Test #1 key On MONDAY Test 1 will be returned according to your seating arrangement. Please take assigned seats to facilitate graded Test 1 distribution.
Average ±st.dev = 70±30 Approx Grades: A ≥ 115; B≥ 96 ; C≥ 60 ; D≥ 45

1) [25 pts]

a) [5 pts]Solution: :FW of $(NH_4)_2SO_4$ =2(14.0+4(1.0))+32.1+4(16.0)=132.1 g/mol

#moles $(NH_4)_2SO_4$ =0.265 acre x $\frac{43560\,ft^2}{acre}$ x $(\frac{12in}{ft})^2$ x $(\frac{2.54cm}{in})^2$ x $(\frac{1m}{100cm})^2$ x $(\frac{15oz}{m^2})$ x $(\frac{29.57mL}{oz})$ x $(\frac{1.10g}{mL})$ x $(\frac{19.5gAmSu}{100g})$ x $(\frac{molAmSu}{132.1gAmSu})$ =**$7.72x10^2$ moles AmSu**

b) [10 pts]answer:FW of $(NH_4)_2SO_4$ =2(14.0+4(1.0))+32.1+4(16.0)=132.1

grams N = $7.72x10^2$ moles AmSu x $(\frac{2molN}{1molAmSu})$ x $\frac{14.0gN}{molN}$ =**$2.16x10^4$g**

2) [25 pts total]

a) [5 pts] answer: (1) Law of conservation of mass and (2) law of constant proportion

b) [5 pts] answer: Law of multiple proportions.

c) [15 pts]

Take the ratios of say, O to N in both compounds and then take a ratio of those two ratios to demonstrate the multiple proportion. Do not use any atomic weights since that was not known then. Use only the given %'s:
Compound A : ratio of O to N = (100-25.93)/(25.93)=2.856
Compound B: ratio of O to N = (100-63.63)/63.63 = 0.572
The ratios of these two ratios:
2.856/0.572 = 5.00≈ 5 , an integer –i.e. a multiple proportion

3) [10 pts]

answer: convert all T's to the same temp, say, °C:
T_1 = (190.0°F-32)(5/9)=87.8°C,
T_2 = 309K-273= 36°C (this is the melting point).
If it is in contact with 100°c water, then the substance must be a gas since 100°>87.8°. A substance above its boiling point is a gas (not a liquid becoming a gas, or a solid becoming a liquid, etc).

4) [25 pts] a) [15pts]

answer:

OK total mass of the substance: . $m_{total} = V_{gas}d_{gas}$ = (40.5L)(1.45g/L)=58.7g

Final vol, $V_{final}=V_{Liquid} + V_{Solid} = m_L/d_L + m_S/d_S$ (note: d=density = mass/vol=m/V so V=m/d)

where m_s = mass solid =0.355(58.7)=20.8g and m_L=mass liquid = 58.7-20.8 = 37.9 g

so, V_{final} = 37.9g/1.22 +20.8/1.52 = 31.1mL + 13.7mL = 44.8 mL

b) [10 pts]

answer: according to archimedes' principle: mass of liquid displaced

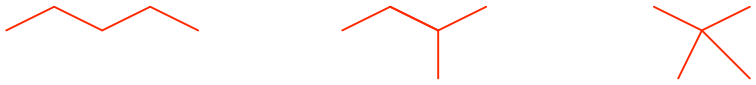
apparent mass = mass(in air)-buoyant force (in grams) = $m_{air} - m_{liq} = m_{solid} - V_{solid}(d_{liq})$
= 20.8g – (20.8/1.52)(1.22)=4.11g

5) [20 pts]

answer: assume 100g: #mol H= 16.667g(1mol/1.0g)=16.667mol

#molC = (100-16.667)(1/12.0)= 6.94; $C_{6.94}H_{16.667} = CH_{2.40}$ multiply by 5: C_5H_{12} pentane

MW = 5(12.0)+12(1.0)=72.0 g Three possible isomers are, in line structure notation:



6) [25 pts total]
a) [20 pts]

Answer: formula is Na_2CO_3 for the ionic compd: FW = 2(23.0)+12.0+3(16.0)=106.0g/molIn 2.540g of crystal, there (2.540-0.941)(1mol/18g)=0.0888mol $H_2O$and 0.941(1mol/106g)=0.00888 mol Na_2CO_3 . so formula is **Na_2CO_3 * 10H_2O sodium carbonate decahydrate.**

b) [5 pt]
answer: It is a physical process because no molecular or ionic bonds are broken and we can separate the water from the ionic compound without creating a new substance. The substances retain their identity.

7)[20 pts] a) [10 pts]

Answer: The Rutherford experiment involved bombarding a very thin gold foil with "dense" and positively charged alpha particles. Some alpha particles were observed to bounce back giving rise to the concept of a tiny, positive but very dense atomic nucleus where most of the mass of the atom was located and a large space of low density around it where the negative electrons reside.

b) Cathode Ray experiment.

Answer. Two types of descriptions are possible: Earlier experiments showed that a cathode ray (vacuum tube with heated metal electrode) tube would emit negative charges identified by JJ Thomson as "electrons". A later JJ Thomson's experiment involved a cathode ray tube which applied magnetic and electric fields to a beam of electrons. His calculations gave rise to the charge-to-mass ratio of the electron an important value.