

# Tata Institute of Fundamental Research

Entrance test for the Int-PhD and PhD Programmes 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: There is negative marking for incorrect answers)

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 =  $9.27 \times 10^{-24} \text{ JT}^{-1}$ , Nuclear Magnetron =  $5.05 \times 10^{-27} \text{ JT}^{-1}$ )  
[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  $\text{CuSO}_4$  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  $\text{Cu}^{2+}$  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

## **Question Paper Instructions**

**Please read all instructions carefully before you attempt the questions.**

1. This is a multiple-choice question paper with only **ONE** section having a total of 40 questions. Each correct answer will get 3 marks. Every wrong answer will get a -1 mark. Marks are not awarded or deducted when a question is not attempted. It is better not to answer a question if you are not sure.
2. **PLEASE NOTE CAREFULLY:** To get a FULL and CLEAR VIEW of the questions and the options, please click on the > arrow (on right side) on the vertical scrollbar, which allows for maximizing the display.
3. Indicate your answers by clicking the right option.
4. Rough work may be done on blank sheets. If needed, you may ask for extra rough sheets from an invigilator.
5. In answering the questions, please choose the option that best describes the solution to the problem.
6. You can get a list of useful physical constants by clicking on the link **UsefulData** at the top right corner of the display. You may use these values in answering the questions if required.
7. **Use of calculator is permitted in this subject test. To use it click on the calculator icon provided on your screen.**