

Key to test #2

Average  $\pm$  standard deviation:  $94 \pm 36$  (i.e.  $63\% \pm 24\%$ )Approximate grades: A  $\geq 125$  ; B  $\geq 105$ ; C  $\geq 65$ ; D  $\geq 45$ . Highest = 155/150

Part I. Total = 90 points

1)

answer: # mol  $O_2 = (9 \text{ mol } Al_2O_3)(3 \text{ mol } O_2 / 2 \text{ mol } Al_2O_3) = 13.5 \text{ mol}$ 

2)

a)  $Pt(s) + 2 F_2(g) \rightarrow PtF_4(l)$  combination reactionb)  $Zn(s) + 2 HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$  displacement reaction

3)

answer: a)  $3 K_2S + 2 AlCl_3 \rightarrow 6 KCl + Al_2S_3$ b)  $2 C_3H_8O + 9 O_2 \rightarrow 6 CO_2 + 8 H_2O$ 

4

answer: balanced equation is  $4 Fe + 3 O_2 \rightarrow 2 Fe_2O_3$ . Assume Fe is limiting.#g  $Fe_2O_3$  formed =  $90.0 \text{ g Fe} (1 \text{ mol Fe} / 55.85 \text{ g Fe}) (2 \text{ mol } Fe_2O_3 / 4 \text{ mol Fe}) (159.7 \text{ g/mol}) = 128.7 \text{ g}$ Assume  $O_2$  is limiting:#g  $Fe_2O_3$  formed =  $37.0 \text{ g } O_2 (1 \text{ mol } O_2 / 32.0 \text{ g } O_2) (2 \text{ mol } Fe_2O_3 / 3 \text{ mol } O_2) (159.7 \text{ g/mol}) = 123.1 \text{ g}$ 

5)

answer:  $3 Pb(NO_3)_2 + 2 Na_3PO_4 \rightarrow 6 NaNO_3 + Pb_3(PO_4)_2$  $3 Pb^{2+} + 2 PO_4^{3-} \rightarrow Pb_3(PO_4)_2$ 

6)

answer: acid is proton donor; base is proton acceptor. Examples acid = HCl, Base =  $NH_3$ .

7)

answer:  $M_2 = M_1 V_1 / V_2 = (0.108 \text{ M})(50.0 \text{ mL}) / (250.0 \text{ mL}) = 0.0216 \text{ M}$ 

Part II. (total = 60 pts)

8)

answer: # mol C =  $2.20 \times (1 \text{ mol} / 44) = 0.050 \text{ mol C}$ ; # mol H =  $1.20 (1 / 18.0) (2 / 1) = 0.133$  $C_{0.050}H_{0.133} \Rightarrow CH_{2.67} \Rightarrow C_3H_8$  name is propane. The balanced combustion equation is: $C_3H_8 + 4 O_2 \rightarrow 3 CO_2 + 4 H_2O$ 

9)

answer: FW of  $BaSO_4 = 137.3 + 32.1 + 4(16.0) = 233.4$  ;#mol  $BaCl_2 = (0.125 \text{ M})(0.0600 \text{ L}) = 0.0075 \text{ mol}$ #mol  $H_2SO_4 = (0.155 \text{ M})(0.0450 \text{ L}) = 0.006975 \text{ mol} \Rightarrow$  this is limiting#g  $BaSO_4 = 0.006975 \text{ mol } H_2SO_4 (1 \text{ mol } BaSO_4 / 1 \text{ mol } H_2SO_4) (233.4 \text{ g/mol}) = 1.63 \text{ g}$ 

10)

answer: a) at eq pt: #mol NaOH = #mol  $H_2A \times 2$ ; $M_{H_2A} = MV / 2V = (15.0)(0.250) / 2(25.0) = 0.0750 \text{ M}$ b)  $M_{NaOH} = (n_{NaOH}^{\circ} - n_{NaOH,rxtd}) / (V_{tot})$  $= ((.250)(7.5) / (25.0 + 22.5)) = 0.0379 \text{ M}$ c) MW =  $7.95 \text{ g/L} / 0.0750 \text{ mol/L} = 106 \text{ g/mol}$