

**QUESTION 6**

A calibration source was counted yielding the data shown below. Answer the following questions concerning radioactive counting and counting statistics:

**GIVEN****Count Data**

C1	60 cpm
C2	55 cpm
C3	64 cpm
C4	69 cpm
C5	70 cpm
C6	63 cpm
mean	63.5 cpm
std. dev.	5.6 cpm

**Cumulative Distribution of Chi-Square,  $\chi^2$** 

Degrees of Freedom	Probability of a greater value					
	0.900	0.750	0.500	0.250	0.100	0.050
1	0.02	0.10	0.45	1.32	2.71	3.84
2	0.21	0.58	1.39	2.77	4.61	5.99
3	0.58	1.21	2.37	4.11	6.25	7.81
4	1.06	1.92	3.36	5.39	7.78	9.49
5	1.61	2.67	4.35	6.63	9.24	11.07
6	2.20	3.45	5.35	7.84	10.64	12.59
7	2.83	4.25	6.35	9.04	12.02	14.07

**POINTS**

- 10    **A.**    Define the terms “Type I” and “Type II” errors as they apply to the analysis of low-level radioactive samples.
- 5      **B.**    What are “blank” samples and why are they used to determine instrument background?

- 10    **C.**    A radioactive sample is counted yielding 500 counts (gross) in 10 minutes. The background of the counting system is 460 counts in 60 minutes. If the efficiency of the counting system is 15%, calculate the activity of the sample and the associated uncertainty. State any assumptions used in the calculation. **Show all work.**
- 15    **D.**    Briefly describe the purpose of the  $\chi^2$  (Chi-square) test. Using the  $\chi^2$  table shown above, what is the implication if the  $\chi^2$  value is 4.01 and assuming 5 degrees of freedom?
- 10    **E.**    Given the table above, calculate the  $\chi^2$  value for the given data.