Station 1: Chapter 2

1. How many significant figures in the following measurements
   a) 1.5000×10^{23} gold atoms
   b) 1,500 grams of gold
   c) 15 gold bars
   d) 0.00150 cm^3 of gold
   e) 10,050,000 cm of gold
2. Round the following to 4 significant figures
   a) 20,556 in
   b) 5.1598689 g
   c) 0.000568366 cm
   d) 2.3 L

Station 1: Chapter 2

3. Calculate and then round to the correct number of significant figures (include units).
   a) 1.5 g ÷ 20 mL
   b) 12.3265 in + 5.52 in
   c) 12.00 m x 5.9 m
   d) 1.856×10^3 g + 2.56×10^2 g
4. Convert the following to scientific notation
   a) 20,560 in
   b) 0.0005180 cm
5. Convert the following to normal notation
   a) 1.56×10^{-9} g
   b) 5.99×10^7 lbs.

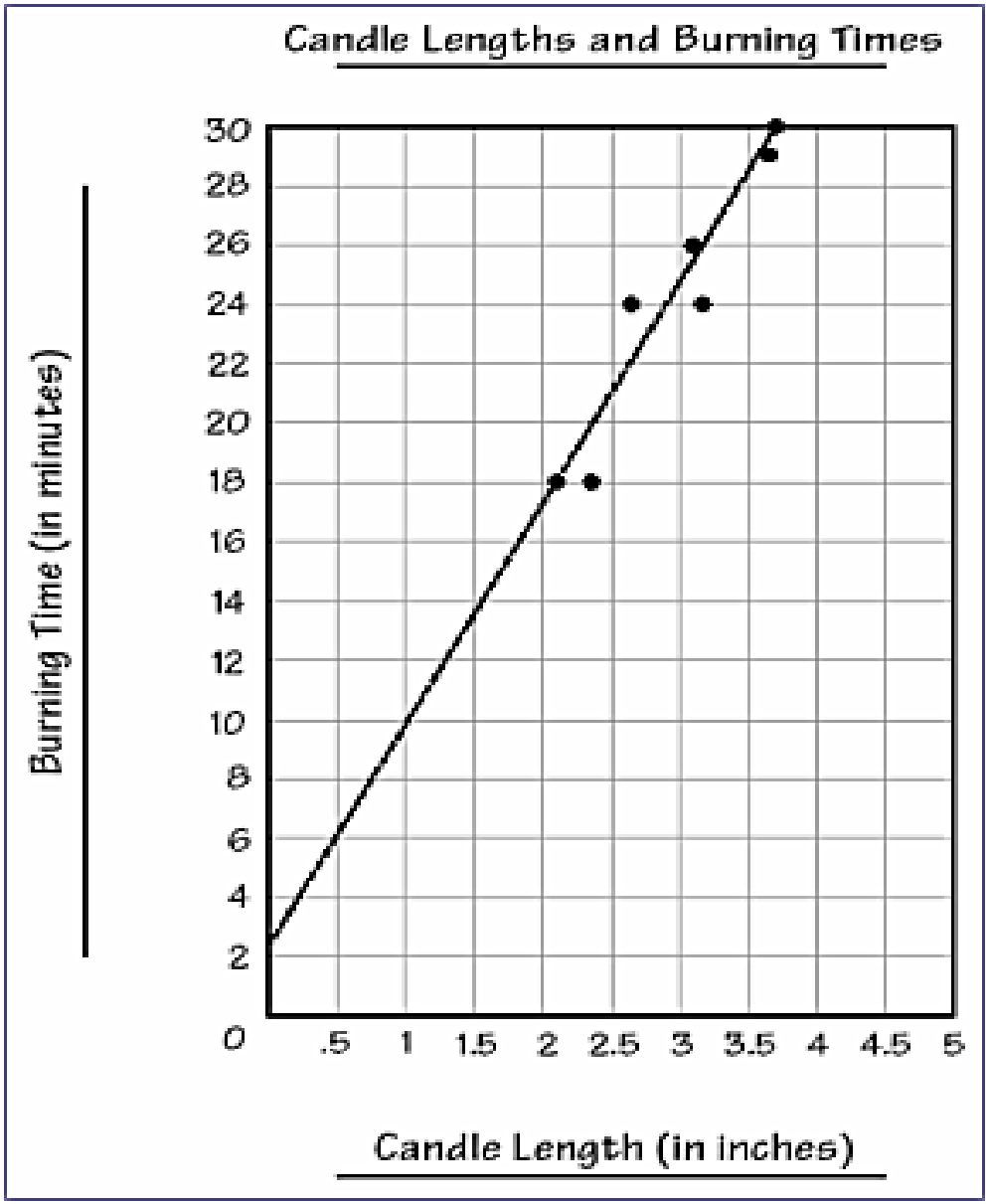
Station 1: Chapter 2

6. Convert 520 m to mm
7. Convert 9.5 g to kg
8. Several groups performed an experiment to find the mass of one mole of copper. The actual molar mass of copper is 63.55 grams. Use their data to determine which group's data has high precision but low accuracy.

Mass (g)	Group 1	Group 2	Group 3
Trial 1	***63.54***	***61.58***	***70.00***
Trial 2	***63.56***	***60.59***	***70.01***
Trial 3	***63.55***	***67.89***	***69.98***
Trial 4	***63.57***	***69.75***	***69.99***
Trial 5	***63.55***	***59.28***	***70.05***

Station 2: Matter, Scientific Method, and Density

1. Use the graph's best fit line (trend line) to determine the amount of time it will take to burn 3 inches of candle.
2. Using the graph, identify…
   a) Independent variable
   b) Dependent variable
   c) A possible controlled variable



Station 2: Matter, Scientific Method, and Density

3. A cup of gold colored metal beads was measured to have a mass 425 grams. To find the volume of the beads, they were placed in a 200 mL graduated cylinder containing 80.0 mL of water. The water level then rose to 128.0 mL. Use this information to determine the volume of the beads, calculate the density of the beads, and then given the following densities, identify the metal.

Gold: 19.3 g/mL
Copper: 8.86 g/mL
Bronze: 9.87 g/mL

Station 2: Matter, Scientific Method, and Density

4. Identify each of the following properties as chemical or physical
   a) Iron can rust
   b) Iron is more dense than aluminum
   c) Magnesium burns brightly when ignited
   d) Oil and water do not mix
   e) Mercury melts at -39°C
5. Identify each of the following changes as chemical or physical
   a) Crushing an aluminum can
   b) Melting an aluminum can to recycle it
   c) Aluminum combining with oxygen to form Al_2O_3
6. How do you separate salt, sand, and iron?

Station 3: Atomic Theory

Sample	Protons	Neutrons	Electrons
A	*11*	*11*	*10*
B	*7*	*7*	*7*
C	*8*	*8*	*10*
D	*10*	*11*	*10*
E	*7*	*8*	*7*
F	*8*	*8*	*8*

1. Identify the letter of the sample or samples in the table that fit the description
   a) Pair of Isotopes
   b) Cation(s)
   c) Anion(s)
2. What is the mass number for sample A
3. Identify the element for sample D
4. Write the isotopic notation for sample C

Station 3: Atomic Theory

5. Chlorine-35 and Chlorine-37 are naturally occurring isotopes for chlorine. If chlorine has an average atomic mass of 35.45 amu, which isotope occurs in greater abundance? (no calculation necessary)
6. An element has two naturally occurring isotopes ^{14}X and ^{15}X. ^{14}X has a mass of 14.00307 amu and a relative abundance of 99.63%. ^{15}X has a mass of 15.00011 amu and a relative abundance of 0.37%. Calculate the average atomic mass and identify the element.

Station 3: Atomic Theory (Honors)

7. Identify the following types of nuclear radiation

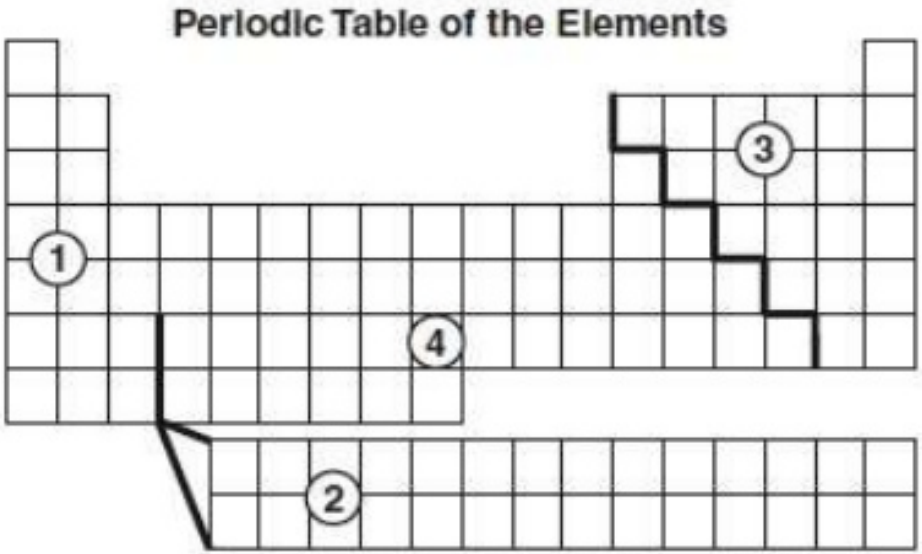
Particle Name	Notation
1)	$^{1}_{0}n$
2)	$^{4}_{2}He$ or $^{4}_{2}\propto$
3)	$^{0}_{0}\gamma$
4)	$^{0}_{-1}e$ or $^{0}_{-1}\beta$

8. Determine the missing particle

a) $^{139}_{57}La + ^{12}_{6}C \longrightarrow \square + 4\,^{0}_{1}n$

b) $^{238}_{92}U \longrightarrow ^{234}_{90}Th + \square$

Station 4: Periodic Table



Use the periodic table to the right to answer the following questions

1. In which numbered region would you find the nonmetals?
2. In which region are the lanthanide and actinides?
3. In which region are the alkali metals and alkaline earth metals?
4. Draw the orbital diagram for carbon
5. Write the full electron configuration for aluminum

Station 4: Periodic Table

6. Write the noble gas electron configuration for Niobium (#41)
7. Write the noble gas electron configuration for Osmium (#76)
8. Draw an electron dot/Lewis structure for arsenic

Honors Only

9. Which element has a higher electronegativity?
   a) F or Br
   b) Al or S
10. What is the trend in atomic radius?
    a) Across a period
    b) Down a group
11. Arrange the following elements from highest to lowest ionization energy (Si, F, Te, O)

Station 5: Bonding

1. What happens to the electrons in the following types of bonds?
   a) Metallic
   b) Ionic
   c) Polar covalent
   d) Nonpolar covalent
2. Which type of compounds are usually solids at room temperature?
3. Which type of compounds are able to conduct an electric current in solution?
4. Which type of compounds are made using only nonmetals?

Station 5: Bonding

5. Which type of compounds have low melting points?
6. Why are metals malleable, ductile, lustrous, and good conductors?
7. What is a polyatomic ion?
8. Which type of elements form cations?
9. What happens to an atom when it forms an anion?
10. Which electrons (valence or core) take part in bonding?
11. What are acids?

Station 6: Lewis Structures

Draw the following Lewis structures. Identify any exceptions.

a) HBr
b) BBr_3
c) SI_6
d) SeO_2
e) SiO_2
f) CF_4

Honors Only

Name the VSEPR shape for each of the molecules above and indicate if it is polar or nonpolar based on symmetry or outside atoms

Station 7: Mixed Naming

Name the following formulas:

1. $BaSO_4$
2. $(NH_4)_3PO_4$
3. PBr_5
4. $MgSO_4$
5. CaO
6. H_3PO_4 (aq)
7. MgO
8. SO_3
9. $Cu(NO_3)_2$
10. HI (aq)
11. NH_3
12. MnO
13. $AgNO_3$
14. As_2O_5
15. Fe_2O_3

Station 7: Mixed Naming

Write the formula for the following compounds:

16. hydrobromic acid
17. magnesium sulfide
18. iodine trichloride
19. ammonium hydroxide
20. calcium chloride
21. hydroselenic acid
22. iron(II) nitride
23. aluminum hydroxide
24. tin(II) fluoride
25. sulfur tetrachloride
26. mercury(II) iodide
27. sulfurous acid
28. lead(II) nitrate
29. water
30. chloric acid

Station 8: Reactions

Balance the following reactions and identify the type of reaction

1)___ $NaNO_3$ + ___ PbO → ___ $Pb(NO_3)_2$ + ___ Na_2O type:___

2)___ AgI + ___ $Fe_2(CO_3)_3$ → ___ FeI_3 + ___ Ag_2CO_3 type:___

3)___ $C_2H_4O_2$ + ___ O_2 → ___ CO_2 + ___ H_2O type:___

4)___ $ZnSO_4$ + ___ Li_2CO_3 → ___ $ZnCO_3$ + ___ Li_2SO_4 type:___

5)___ V_2O_5 + ___ CaS → ___ CaO + ___ V_2S_5 type:___

Station 8: Reactions

6)___$Mn(NO_2)_2$ + ___$BeCl_2$ → ___$Be(NO_2)_2$ + ___$MnCl_2$ type:___

7)___ AgBr + ___ $GaPO_4$ → ___ Ag_3PO_4 + ___ $GaBr_3$ type:___

8)___ H_2SO_4 + ___ $B(OH)_3$ → __ $B_2(SO_4)_3$ + ___ H_2O type:___

9)___ S_8 + ___ O_2 → ___ SO_2 type:___

10)___ Fe + ___ $AgNO_3$ → ___ $Fe(NO_3)_2$ + ___ Ag type:___

Station 8: Reactions (Honors Only)

Predict the products of the following reactions and balance

11. Zinc + copper (II) nitrate →
12. Chlorine + sodium iodide →
13. Silver + hydrochloric acid →
14. Write a balanced molecular equation, complete ionic equation, net ionic equation, and identify the spectator ions when aqueous solutions of iron (III) bromide and barium hydroxide react to produce solid iron (III) hydroxide and aqueous barium bromide.

Two Activity Series		
Metals	**Decreasing Activity**	**Halogens**
lithium	↓	fluorine
potassium		chlorine
calcium		bromine
sodium		iodine
magnesium		
aluminum		
zinc		
HYDROGEN		
copper		
silver		
gold		

Station 9: Moles and Formula Calculations

1) How many moles are in 40.0 grams of water?
2) How many grams are in 3.7 moles of Na_2O?
3) How many atoms are in 14 moles of cadmium?
4) How many moles are in 4.3×10^{22} molecules of H_3PO_4?
5) How many molecules are in 48.0 grams of NaOH?
6) How many grams are in 4.63×10^{24} molecules of CCl_4?
7) TNT (trinitrotoluene) is a white crystalline substance that explodes at 240 °C. Calculate the percent composition of TNT, $C_7H_5(NO_2)_3$.

Station 9: Moles and Formula Calculations (Honors only)

8) Calculate the empirical formula of a substance containing 26.0% nitrogen and 74.0% oxygen.

9) If the substance found in question number 8 has a molar mass of 324 g/mol, what is the molecular formula?

10) Analysis of a hydrate of iron (III) chloride revealed that in a 10.00 g sample of the hydrate, 6.00 g is anhydrous iron (III) chloride. Determine the formula of the hydrate and name it.

Station 1: (Answers)

Question 1

a) 5
b) 2
c) ∞
d) 3
e) 4

Question 2

a) 20,560 in
b) 5.160 g
c) 0.0005684 cm
d) 2.300 L

Question 3

a) 0.08 g/mL
b) 17.85 in
c) 71 m^2
d) 2.112×10^3 g

Question 4

a) 2.056×10^4 in
b) 5.180×10^{-4} cm

Question 5

a) 0.00000000156 g
b) 59,900,000 lbs.

6) 520,000 mm

7) 0.0095 kg

8) Group 3

Station 2: Answers

1. 25 minutes
2. Variables
   a) Candle length
   b) Burning Time
   c) Candle type, same room (atmospheric conditions)
3. Volume = 48.0 mL
   Density = 8.85 g/mL
   Identity = copper
4. Properties
   a) chemical
   b) physical
   c) chemical
   d) physical
   e) physical
5. Changes
   a) physical
   b) physical
   c) Chemical
6. First, use a magnet to remove the iron. Second, add water and run mixture through a filter. Finally, evaporate the water to crystallize the salt.

Station 3: Answers

1. Questions
   a) B and E
   b) A
   c) C
2. 22
3. Neon
4. ${}^{16}_{8}O^{2-}$
5. Chlorine-35
6. 14.01 amu (Nitrogen)

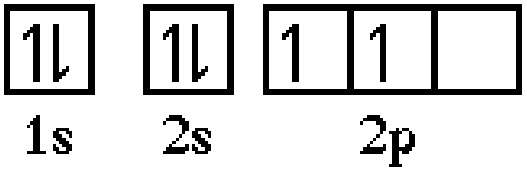
Honors Only

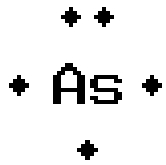
7. Radiation

Particle Name	Notation
1) neutron	${}^{1}_{0}n$
2) Alpha particle	${}^{4}_{2}He$ or ${}^{4}_{2}\propto$
3) Gamma radiation	${}^{0}_{0}\gamma$
4) Beta particle (electron)	${}^{0}_{-1}e$ or ${}^{0}_{-1}\beta$

8. Missing Particles
   a) ${}^{151}_{63}Eu$
   b) ${}^{4}_{2}\mathrm{He}$

Station 4: Answers

1. Region 3
2. Region 2
3. Region 1
4. 

5. $1s^2\ 2s^2\ 2p^6\ 3s^2 3p^1$
6. [Kr] $5s^2\ 4d^3$
7. [Xe] $6s^2\ 4f^{14}\ 5d^6$
8. 

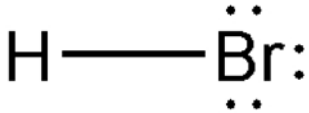
Honors Only

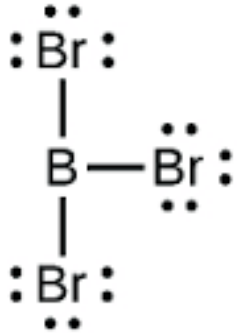
9. Higher EN
   a) F
   b) S
10. Trend in Atomic Radii
    a) There is a decrease in atomic radii as you move from left to right across a period.
    b) Atomic radii generally increase as you move down a group
11. F > O > Si > Te

Station 5: Answers

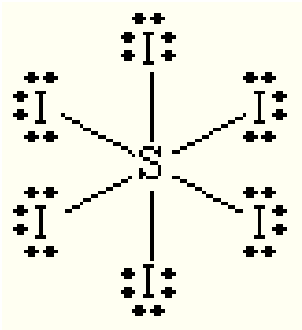
1. a) A sea of mobile electrons surround the positive metal ions
   b) The electrons are transferred
   c) Electrons are shared unequally
   d) Electrons are shared equally (usually between identical atoms)
2. Ionic and metallic
3. *ionic* (metallic do not dissolve)
4. covalent
5. covalent
6. Electron sea
7. A group of atoms with a charge
8. metals
9. Gains electrons and becomes negative
10. Valence
11. Polar covalent compounds that usually start with hydrogen in their formula

Station 6: Answers

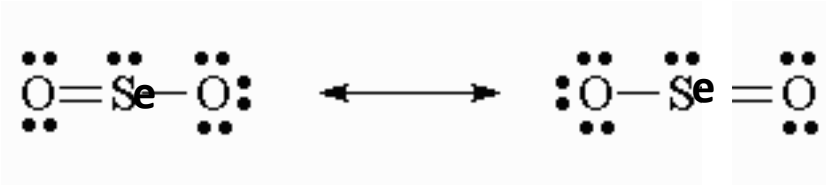
a) 

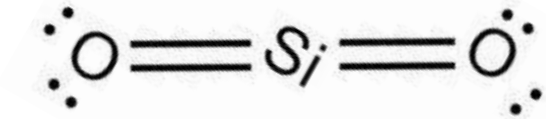
b) 

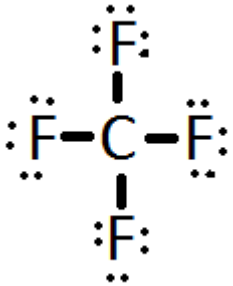
Electron deficient

c) 

Expanded Octet

d) 

e) 

f) 

Honors Only

a) Linear and Polar
b) Trigonal planar and nonpolar
c) Octahedral and nonpolar
d) Bent and polar
e) Linear and nonpolar
f) Tetrahedral and nonpolar

Station 7: Answers

1. Barium sulfate
2. Ammonium phosphate
3. Phosphorus pentabromide
4. Magnesium sulfate
5. Calcium oxide
6. Phosphoric acid
7. Magnesium oxide
8. Sulfur trioxide
9. Copper (II) nitrate
10. Hydroiodic acid
11. Ammonia
12. Manganese (II) oxide
13. Silver nitrate
14. Diarsenic pentoxide
15. Iron (III) oxide
16. HBr
17. MgS
18. ICl_3
19. NH_4OH
20. $CaCl_2$
21. H_2Se
22. Fe_3N_2
23. $Al(OH)_3$
24. SnF_2
25. SCl_4
26. HgI_2
27. H_2SO_3
28. $Pb(NO_3)_2$
29. H_2O
30. $HClO_3$

Station 8: Answers

1) 2 $NaNO_3$ + __PbO → __$Pb(NO_3)_2$ + __Na_2O (DR)

2) 6 AgI + __$Fe_2(CO_3)_3$ → 2 FeI_3 + 3 Ag_2CO_3 (DR)

3) __$C_2H_4O_2$ + 2 O_2 → 2 CO_2 + 2 H_2O (combustion)

4) __$ZnSO_4$ + __Li_2CO_3 → __$ZnCO_3$ + __Li_2SO_4 (DR)

5) __V_2O_5 + 5 CaS → 5 CaO + __V_2S_5 (DR)

7) 3 AgBr + __$GaPO_4$ →__Ag_3PO_4 +__$GaBr_3$ (DR)

8) 3 H_2SO_4 + 2 $B(OH)_3$ →__ $B_2(SO_4)_3$ + 6 H_2O (DR)

9) __S_8 + 8 O_2 → 8 SO_2 (synthesis and combustion)

10) __Fe + 2 $AgNO_3$ →__$Fe(NO_3)_2$ + 2 Ag (SR–cationic)

Station 8: Answers (Honors)

11) $Zn + Cu(NO_3)_2 \rightarrow Zn(NO_3)_2 + Cu$

12) $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$

13) $Ag + HCl \rightarrow$ No Reaction

14) Molecular:

$3Ba(OH)_2\ (aq) + 2FeCl_3\ (aq) \rightarrow 2Fe(OH)_3\ (s) + 3BaCl_2\ (aq)$

Complete Ionic:

$3Ba^{2+}(aq) + 6OH^{-}(aq) + 2Fe^{3+}(aq) + 6Cl^{-}(aq)$

$\rightarrow 2Fe(OH)_3(s) + 3Ba^{2+}(aq) + 6Cl^{-}(aq)$

Net Ionic:

$6OH^{-}(aq) + 2Fe^{3+}(aq) \rightarrow 2Fe(OH)_3(s)$ Spectators: $Ba^{2+}(aq)$ & $Cl^{-}(aq)$

Station 9: Answers

1) 2.22 mol H_2O
2) 230 g Na_2O
3) 8.4×10^{24} atoms Cd
4) 0.071 mol H_3PO_4
5) 7.23×10^{23} molecules NaOH
6) 1180 g CCl_4
7) 31.01 % C, 2.22%H, 18.50%N, 42.26%O

Honors

8) N_2O_5
9) N_6O_{15}
10) $FeCl_3 \cdot 6H_2O$ Name: Iron (III) chloride hexahydrate

Station 9: answers

1) How many moles are in 40.0 grams of water?

$$40.0 \text{ g } H_2O \times \frac{1 \text{ mole } H_2O}{18.01 \text{ g } H_2O} = 2.22 \text{ mole } H_2O$$

2) How many grams are in 3.7 moles of Na_2O?

$$3.7 \text{ moles } Na_2O \times \frac{62 \text{ g } Na_2O}{1 \text{ mole } Na_2O} = 230 \text{ g } Na_2O$$

3) How many atoms are in 14 moles of cadmium?

$$14 \text{ mole Cd} \times \frac{6.022 \times 10^{23} \text{ atoms Cd}}{1 \text{ mole Cd}} = 8.4 \times 10^{24} \text{ atoms Cd}$$

4) How many moles are in 4.3×10^{22} molecules of H_3PO_4?

$$4.3 \times 10^{22} \text{ molecules } H_3PO_4 \times \frac{1 \text{ mole } H_3PO_4}{6.022 \times 10^{23} \text{ molecules } H_3PO_4} = 7.1 \times 10^{-2} \text{ moles } H_3PO_4$$

Station 9: answers

5) How many molecules are in 48.0 grams of NaOH?

$$48.0 \text{ molecules NaOH} \times \frac{1 \text{ mole NaOH}}{40 \text{ g NaOH}} \times \frac{6.022 \times 10^{23} \text{ molecules NaOH}}{1 \text{ mole NaOH}}$$

$$= 7.23 \times 10^{23} \text{ molecules NaOH}$$

6) How many grams are in 4.63×10^{24} molecules of CCl_4?

$$4.63 \times 10^{24} \text{ molecules } CCl_4 \times \frac{1 \text{ mole } CCl_4}{6.022 \times 10^{23} \text{ molecules } CCl_4} \times \frac{153.8 \text{ g } CCl_4}{1 \text{ mole } CCl_4} = 1180 \text{ g } CCl_4$$

7)

$$\frac{84.07 \text{ g C}}{227.15 \text{ g TNT}} \times 100/100 = 37.01\% \text{ C}$$

$$\frac{5.05 \text{ g H}}{227.15 \text{ g TNT}} \times 100/100 = 2.22\% \text{ H}$$

$$\frac{42.03 \text{ g N}}{227.15 \text{ g TNT}} \times 100/100 = 18.50\% \text{ N}$$

$$\frac{96.00 \text{ g O}}{227.15 \text{ g TNT}} \times 100/100 = 42.26\% \text{ O}$$