ENVS4450: ^{210}Pb Dating

1. Derive the equation $a = - \lambda m$ (where a = sedimentation rate, λ = decay constant, m = slope) from a graph of unsupported ^{210}Pb activity vs. depth.

The equation describing the graph of unsupported ^{210}Pb vs. depth is:

$$t = \frac{1}{\lambda} \ln(^{210}Pb_0 / {}^{210}Pb_x)$$

2. The following data were obtained for the dried sediment sections of a core collected in 1988 from the unmixed sediment column of a freshwater lake close to an industrial area in North America. Assuming negligible compaction, use the ^{210}Pb data shown below and the constant initial concentration model (CIC model) to calculate the sedimentation rate. Derive a timescale for the sediment core.

Sediment Depth (cm)	^{210}Pb (Bq kg^{-1})
0-2	261
2-4	125
4-6	74
6-8	54
8-10	41
18-20	43

(a) What is the level of background 'supported' ^{210}Pb in the core?

(b) Complete the following table:

Sediment Depth (cm)	^{210}Pb (Bq kg^{-1})	Mean Depth (cm)	Unsupported ^{210}Pb (Bq kg^{-1})	ln (Unsupp. ^{210}Pb)
0-2	261			
2-4	125			
4-6	74			
6-8	54			
8-10	41			
18-20	43			

(c) Draw a graph of ln (unsupported ^{210}Pb) vs. depth and calculate the slope.

(d) Assuming a ^{210}Pb half-life of 22.35 years calculate the sedimentation rate (cm yr^{-1}).

(e) Derive a timescale for the core.

Sediment depth (cm)	Years	Date
2		
4		
6		
8		
10		