Examination in Technical Biology (7.5 p)

December 17, 2010, kl 14.00-19.00. Vic 2 och 3. Points required to pass the exam 22 p.
Grading: (22-27.5) p = grade 3; (28-34.5) p = grade 4; (35-50) p = grade 5

Note: Hand in your answer in two separate cover paper according to:
A = Questions 1-6
B = Questions 7-14

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1. Discuss two different ways how archaea and/or bacteria adjust the lipid content of their plasma membranes in response to various temperatures. (2 p)

2. Describe the microbial fate/response when solutes such as salts and sugars are used to decrease water availability. Explain how some microbes adjust to the new environment. (2 p)

3. Discuss why microbes in a biofilm are more resistant to environmental changes than free-floating microbes. (1 p)

4. Briefly describe how the structure of transfer RNA determines the amino acid specificity throughout protein synthesis. (1 p)

5. Why do β-lactam antibiotics have a higher therapeutic index than most other antibiotics? (1 p)

6. (a) What is White Biotechnology? Explain in a few sentences why White Biotechnology has gained interest in the last decade. (1 p)
   (b) Describe the biorefinery concept. (1 p)

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7. Select any four amino acids, draw their structures, and indicate the atoms that can serve as hydrogen bond donors and/or acceptors when the amino acids are situated in the middle of a polypeptide. (4 p)

8. Proteins may have up to four levels of structure. For each type, describe the kind of bonding interactions that maintain that type of structure. Select from covalent or noncovalent. If you choose noncovalent, also select specific types (hydrogen bonding, hydrophobic, ionic).
   (a) Primary (1 p)
   (b) Secondary (1 p)
   (c) Tertiary (1 p)
   (d) Quaternary (1 p)

9. What is the molecular basis of separation in each of the following chromatographic techniques?
   (a) Ion-exchange chromatography (1 p)
   (b) Affinity chromatography (1 p)
   (c) Gel filtration chromatography (1 p)

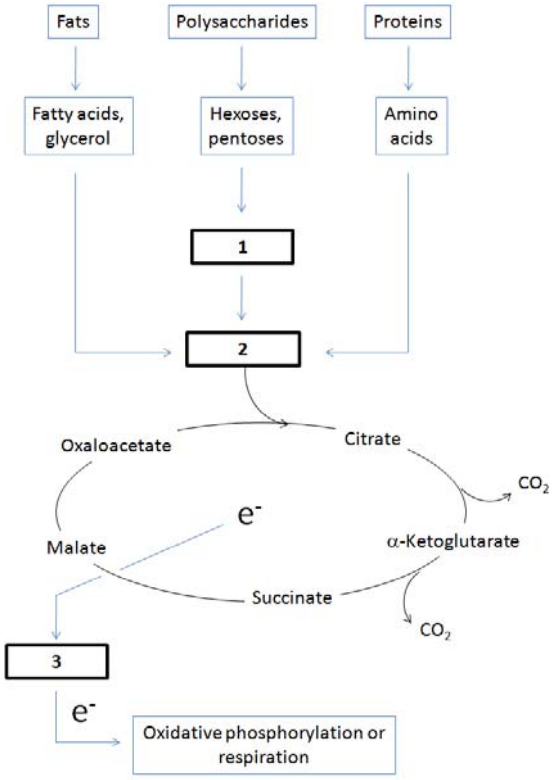
10. In a laboratory experiment you completed a study of enzyme kinetics. The following data were collected:

[S] (μM)	V_0 (μM/min)
50	10
100	19
150	31
200	38
300	55
400	62
800	68
1000	70

Estimate the K_M for this substrate:enzyme combination, and explain how you obtain the result. (2 p)

11. Glycolysis can proceed under anaerobic (oxygen-free) condition. Does this mean that glucose is not oxidized during glycolysis under anaerobic condition? Why? (3 p)

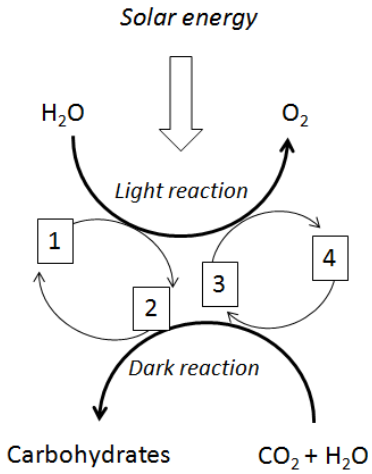
12. A simplified energy metabolic (catabolic) chart is shown here:



(a) Give the names of the intermediates/co-factors that are numbered **1**, **2**, and **3**. Note: **1** is the final product of glycolysis; **3** may represent more than one type of electron carrier. (3 p)
(b) What is the name of the cyclic pathway? (1 p)
(c) Explain how electron transport chain is coupled to oxidative phosphorylation at the bottom of the chart. (2 p)

13. (a) What is gluconeogenesis? (1 p)
(b) Explain the difference between gluconeogenesis and glycolysis. (1 p)

14. Photosynthesis is composed of a Light reaction and a Dark reaction. The two reactions are coupled through intermediates that act as energy currency or electron carrier, as shown in the following diagram:



(a) Give the name of the four intermediates **1**, **2**, **3** and **4**. Note: use **1** or **2** as the energy currency, and **3** or **4** as the electron carrier. (2 p)
(b) Explain briefly how the energy currency is produced during the Light reaction. (1 p)