Sample exam questions from the recent past

Sample 1

4.012 g of ammonia mixed with 2.76 moles of nitrogen and 8.28 moles of hydrogen is fed to a mixer where 100 % excess air is added. Assume nitrogen is inert, but that both ammonia and hydrogen are burned. What are the product mole fractions out of the combustor if the fractional conversion for ammonia is 97% and that of hydrogen is 98%?

Sample 2

Acetic acid vapor at 327°C and 30 atm is fed into a pipe that has a diameter of 5 inches with a velocity of 1 m/s. What is the mass flowrate of the acetic acid into the pipe?

Sample 3

Ethane is heated up in a catalytic reactor to produce hydrogen gas and ethylene. The conversion in the reactor is 20%. The product stream is sent to a condenser where 98% of the ethane and 90% of the ethylene is removed as a liquid, while none of the hydrogen is condensed. The liquid stream passes to a distillation column where the overhead stream contains 96 mole percent ethylene while the bottoms contains 89 mole percent ethane. What is the total molar flowrate of the final ethylene stream if 100 kg/hr of ethane is fed to the reactor. How much ethane (moles/hr) is coming out in the bottoms stream? What should you do with this stream?

Sample 4

Describe four different criteria you would use to decide whether you could use the ideal gas law or not.

Sample 5

1 Liter of hexane at 10°C is burned to a fractional conversion of 60% when mixed with 35% excess air. What are the mole fractions of all chemicals in the product?

Sample 6

Using compressibility factors, find the density of air in Antarctica at -15°C and 1.05 atm.