HÖGSKOLAN
I SKÖVDE

TENTAMEN

Course	Cell Biology		
Sub-course			
Course code	bv108g	Credits for written examination	5.5
Date	2024-03-08	Examination time	08.30-12.30

Examination responsible	Henrik Thilander
Teachers concerned	
Aid at the exam/appendices	Dictionary

Other

Instructions

- ☐ Take a new sheet of paper for each teacher.
- ☒ All answers are written in the exam.
- ☐ Write only on one side of the paper.
- ☒ Write your name and personal ID No. on all pages you hand in.
- ☐ Use page numbering.
- ☒ Don´t use a red pen.
- ☒ Mark answered questions with a cross on the cover sheet.

Grade points

The written examination will exam course objective 1-4. To pass the exam **all objectives** must be passed and to pass an objective you need ≥50% of the objective's score. If one or multiple objectives are graded fail (F) the written exam will receive the grade fail (F). If all objectives are passed, the total score of the exam will result in grade A-E according to this:

E: total score ≥50%
D: total score ≥60%
C: total score ≥70%
B: total score ≥80%
A: total score ≥90%

Examination results should be made public within 18 working days

Good luck!

Instructions

- Make sure that your answers are easy to understand and that they are written in a concise way. Make sure that the information is given in a logical order and is easy to follow.
- It is much easier to correct your exam in a fair way if you do not just write a lot of text but instead divide your answer in paragraphs and for-example give headings to the different paragraphs. If your answers are not easy to follow this will probably result in few points.
- Make sure that it is easy to read your handwriting. If it is not possible to read some parts of your answer you will automatically get 0 p on the whole question.
- If you make figures, be sure that these show exactly what you want them to show.
- Do not write things that is not relevant for the question. If you write non-relevant information just for show-off this can result in minus-points.
- If you are supposed to give a specific number of examples "extra" examples will not be corrected.
- If you need more space for answering a questions in the exam use the back-side of the paper belonging to the question.
- Make sure that you have written your name and social security number on **each** page!

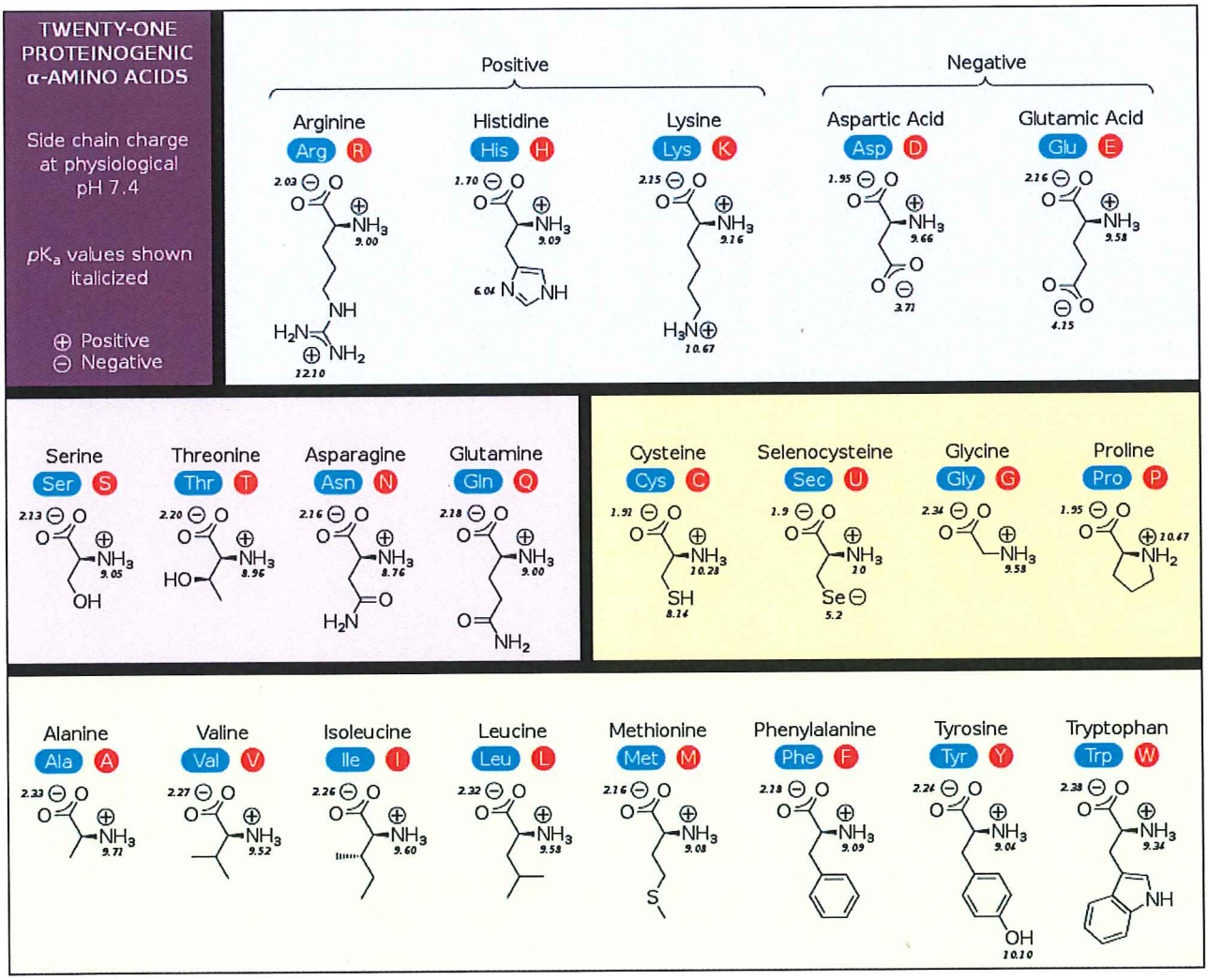
Good luck!

/Henrik

Name		Personal ID	

1. The tertiary structure of a protein can be held in place by different chemical bonds between the amino acids' sidechains. Name two types of bonds and give an example of two amino acids that can form the specific bond. Use the figure below as help to identify the amino acids. Both the name and the amino acids has to be correct for points. **(1 p for each chemical bond and amino acids that is entirely correct. Max 2 p)**

Chemical bond	Amino acid 1	Amino acid 2



Name		Personal ID	

2. It is often said that water can move freely in and out of a cell, but this statement is not entirely true. Explain in general how water move in and out of the cell, why it have to use this system and what this particular mechanism is called. **(1.5 p)**

3. Give a biochemical explanation to why can humans can degrade starch but not cellulose? **(1.5 p)**

4. Explain in general the process of active transport and provide an example of molecules that utilize this transport mechanism. **(2p)**

5. Briefly explain the following: **(1p)**
   a. Prosthetic group

   b. Hydrolysis

6. Explain what denaturation in protein is and the mechanism of why it is occurring. **(2 p)**

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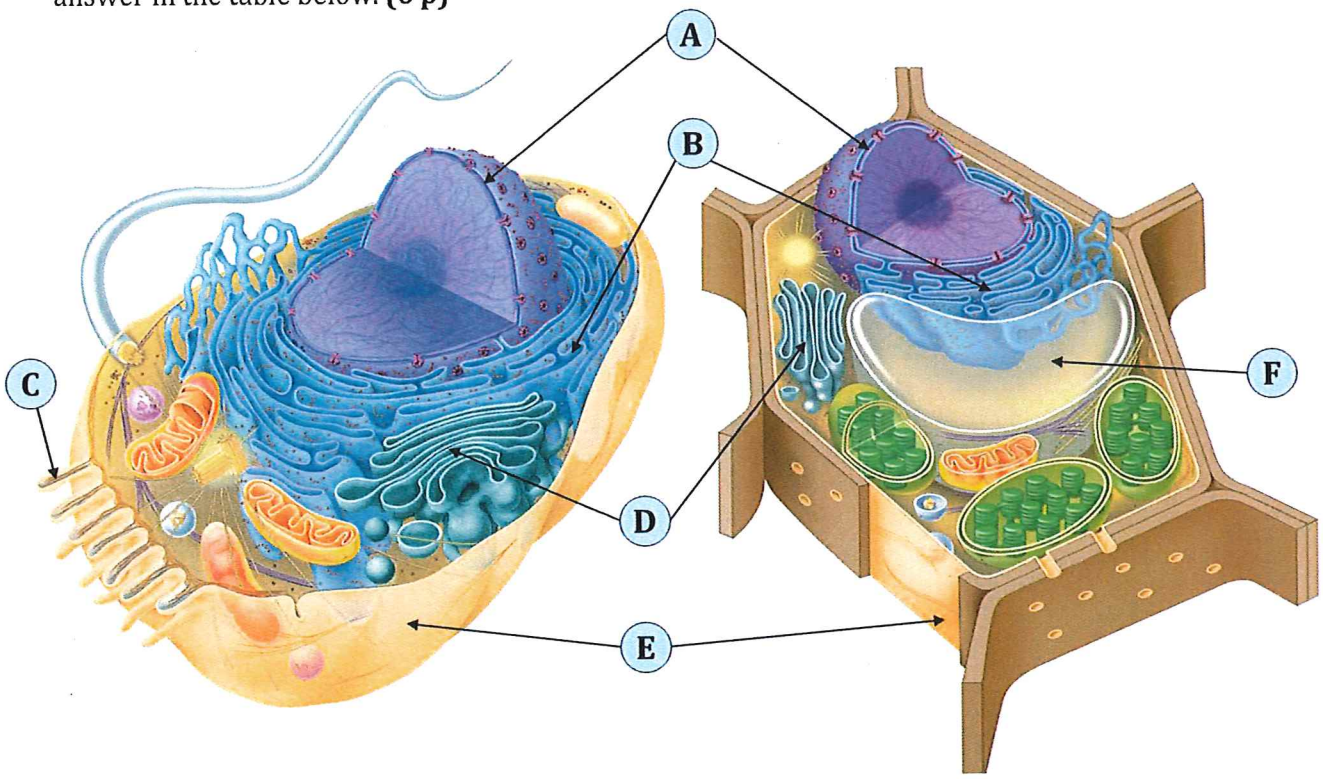
Name		Personal ID	

7. Which of the following cell structures can be found in animal, plant and prokaryotic cells, respectively? Mark your answers in the table below. **(0.5 p for each cell structure that is entirely correct. Max 0.5*8 p)**

Cell structure	Animal cell	Plant cell	Prokaryotic cell
Cell membrane			
Nucleus			
Chloroplasts			
Cell wall			
Endoplasmic reticulum			
Cytoskeleton			
Mitochondria			
Ribosomes			

8. Name the numbered structures (A-F) in the cells and briefly explain their functions. Give your answer in the table below. **(6 p)**



Cell structure	Name	Function
A		
B		
C		
D		
E		
F		

Name		Personal ID	

9. Serum albumin is a protein secreted by hepatocytes (liver cells). Give a detailed explanation of the cell's production of this protein, and your explanation has to include where the protein is produced, how the protein is transported in the cell, organelles or structures involved and how the protein is secreted. **(4 p)**

10. What is the function of the light reaction in chloroplasts? **(1 p)**

11. Briefly explain the function of the following terms/components. **(3 p)**
    a. Coenzyme A
    b. NAD^+
    c. Glycolysis
    d. Catabolism
    e. β-oxidation
    f. Calvin cycle

12. Briefly explain why one NADH + H^+ will generate more ATP compared to $FADH_2$. **(2 p)**

Name		Personal ID	

13. Name in order and briefly explain the three stages of cell signaling. **(3 p)**

14. Briefly describe the three stages of how a ligand-gated ion channel operates. **(1.5 p)**

15. Taste is detected through different taste buds. Salt is detected when the salt concentration is outside of the cell and ion channels allow passive leakage of sodium ions into the cell. This results in a change of membrane potential which signals the brain of salt taste. Umami, often described as taste of broth, is instead detected through the glutamate receptor, which is a G protein-coupled receptor, and will result in a taste signal.

    If you eat salty potato chips and then rinse your mouth with water, you will no longer taste salt. If you on the other hand eat taco flavored potato chips, that are usually flavored with glutamate, and then rinse with water, you will notice that the taste lingers. Give a cell biological explanation to this phenomenon. **(3 p)**

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Answer the following five questions by making a circle around the one correct alternative.

16. What is the second messenger in this pathway? Epinephrine → G-protein-linked receptor → G-protein → adenylyl cyclase → cAMP **(0.5 p)**
    a. G-protein-linked receptor.
    b. G-protein.
    c. GTP.
    d. adenylyl cyclase.
    e. cAMP.

17. What is the role of phosphatases in cell signaling? **(0.5 p)**
    a. Phosphatases facilitate receptor internalization
    b. Phosphatases are not involved in cell signaling
    c. Phosphatases activate signaling pathways
    d. Phosphatases amplify the signal strength
    e. Phosphatases dephosphorylate proteins

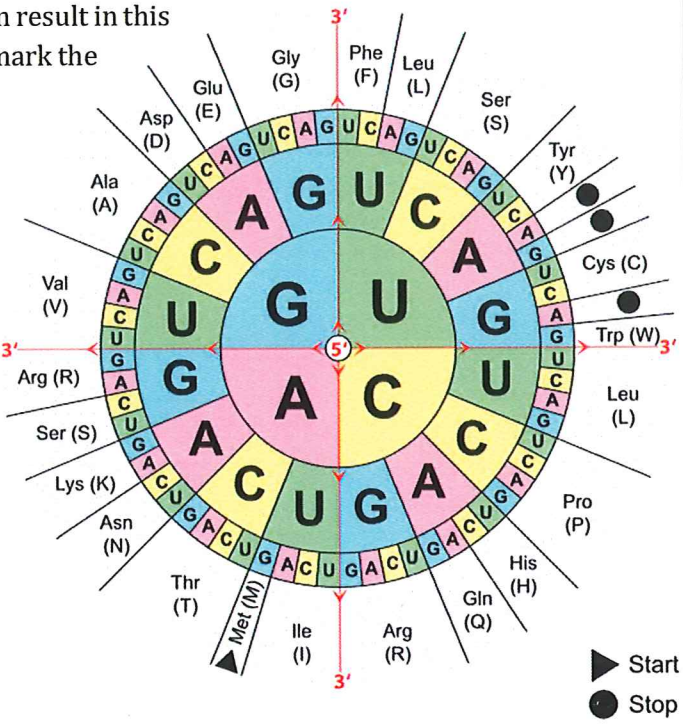
18. What is a ligand? **(0.5 p)**
    a. An intracellular signaling molecule influencing the production of cyclic AMP.
    b. A molecule that attaches to a receptor, triggering changes within the cell.
    c. A small membrane-bound protein generating important signals within the cell.
    d. An enzyme that hydrolyzes GTP to GDP.
    e. A secreted hydrophobic molecule.

19. Once phosphorylated, the intracellular segment of a receptor tyrosine kinase? **(0.5 p)**
    a. Terminates intracellular signaling cascades.
    b. Activates adenylate cyclase.
    c. Causes dissociation of the ligand from an allosteric binding site.
    d. Allows docking of intracellular proteins involved in signal transduction.
    e. Initiates the breakdown of extracellular matrix proteins.

20. When a cell releases a signal molecule into the environment and a number of cells in the immediate vicinity respond, this type of signaling is? **(0.5 p)**
    a. Typical of hormones.
    b. Paracrine signaling.
    c. Autocrine signaling.
    d. Endocrine signaling.
    e. Synaptic signaling.

Name		Personal ID	

21. Write the gene sequence (template strand) that can result in this peptide: Met-Ser-Trp-Trp-His-Leu. Remember to mark the ends of the DNA strand. **(3 p)**



22. Human mRNA can be modified in a process called alternative splicing. Explain in detail what alternative splicing is. **(2p)**

23. Briefly explain the function of the following terms/components **(2 p)**
    a. Promoter

    b. Poly-A tail

    c. Ribozyme

    d. Anticodon

Name		Personal ID	

24. What is the effect on protein level of a nonsense mutation, a missense mutation and a silent mutation, respectively in a gene? **(1.5 p)**

25. Give three examples of post-translational modification. **(1.5 p)**