Station #1 – Definitions, Candle Lab

Define or describe in your own words to your partner. Take turns!

observation

give an example from the candle lab the wax is solid when the candle is not lit.

hypothesis/ prediction explanation / assumption to explain an observed phenomenon

give an example from the candle lab the mass of the candle will decrease because the wax is melted and evaporate.

experiment

give an example from the candle lab The candle is weighed before and after it is lit (for 3 minutes) to see if there is any change in mass.

conclusion

give an example from the candle lab The wax is clearly the fuel because it is used up when the candle is lit, resulting in the decrease in mas

chemical change change from one substance to other substances by reorganizing the atoms

give an example separate hydrogen and oxygen in water (water electrolysis)

$2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$

physical change change in the form of a substance but not the composition

give an example separate salt water using distillation (boil water, change it from liquid to gaseous)

NaCl H_2O

radioactive decay unstable nucleus spontaneously changes to form a more stable nucleus

Dalton's Atomic Theory, list each part 1. all elements are made of tiny particles called ator

2. All atoms of a given element are identical

3. atoms from one element are different from those of any other element

4. atoms from different elements combine and form compounds 5. atoms cannot be destroyed = indivisible

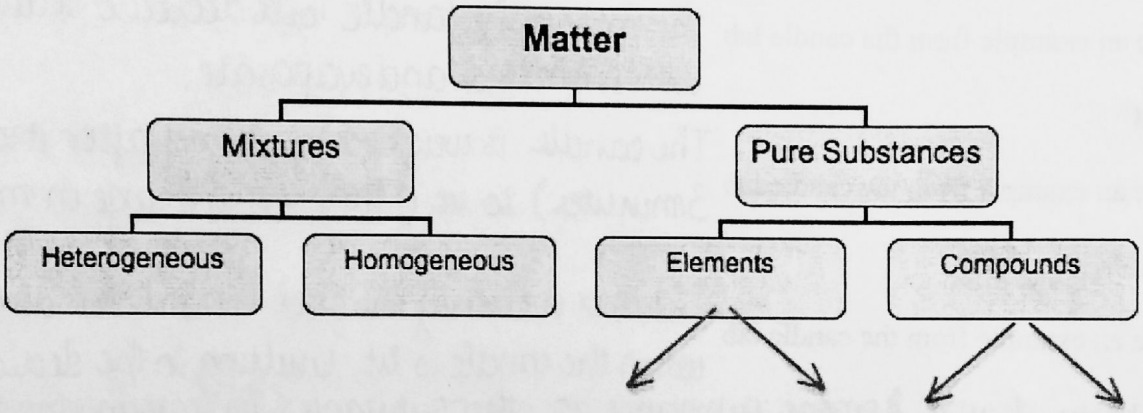
What part(s) of Dalton's Atomic Theory no longer hold true according to the research that has been conducted to date?

No. 5. no longer holds true. J.J. Thomson and cathode ray tube experiment proved that there were subatomic particles.

Station #2 – Classification of Matter

Classify the following listed below and the models shown on the bench.

paraffin, $C_{25}H_{52}$	table Salt, NaCl	carbon dioxide, CO_2
oxygen, O_2	salt water	air in the room
graphite, C	water, H_2O	homogenized milk
phosphorous, P_4	aluminum, Al	sand and water
iced tea	magnesium, Mg	chicken soup



Heterogeneous	Homogeneous	Elements: atomic	Elements: molecular	Compounds: ionic	Compounds: molecular
iced tea	saltwater	Al	oxygen O_2		
sand + water	air in the room	Mg	graphite C	NaCl	paraffin $C_{25}H_{52}$
chicken soup	homogenized milk		phosphorous		water H_2O
					CO_2

note: ionic compounds have a metal and a nonmetal, molecular compounds have 2 nonmetals

How can you tell the difference between a mixture and a compound?

mixture: separate its components using physical changes

compound: separate its components by chemical changes.

What is the main difference between an atomic element and a molecular element?

atomic element: its atoms are the smallest building block

molecular element: its smallest building blocks are molecules, where atoms are bonded to each other.

Describe how you would separate the following mixtures, note the physical property you use when performing the separation:

- Salt and water (different boiling points) boil water → let it evaporate and condense the water vapor
  * distillation *
- An alloy of tin and copper (different melting points)
  Heat alloy to melting temp of tin (449°F), tin would melt while copper would remain solid.
- Iron filings and plastic filings (iron is magnetic)
  Use a big magnet
- Styrofoam pellets and sand (different sizes)
  Filter: sand would go through while styrofoam pellets would stay on the filter.

Station #3 - Isotopes

Fill in the following table:

Name	Symbol	atom, cation or anion	Mass number	# of n	# of p	# of e	metal, nonmetal or metalloid
aluminum	$^{27}_{13}Al$	atom	27	14	13	13	metal
helium	$^{4}_{2}He$	atom	4	2	2	2	nonmetal
oxygen	$^{16}O^{2-}$	anion	16	8	8	10	nonmetal

1. Uranium-235 and Uranium-238 are considered isotopes of one another. How are Uranium-235 and 238 similar, and how are they different?
   same #'s of protons (92)
   different #'s of neutrons 235-92 = 143 neutrons and 238-92 = 146 neutrons
2. Define isotope: atoms with the same number of protons but different number of neutrons
3. The number of protons determines the name of the atom.
4. The mass number of an atom is the number of protons plus the number of neutrons in the nucleus of the atom.
5. The isotope notation for nitrogen-15 is as follows:
   a. The number 15 is the mass number.
   b. The number 7 is the atomic number.
   c. How many neutrons does nitrogen-15 have? 15-7=8
6. Write the following in isotope notation:
   a. the atom with 12 protons and 12 neutrons. $^{24}_{12}Mg$
   b. the atom with 79 protons and 117 neutrons. $^{196}_{79}Au$
   c. the copper atom that has 34 neutrons. $^{63}_{29}Cu$

Station #4 – Nuclear Reactions and Half Life

1. From the periodic table given pick one of each of the types of radioactive decay and write a proper balanced nuclear equation. Describe what is happening to the nucleus in each reaction.
   a. Alpha decay $^{233}_{92}U \rightarrow ^{4}_{2}He + ^{229}_{90}Th$

   b. Beta decay $^{32}_{15}P \rightarrow ^{0}_{-1}e + ^{32}_{16}S$

   c. Electron capture $^{68}_{32}Ge + ^{0}_{-1}e \rightarrow ^{68}_{31}Ga$

   d. Positron emission $^{18}_{9}F \rightarrow ^{0}_{1}e + ^{18}_{8}O$

2. One isotope of krypton, Kr-76, undergoes spontaneous electron capture with a half-life of 15 hours. You have a 100 gram sample.
   a. Write the complete electron capture nuclear reaction for krypton-76, using full symbols for all isotopes and particles. $^{76}_{36}Kr + ^{0}_{-1}e \rightarrow ^{76}_{35}Br$

   b. What percent of the 100 gram sample of krypton-76 will remain after 4 half-lives? Ans: 6.25%

   c. What mass of the 100 gram sample of krypton-76 will remain after 15 hours? = 1 half life

   $100g\left(\frac{1}{2}\right)^1 = 100g \times \frac{1}{2} = 50g$

   d. What mass would remain after an *additional* 30 hours? Ans: 12.5g

   = 2 cycles

   $50g\left(\frac{1}{2}\right)^2$

   $= 50g \times \frac{1}{4} = 12.5g$

Station #5

Label the following
Metals, Nonmetals, Metalloids
Alkali Metals, Alkaline Earth Metals, Transition Metals, Halogens, Noble Gases, Rare Earth Metals, di atomics and Common ionic charges for groups 1, 2, 13, 14, 15, 16, 17

Alkali Metals

Alkaline Earth

Halogens

← Metals Nonmetals →

← Transition metals →

hydrogen 1 H 1.0079																	helium 2 He 4.0026
lithium 3 Li 6.941	beryllium 4 Be 9.0122											boron 5 B 10.811	carbon 6 C 12.011	nitrogen 7 N 14.007	oxygen 8 O 15.999	fluorine 9 F 18.998	neon 10 Ne 20.180
sodium 11 Na 22.990	magnesium 12 Mg 24.305											aluminum 13 Al 26.982	silicon 14 Si 28.086	phosphorus 15 P 30.974	sulfur 16 S 32.065	chlorine 17 Cl 35.453	argon 18 Ar 39.948
potassium 19 K 39.098	calcium 20 Ca 40.078		scandium 21 Sc 44.956	titanium 22 Ti 47.867	vanadium 23 V 50.942	chromium 24 Cr 51.996	manganese 25 Mn 54.938	iron 26 Fe 55.845	cobalt 27 Co 58.933	nickel 28 Ni 58.693	copper 29 Cu 63.546	zinc 30 Zn 65.39	gallium 31 Ga 69.723	germanium 32 Ge 72.61	arsenic 33 As 74.922	selenium 34 Se 78.96	bromine 35 Br 79.904	krypton 36 Kr 83.80
rubidium 37 Rb 85.468	strontium 38 Sr 87.62		yttrium 39 Y 88.906	zirconium 40 Zr 91.224	niobium 41 Nb 92.906	molybdenum 42 Mo 95.94	technetium 43 Tc [98]	ruthenium 44 Ru 101.07	rhodium 45 Rh 102.91	palladium 46 Pd 106.42	silver 47 Ag 107.87	cadmium 48 Cd 112.41	indium 49 In 114.82	tin 50 Sn 118.71	antimony 51 Sb 121.76	tellurium 52 Te 127.60	iodine 53 I 126.90	xenon 54 Xe 131.29
cesium 55 Cs 132.91	barium 56 Ba 137.33	57-70 *	lutetium 71 Lu 174.97	hafnium 72 Hf 178.49	tantalum 73 Ta 180.95	tungsten 74 W 183.84	rhenium 75 Re 186.21	osmium 76 Os 190.23	iridium 77 Ir 192.22	platinum 78 Pt 195.08	gold 79 Au 196.97	mercury 80 Hg 200.59	thallium 81 Tl 204.38	lead 82 Pb 207.2	bismuth 83 Bi 208.98	polonium 84 Po [209]	astatine 85 At [210]	radon 86 Rn [222]
francium 87 Fr [223]	radium 88 Ra [226]	89-102 * *	lawrencium 103 Lr [262]	rutherfordium 104 Rf [261]	dubnium 105 Db [262]	seaborgium 106 Sg [266]	bohrium 107 Bh [264]	hassium 108 Hs [269]	meitnerium 109 Mt [268]	ununnilium 110 Uun [271]	unununium 111 Uuu [272]	ununbium 112 Uub [277]		ununquadium 114 Uuq [289]	3-	2-	1-	
1+	2+												3+	4+ 4-				

Common Ionic Charge →

Noble/Inert Gas

Rare Earth Metals →

*Lanthanide series	lanthanum 57 La 138.91	cerium 58 Ce 140.12	praseodymium 59 Pr 140.91	neodymium 60 Nd 144.24	promethium 61 Pm [145]	samarium 62 Sm 150.36	europium 63 Eu 151.96	gadolinium 64 Gd 157.25	terbium 65 Tb 158.93	dysprosium 66 Dy 162.50	holmium 67 Ho 164.93	erbium 68 Er 167.26	thulium 69 Tm 168.93	ytterbium 70 Yb 173.04
**Actinide series	actinium 89 Ac [227]	thorium 90 Th 232.04	protactinium 91 Pa 231.04	uranium 92 U 238.03	neptunium 93 Np [237]	plutonium 94 Pu [244]	americium 95 Am [243]	curium 96 Cm [247]	berkelium 97 Bk [247]	californium 98 Cf [251]	einsteinium 99 Es [252]	fermium 100 Fm [257]	mendelevium 101 Md [258]	nobelium 102 No [259]

Metalloids: around the stairs: B, Si, Ge, As, Sb, Te, Po, At

Diatomics: molecules composed of 2 atoms

H_2, N_2, O_2, F_2, Cl_2, I_2, Br_2