Рабочий лист № 3

Subject: **"The Gibbs energy"**

Theoretical part

Vocabulary

- Найдите соответствие, запишите слова в словарную тетрадь.

to simplify	сворачивание белка	to suggest	упрощать
the Gibbs energy	приобретать	non-expansion work	понимание
to be proportional to	быть погруженным	assembly	цепочка
the criterion of spontaneous change	третичная/четвертичная структура	to remark	критерий самопроизвольности
to establish	амфипатический	the folding of proteins	описывать
to describe	внутренняя часть	tertiary/quaternary structure	быть пропорциональным
conclusion	замечать, наблюдать	well-defined	устанавливать
insight	фосфолипид	interior	взаимодействие
hydrophilic	сбор, собрание	repelling	препятствовать
chain	отталкивающий	phospholipid	энергия Гиббса
cage	не работа расширения	amphipathic	клетка
to oppose	четко определенный	to be immersed in	гидрофильный
interaction	предлагать	to acquire	заключение, вывод

- Составьте 3 предложения, употребляя словарные слова.

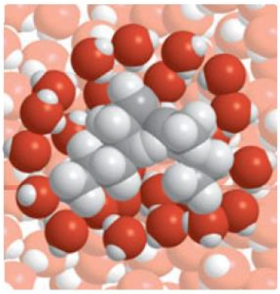
Examples: *At constant temperature and pressure, a system tends to change in the direction of decreasing Gibbs energy.*
At constant temperature and pressure, the change in Gibbs energy accompanying a process is equal to the maximum non-expansion work the process can do.

____
____
____
____

Main laws, equations and definitions

- Прочитайте и запишите русские аналоги (воспользуйтесь конспектами лекций, учебником, интернетом).

Definition of Gibbs energy: ____



Practical part and home work

- Прочитайте и переведите на русский язык

Fig. 2.14. When a hydrophobic molecule (in shades of gray) is surrounded by water, the H_2O molecules (with their oxygen atoms shown in red) form a cage, of which a cross-section is shown here. As a result of this acquisition of structure, the entropy of water decreases, so the dispersal of the hydrophobic molecule into the water is entropy opposed; its coalescence is entropy favored.

____
____
____
____

2.7 The hydrophobic interaction

To gain insight into the thermodynamic factors that contribute to the spontaneous assembly of biological macromolecules, we need to examine in detail some of the interactions that bring molecular building blocks together.

Throughout the text we shall see how concepts of physical chemistry can be used to establish some of the known ‘rules’ for the assembly of complex biological structures. Here, we describe how the Second Law can account for the formation of such organized assemblies as proteins and biological cell membranes.

As remarked in the Prologue, we do not know all the rules that govern the folding of proteins into well-defined three-dimensional structures. However, a number of general conclusions from experimental studies give some insight into the origin of tertiary and quaternary structure in proteins. Here we focus on the observation that, in an aqueous environment (including the interior of biological cells), the chains of a protein fold in such a way as to place hydrophobic groups (water-repelling, non-polar groups such as –CH2CH(CH3)2) in the interior, which is often not very accessible to solvent, and hydrophilic groups (water-loving, polar or charged groups such as –NH3+) on the surface, which is in direct contact with the polar solvent. A species with both hydrophobic and hydrophilic regions is called **amphipathic***. Phospholipids also are amphipathic molecules that can group together to form bilayer structures and cell membranes (recall Fig. F.1).

To understand the process in more detail, imagine a hypothetical initial state in which a polypeptide chain is immersed in water and has not acquired its final structure. Each hydrophobic group is surrounded by a cage of water molecules (Fig. 2.14). Now consider the actual final state in which hydrophobic groups are clustered together. Although the clustering together results in a negative contribution to the change in entropy of the system (the solution), fewer (albeit larger) cages are required and more solvent molecules are free to move. The net effect of the formation of clusters of hydrophobic groups is then a decrease in the organization of the solvent and a net increase in entropy of the system. This increase in entropy of the solvent is large enough to result in the association of hydrophobic groups in an aqueous environment being spontaneous. The process that drives the spontaneous clustering of hydrophobic groups in the presence of water is called **the hydrophobic interaction.**

* The ***amphi-*** part of the name is from the Greek word for ‘both’ and the ***-pathic*** part is from the same root (meaning ‘feeling’) as sympathetic.

- Посмотрите фильм и ответьте на вопрос **How Cells Obtain Energy?**

____
____
____
____
____