**Xiamen Radiochemistry Practical**

**Beta Counting**

**1) detector operations**

**a. plateau/high voltage set-up**

Notes here-

**b. calibration/efficiency**

Bq= counts per second/efficiency

99Tc standard = known Bq = \_\_\_\_\_\_\_\_\_\_\_, long half-life (no decay correction)

What is count rate=\_\_\_\_\_\_\_\_ cps

(convert from cpm to cps; how long to count?; what are red & green flashes)

What is detector background = \_\_\_\_\_\_\_\_\_\_ (why so low? “guard” detector)

Calculate detector efficiency =\_\_\_\_\_\_\_\_\_

Calculate uncertainty (1/square root of net counts) =\_\_\_\_\_\_\_\_\_

**c. external absorption**

What is effect of adding Al foil? Al foil density = \_\_\_\_

What is count rate without foil/with foil = \_\_\_\_\_\_\_\_\_\_\_\_\_\_

Does this match expectations?

Need to know (how would you find out?)

Energies: beta max.

99Tc = 0.294 MeV

234Th = 0.188 MeV

234mPa = 2.28 MeV

**d. Application to 234Th in seawater**

234Th half life = 24.1 d- what is energy of beta = \_\_\_\_\_\_\_\_\_

Review sample collection, preparation, Mn precipitation; idea of chemical yield, decay, ingrowth

What isotope are we measuring on beta counter? 234mPa- what is energy = \_\_\_\_\_\_\_\_

Is 234mPa in secular equilibrium?

What about other U-Th series isotopes in Mn precipitate?

What do you need to know beyond just count rate and detector efficiency to calculate 234Th activity in seawater?

1. sample volume
2. decay 234Th between precipitation and counting and between sampling and precipitaton
3. ingrowth from 238U between sampling and precipitation
   1. filtration can take 6-12 hours; U not carried by MnO2 but Th, Ra is carried
4. chemical yields
   1. add 230Th for later analyses; ppt is not 100% efficient; use ICPMS or alpha after final count
5. Final count after 6 months- other beta emitters from Ra daughters

Enter data & review spreadsheets

What would count rate look like in 10 days? 24.1 days? 48 days? After 6 months?

Exponential decay A = A0 exp (-λ\* t)

λ= ln2/ half life = \_\_\_\_\_\_\_\_\_

what units? (d-1)

234Th ingrowth = 238U (1- exp (-λ\* t))

How do we know 238U? = 0.0713 x salinity = dpm/L X 1/60 = Bq/L

For salinity = 35, what is 238U = \_\_\_\_\_\_\_ dpm; = \_\_\_\_\_\_\_ Bq

Notes here: