A new organism has been found which produces a product P. A series of 1.5 L chemostat experiments are conducted with the following steady-state results, where
F = nutrient feed rate,
X = effluent cell mass concentration,
P = effluent product concentration,
I = effluent undesirable product concentration.

F (mL/h)	X (g/L)	Q_P (g/Lh)	Q_I (g/Lh)
75	2.86	0.36	0.143
150	3.33	0.83	0.167
225	3.45	1.21	0.173
300	3.64	1.27	0.182
450	3.75	1.31	0.338
600	3.81	1.34	0.533

a) Is the generation of P growth-associated, non-growth associated or mixed growth associated? What about I? Explain.
b) You are asked to design a constant growth rate fed-batch process for the production of P. What growth rate would you recommend? Explain.

A 2 L chemostat has been operating at steady-state at a dilution rate of 0.3 h^{-1}. The feed contains 10 g/L of the carbon source S. When this feed is about to run out, you replace it with a new feed so that the chemostat may continue. However, by accident this new feed contains S at a concentration of only 8 g/L. Nothing else (e.g., flow rate, volume, temperature, pH, etc.) changes. You are surprised to find that the cell mass concentration in the effluent did not change. How can this be? Explain. What can you predict about the concentration of S in the effluent for these two conditions?