G.1

A 1,440 mg/L solution of vancomycin is adsorbed in a 26.8 cm fixed-bed column at a volumetric flowrate of 2.9 L/h and the following breakthrough curve is obtained:

Time (h)	Conc. in Effluent (mg/L)
0.00	0
2.00	0
4.00	0
6.00	0
8.00	0
8.80	0
9.00	1
9.20	4
9.40	9
9.60	33
9.80	80
10.00	142
10.20	238
10.40	365
10.60	498
10.80	650
11.00	808
11.25	980
11.50	1115
11.75	1235
12.00	1330
12.50	1410
12.80	1440
13.00	1440
14.00	1440
15.00	1440

Breakthrough is taken to occur when the concentration in the effluent from the bed is 1 mg/L. If the process is scaled up to a 43.9 cm column (and using the same flowrate and bed cross-sectional area), then

a) Estimate the breakthrough time in the larger column.
b) Approximately how much vancomycin is adsorbed at the breakthrough time for each of the two columns?
c) Given the fact that the larger column is 64% longer than the smaller column, how do you reconcile the different value for the increase in the amount of vancomycin adsorbed in the larger column compared to the smaller column?