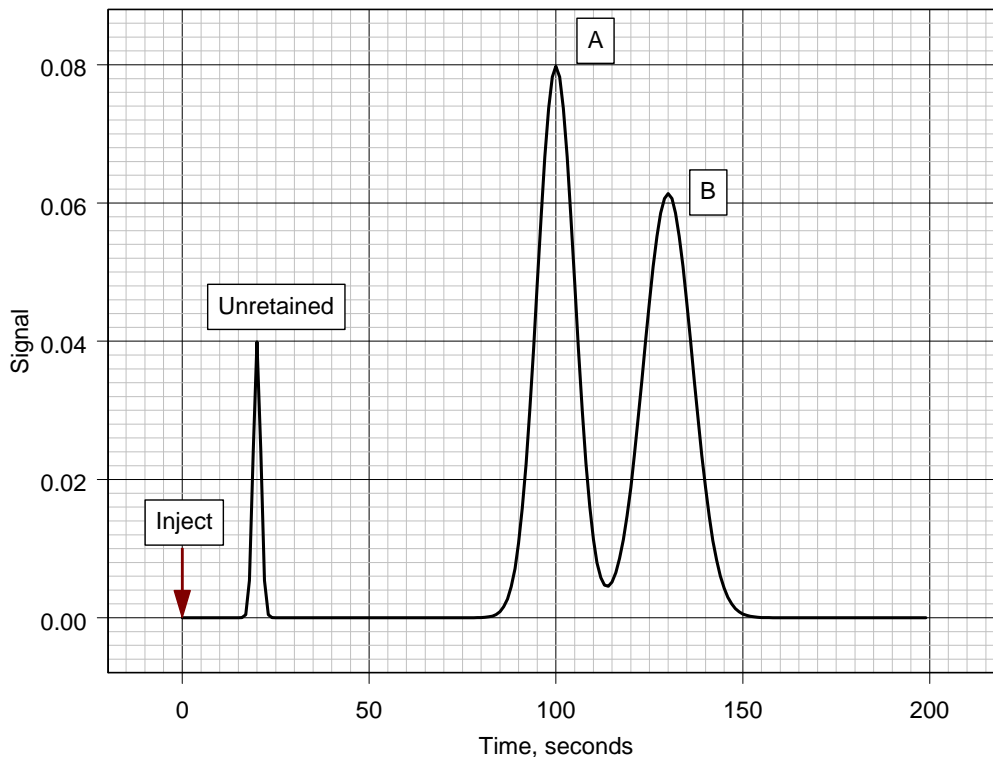


Problem Set 10. Chromatography Calculations  
 Chem 2222 Summer 2008. **Answers in red**

1. Chromatogram Calculations

The chromatogram was obtained on a 5.0-cm long column. For solute A, report



- a) the retention time,  $t_r$  **100 s**
- b) the adjusted retention time,  $t_r'$  **80 s**
- c) the retention factor,  $k$  **4.0**
- d) the number of theoretical plates,  $N$  **330**
- e) the plate height,  $H$  (include units) **0.015 cm**
- f) the resolution for solutes A and B. **1.20**

2. A urine sample was analyzed by gas chromatography for cocaine using benzoylecgonine as an internal standard. The cocaine in a 100-mL sample of urine was extracted into methylene chloride. After addition of 0.200 g benzoylecgonine, the extract mixture was diluted to exactly 25 mL. Injection of 1.0  $\mu\text{L}$  of the prepared sample onto a GC column at 225  $^\circ\text{C}$  yielded peak areas of 680 for cocaine and 606 for the internal standard. Using the calibration data provided below, calculate the concentration of cocaine (mg/mL) in the urine sample.

	Cocaine mg/mL	Int. Std. mg/mL		
Standard	$c_x$	$c_{is}$	$A_x$	$A_{is}$
1	2.50	5.00	120	600
2	5.00	5.00	241	603
3	10.00	5.00	480	596
4	25.00	5.00	1198	602

$A_x$  and  $A_{is}$  are the peak areas for cocaine and the internal standard, respectively.  
 $c_x = 5.63 \text{ mg/mL}$

3. Similar to Skoog7e24-21. The following data are for a liquid chromatography column

Length of Packing	200 mm
Flow rate	0.95 mL/min
$V_M$	2.33 mL
$V_S$	0.134 mL

A chromatogram of a mixture of species A and B provided the following data: (corrected data in blue)

	Retention Time, s	Width of Peak Base (w), s
Unretained	147.0	
A	690.7	25.8
B	720.0	26.9

For solutes A and B, calculate:

- |   |                                     |
|---|-------------------------------------|
| a) the average number of theoretical plates | $N = 1.14 \times 10^4$              |
| b) the average plate height                 | $H = 1.75 \times 10^{-5} \text{ m}$ |
| c) the retention factors                    | $k_A = 3.70$ $k_B = 3.90$           |
| d) the selectivity factor                   | $\alpha = 1.05$                     |
| e) the distribution constants               | $K_A = 64.2$ $K_B = 67.7$           |
| f) the resolution                           | $R_s = 1.11$                        |