KSU – Chemical Engineering Department
ChE 320 (Chemical Reactor Engineering) – TUT #5
Name: **ID:** **SN:**

1. The gas phase reaction, $A + B \rightarrow C + D$, is carried out in a PBR using a microporous resin as a catalyst. The reaction is first order in A and pseudo zero order in B. The feed is equal molar in A and B and the temperature is 118 ^{o}C and the pressure is 10 atm. The pressure drop parameter, α, is 0.01 g^{-1}, and the total volumetric rate is 25 L/min The specific rate constant is 1.2 L/g cat. min.
    a. Calculate the weight of catalyst that one could use and maintain an exit pressure of 1 atm.

    b. Determine the catalyst weight necessary to achieve 90% conversion. Solve the following nonlinear equation, using Polymath, for the weight, w:

    $$\ln 10 = (2kC_{Ao}/3\alpha F_{Ao})[1-(1-\alpha w)^{3/2}].$$

2. The elementary gas-phase reaction, $A \rightarrow B + 2C$, is carried out isothermally in a PFR. The specific reaction rate at 50 ^{o}C is 10^{-4} min^{-1} and the activation energy is 85 kJ/mol. Pure A enters the reactor at 10 atm and 127 ^{o}C and a molar flow rate of 2.5 mol/min. The pressure drop parameter, $\alpha = 0.001$. What are the conversion, X, and pressure ratio, y, at V = 500 L? Solve this problem using Polymath. Initial values [X, y, V] = [0, 1, 0]. R = 8.31 J/mole = 0.082 L.atm/mole.K. The equations describing this system are:

    $$dX/dV = (-r_A/F_{Ao})$$
    $$dy/dV = (-\alpha/2y)(1+\varepsilon X)$$

    Auxiliary equations include: ε, rate equation, rate constant at 127 ^{o}C, among other parameters given in the problem.