

Examination

Biochemistry and Molecular Biology (KBB032) (2019)

Date and place: Wednesday, October 30, 08.30, “H”

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Aids: Chalmers approved calculator

”Grade limits”: 50% = 3; 65% = 4; 80% = 5

Code.....

1. Glycolysis is one of the most central metabolic pathways in a cell. What end products are formed from one mole of glucose? Key reactions are catalysed by Hexokinase, Phosphofructokinase and Pyruvate kinase, respectively. Describe the reactions carried out by these enzymes. How do you think the flux through the pathway would be affected by a high concentration of ATP or AMP, respectively (motivate your answer)? (10p)

2. Formation of ATP via oxidative phosphorylation is an extremely important process in the cell. (10p)
- A) Describe the process that “liberates energy” and which factors that determines the amount of energy “liberated”
 - B) What is the “force” used by ATP:ase for formation of ATP, which are the components constituting this force?
 - C) How will the process be affected if subjected to oligomycin or 2,4-DNP, respectively (motivate your answer)
 - D) Explain briefly the difference between substrate level phosphorylation and oxidative phosphorylation.

3. Acetyl-CoA is a very important metabolite in cellular metabolism. Give the name of one enzyme that is generating and one that is consuming this metabolite. Describe the reactions carried out by these two enzymes (8p)

4. What is the degree of reduction (available electrons per C-mole) of the following compounds. (5p)

Glucose

Ethanol

Glycerol

Carbon dioxide

Methane

5. What end products (including how many) are formed after one “turn” of the TCA-cycle. (5p)

6. What products are formed in cyclic and non-cyclic photosynthesis, respectively? (4p)

7. Give the name of the pathway producing the main part of reducing power, NADPH, in a cell. What glycolytic intermediate is the precursor for this pathway and give the name of the first enzyme in this pathway. (3p)

8. Explain (with one or two sentences) what is meant by the following expressions. (5p)

- a) Endosymbiont theory
- b) Essential amino acid
- c) Feed-back inhibition
- d) Gluconeogenesis
- e) Fermentation

Code: _____

9. Below is found a nucleotide sequence.

GAUCGUUAGCC

- a. Is it DNA or RNA? motivate your answer. (2p)
- b. What would be the sequence of the complementary strand, (written in the 5' to 3' direction)? (2 p)

10. The replication fork is the site of DNA synthesis. Describe the architecture of the replication fork including the DNA-strands involved and the role(s) of the proteins associated with the process. (10 p).

11. Explain the mechanism by which "Base excision repair" (BER) accomplishes the correction of an incorrect base-pairing in a chromosome. What happens on the level of DNA and which protein functions are required. (4 p)

12. There are three major classes of RNA which are involved directly in protein synthesis, which are they, and what are their roles? (3 p)

13. In translation elongation, the components are free amino acids, tRNA and mRNA bound to ribosomes. Four high-energy bonds are used for each amino acid added to the growing protein. In which steps is this energy used, and in which form? Your answer should include the proteins involved and a description of the process steps. (10 p)

14. Describe the regulation of the E.coli lactose operon in relation to the presence or absence of lactose and glucose. Include an explanation of the roles of proteins and DNA-sequences involved. Also indicate how the level of mRNA expression changes. (6 p)

15. There are three sequences that need to be present on a plasmid for it to be useful as a cloning vector. Which are these sequences, and what are their roles? (3 p)

16. Explain the meaning of the following 10 terms (1 p each/10 p total)

- a. Histone
- b. M-phase
- c. Telomere
- d. Transposase
- e. Dideoxy nucleotide
- f. Alternative splicing
- g. Mediator-complex
- h. 5' cap
- i. Shine-Dalgarno sequence
- j. PCR