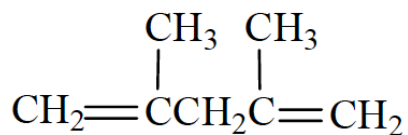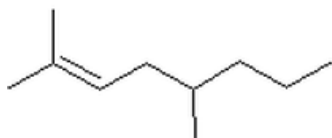# Final Exam Review

Unit 1: Organic Chemistry

Organic Chemistry I

Alkane & Formula	Structural Formula	Condensed Structural Formula	Carbon Skeleton Formula
	H–C–C–C–C–C–H (pentane structure with H's)		
Nonane C_9H_{20}			

Organic Chemistry II

Name the following hydrocarbons:

_____

$$CH_2{=}\overset{\overset{\displaystyle CH_3}{|}}{C}CH_2\overset{\overset{\displaystyle CH_3}{|}}{C}{=}CH_2$$
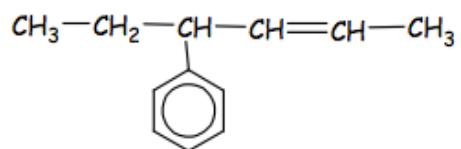
_____

Draw the following hydrocarbons:

3-methyl-4,5-diethyl-1-decene

3,3-diethyl-1,8-nonadiene

Organic Chemistry III

CH_3 (on cyclopropane ring)

CH_3 (on cyclopropane ring)
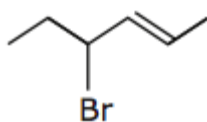
_____

$CH_3-CH_2-CH-CH=CH-CH_3$

_____
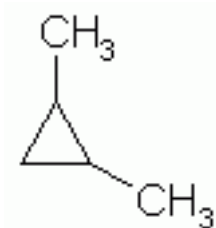
Draw the following hydrocarbon:

1-ethyl-1,3,3-tripropylcyclobutane

1,3-diethylcyclooctane

Organic Chemistry IV

Name the following hydrocarbon:


```
    H  OH  H   H   H
    |   |   |   |   |
H — C — C — C — C — C — H
    |   |   |   |   |
    H   H   H   H   H
```

_____

Br

_____
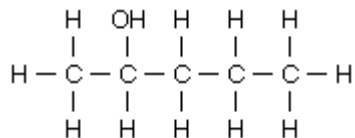
Draw the following hydrocarbon:

1,1-difluoro-2-hexanol

3-bromo, 2-chloropentane

Circle and identify at least 3 different functional groups in the following molecules:

<u>**Organic Chemistry V**</u>

Classify the following type of reactions as combustion, substitution, addition, elimination or polymerization:

_____

$$H_2C=CH_2 + H_2O \rightarrow CH_3-CH_2OH$$

_____

$$(CH_3)_3C-Br + OH^- \rightarrow (CH_3)_3C-OH + Br^-$$
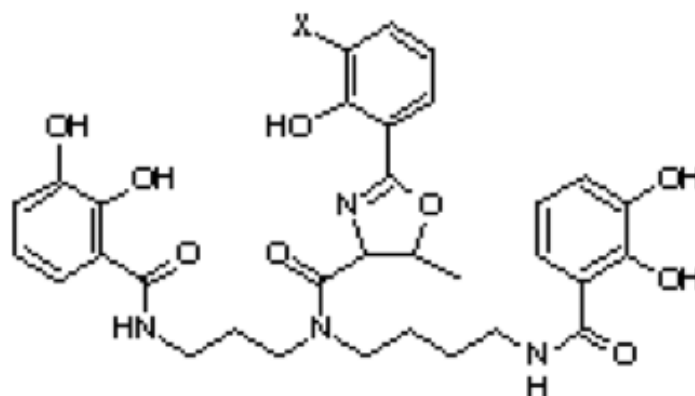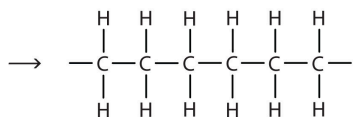
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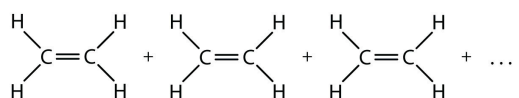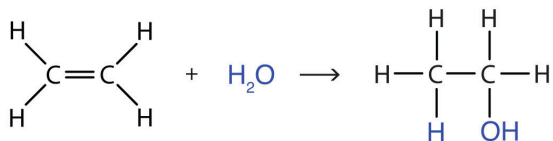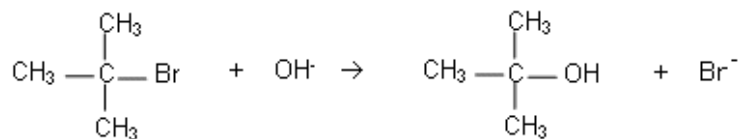
Unit 2: Atomic Theory

Atomic Theory I

Element Symbol	Element Name	Atomic Number	Mass Number	Number of protons	Number of neutrons	Number of electrons
Ti $^{4+}$		22				
	Cadmium					48

Calculate the average atomic mass of silver if 13 out of 25 atoms are silver-107 and 12 out of 25 atoms are silver-109.

Atomic Theory II-III

Element: **Oxygen**

Full Electron Configuration	Core Notation Orbital Diagram
Core Notation	Core Notation Orbital Diagram for O^{2-}

Element: **Iron**

Full Electron Configuration	Core Notation Orbital Diagram
Core Notation	Core Notation Orbital Diagram for Fe^{3+}

Atomic Theory IV

Fill in the blanks for the following table:

Molecule	Lewis Diagram	Notation	Shape
	:F: | :F—Kr—F: | :F:		Name: Diagram:
			Name: Square pyramidal Diagram:

Atomic Theory V

Arrange the following from largest atomic radius to smallest atomic radius:
   a) Ca, Ba, Mg, Sr

   b) Explain how you arranged the above

Arrange the following from highest ionization energy to lowest ionization energy:
   a) Zr, Ag, Mo, Lu

   b) Explain how you arranged the above

Arrange the following from most electronegative to least electronegative:
   a) Ca, Mg, B, Be

   b) Explain how you arranged the above

Use the following particles to answer the questions below:

Chemical Name:	Magnesium atom	Phosphorus ion	Fluorine atom	Calcium atom	Potassium ion
Chemical Formula:					

   a) Rank the particles in atomic size from smallest to biggest (you must use **chemical formulas** and *not* the chemical name):
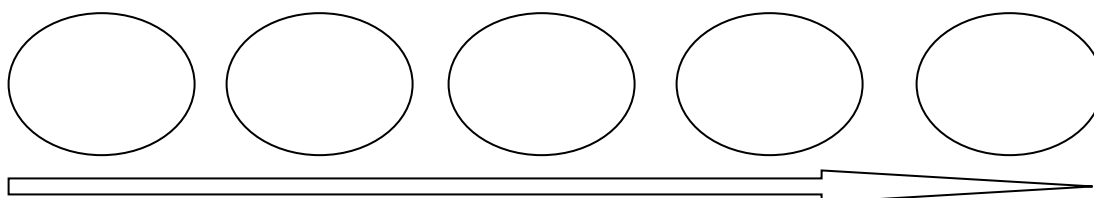
   b) Which of the particles would have the greatest electronegativity?   _____

   c) Which of the particles would have the greatest ionization energy?   _____

Determine the type of bond that forms between the following atoms

      a) Na and Cl

      b) H and O

      c) Br and Br

Mole I-III

How many moles are in 7.50×10^{24} atoms of lithium?

How many molecules are in 0.23 mol of KCl?

What does 2.65 mol of sodium chloride weigh?

How many carbon atoms are in 72.6 g of propane (C_3H_8)?

Mole IV

How many mol are in 0.72 L of 2.5 M NaOH?

What would be the resulting molar concentration if 1.0 g KCl was dissolved in 2.0 L of water?

What mass of sodium hydroxide would you need to prepare 2.0 L with a concentration of 0.010 M?

<u>**Mole V**</u>

A sample of caffeine is analyzed and found to contain 1.4844 g C, 0.1545 g H, 0.4947 g O and 0.8661 g N. It was determined that the molar mass is 194.19 g/mol. What is the molecular formula of caffeine?

Find the percent composition of each element by mass of ammonium phosphate.

<u>**Unit 4: Stoichiometry**</u>

<u>**Stoichiometry I-II**</u>

Write out a complete balanced chemical formula:

a) Magnesium oxide reacts with chlorine gas to form magnesium chloride and oxygen gas.

b) Water decomposes into its elements.

Lithium metal reacts violently with water

a) If 4.37 moles of hydrogen gas are produced, how many moles of lithium metal reacted?

b) How many grams of lithium is this?

Stoichiometry III

Sodium metal reacts with the oxygen in the air to produce sodium oxide

   a) Write out the balanced equation below:

   b) If 9.11 mol of sodium reacted at STP, how many liters of oxygen reacted?

   c) If 2.3L of 0.45M sodium reacted, how many grams of sodium oxide were produced?

The formula for benzoic acid is $C_7H_6O_2$

   a) What is the balanced combustion reaction?

   b) What volume of 3.8g of 1.72M $C_7H_6O_2$ is required for this reaction?

Stoichiometry IV

Given the balanced reaction:

$$4\ FeS + 7\ O_2 \rightarrow 2\ Fe_2O_3 + 4\ SO_2$$

A 439.5 g sample of FeS is mixed with 256.0 g of O_2.

a) Identify the limiting reactant.

b) Calculate the mass of each product that is produced.

c) Calculate the mass of the excess reactant left over.

Stoichiometry V

Consider the reaction:

$$\_\_\_Al + \_\_\_O_2 \rightarrow \_\_\_Al_2O_3$$
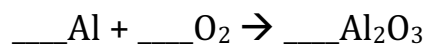
a) A 20.0 g sample of Al reacts to produce 32.7g of Al_2O_3. What is the percentage yield of the reaction?

b) If this reaction has a percentage yield of 74.2%, what mass of Al_2O_3 can be produced with 50.0g of Al?

Consider the reaction:

$$\_\_\_KO_2 + \_\_\_CO_2 \rightarrow \_\_\_K_2CO_3 + \_\_\_O_2$$

a) A 30.0g sample of KO_2 is 59.3% pure. What mass of K_2CO_3 can the sample produce?

b) Another sample of KO_2 with a mass of 150.0g is reacted so as to produce 89.7g of K_2CO_3. What is the percentage purity of KO_2?

<u>**Unit 5: Solution Chemistry**</u>

<u>**Solution I**</u>

Consider a 500. mL solution made by dissolving 6.7 g of $CuSO_4$ in water.

    a) What is the molarity of this solution?

    b) If this solution (from the above question) was then diluted by adding 250 mL of water, what is the final concentration?

When 350.0 mL of 0.250 M $MgCl_2$ is boiled down to a final volume of 275.0 mL, what is the molarity of the $MgCl_2$ in the resulting solution?

<u>**Solution II**</u>

Write the balanced ionization equation for the following solutes in water:

    a) Na_3PO_4

    b) BaF_2

250.0 mL of 0.60 M HCl is added to 300.0 mL of 1.0 M HBr. What is the final concentration of each ion in solution?

Write a formula equation, complete ionic equation and net ionic equation for the following reactions:

    a.   Potassium phosphate and copper (II) chloride

    b.   Silver nitrate and sodium phosphate

2. A solution contains the following ions. Using a flow chart, show what compounds could be added and in what order to separate these ions.

$$OH^-, S^{2-}, SO_4^{2-}$$
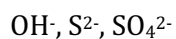
Solution III

Consider the following results from a titration lab.

3.00 g of NaOH was dissolved to make a 100. mL solution
Below is the volume of the NaOH solution needed to neutralize 10.0 mL H_3PO_4.

	Trial #1	Trial #2	Trial #3
Initial reading of burette (mL)	0.00	12.45	24.94
Final reading of burette (mL)	12.45	24.94	37.36

What is the concentration of the standardized solution of NaOH?

What was the average volume of NaOH was needed?

What is the concentration of the acid?