EXAM 2 Practice

Recommended REVIEW

* Vocabulary

* All Guiding Questions, all i-clicker Discussion questions, Webassign homework, worked inclass & in-lab examples & calculations.

All resources in re: 3-d Shapes & Lewis Structures

Be well versed in covalent bonding, Lewis structures, and electronic & molecular shapes, particularly of ammonia, CO_2 , NH_3 , water, H_2O , and methane, CH_4 .

The following practice questions contain a selection of problems, which resemble the type of questions on Exam 2. They are not comprehensive, but only a representation for you to measure your level of understanding and time management skills. There will be 80 minutes alotted for the Exam, which is structured on the same basis as Exam 1: 25 M/C, 10 T/F, matching, fill-in and quantitative math problems.

Answers and solutions are not provided to the practice questions. Please attempt the questions, and see me if you are stuck on any of them after you have tried to answer them.

Practice Questions

The ion ⁴⁵Sc³⁺ has

A) 24 electrons, 21 protons and 24 neutrons

B) 18 electrons, 21 protons and 24 neutrons

- C) 24 electrons, 24 protons and 21 neutrons
- D) 18 electrons, 24 protons and 21 neutrons

In which groups do all the elements have the same number of valence electrons?

- A) K, Ca, Ar, S
- B) Na, Mg, S, Cl
- C) Na, K, Rb, Cs
- D) Li, Be, B, C
- E) None of these

The electron configuration for the barium atom is:

- A) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^2$
- B) [Xe] $6s^2$
- C) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^1$
- D) $1s^22s^22p^63s^23p^64s^2$
- E) none of these

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

- a. Mg₃N
- b. Mg_3N_2
- c. MgN
- d. Mg_2N_3
- e. MgN_2

An ionic compound containing phosphorus and an unknown metal "M", which has more than one possible oxidation number, has a molecular formula "M"P with a ratio of one metal ion to one phosphorus ion. The oxidation number of the metal in the compound is:

- a. +1
- b. -1
- c. +2
- d. -3
- e. +3

In comparing a balloon containing 25 grams of helium to a balloon containing 25 grams of neon, which one of the following statements is TRUE?

A) Each balloon has an equal number of atoms.

B) The helium balloon has more atoms.

- C) The neon balloon has more atoms.
- D) This scenario cannot happen because gases have no mass.
- E) none of the above

Calculate the molar mass (Molecular Weight) of (NH₄)₃PO₄

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

An unknown compound XY has an X- to-Y mass ratio of 4.0 (X/Y = 4.0). If decomposition of compound XY gives 12.0 grams of X, then how many grams of Y must form?

- a. 48.0 grams
- b. 12.0 grams
- c. 4.0 grams
- d. 3.0 grams
- e. none of the above

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, N₂
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

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.

The name *trisodium phosphate* is incorrect for the compound Na₃PO₄ because:

A) this compound should be called trisodium monophosphate.

B) the sodium has a negative 3 charge.

- C) you cannot use a prefix for the first element in a molecular compound.
- D) you cannot use a prefix for the first element of an ionic compound.

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

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	a. (1) only
(2) Evaporate water	b. (1) and (2)
(3) Drain solution	c. (2) and (3)
	d. (1) and (3)
	e. (1), (2), and (3)

Methane gas (CH₄), on complete combustion in air, produces:

- 1. CO₂
- 2. H₂
- 3. H₂O
- a. 1 and 2 only
- b. 1 and 3 only
- c. 2 and 3 only
- d. All of 1 and 2 only

Identify the double displacement reactions among the following:

- 1. $KCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + KNO_3(aq)$
- 2. Na₂SO₄(aq) + BaCl₂(aq) \rightarrow BaSO₄(s) + 2NaCl(aq)
- 3. $H_2SO_4((aq) + 2NaOH(aq) \rightarrow Na_2SO_4((aq) + 2H_2O(l))$

A) 1 and 2 only
B) 1 and 3 only
C) 2 and 3 only
D) All of 1, 2, and 3
E) None of 1, 2, and 3

What are the coefficients for the following reaction when it is properly balanced?

____potassium iodide + ____lead (II) acetate \rightarrow ____lead (II) iodide +____potassium acetate

A) 2, 1, 1, 1 B) 2, 1, 1, 2 C) 3, 2, 2, 1 D) 1, 1, 2, 2 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 HNO₃ 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 $A + BC \rightarrow AC + B$?

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

When the equation, $__O_2 + __C_6 H_{14} \rightarrow __CO_2 + __H_2O$ is balanced, the coefficient of O₂ 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.

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

There are 3 carbon atoms in one molecule of aluminum carbonate.

The mass of 2.0 moles of H₂O is greater than the mass of 1.0 mole of CO₂

One mole of I₂ has more atoms in it than one mole of Na.

One mole of lead(II) nitrate contains six moles of oxygen atoms.

The chemical formula CuBr₂ indicates that this compound is composed of 1 gram of copper and 2 grams of bromine.

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

The molar mass of a compound serves as a conversion factor between grams and moles.

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.

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

Match the ion with its number of electrons.

$_Ca^2$	54
$_$ Na ⁺	36
$_$ Se ²⁻	28
$_{2} Zn^{2+}$	10
I	18

Define:

Solute: Solvent: Solution: Cation: Anion: Condensation: Vaporization: Fermentation: Decomposition: Synthesis: Precipitation: Limiting Reactant (Reagent):

a) Draw a Lewis structure for a methane molecule, CH₄,



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?

Provide the coefficients for the following reactions when they are properly balanced.

____nitrogen monoxide + ____carbon monoxide \rightarrow ____nitrogen + ____carbon dioxide

Consider various possible mathematical problems requiring dimensional analysis:

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

Butane, C_4H_{10} , burns to give carbon dioxide and water as represented in the following balanced equation.

spark 2 C₄H₁₀(g) + 13 O₂(g) \rightarrow 8 CO₂(g) + 10 H₂O(g)

- a) What is the theoretical amount of CO_2 that could be produced from burning 580. grams of butane with an excess of oxygen?
- b) If a theoretical yield of CO₂ were 1.76 kg and 1,600. grams were obtained, what is the % yield?
- c) If 580. grams of butane were mixed with 1.04 kg of oxygen and ignited, is all of the butane burned? If not, what remains and how much is there? Show a limiting reactant calculation to support your answer.

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?

How many grams of potassium chloride, KCl, are contained in 5.0 mL of an injectable 15% (weight:volume) pharmaceutical i.v. solution of potassium chloride that is used to treat hypokalemia, a condition which occurs when blood potassium levels are too low.?

Potassium chloride is commonly used to treat electrolyte imbalances. How much must potassium chloride must be accurately weighed to prepare 250.00 mL of a 0.200 M solution of potassium chloride?

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 10⁵ 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?