Hands-on Activity: Time to Fizz***	
Week 5	Tuesday, Sept 29	Chemical reactions part 3	5-PS1-4
	Thursday, Oct 1	How does a toaster work?	4-PS3-2, 4-PS3-4
	Friday, Oct 2	***Hands-on Activity: Lemon or Vinegar Battery***	
Week 6	Tuesday, Oct 6	The building block of life	4-PS4-3
	Thursday, Oct 8	Where does fuel come from?	4-ESS1-1, 4-ESS3-1
	Friday, Oct 9	***Gameshow review***	
Week 7	Tuesday, Oct 13	What is fire *really*?	
	Thursday, Oct 15	Can we predict a volcano?	4-ESS3-2
	Friday, Oct 16	***Hands-on Activity: Build a Levee***	
Week 8	Tuesday, Oct 20	All about the solution	
	Thursday, Oct 22	Acids and bases	
	Friday, Oct 23	***Gameshow review***	
Week 9	Tuesday, Oct 27	Why do we chlorinate pools?	
	Thursday, Oct 29	Photosynthesis	5-PS3-1, 5-LS1-1
	Friday, October 30	***Hands-on Activity: Frankenseeds***	
Week 10	Tuesday, Nov 3	All about the sugars	
	Thursday, Nov 5	Why can't you eat books?	
	Friday, Nov 6	***Gameshow review***	

The gameshow reviews are interactive and best when attended live (10:00-10:45 a.m. Pacific / 1:00-1:45 p.m. Eastern time). If you can't attend live, it is recorded and you can watch the replay afterward. The questions used during the gameshow will also be emailed to all participants and can be used as a traditional assessment.

Have questions? Contact jenny@science.mom

	Date	Topic	NGSS (if applicable)
Week 11	Tuesday, Nov 10	Lipids!	
	Thursday, Nov 12	Plankton!	
	Friday, Nov 13	***Hands-on Activity: Plant Propagation***	
Week 12	Tuesday, Nov 17	Bioluminescence	
	Thursday, Nov 19	From cells to colonies	4-LS1-1
	Friday, Nov 20	***Gameshow review***	
Week 13	Tuesday, Nov 24	*Thanksgiving break - No class*	
	Thursday, Nov 26		
	Friday, Nov 27		
Week 14	Tuesday, Dec 1	The nitrogen cycle	5-LS2-1
	Thursday, Dec 3	Water reclamation	
	Friday, Dec 4	***DIY Water Filter***	
Week 15	Tuesday, Dec 8	Fireworks and lab safety	
	Thursday, Dec 10	***Gameshow review***	
	Friday, Dec 11	***Gameshow review***	

Supply List for Friday Hands-on Activities:

September 4 - Modeling Clay Orbitals

- ToothpicksModeling clay or play dough (7 different colors)

September 18 - Edible Experiments

- Granulated Sugar (at least 7 cups)
- Kool-aid packets
- Cake pop sticks or string
- A ruler
- 2 mason jars with lids
- Coffee filters or paper
- 2 Microwavable popcorn packets
- Water and ice

September 25 - Time to Fizz!

- Alka-Seltzer tablets (at least 6)
- Clear cups or bottles
- Baking soda
- Pop Rocks (2 packs)
- Soda in a bottle with a narrow top
- Balloon
- Food Coloring
- Vinegar
- Vegetable oil (a whole bottle)

October 2 - Lemon or Vinegar Batteries!

- Citrus fruit such as lemons OR vinegar and three small cups
- An LED diode
- Copper penny or wire
- Galvanized nail or zinc sheets
- Alligator clips

October 16 - Build a Levee

- A rectangular Tupperware container (or a 9”×13” casserole dish)
- Duct tape
- A plastic bag
- Building materials such as sand, gravel, raisins, flour, or cornmeal
- (Optional) legos or other small items to represent the town

October 30 Frankenseeds

- Cardboard egg carton(s)
- Paper towels
- At least 6 types of seeds from the kitchen (could include rice, beans, lentils, chia seeds, walnuts, sunflower seeds, almonds, peanuts, flax seeds quinoa, or seeds from inside foods like apples, peas, avocados, pears, oranges, kiwis, or cucumbers)

November 13 - Plant Propagation

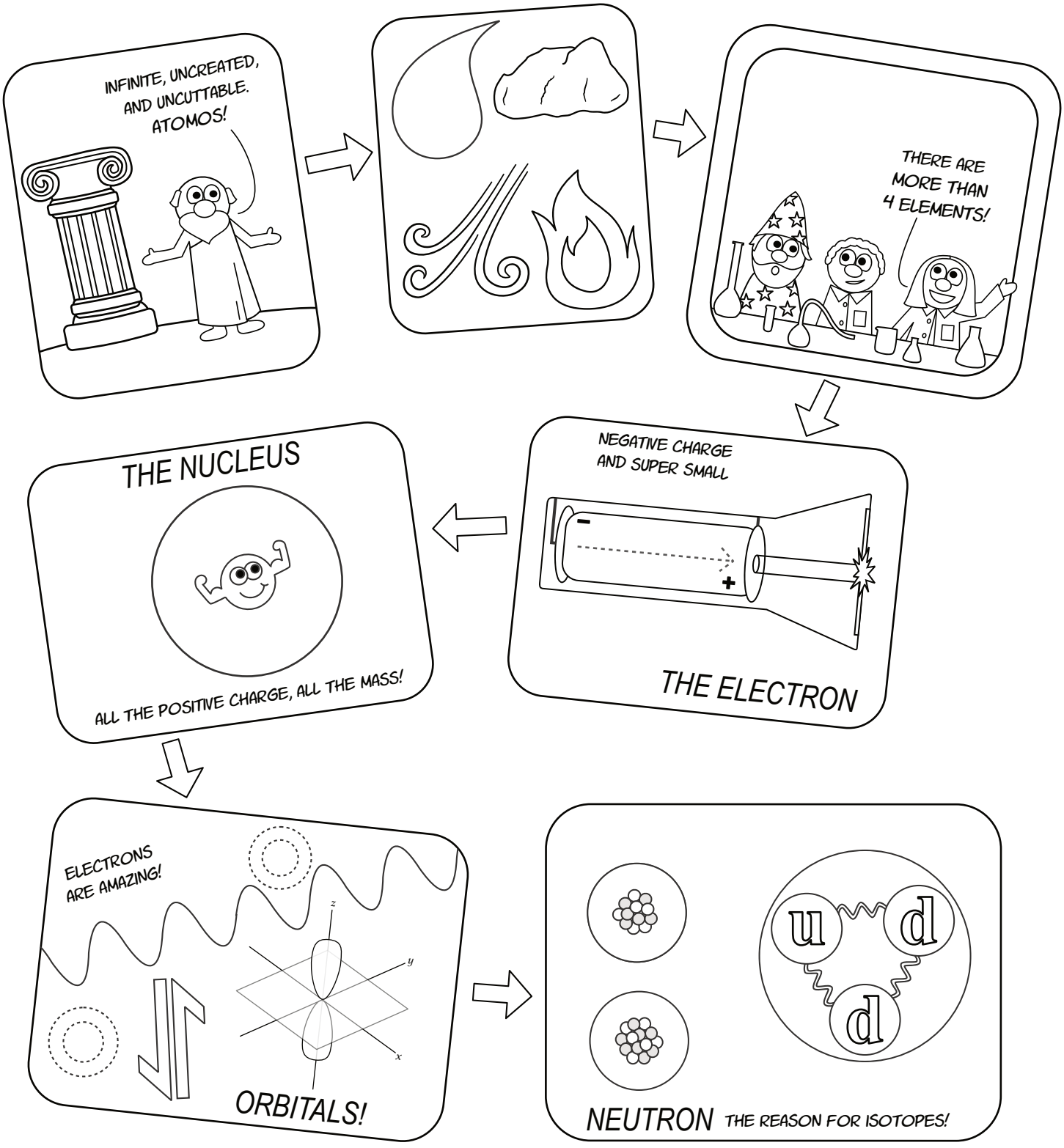
- One root vegetable (such as a carrot, beet, turnip, radish, or rutabaga)
- One tuber (sweet potato, potato, ginger, or turmeric)
- A pineapple
- 3 cups (drinking cups will work fine)
- Toothpicks

December 4 - DIY Water Filter

- 2 liter plastic bottle
- Scissors (some adult supervision may be needed when cutting the bottle)
- sand
- gravel
- Activated charcoal
- Coffee filters
- A small square of cotton fabric

The story of the ATOM

WHAT ARE THINGS REALLY MADE OF?



DRAW THE MODEL OF THE ATOM IN THESE BOXES!

SOLID SPHERE

1803
JOHN DALTON

- ELEMENTS ARE MADE OF DIFFERENT ATOMS
- THE ATOM ISN'T THE SMALLEST PARTICLE

PLUM PUDDING

1904
J.J. THOMPSON

- ELECTRONS ARE SMALL AND NEGATIVELY CHARGED
- MODEL HAD NO NUCLEUS

PLANETARY

1911
RUTHERFORD

- POSITIVE CHARGE IS LOCATED IN THE NUCLEUS
- DIDN'T PREDICT ELECTRON BEHAVIORS

BOHR

1913
NIELS BOHR

- ELECTRONS OCCUPY DISTINCT ENERGY LEVELS
- DID NOT EXPLAIN LARGER ATOMS

YOUR NOTES:

Welcome to the Elemental Cafe

How to order an element:

1. Choose the number of protons*
2. Make it an isotope! Adjust the number of neutrons
3. Make it an ion!** Adjust the number of electrons

* *NUMBERS ABOVE 90 ARE NOT SERVED.*

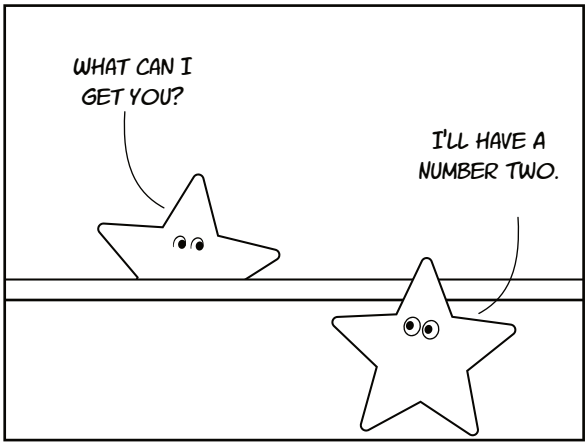
** *LIMITED AVAILABILITY.*

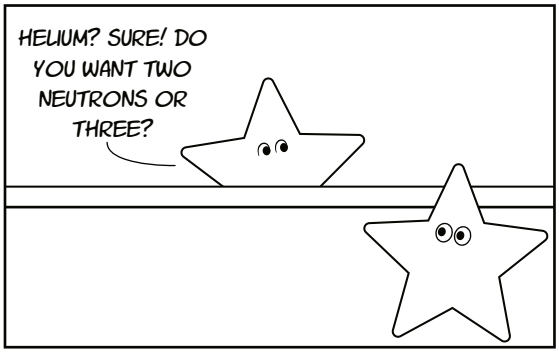
Daily Special

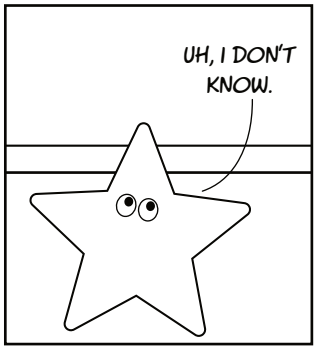
CARBON 14

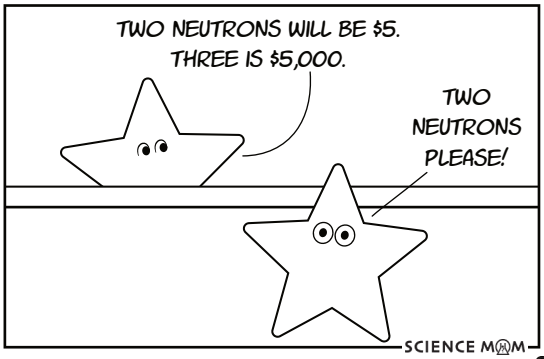
6 PROTONS
8 NEUTRONS
6 ELECTRONS

Remarkably stable!









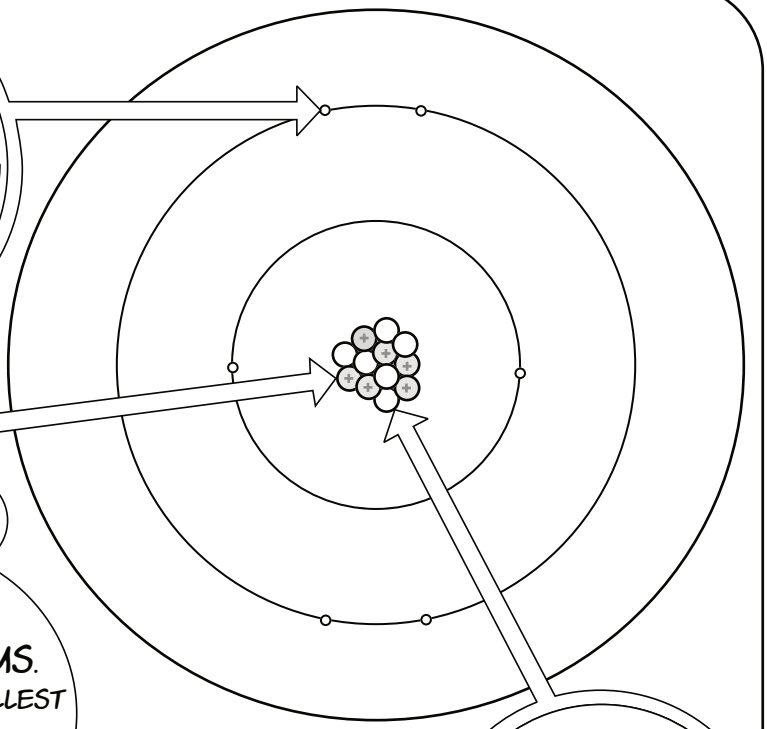
SCIENCE M@M

FILL IN THE BLANKS USING THESE VOCABULARY WORDS:

element	positive	no	nucleus	orbitals	neutrons
nucleus	protons	nucleus	118	matter	negative

ELECTRONS

HAVE A _____ CHARGE AND OCCUPY SPACES AROUND THE NUCLEUS KNOWN AS _____ THEY DON'T ADD ANY REAL MASS TO THE ATOM.



PROTONS

HAVE A _____ CHARGE AND EXIST IN THE _____ OF THE ATOM. THE NUMBER OF PROTONS DETERMINES WHICH ELEMENT THE ATOM IS.

ALL _____ IS MADE OF **ATOMS**. ATOMS ARE THE SMALLEST PIECE OF AN _____ THAT STILL BEHAVES LIKE THAT ELEMENT.

AN **ELEMENT** CANNOT BE BROKEN INTO SIMPLER SUBSTANCES BY CHEMICAL REACTIONS. THERE ARE _____ KNOWN ELEMENTS.

ATOMS ARE MOSTLY MADE OF EMPTY SPACE. ALL OF THEIR MASS IS IN THE THE _____

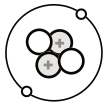
NEUTRONS

HAVE _____ CHARGE AND EXIST IN THE _____ OF THE ATOM. THEY ARE ABOUT THE SAME SIZE AS PROTONS.

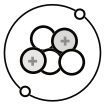
THE **NUCLEUS** OF THE ATOM CONTAINS _____ AND _____ BUT NOT ELECTRONS.

ISOTOPES

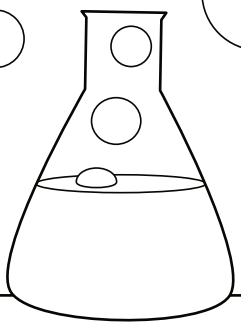
ARE VARIATIONS OF THE SAME ELEMENT THAT HAVE A DIFFERENT NUMBER OF NEUTRONS.



HELIUM



ALSO HELIUM

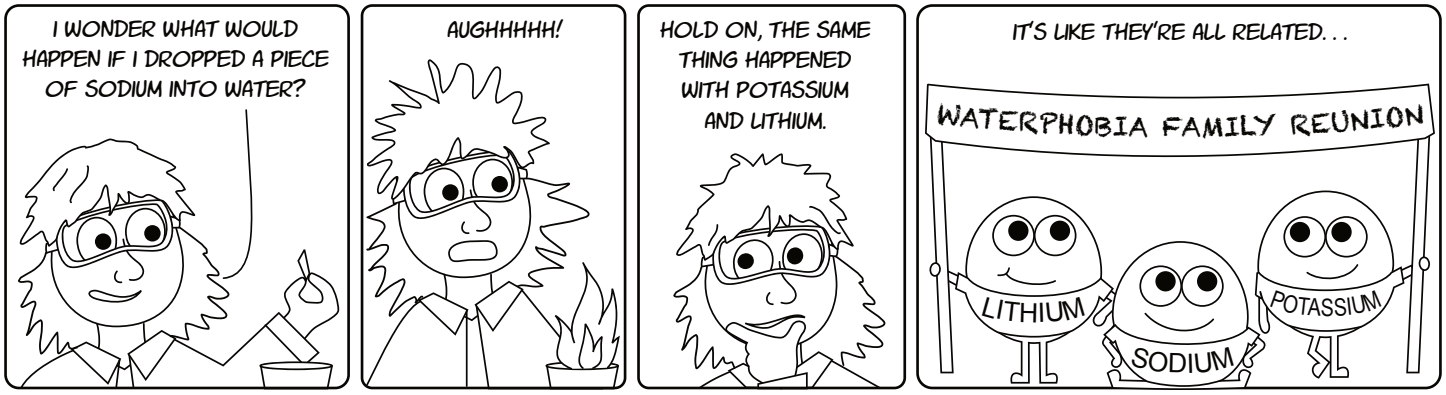


SCIENCE MOM

YOUR NOTES:

The PERIODIC table

PRETTY MUCH THE COOLEST CHART EVER



The ATOMIC NUMBER is the number of _____

5

CHEMICAL SYMBOL

B

ELEMENT NAME

Boron

10.81

The ATOMIC MASS is the average number of _____ and _____.

THE PERIODIC TABLE EVERY SINGLE ELEMENT!

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 Aluminum	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 Caesium	56 Ba Barium	57 La Lanthanum	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	89 Ac Actinium	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

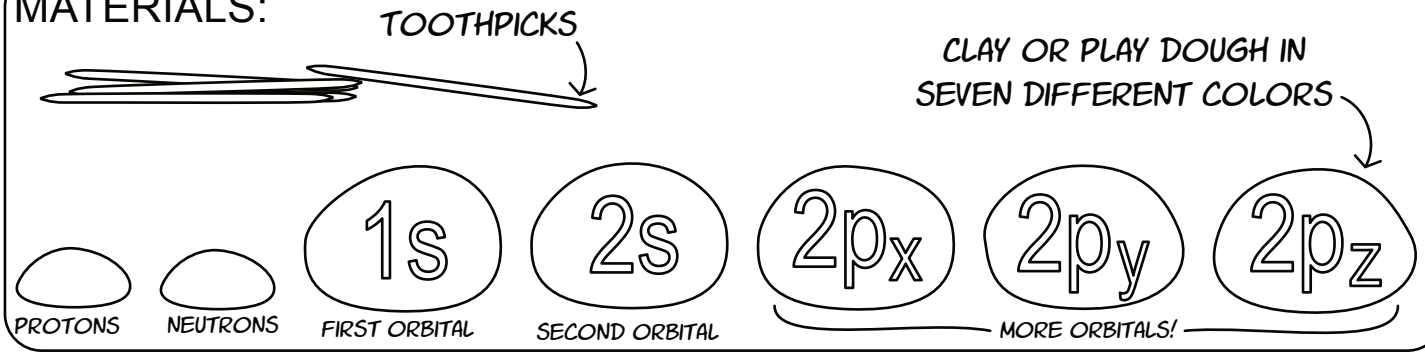
58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium
90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium

ARRANGING ALL OF THE ELEMENTS BY NUMBER CREATES A REALLY WIDE TABLE. SO THIS BLOCK (THE LANTHANIDES AND ACTINIDES) IS USUALLY SHOWN BELOW THE REST OF THE ELEMENTS.

Hands-on Activity

BUILD MODELS OF ATOMS

MATERIALS:



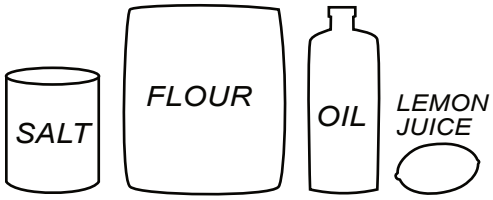
Don't have modeling clay? No problem! Make play dough using this recipe:

PLAY DOUGH

1 cup flour
1/3 cup salt
3/4 cup water
3 Tbsp lemon juice
1 Tbsp cooking oil
Food coloring

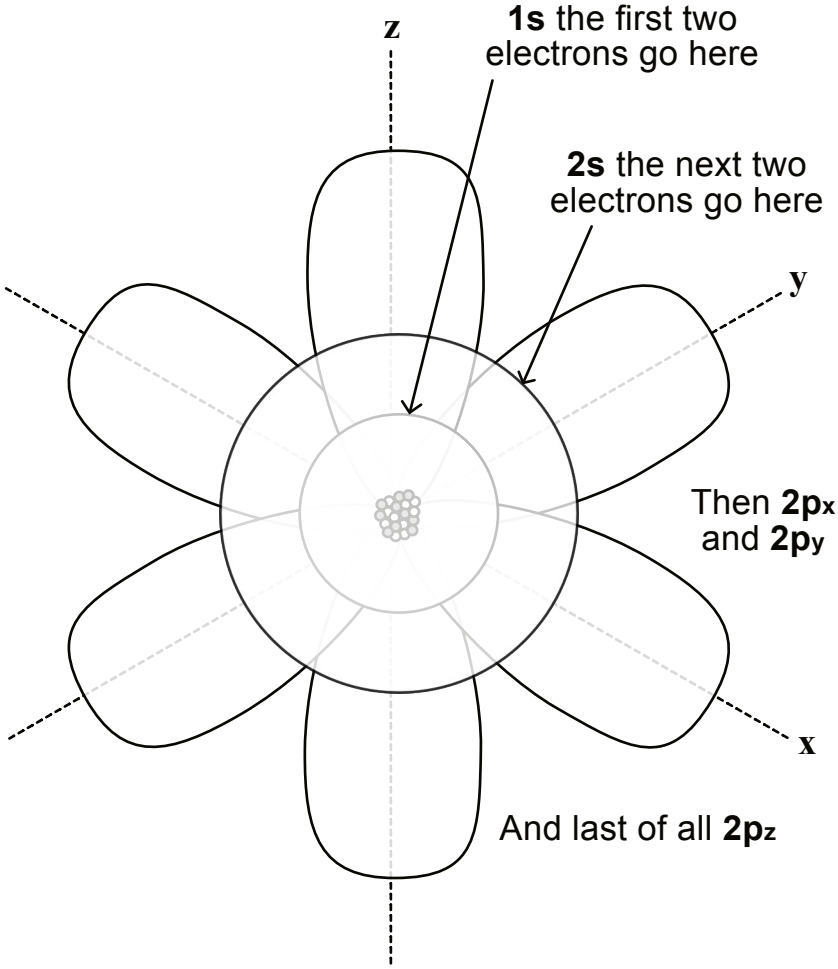
Mix the flour and salt together in a bowl. Heat the water to boiling and add the oil and lemon juice. Then mix all the ingredients together. For best results, mix in a pot over the stovetop until mixture is thick (about 1 minute).

Let sit and cool for a few minutes before kneading. Add another spoonful of flour if the dough is too tacky. Kool-aid drink packets can be used instead of food coloring.



ORBITALS

WHERE AN ELECTRON IS MOST LIKELY TO BE



~ INSTRUCTIONS ON PAGE 6 ~

INSTRUCTIONS:

Shape the colors of clay that represent neutrons and protons into small spheres and put them together to make the nucleus. Then cover the nucleus in layers of clay to represent the orbitals. Use the images below to guide you in making models of a hydrogen, helium, lithium, carbon, fluorine, and neon atom. Partially-filled orbitals can be represented by moulding half of the orbital. Use toothpicks to attach the p-orbitals.

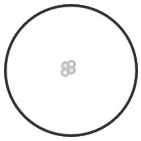
HYDROGEN

1 PROTON
0 NEUTRONS
1 ELECTRON

WARNING! VERY REACTIVE ORBITAL INCOMPLETE

HELIUM

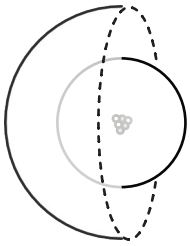
2 PROTON
2 NEUTRONS
2 ELECTRON



CONGRATULATIONS!
YOU ARE REMARKABLY STABLE

LITHIUM

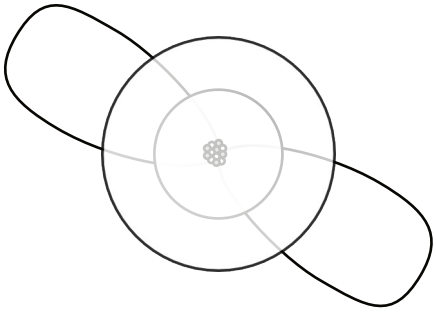
3 PROTON
3 NEUTRONS
3 ELECTRON



WARNING! VERY REACTIVE ORBITAL INCOMPLETE

CARBON

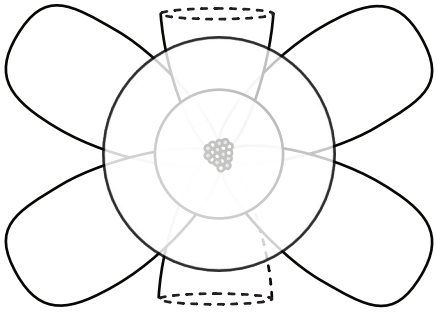
6 PROTON
6 NEUTRONS
6 ELECTRON



CONGRATULATIONS!
YOU ARE MODERATELY STABLE

FLUORINE

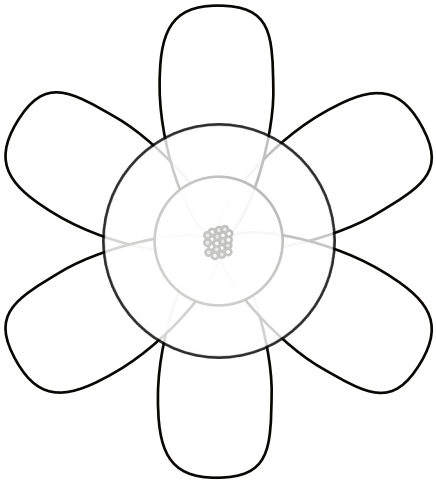
9 PROTON
9 NEUTRONS
9 ELECTRON



WARNING! VERY REACTIVE ORBITAL INCOMPLETE

NEON

10 PROTON
10 NEUTRONS
10 ELECTRON



CONGRATULATIONS!
YOU ARE REMARKABLY STABLE