Tata Institute of Fundamental Research

Entrance test for the Ph.D. Programme in

CHEMICAL SCIENCES

SYLLABUS

The syllabus for the Written test in Chemistry is similar to the typical standard syllabus followed in any Indian university for the B.Sc. and M.Sc. degree course. The questions are aimed at testing the basic understanding and knowledge in the areas of physical, organic, inorganic, analytical, electro and quantum chemistry, biophysics, thermodynamics, spectroscopy (NMR, fluorescence, IR, UV and X-ray), logic and statistics and mathematical methods.

SAMPLE QUESTIONS

(NOTE: Wrong answers will get you negative marks)

1. In a magnetic field of 1.17 Tesla, a proton absorbs energy at a frequency of 50 MHz. For the same field, an electron absorbs at a frequency of:
(Bohr Magneton = 9.27×10^{-24} JT^{-1}, Nuclear Magneton = 5.05×10^{-27} JT^{-1})
[a] 50 MHz [b] 92.5 MHz [c] 500 MHz [d] 25 GHz [e] 92.5 GHz [f] none of the above

2. Assuming no degeneracy in the genetic code, the number of amino acids that would have to exist if the code is four units long could be:
[a] 20 [b] 64 [c] 128 [d] 256

3. 10 ml of 0.4M $CuSO_4$ solution is electrolyzed with a current of 1.93 A for 5 min. Assuming that the volume of the solution does not change during electrolysis, the molar concentration of Cu^{2+} after electrolysis is:
[a] 0.05 M [b] 0.1 M [c] 0.2 M [d] 0.3 M

4. The pK of histidine is 6.0. A 60 mM solution of histidine is adjusted to a pH of 5.0. The concentration of protonated form (in mM) will be:
[a] 54.6 [b] 30.0 [c] 5.46