EXAM 2

***Recommended REVIEW***

* Vocabulary
* All Guiding Questions, all embedded i-clicker Powerpoint questions, Webassign questions, and worked examples.

Example:

***TED: Mole / Guiding Questions***
***How big is a mole? (calculations)***
*Atoms / Compounds / Molecular Formulas*

*Practice Questions*

Iodine is found in sea water and plays an important biochemical role within the thyroid gland in humans. In sea water the form of iodine is the ion, which consists of 53 protons and 54 electrons. Therefore the ion is….

a. positive and called an anion.
b. positive and called a cation.
c. negative and called an anion.
d. negative and called a cation.

Use the Periodic Table to determine the formula of magnesium nitride.

a. $Mg_3N$
b. $Mg_3N_2$
c. $MgN$
d. $Mg_2N_3$
e. $MgN_2$

Butane, $C_4H_{10}$, burns to give carbon dioxide and water. What are the coefficients in the balanced equation for the reaction?

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$$\_\_\ C_4H_{10}(g) + \_\_\ O_2(g) \xrightarrow{\text{spark}} \_\_\ CO_2(g) + \_\_\ H_2O(g)$$

Calculate the molar mass (Molecular Weight) of $(NH_4)_3PO_4$

a. 113 g/mol
b. 121 g/mol
c. 149 g/mol
d. 182 g/mol

Calculate the number of moles silver nitrate, $AgNO_3$ (molar mass = 169.9g/mol), in 126 g of silver nitrate.

Select the formula for a compound that has 8 carbon atoms, 15 hydrogen atoms, 3 nitrogen atoms, and 3 oxygen atoms.

a. $C_8H_{15}N_3O_3$ b. $C_{15}H_8N_3O_3$ c. $C_{14}H_3N_3O$ d. $(C_8H_{15}NO)_3$

Strychnine has received notoriety in murder mysteries as a poison. It has a formula of $C_{21}H_{22}N_2O_2$. How many moles of carbon atoms and oxygen atoms are there in one mole of strychnine?

a. 21 mol of carbon atoms and 1 mol of oxygen atoms
b. 21 mol of carbon atoms and 2 mol of oxygen atoms
c. 22 mol of carbon atoms and 21 mol of oxygen atoms
d. 2 mol of carbon atoms and 2 mol of oxygen atoms

The formula for the illegal drug cocaine is $C_{17}H_{21}NO_4$ (molar mass = 303.4 g/mol). What is the percentage of oxygen in the compound?

(a) 4.62%
(b) 5.27%
(c) 6.99%
(d) 21.1%
(e) 67.3%

How many valence electrons does aluminum have and which Nobel gas is isoelectronic with the aluminum ion?

a. 2, He
b. 2, $N_2$
c. 3, Ne
d. 3, Ar
e. 3, Xe

Place the following elements in order of **increasing** electronegativity: Be, Mg, Sr, Ca

a) Be < Mg < Sr < Ca
b) Be < Ca < Sr < Mg
c) Sr < Ca < Mg < Be
d) Sr < Mg < Ca < Be

Predict the polarity of methyl alcohol, $CH_3OH$, and methane, $CH_4$. The geometry about the carbon atom is tetrahedral, and bent about the oxygen atom.

a) Methyl alcohol is polar, and methane is nonpolar.
b) Both are nonpolar.
c) The polarities cannot be predicted.
d) Methyl alcohol is nonpolar, and methane is polar.
e) Both are polar.

Which physical state of matter exhibits the highest kinetic energy?

a) solid state
b) liquid state
c) gaseous state
d) metamixt state

The molar mass of iron is:

a) 12 grams/mole
b) $6.02 \times 10^{23}$ grams/mole
c) 26 grams/mole
d) 55 grams/mole

Which of the following statements about chemical formulas is FALSE?

a) The subscripts represent the relative number of each type of atom in the compound.
b) The subscripts represent the relative mass of each type of atom in the compound.
c) The subscripts do not change for a given compound.
d) Different compounds made of the same elements have different subscripts.
e) All of the statements are true.

Atoms in molecules auto-arrange themselves in 3 dimensions to maximize the _____ of opposite charges between the atoms and minimize the _____ of like charges of the atoms, to produce the best favorable arrangement of all atoms in a molecule illustrated.

Which two that best complete the statement?

a) distance apart
b) proximity
c) attraction
d) repulsion
e) strength
f) weakness

Samantha prepared a 1.0 M (mol/L) solution of $CaCl_2$. Which action(s) will increase the concentration of the solution?

(1) Add more $CaCl_2$
(2) Evaporate water
(3) Drain solution

a. (1) only
b. (1) and (2)
c. (2) and (3)
d. (1) and (3)
e. (1), (2), and (3)

Methane gas ($CH_4$), on complete combustion in air, produces:

1. $CO_2$
2. $H_2$
3. $H_2O$

a. 1 and 2 only
b. 1 and 3 only
c. 2 and 3 only
d. All of 1 and 2 only

What type of reaction is the generic equation $A + B \rightarrow AB$?

a. synthesis/combination
b. decomposition
c. single displacement
d. double-displacement
e. none of the above

How many grams of $Ca(NO_3)_2$, Molar Mass = 164 g/mol, can be produced by reacting 0.40 moles of $HNO_3$ with 7.40 g of $Ca(OH)_2$, Molar Mass = 74 g/mol?

a. 10.2 g
b. 16.4 g
c. 32.8 g
d. 65.6 g
e. 7.40 g

What type of reaction is the generic equation A + BC → AC + B?

a. synthesis/combination
b. decomposition
c. single displacement
d. double-displacement
e. none of the above

When the equation, ___$O_2$ + ___$C_6H_{14}$ → ___$CO_2$ + ___$H_2O$ is balanced, the coefficient of $O_2$ is:

a. 3
b. 10
c. 19
d. 38
e. none of the above

***True (A) / False (B)***

In the Periodic Table, the relative size of atoms increases across a row and down a column.

In the Periodic Table, electronegativity of atoms increases across a row and decreases down a column.

Matter and energy cannot be created or destroyed, but they can inter-convert from either, energy to matter, or matter to energy.

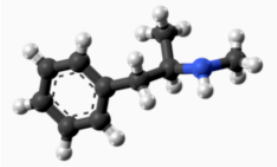
Plants remarkably combine two molecules using enzyme catalysts found in chlorophyll to form molecules of sugar and diatomic oxygen molecules.

The burning of methane or any hydrocarbon, such as octane, involves both breaking bonds and forming bonds.

Atoms having the same electronegativities are expected to form no bonds.

The change of state from a liquid to a gas requires energy from the surroundings.

Enzymes have no effect on biological reactions.



***A structure of methamphetamine is shown above.***
It has a molecular formula of $C_{10}H_{14}O$

A 1.0 M solution of sodium chloride is a weaker electrolyte solution than a 1.0 M solution of calcium chloride.

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***REVIEW ALL resources in re: 3-d Shapes & Lewis Structures***

One example:
a) Draw a Lewis structure for a methane molecule, $CH_4$,

b) Provide the total number of ***valence*** electrons in the molecule.

c) Provide the total number of ***free pairs*** of electrons.

d) Identify the molecular shape of the molecule.

e) Is the C-H bond: ionic, covalent or polar covalent?

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*Be well versed in covalent bonding, Lewis structures, and electronic & molecular shapes*, particularly of ammonia, $NH_3$, water, $H_2O$, and methane, $CH_4$.

*Various mathematical problems requiring dimensional analysis:*

The kidneys of a normal adult male filter 125 mL of blood per minute. If the body of an adult male has 1.50 gallons of blood, how many times has his blood supply been filtered in one day?

When one gram of methane gas, $CH_4(g)$, is burned, 55.5 kJ of heat are released. How many pounds of methane gas must be burned to release $2.686 \times 10^3$ kJ of heat?

There are about $1. \times 10^5$ chemical reactions per second in each of the 10 billion nerve cells in the brain. How many chemical reactions take place in a day in a single nerve cell?

How much energy (kJ) is produced from the complete combustion of one gallon of isooctane ($C_8H_{18}$, *gasoline*), d= 0.69 g/mL? The heat of reaction, that is, the amount of energy produced per mole of isooctane, is –5,460.0 kJ/mol.