Test 2 key:
To obtain your grade, multiply your scantron grade (out of 25 maximum) by 4.5 (instead of 4 points – why? Due to the great generosity of your professor, to give you more points!). Add that to the points from the last 3 problems.

Average ± standard deviation for this test: 96 (64%) ± 29 (19%)
Highest grade = 99 points
Approximate letter grade: A ≥ 130 out of 150; B≥ 115 pts; C ≥ 80 pts Highest=149/150

Key for Test #2

Questions	Version A	Version B	Version C
1	E #mol O_2=12molAl_2O_3 x (3molO_2/2molAl_2O_3)=18mol	B	D
2	C	B mol HSO=45(.155)=6.98mmol Mol BaCl=60(.125)=7.5mmol (HSO limiting): gBaSO=6.98mm (1/1)(233.5)=1630mg=1.63gBaSO	B gN_2O= 57gO_2(1/32)(2/1)(44g)=157
3	E $3K_2S+2AlCl_3 \rightarrow 6KCl+Al_2S_3$	C	C molYNO =50(.265) =13.25mmol; gYCO= 13.25mmol (442)(1/2) =2930mg =2.93g
4	B gN_2O= 57gO_2(1/32)(2/1)(44g)=157	A $M_2=M_1V_1/V_2$ =(50.0(.108))/250=.0216	A
5	E	D m=q/CΔT=50000/(2.06(40)) = 607g	C C=q/mΔT=60/(21.6(6.04)) = .46 J/gK
6	A #gO_2needed=110.0gFe x (1mol/55.85g)(3 O_2/4 Fe)(32g O_2/mol) =47g <64g Fe limitg: #gFe_2O_3=110gFe x (1/55.85)(2 Fe_2O_3/4) (160) =157g	A	D m=q/CΔT=50000/(2.06(40)) = 607g
7	B #gCS_2 =225gC(1/12) (1/5)(76) =285g; %yield= (100%)(195/285)=68%	C molYNO =50(.265) =13.25mmol; gYCO= 13.25mmol (442)(1/2) =2930mg =2.93g	C
8	C	E $3K_2S+2AlCl_3 \rightarrow 6KCl+Al_2S_3$	C want M_{Na}=.300M So M_{Na2S}=.150M;V_2= M_1V_1/M_2 V_2= 1.50(25)/.15 = 250 mL
9	D	C $2HCl+Ca(OH)_2 \rightarrow 2H_2O+CaCl_2$ @ep: molHCl=2xmolCaOH $M_1V_1=2M_2V_2 \Rightarrow M_1=2M_2V_2/V_1$ M_{HCl} = 2(31.22)(.08152)/25=.204M	B #gCS_2 =225gC(1/12) (1/5)(76) =285g; %yield= (100%)(195/285)=68%
10	B	C	C
11	A	D	A ΔH=225g(1/26)(-1300) kJ= = -11250kJ =-1.1x10^4kJ
12	A $M_2=M_1V_1/V_2$ =(50.0(.108))/250=.0216	B gN_2O= 57gO_2(1/32)(2/1)(44g)=157	C $2HCl+Ca(OH)_2 \rightarrow 2H_2O+CaCl_2$ @ep: molHCl=2xmolCaOH $M_1V_1=2M_2V_2 \Rightarrow M_1=2M_2V_2/V_1$ M_{HCl} = 2(31.22)(.08152)/25=.204M

Questions	Version A	Version B	Version C
13	C want M_{Na}=.300M So M_{Na2S}=.150M;V_2= M_1V_1/M_2 V_2= 1.50(25)/.15 = 250 mL	C want M_{Na}=.300M So M_{Na2S}=.150M;V_2= M_1V_1/M_2 V_2= 1.50(25)/.15 = 250 mL	E
14	C molYNO =50(.265) =13.25mmol; gYCO= 13.25mmol (442)(1/2) =2930mg =2.93g	B #gCS_2 =225gC(1/12) (1/5)(76) =285g; %yield= (100%)(195/285)=68%	B mol HSO=45(.155)=6.98mmol Mol BaCl=60(.125)=7.5mmol (HSO limiting): gBaSO=6.98mm (1/1)(233.5)=1630mg=1.63gBaSO
15	B mol HSO=45(.155)=6.98mmol Mol BaCl=60(.125)=7.5mmol (HSO limiting): gBaSO=6.98mm (1/1)(233.5)=1630mg=1.63gBaSO	C C=q/mΔT=60/(21.6(6.04)) = .46 J/gK	B
16	C 2HCl+$Ca(OH)_2$→$2H_2O$+$CaCl_2$ @ep: molHCl=2xmolCaOH $M_1V_1=2M_2V_2$=> $M_1=2M_2V_2/V_1$ M_{HCl} = 2(31.22)(.08152)/25=.204M	C	A
17	B	A ΔH=225g(1/26)(-1300) kJ= = -11250kJ =-1.1x10^4kJ	E
18	E	A q=mCΔT=25(.92)(48.5-22) = 610J = 0.610 kJ	A
19	A q=mCΔT=25(.92)(48.5-22) = 610J = 0.610 kJ	E	E $3K_2S$+2$AlCl_3$ → 6KCl+Al_2S_3
20	C C=q/mΔT=60/(21.6(6.04)) = .46 J/gK	A #gO_2needed=110.0gFe x (1mol/55.85g)(3 O_2/4 Fe)(32g O_2/mol) =47g <64g Fe limitg: #gFe_2O_3=110gFe x (1/55.85)(2 Fe_2O_3/4) (160) =157g	A q=mCΔT=25(.92)(48.5-22) = 610J = 0.610 kJ
21	D m=q/CΔT=50000/(2.06(40)) = 607g	B	B
22	A ΔH=225g(1/26)(-1300) kJ= = -11250kJ =-1.1x10^4kJ	E #mol O_2=12molAl_2O_3 x (3molO_2/2molAl_2O_3)=18mol	C
23	C	A	E #mol O_2=12molAl_2O_3 x (3molO_2/2molAl_2O_3)=18mol
24	A	A	A $M_2=M_1V_1/V_2$ =(50.0(.108))/250=.0216
25	A	E	A #gO_2needed=110.0gFe x (1mol/55.85g)(3 O_2/4 Fe)(32g O_2/mol) =47g <64g Fe limitg: #gFe_2O_3=110gFe x (1/55.85)(2 Fe_2O_3/4) (160) =157g

Problems:
Titration problem:
a) H_2SO_4 + 2 NaOH --> $2H_2O$ + Na_2SO_4
at the equivalence point: # equiv H_2SO_4 = # equiv. NaOH
=> 2 x # moles H_2SO_4 = # moles NaOH (but # moles = MV right?)
2 $M_{H2SO4}V_{H2SO4} = M_{NaOH}V_{NaOH}$
M_{NaOH} = 2 $M_{H2SO4}V_{H2SO4}$/ V_{NaOH}= 2(15.0 mL)(.25M)/(25.0 mL) = **.30M**

b) [NaOH] = # moles NaOH remaining/ total volume = ½ original moles/ total volume
=1/2 ($M_{NaOH}V_{NaOH}$)/(V_t) = (1/2)((.30M)(25.0mL)/(25.0mL+7.5mL)= 0.115M = 0.12 M

Heating problem:
Heat = heat to raise 0°C water to 100°C + heat to raise 100°C water to 100°C steam = q
= $mC_p\Delta T + m\Delta H_{vap}$ = 12.0g (4.18 J/gK)(100)K + 12.0g(2260J/g) = **32.1 kJ**

Hess's Law problem:
First, number the reactions #1, #2, and #3
By inspection, we see that we need to reverse (#1) and divide it by 2, i.e. "(-1/2)(#1)"

Doing the rest of the others, we see that the overall calculation is:
(-1/2)(#1) -(1/2)(#2) +(#3) = +(544/2) +(1648.8/2)+(-1118) = **-22 kJ**