CDP2-D_B The irreversible gas-phase nonelementary reaction

$$A + 2B \longrightarrow C$$

is to be carried out isothermally in a constant-pressure batch reactor. The feed is at a temperature of 227°C, a pressure of 1013 kPa, and its composition is 33.3% A and 66.7% B. Laboratory data taken under identical conditions are as follows (note that at $X = 0$, $-r_A = 0.00001$):

$-r_A$ (mol/dm$^3 \cdot$ s) $\times 10^3$	0.010	0.005	0.002	0.001
X	0.0	0.2	0.4	0.6

(a) Estimate the volume of a plug-flow reactor required to achieve 30% conversion of A for an entering volumetric flow rate of 2 m^3/min.
(b) Estimate the volume of a CSTR required to take the effluent from the plug-flow reactor (PFR) above and achieve 50% total conversion (based on species A fed to the PFR).
(c) What is the total volume of the two reactors?
(d) What is the volume of a single plug-flow reactor necessary to achieve 60% conversion? 80% conversion?
(e) What is the volume of a single CSTR necessary to achieve 50% conversion?
(f) What is the volume of a second CSTR necessary to raise the conversion from 50% to 60%?
(g) Plot the rate of reaction and conversion as a function of PFR volume.
(h) Give a critique of the answers to this problem.