Greater Atlanta Christian School

SUMMER REVIEW

FOR

HONORS CHEMISTRY

2024

This packet is a set of activities designed to review of some basic skills and content needed for 10th grade science. Students enrolled in Honors Chemistry for the Fall should thoroughly complete this review over the summer to turn in on the first day of school.

MATH SKILLS

GOAL: Students should recognize equivalent representations of numbers and be able to manipulate and solve for variables in algebraic equations.

1.1 Can you complete the following problems WITHOUT a calculator??

1) Adding 3/7 to 1/8 gives
   a) 17/56
   b) 3/56
   c) 15/56
   d) 31/56

2) Subtracting 1/3 from 6/7 gives
   a) 2/7
   b) 11/21
   c) 13/27
   d) 6/27

3) Multiplying 4/7 by 3/8 gives
   a) 21/32
   b) 3/14
   c) 3/2
   d) 32/21

4) Dividing 5/9 by 3/5 gives
   a) 1/3
   b) 25/27
   c) 14/13
   d) 3

5) 0.0124 as a fraction is
   a) 124/10000
   b) 124/1000
   c) 1/124
   d) 124/100

6) 4/7 can also be represented as
   a) 7/4
   b) 0.4
   c) 1 3/4
   d) 40/70

7) 555,000,000 written in scientific notation is
   a) 5.55×10^{8}
   b) 555×10^{7}
   c) 55.5×10^{7}
   d) 5.55×10^{-8}

8) 7.25×10^{-6} written as a regular number is
   a) 0.000725
   b) 7250000
   c) 0.000000725
   d) 0.00000725

9) Adding 3×10^{5} and 5×10^{5} gives
   a) 8×10^{5}
   b) 8×10^{10}
   c) 1.5×10^{11}
   d) 1.5×10^{26}

10) Subtracting 2.5×10^{4} from 7.5×10^{5} gives
   a) 5×10^{9}
   b) 7.25×10^{5}
   c) 7.5×10^{1}
   d) 5×10^{1}

11) Multiplying 2.5×10^{3} by 520 gives
   a) 1.3×10^{6}
   b) 1.30×10^{5}
   c) 5.2×10^{6}
   d) 1.3×10^{5}

12) Dividing 1.6×10^{-5} by 2.0×10^{-4} gives
   a) 3.6×10^{-9}
   b) 8×10^{-2}
   c) 0.04
   d) 4×10^{-8}

13) Square of 1.2×10^{-4} is
   a) 1.2
   b) 1.44×10^{-8}
   c) 1.2×10^{-16}
   d) 1.44×10^{-16}

14) 140.934 rounded to the tenths place is
   a) 141
   b) 140.93
   c) 141.0
   d) 140.9

15) 85.467 rounded to the hundredths place is
   a) 85.5
   b) 85.468
   c) 86.0
   d) 85.47

16) 22.98977 rounded to the hundredths place is
   a) 22.9898
   b) 22.99
   c) 23.0
   d) 22.990

1.2 Complete the following problems, showing ALL of your work. Calculators are allowed for this section.

Without Numbers:

If $X = \frac{Y}{Z}$ then solve for Z.

If $A = \frac{B}{C}$ then solve for B.

With Numbers and Units:

If $D = \frac{m}{V}$ and D = 1.09 g/mL, m = 14.5 g. Solve for V in mL.

If $M = \frac{mol}{L}$ and you have .5 L of a 12 M solution, how many mol of solution do you have?

Without Numbers:

If AB = CD then solve for D.

If XY = WZ then solve for Y.

If $c = \lambda\nu$ Solve for λ.

If $E = h\nu$ Solve for ν.

With Numbers and Units:

If $P_1 \times V_1 = P_2 \times V_2$ and $P_1 = 1.0$ atm
$V_1 = 50$ mL
$P_2 = .75$ atm
Solve for V_2.

If $M_1 \times V_1 = M_2 \times V_2$ and $M_1 = 12$ M
$M_2 = 6$ M
$V_2 = 500$ mL
Solve for V_1.

If $c = \lambda\nu$ and $c = 3 \times 10^8$ m/s
$\nu = 5.09 \times 10^{14}$ /s
Solve for λ.

If $E = h\nu$ and $E = 3.20 \times 10^{11}$J
$h = 6.626 \times 10^{-34}$ J/s
Solve for ν.

Without Numbers:

$\frac{X}{Y} = \frac{W}{Z}$ Solve for Z.

$\frac{A}{B} = \frac{C}{D}$ Solve for C.

If $PV = nRT$ Solve for P.

If $Q = mC\Delta T$ what does the Δ stand for in math terms?

With Numbers and Units:

If $\frac{P_1}{T_1} = \frac{P_2}{T_2}$

$P_1 = 101.3$ kPa
$T_1 = 273$ K
$P_2 = 300$ kPa
Solve for T_2.

If $\frac{n_1}{V_1} = \frac{n_2}{V_2}$

$n_1 = 6.2$ mol
$V_1 = 250$ mL
$V_2 = 150$ mL
Solve for n_2.

If $P\ (.500) = (2.0)(.0821)(273)$ Solve for P without units.

If $Q = mC\Delta T$ and

$m = 12$ g
$C = 4.18$ J/g°C
$\Delta T = 15$ °C
Solve for Q.

TAKE A NOTE

GOAL: Students should be able to take notes and use them to explain a new concept to others.

2.1 Watch the following video on chemical reactions at

https://ed.ted.com/lessons/how-to-speed-up-chemical-reactions-and-get-a-date

Take notes on this page and then write a summary paragraph to explain the concept to another person who has not watched the video.

NOTES

SUMMARY

PERIODIC TABLE

GOAL: Students should be familiar with the components and structure of the Periodic Table of Elements.

3.1 Use the Periodic Table below and the Clues on page 10 to complete the Crossword Puzzle.

The Periodic Table of Elements

6 ← Atomic Number
C ← Chemical Symbol
CARBON ← Chemical Name
12.011 ← Atomic Weight

METALS — NON-METALS

1 H HYDROGEN 1.0079																	2 He HELIUM 4.0026
3 Li LITHIUM 6.941	4 Be BERYLLIUM 9.0122											5 B BORON 10.811	6 C CARBON 12.011	7 N NITROGEN 14.007	8 O OXYGEN 15.999	9 F FLUORINE 18.998	10 Ne NEON 20.180
11 Na SODIUM 22.990	12 Mg MAGNESIUM 24.305											13 Al ALUMINUM 26.982	14 Si SILICON 28.086	15 P PHOSPHORUS 30.974	16 S SULFUR 32.066	17 Cl CHLORINE 35.453	18 Ar ARGON 39.948
19 K POTASSIUM 39.0983	20 Ca CALCIUM 40.078	21 Sc SCANDIUM 44.956	22 Ti TITANIUM 47.867	23 V VANADIUM 50.942	24 Cr CHROMIUM 51.996	25 Mn MANGANESE 54.938	26 Fe IRON 55.845	27 Co COBALT 58.933	28 Ni NICKEL 58.693	29 Cu COPPER 63.546	30 Zn ZINC 65.38	31 Ga GALLIUM 69.723	32 Ge GERMANIUM 72.630	33 As ARSENIC 74.922	34 Se SELENIUM 78.971	35 Br BROMINE 79.904	36 Kr KRYPTON 83.798
37 Rb RUBIDIUM 85.468	38 Sr STRONTIUM 87.62	39 Y YTTRIUM 88.906	40 Zr ZIRCONIUM 91.224	41 Nb NIOBIUM 92.906	42 Mo MOLYBDENUM 95.95	43 Tc TECHNETIUM [98]	44 Ru RUTHENIUM 101.07	45 Rh RHODIUM 102.91	46 Pd PALLADIUM 106.42	47 Ag SILVER 107.87	48 Cd CADMIUM 112.41	49 In INDIUM 114.82	50 Sn TIN 118.71	51 Sb ANTIMONY 121.76	52 Te TELLURIUM 127.60	53 I IODINE 126.90	54 Xe XENON 131.29
55 Cs CESIUM 132.91	56 Ba BARIUM 137.33		72 Hf HAFNIUM 178.49	73 Ta TANTALUM 180.95	74 W TUNGSTEN 183.84	75 Re RHENIUM 186.21	76 Os OSMIUM 190.23	77 Ir IRIDIUM 192.22	78 Pt PLATINUM 195.08	79 Au GOLD 196.97	80 Hg MERCURY 200.59	81 Tl THALLIUM 204.38	82 Pb LEAD 207.2	83 Bi BISMUTH 208.98	84 Po POLONIUM [209]	85 At ASTATINE [210]	86 Rn RADON [222]
87 Fr FRANCIUM [223]	88 Ra RADIUM [226]		104 Rf RUTHERFORDIUM [263]	105 Db DUBNIUM [268]	106 Sg SEABORGIUM [271]	107 Bh BOHRIUM [270]	108 Hs HASSIUM [270]	109 Mt MEITNERIUM [278]	110 Ds DARMSTADTIUM [281]	111 Rg ROENTGENIUM [281]	112 Cn COPERNICIUM [285]	113 Nh NIHONIUM [286]	114 Fl FLEROVIUM [289]	115 Mc MOSCOVIUM [289]	116 Lv LIVERMORIUM [293]	117 Ts TENNESSINE [294]	118 Og OGANESSON [294]
			57 La LANTHANUM 138.91	58 Ce CERIUM 140.12	59 Pr PRASEODYMIUM 140.91	60 Nd NEODYMIUM 144.24	61 Pm PROMETHIUM [145]	62 Sm SAMARIUM 150.36	63 Eu EUROPIUM 151.96	64 Gd GADOLINIUM 157.25	65 Tb TERBIUM 158.93	66 Dy DYSPROSIUM 162.50	67 Ho HOLMIUM 164.93	68 Er ERBIUM 167.26	69 Tm THULIUM 168.93	70 Yb YTTERBIUM 173.05	71 Lu LUTETIUM 174.97
			89 Ac ACTINIUM [227]	90 Th THORIUM 232.04	91 Pa PROTACTINIUM 231.04	92 U URANIUM 238.03	93 Np NEPTUNIUM [237]	94 Pu PLUTONIUM [244]	95 Am AMERICIUM [243]	96 Cm CURIUM [247]	97 Bk BERKELIUM [247]	98 Cf CALIFORNIUM [251]	99 Es EINSTEINIUM [252]	100 Fm FERMIUM [257]	101 Md MENDELEVIUM [258]	102 No NOBELIUM [259]	103 Lr LAWRENCIUM [262]

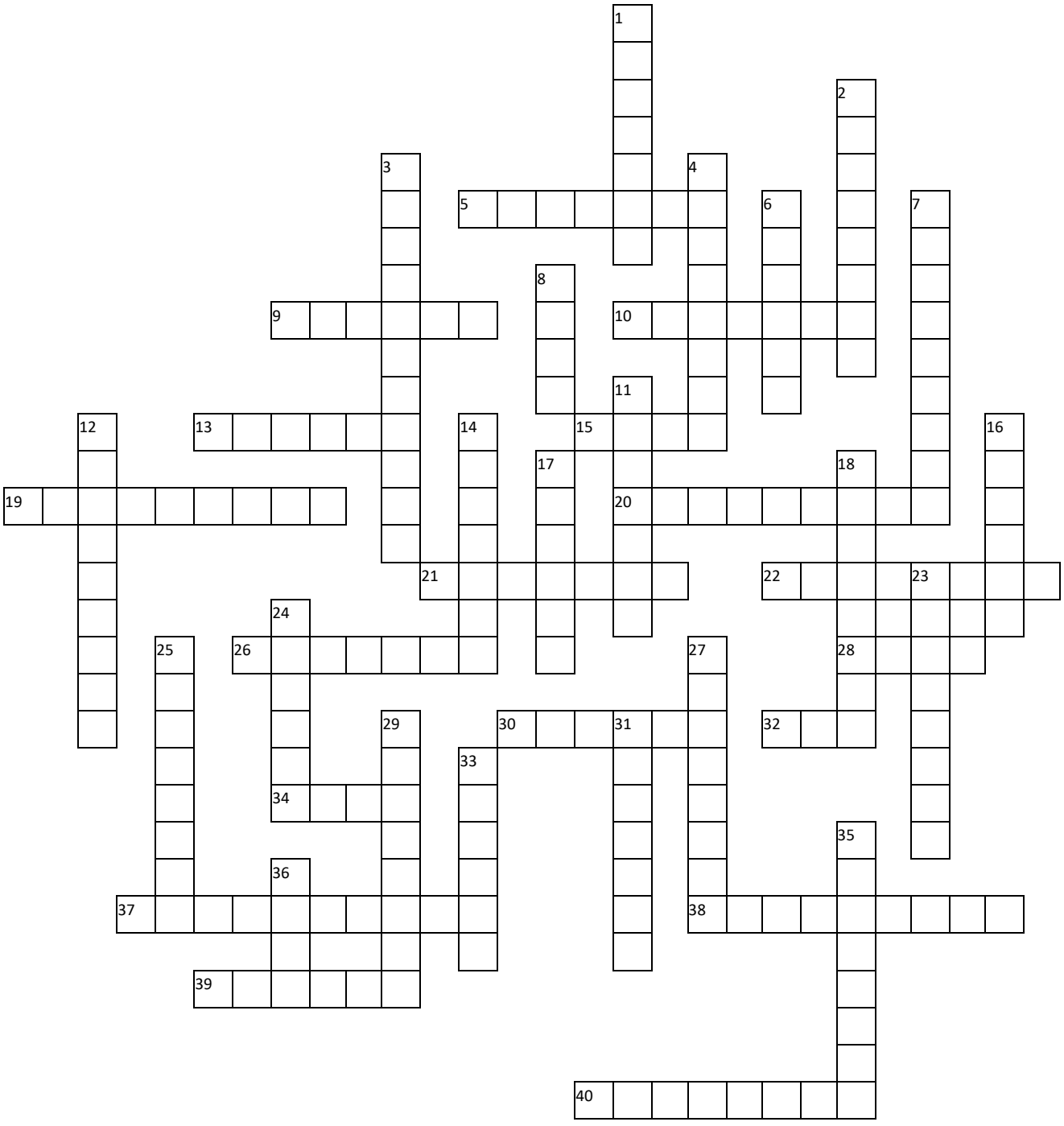
KEY

- ▢ = Solid at room temperature
- ● = Liquid at room temperature
- ☁ = Gas at room temperature
- ☢ = Radioactive
- ♙ = Artificially Made

http://education.jlab.org/

Last revised on October 28, 2016

CROSSWORD PUZZLE



CROSSWORD CLUES

Across

5 The only liquid metal at room temperature
9 A metal that conducts electricity very well and is the color of its name
10 Liquid halogen
13 Related by its name to the country of Argentina
15 A strong, hard magnetic silvery-gray metal
19 Atomic weight is 87.62 amu
20 Element most associated with bananas
21 A valley in northern California related to the technology industry
22 Where you might find Spain, France & Italy
26 The metal that is solid at room temperature but melts in your hand
28 Has 79 protons
30 This element's name is also a vibrant shade of blue
32 Element with only 3 letters in its name
34 Gas for bright, colored lighted signs
37 Named after a state adjacent to Georgia
38 Name that often gets mixed up with atomic number 12
39 One of the two components of table salt and often found in street lamps
40 Often made into a foil and useful because it does not conduct heat

Down

1 Has the atomic number 92
2 Has the chemical symbol "W"
3 Can glow white and often mixed up with the element with the symbol "K"
4 Not a metal but found on the left side anyway
6 Lightest of the noble gases
7 Radioactive element named after a debatable planet
8 A modern penny is covered in copper but made mostly of this metal
11 A noble gas and Superman's home
12 Imitation diamond
14 The Period 4 element found in milk, bones and chalk
16 A yellow nonmetal often associated with the smell of rotting eggs
17 Group 17, Period 5
18 Makes up 78% of Earth's atmosphere
23 Radioactive and named after Marie Curie's home country
24 When in the form of coal, it is used as fuel
25 A yellow-green poisonous gas, but its compounds are often found in swimming pools.
27 "I'm bulletproof." - Sia
29 Transition metal with only one letter in its chemical symbol
31 A common poison in the 20th century
33 Breathe in, not out
35 Considered the highest quality metal for jewelry
36 The chemical symbol does not have any of the same letters as the English name and large amounts of it in drinking water can be dangerous.

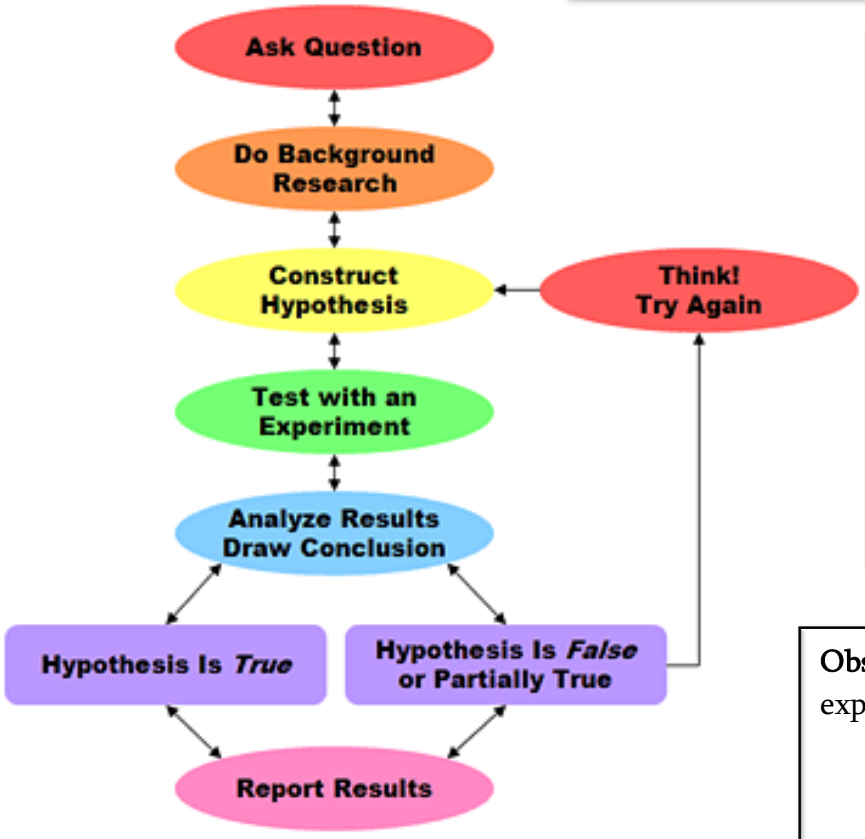
EXPERIMENTAL DESIGN

GOAL: Students should be able to identify parts of a scientific experiment.

4.1 Terminology Review

Hypothesis: Tentative explanation of observations, may or may not be supported by experimental data

Experiment: a procedure used to test a hypothesis



Constants: the factors in the experiment that stay the same

Variables: the factors in the experiment that change

- **Independent Variable (IV):** the variable that the experimenter changes
- **Dependent Variable (DV):** the variable that changes as a result of the experiment (usually what is measured)

Control: standard used as a comparison for

Observation: information obtained during an experiment

- **Qualitative Data:** collected using 4 senses
- **Quantitative Data:** collected using scientific instruments; numbers

Graph: a diagram showing the relation between variable quantities, typically of two variables, each measured along one of a pair of axes at right angles.

Model: visual, verbal, mathematical explanation of experimental data

Scientific Theory: a well-tested explanation for a broad set of observations but often is eventually modified

Scientific Law: a concise statement about a relationship in nature that is supported by many experiments and generally accepted to be true

4.2 Using the Terminology Review on page 11 and your general knowledge from previous science courses, answer these questions <u>using complete sentences</u>.

1. How does a hypothesis differ from a theory?

2. Describe what is needed for a hypothesis to develop into a theory.

3. Can a hypothesis that has been rejected be of any value to a scientist? Why or why not?

4. What is a scientific law, and how does it differ from a theory?

5. What are the parts of "the scientific method"?

6. Why does a scientist include a control in the design of an experiment?

7. What is the difference between an independent and a dependent variable in an experiment?

8. Why should an experiment be repeated?

4.3 Consider the following experiment:

Isabella wanted to test what would happen when she added various amounts of Chemical X to water.

She set up 3 test tubes in a test tube rack.

Isabella placed 5 mL of distilled water in each test tube. The temperature of the water in each test tube was 23ºC at the start of the experiment. The test tubes were the same size and made of Pyrex.

To the first test tube, she added no Chemical X.
To the second test tube, she added 2.5 grams of Chemical X.
To the third test tube, she added 5.0 grams of Chemical X.

She recorded both quantitative and qualitative data.
Her quantitative data were the temperature changes.
Her qualitative data were color changes.

Isabella's Data Table

Test Tube #	Initial Temperature	Final Temperature	Temperature Change	Initial Color	Final Color
1	23	23	0	Clear	Clear
2	23	23	0	Clear	Purple
3	23	23	0	Clear	Green

1. What is Isabella's independent variable?

2. What is Isabella's dependent variable(s)?

3. What is Isabella's control?

4. What are the constants in Isabella's experiment?

4.4 Identify the parts of the following 2 experiments:

Marie decides to design an experiment to evaluate the effectiveness of a "new and improved" chemical fertilizer on her bean plants. She places 5 bean plants in pots, using the same type of soil and the same size and type of pots. She labels them 1 through 5. Each week, for 6 weeks, she waters and fertilizes the plants as follows:

- Pot #1: 1 ml fertilizer mixed in 1 gallon of water
- Pot #2: 2 ml fertilizer mixed in 1 gallon of water
- Pot #3: 3 ml fertilizer mixed in 1 gallon of water
- Pot #4: 8 ml fertilizer mixed in 2 gallons of water
- Pot #5: 1 gallon of water only

As a result of their care over 6 weeks, the bean plants grow as follows:

- Pot #1: 5 inches of vine with 2 bean sprouts
- Pot #2: 8 inches of vine with 4 bean sprouts
- Pot #3: 16 inches of vine with 8 bean sprouts
- Pot #4: 12 inches of vine with 8 bean sprouts
- Pot #5: 5 inches of vine with 3 bean sprouts

Independent Variable _____

Dependent Variable _____

Control _____

Pierre is in a hardware store and notices fertilizers have three main ingredients: nitrogen, phosphorous and potassium. He wonders if increasing the initial amount of fertilizer given to his beloved cherry tomato plants will affect the production and size of tomatoes. He thinks that tomato plants with the highest initial amount of fertilizer will result in the greatest production.

Pierre begins by growing forty cherry tomato plants and divides them equally into four groups: A, B, C, and D. He then adds no fertilizer to group A, 1.0 g to group B, 1.5 g to group C and 2.0 g to group D. He gives all groups the same amount of sunlight and water. He massed each mature tomato to determine the total production. He also finds the average mass of the cherry tomatoes for each group. Data is shown in the table below.

	Group A	Group B	Group C	Group D
Total production mass	**300.0 g**	**350.2 g**	**455.0 g**	**400.2 g**
Average mass of cherry tomato	**5.0 g**	**3.2 g**	**7.0 g**	**5.0 g**

Independent Variable _____

Dependent Variable _____

Control _____

LAB SIMULATION

GOAL: Students should be able to use an online computer program to simulate scientific experimentation and to draw models as shown.

7.1 Using your computer, play (or download and play) the "Build an Atom" simulation at https://phet.colorado.edu/en/simulation/build-an-atom. Then choose "Atom" from the 3 simulations offered.

Build the following atoms or ions by manipulating the subatomic particles in the buckets. Be sure to be in "Orbits" Model mode, expand the Net Charge and Mass Number boxes, and check all three boxes in the bottom right corner (Element, Neutral/Ion, and Stable/Unstable). Then draw the models in detail in the boxes below.

4 Protons, 4 Neutrons, 4 Electrons

Model	Element Name & Symbol
	Net Charge
	Mass Number

This is an unstable neutral atom. What can you do to make it stable?

Based on this simulation, how do you think the Mass Number determined?

Based on this simulation, what determines the name of the element?

7 Protons, 7 Neutrons, 7 Electrons

Model	Element Name & Symbol
	Net Charge
	Mass Number

What can you do to turn this atom into a stable ion with a net charge of -3?

Model

Build a stable ion with a mass number of 11 and a charge of +3.

Model	Element Name & Symbol
	Net Charge
	Mass Number