MOL100

Notes from the book

Multiple choice

Question:

Eukaryotic cells proliferate by a program that is called the cell cycle and which consists of different phases. Select the most correct answer about the cell cycle phases.

Select one alternative:

- A. DNA replication occurs in S-phase
- B. G1 phase is immediately followed by G2 phase.
- C. Cells that are not dividing anymore, stay most often in G1 phase.
- D. In M-phase, the cell divides into two daughter cells.
- E. A, C and D are correct.
- F. A and D are correct.
- G. B and D are correct

Question:

Bacteria are often used as "tools" in molecular biology. They are also often used as study objects to understand the molecular basis of biological processes. What are the reasons for these two different uses? Choose the most correct answer.
Select one alternative:

- A. They divide fast and can easily grow in plastic dishes with growth medium and agar.
- B. Many molecular processes are very similar in bacteria and eukaryotic cells
- C. Bacteria contain the same organelles as eukaryotic cells.
- D. B and C are correct.

- E. A, B and C are correct.
- F. A and B are correct.

Question:
Proteins consist of chains of amino acids. Which statement about the properties of amino acids is NOT correct?
Select one alternative:

- The side chains determine the properties of amino acids.
- The alpha carbon of an amino acid is bound to four chemical groups.
- A peptide bond forms between two carbon atoms of adjacent amino acids.
- Cysteine is an amino acid that can form disulphide bonds.

Question:

Nucleic acids and carbohydrates (sugars) are two of the "chemical building blocks" of cells. Which statement about nucleic acids and carbohydrates is NOT correct?

Select one alternative:

- DNA is a nucleic acid in which the nucleotides are connected to each other by phosphodiester bonds.
- Aldoses and ketoses are monosaccharides that differ in the position of their carbonyl group.
- Glycosidic bonds are made between a carbonyl and a hydroxyl group of two monosaccharides.
- The bases of the complementary strands of the DNA double helix are held together by non-covalent bonds.

Question:

Some proteins can accumulate into biomolecular condensates. Such condensates are not enclosed by a membrane, but they can help to organize the functions inside a cell. Which statement about biomolecular condensates is NOT correct?

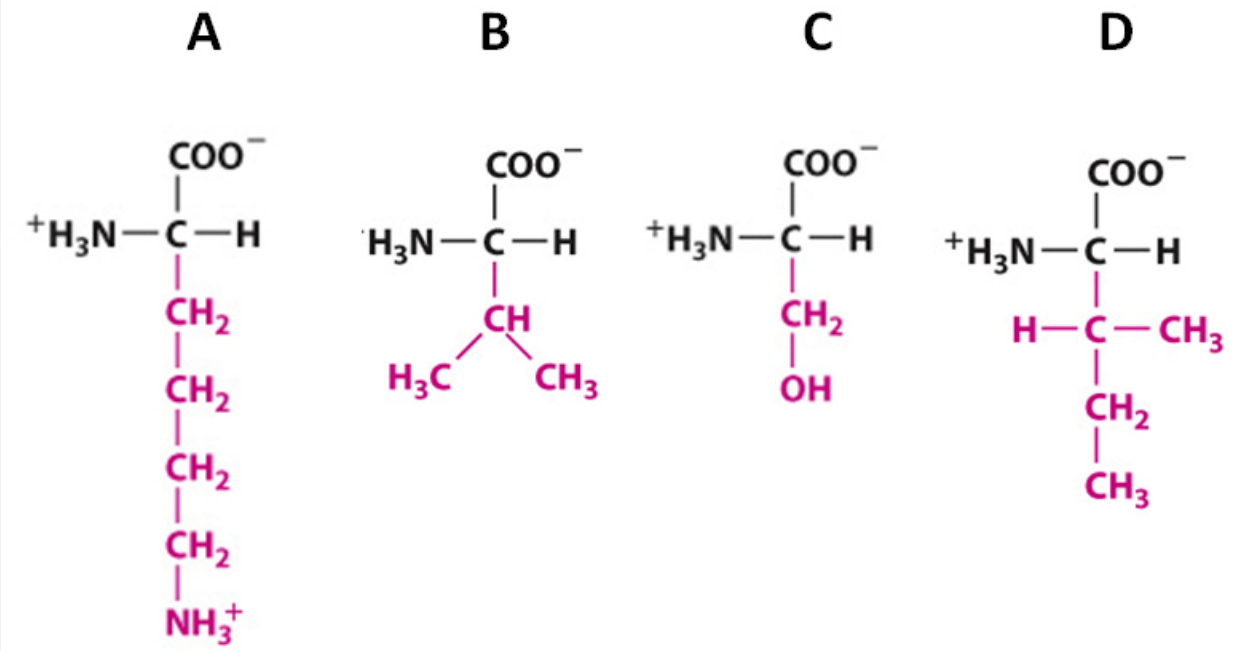
Select one alternative:

- Proteins in a biomolecular condensate often bind to each other via intrinsically disordered regions.
- Biomolecular condensates can contain one or several different proteins.
- Biomolecular condensates exist in the cytosol and in different organelles.

- When a protein forms a biomolecular condensate, it acquires a specific quaternary structure.
- The concentration of the protein and the pH are among the factors that decide whether a biomolecular condensate forms.

Question:

Which of the amino acids shown in the figure is a basic amino acid?



Select one alternative:

- A
- B
- C
- D

Question:
When the forward and reverse rate of a chemical reaction are equal, the reaction has reached the…
Select one alternative:

- Chemical equilibrium
- Dissociation constant
- Michaelis constant
- Steady state

Question:

Enzymes are essential facilitators of chemical reactions in cells. Which statements about the structure and function of enzymes are correct? Select the most correct answer.

Select one alternative:

- A. The active site of an enzyme consists of the catalytic site and the substrate-binding site.
- B. The binding of a substrate to an enzyme can be affected by the pH value.
- C. The catalytic site of an enzyme determines the specificity and the affinity for the substrate.
- D. Enzymes increase the amount of activation energy that can be used for the chemical reaction.
- E. A, B and C are correct.
- F. B and D are correct.
- G. A and B are correct.

Question:

Fluorescence microscopy is a specific type of light microscopy. Which statement about fluorescence microscopy is NOT correct?

Select one alternative:

- In a fluorescence microscope, a dichroic mirror reflects the excitation light on the sample, and lets the light emitted by a fluorescent molecule pass.
- A fluorescent molecule emits light of a specific wavelength after it has been excited by a different wavelength.
- A confocal laser scanning microscope is faster but has a lower resolution than a widefield fluorescence microscope.
- Immunofluorescence microscopy uses antibodies to detect specific molecules in a sample.

Question:

The properties of a lipid bilayer (a biomembrane) can be affected by the fatty acids and the head groups of the phospholipids in the biomembrane. Which statement(s) about biomembranes are correct? Choose the most correct answer.

Select one alternative:

- A. The curvature of a biomembrane can be affected by the type of head groups.
- B. Unsaturated fatty acids make biomembranes more fluid.
- C. Shorter fatty acids make biomembranes less fluid.
- D. A and B are correct.
- E. A, B and C are correct.

Question:
Biomembranes contain many proteins. Which statement about membrane proteins is correct?
Select one alternative:

- Phospholipids, but not proteins can move laterally in biomembranes.
- The intra- and extracellular domains of transmembrane proteins are hydrophilic.
- Beta sheets are the most common secondary structure of transmembrane domains.
- GPI anchors (glycosylphosphatidylinositiol) can attach proteins to the exoplasmic and cytoplasmic leaflets of biomememembranes.

Question:

Which of the statements about DNA and RNA is NOT correct?

Select one alternative:

- Single-stranded RNA can form secondary structures.
- In a DNA strand, the nucleotides are connected by phosphodiester bonds, in RNA by phosphomonoester bonds.
- In RNA, uracil nucleotides are used instead of thymidine nucleotides.
- Both DNA and RNA consists of nucleotides that contain a pentose.
- RNA is less stable than DNA.

Question:

Eukaryotic cells contain several kinds of organelles. Which statement about these different organelles is correct?

Select one alternative:

- Mitochondria and chloroplasts are the only organelles that are surrounded by two membranes.
- The membrane of the endoplasmic reticulum is directly connected to the nuclear envelope.
- The rough endoplasmic reticulum has mitochondria on its surface.
- Proteins are synthesized at the cis-face of the Golgi.

Question:
The cytoskeleton is a network of different types of filaments that extend throughout the cytoplasm. Which statement about the cytoskeleton is NOT correct?t
Select one alternative:

- Microtubules and actin filaments are two types of cytoskeletal filaments that both consist of chains of small subunits
- The cytoskeleton is important for the transport of molecules and vesicles in the cell.
- The shape of a cell changes because actin filaments regulate the growth of microtubules.
- Cytoskeletal filaments of neighbouring cells are connected by anchoring junctions in the cell membrane.

Question:

Transcription is the process in which an RNA strand is made based on a template DNA strand. Which statement about transcription is NOT correct?

Select one alternative:

- RNA can form Watson-Crick base pairs with the DNA strand.
- At the transcription stop site, the mRNA strand is released, and the RNA polymerase moves along the template DNA strand to transcribe the next gene.
- RNA polymerase separates (melts) the two DNA strands to obtain access to the template strand.
- RNA polymerase synthesizes RNA strands only in 5’ to 3’ direction of the RNA strand.

Question:
Allosteric regulators can regulate protein activity by… (select the correct answer)
Select one alternative:

- A. … lowering the activation energy for exergonic reactions.
- B. … changing the conformation of a protein.

- C. … covalent binding to the regulatory site of a protein.
- D. A, B and C are correct
- E. B and C are correct.

Question:
In polyacrylamide gel electrophoresis, the movement (migration) of proteins through a gel depends on their mass, their charge and their conformation. When SDS (sodium dodecyl sulfate) is added to the protein sample, the proteins will be separated in the gel only according to their mass. How does SDS do this? Choose the most correct answer.
Select one alternative:

- A. SDS unfolds proteins, so the conformation of the protein does not affect the migration of the proteins through the gel anymore.
- B. SDS removes the electrical charge of the proteins, so the charge of the proteins does not affect the migration of the proteins through the gel anymore.
- C. SDS folds all proteins into a globular conformation, so there is no difference in conformation that could affect the migration through the gel.
- D. SDS has a strong negative charge. When proteins are bound by SDS, their own charge is minimal compared to the negative charge of SDS and does not affect the migration through the gel anymore.
- E. C and D are correct.
- F. A and B are correct.
- G. A and D are correct.

Question:
Which statement/answer about non-covalent interactions is most correct?
Select one alternative:

- A. Transient dipoles cause van-der-Waals interactions.
- B. The hydrophobic effect describes the bonds between non-polar and polar molecules.
- C. Ionic interactions occur either between cations or between anions.
- D. Non-covalent interactions are rare between biological macromolecules.
- E. A, B and C are correct.
- F. A and B are correct.
- G. A and D are correct.

Essay

Question:

Translation is the process in which a polypeptide is generated based on a messenger RNA. Describe the three phases of translation and the most important molecules involved in this process.

A. **Initiation (2.5p)**
B. **Elongation (2p)**
C. **Termination (0.5p)**

max 300 words
Remember that you can use drawings to support your answer.

Question:

The abundance (amount) of proteins is regulated via their synthesis and via their degradation. There are two important ways of protein degradation, one of them is proteasomal degradation.

A. **How are proteins marked for proteasomal degradation? (1.5p)**
B. **Explain the structure of the proteasome and how it degrades proteins. (2.5p)**

C. Which organelle is the second important way for protein degradation and how does it function? (1p)

max 300 words
Remember that you can use drawings to support your answer.
Fill in your answer here