Quiz 4(Chemistry 112) **NAME**__________________________________

1) Consider the following Redox Reaction:

$$As_2O_3\,(s) + NO_3^-\,(aq) \rightarrow H_3AsO_4\,(aq) + NO\,(g) \quad \text{(in acidic solution)}$$

Using the rules for oxidation number;

a) define the **oxidation states/number** for each element and
b) determine **define what is being oxidized** and what is being **reduced**
c) **How many electrons** are being transferred.
d) Separate the equation into it's **two redox half cell reactions** (oxidation and reduction parts)
e) Write the **balanced equation** in an acidic environment. That is use H+ or H3O+ for supplying/balancing H's and the waters to finally balance O's

$\boxed{\begin{array}{l} As_2O_3 :: (+3)_2(-2)_3 \\ H_3AsO_4 :: (+1)_3(+5)(-2)_4 \\ NO_3^- :: (+5)(-2)_3^- \\ NO :: (+2)(-2) \end{array}}$

$$3\left(\overset{+3}{As_2}O_3 \xrightarrow{4e} 2H_3\overset{+5}{As}O_4 + 4e\right)$$

oxidation

$$4\left(3e^- + \overset{+5}{N}O_3^- \xrightarrow{3e} \overset{+2}{N}O\right)$$

reduction

$$3As_2O_3 + 4NO_3^- \xrightarrow{12e} 6H_3AsO_4 + 4NO$$

21 O + ØH   28 O + 18H

Add $7H_2O$ to balance Oxygen; Add 4H+ (Left) to bal. H

$$4H^+ + 7H_2O + 3As_2O_3 + 4NO_3^- \longrightarrow 6H_3AsO_4 + 4NO$$

2) Using the below Table which defines the relative oxidation driving force of a collection of metals:

TABLE 4.5 Activity Series of Metals in Aqueous Solution

Metal	Oxidation Reaction
Lithium	$Li(s) \longrightarrow Li^+(aq) + e^-$
Potassium	$K(s) \longrightarrow K^+(aq) + e^-$
Barium	$Ba(s) \longrightarrow Ba^{2+}(aq) + 2e^-$
Calcium	$Ca(s) \longrightarrow Ca^{2+}(aq) + 2e^-$
Sodium	$Na(s) \longrightarrow Na^+(aq) + e^-$
Magnesium	$Mg(s) \longrightarrow Mg^{2+}(aq) + 2e^-$
Aluminum	$Al(s) \longrightarrow Al^{3+}(aq) + 3e^-$
Manganese	$Mn(s) \longrightarrow Mn^{2+}(aq) + 2e^-$
Zinc	$Zn(s) \longrightarrow Zn^{2+}(aq) + 2e^-$
Chromium	$Cr(s) \longrightarrow Cr^{3+}(aq) + 3e^-$
Iron	$Fe(s) \longrightarrow Fe^{2+}(aq) + 2e^-$
Cobalt	$Co(s) \longrightarrow Co^{2+}(aq) + 2e^-$
Nickel	$Ni(s) \longrightarrow Ni^{2+}(aq) + 2e^-$
Tin	$Sn(s) \longrightarrow Sn^{2+}(aq) + 2e^-$
Lead	$Pb(s) \longrightarrow Pb^{2+}(aq) + 2e^-$
Hydrogen	$H_2(g) \longrightarrow 2H^+(aq) + 2e^-$
Copper	$Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^-$
Silver	$Ag(s) \longrightarrow Ag^+(aq) + e^-$
Mercury	$Hg(l) \longrightarrow Hg^{2+}(aq) + 2e^-$
Platinum	$Pt(s) \longrightarrow Pt^{2+}(aq) + 2e^-$
Gold	$Au(s) \longrightarrow Au^{3+}(aq) + 3e^-$

Ease of oxidation increases

Lis

List

a) List THREE METALS that will react with BOTH Acid and $CrCl_3$ (Cr^{+3})

Any metal ABOVE and INCLUDING Zn^0

b) List THREE METALS CATIONS that will NOT react with Lead.Metal

Any Cation BELOW + INCLUDING H+ WILL

Thus

Any Cation ABOVE WILL NOT INCLUDING Sn^{+2}

3) $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g) \quad \Delta H = -802$ kJ,

Using the Bond Enthalpies

O=O	485 kJ	C-C	346 kJ
C=O	799 kJ	OH	463 kJ
C-H	413 kJ	C-O	363 kJ

Determine the above ΔH_{rxn} for the combustion of Methane. Why is it different from above Enthalpy determined by experimental data.

$\sum$ broken − $\sum$ formed
$4(CH) + 2(O{=}O) - [2(C{=}O) + 4(OH)]$
$4 \cdot 413 + 2 \cdot 485 - [2 \cdot 799 + 4 \cdot 463]$
-828 kJ

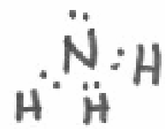
Difference due to use of AVERAGE Bond Energies.

Show the **Lewis Dot** Stuictures ; VSEPR geometries(structure/angles); and Hybridization for central atoms for the following Molecules/Ions

CO_2

2 domains (2 double bonds)
=> Linear (180°)
sp

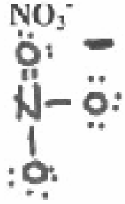
NH_3



sp³ Tetrahedral distorted.

107°

NO_3^-



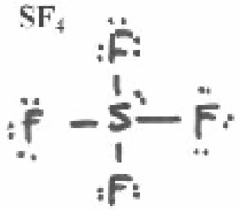
(3 Resonant structures)

3 domains (Trigonal Planar)
120°
sp² (extra credit)

NO_2 * → (extra credit)

3 domains – sp²
Bent > 120 (136)

SF_4



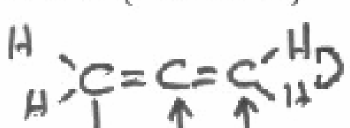
sp³d (extra credit)
5 domains
trigonal bipyramidal

(picture adequate)

SiO_2

(Same as CO_2)
sp

CH2CCCH2(extra credit)



120°
sp² sp sp²
C–C–C is linear

* Should have asked N_2O which is linear