

Self-assessment entrance test for Nanobiophysics

Dear prospective student,

This test should assist you in finding the right Master program and in checking critically for yourself whether you have the necessary background knowledge to follow the Master in Nanobiophysics adequately. Completing the test will not take more than 1 hour.

You will find the solution in a separate file on our website. **But don't betray yourself!** Our recommendations concerning the number of correct answers are:

- More than 12: The Master program in Nanobiophysics seems to be an excellent choice for you.
- Between 7 and 11: The Master program in Nanobiophysics seems to be okay for you, but you show some missing prerequisites which can be compensated by studying
- Less than 7: You might think about choosing a different Master program

Should you decide to apply, we kindly request you to send us the original draft of your solutions along with the required application documents. Please note: we are keen to know where exactly you made mistakes; this will actually help us to fine-tune the contents of the lectures a bit more according to your needs.

1. Are you willing to improve your soft skills? (e.g. social and communication skills)
2. What is a polymer?
3. What is $\int_0^\pi \sin^2(x) dx$?
4. What is the gradient of f , if $f(x, y) = x^2 - y^2$?
5. What are the main cytoskeleton elements in mammalian cells and how do they function?
6. Calculate the normalized eigenvectors of the matrix $\begin{pmatrix} 3 & -1 \\ -1 & 3 \end{pmatrix}$.
7. Why can carbon build up to 4 covalent bonds?
8. Derive the Newton equation of motion of the Lagrangian

$$L(x, \dot{x}) = \frac{1}{2} m (\dot{x})^2 - \frac{1}{2} m \omega^2 x^2$$

9. What does the expression $-i\hbar\nabla$ in quantum mechanics stand for?
10. What are fundamental intermolecular forces?
11. Do you have programming skills? If yes, are you willing to improve them?
12. Given an ideal gas. Derive the isothermal compressibility as a function of pressure and temperature
13. Could you describe the mechanism of endocytosis?
14. A disease is inherited from the parents to their children with a probability of $\frac{1}{2}$. What is the probability that at least one of four children got the disease?
15. How can 'entropy' be measured in a thermodynamic experiment?