Chemistry 101 Midterm Test #2 KEY X ±sd = 89±19 I. Multiple choice: (5 points each, Any questions after #20 is considered bonus)

_____ (1) a) Oxygen is the limited reagent in the combustion reaction. _____ (2) e) Whether the reaction will proceed as written. _____ (3) a) H_2SO_4 and $CuSO_4$. _____ (4) e) theoretical yield. _____(5) d) AgCl _____ (6) c) K_2SO_4 _____ (7) c) $Al^{3+} + 3\ OH^{-} \rightarrow AL(OH)_3$ _____(8) b) Strong acids are very concentrated. _____ (9) a) formation of a gas, precipitate or water. _____ (10) a) Zn _____ (11) c) $Mg \rightarrow Mg^{2+}$ _____ (12) e) None of the previous.	_____ (13) a) +5 _____ (14) e) displacement. _____ (15) b) exchange _____ (16) a) 1 3 2 3 _____ (17) e) 36.0 _____ (18) d) 6 _____ (19) d) 16 _____ (20) c) VCl_3 _____ (21) c) C_2H_5 _____ (22) c) 0.572 M _____(23) b) 68.4%

II

(1) answer: first, get the MW's: $C_2HOCl_3 + 2\ C_6H_5Cl \rightarrow C_{14}H_9Cl_5 + H_2O$

C_2HOCl_3 = 2(12.0)+(1.01)+16.0+3(35.45)=147.36g/mol ; total we have is: 25.0g/147.36=0.170 mol

C_6H_5Cl =6(12.0)+3(1.01)+35.45=110.48g/mol total we have is 25.0/110.48 = 0.226. It should at least be twice C_2HOCl_3 . So C_6H_5Cl is the limiting reagent.

$C_{14}H_9Cl_5$ =14(12.0)+9(1.01)+5(35.45)=354.34g/mol

OK: #g $C_{14}H_9Cl_5$ = 0.226 mol C_6H_5Cl (1 mol $C_{14}H_9Cl_5$ /2 mol C_6H_5Cl)(354.34g/mol) **= 40.1 g**

(2) a) answer: $2\ H_3PO_4 + 3Mg(OH)_2 \rightarrow 6H_2O + Mg_3PO_4$

@ep: #mol H^+ = #molOH^-; but mol H^+=3 x #mol H_3PO_4 and mol OH^- = 2 x #mol $Mg(OH)_2$;so 3 M_1V_1 = 2 M_2V_2 (where 1= H_3PO_4 & 2= $Mg(OH)_2$): M_2 =(3/2)(M_1V_1/V_2)=(3/2)(24.0)(.15)/(18.0)=**0.30M**

b) answer: @ equivalence point (ep), only Mg^{2+} and PO_4^{3-} ions are present. (that is, assuming that the Mg_3PO_4 is soluble) this is how you could calculate the ions:

mmol Mg^{2+} = .30M(18.0mL)=5.4 mmol Mg, mmol PO_4^{3-} = .15(24)= 3.6mmol PO_4.

[Mg^{2+}]=5.4mmol/(18.0+24.0mL)=**0.129M**; [PO_4^{3-}]=**0.0857 M.**
However, if you recognized that Mg_3PO_4 is actually insoluble, you can say that the answers are really 0.0M for both ions.

c) answer: look at the equation:
$2\ H_3PO_4 + 3Mg(OH)_2 \rightarrow 6H_2O + Mg_3PO_4$

after we add 12.0mL of acid: mmol $Mg(OH)_2$ reacted=12.0x(.15)(3mol$Mg(OH)_2$/2molH_3PO_4)=2.7mmolH_3PO_4
mmol Mg^{2+} remaining= total – reacted
= (3 mmol $Mg(OH)_2$(18.0mL) – 2.7 mmol = 2.7 mmol $Mg(OH)_2$.
so $[Mg(OH)_2]_{remaining}$=2.7mmol/(18.0+12.0)mL= **0.0900 M**

4) Balance the following equation: (show how you got it below. For example, show the half reactions, etc)[10 pts]

$NH_3 + O_2 \rightarrow NO + H_2O$

Answer: ox. #'s: -3,+1 0 +2,-2 +1,-2

oxidation half rxn: balance O's: $NH_3 \rightarrow NO + 5e^-$ => balance H's (assume acidic) $NH_3 + H_2O \rightarrow NO + 5e \Rightarrow NH_3 + H_2O \rightarrow NO + 5e + 5H^+$

reduction half rxn: balnce O's & e's: $O_2 + 2e \rightarrow H_2O$ => balance H's (assume acidic) $O_2 + 4e \rightarrow 2H_2O \Rightarrow 4\ H^+ + O_2 + 4e \rightarrow 2H_2O$

OK. To add the 2 half rxns, need to multiply the first by 4 and the second by 5 and then add:

$4\ NH_3 + 5O_2 \rightarrow 4\ NO + 10\ H_2O$