

Exam duration: 135 mins

Name _____

Surname _____

Date of birth _____

*In the tasks 1 – 5 select **only one** correct answer.*

1. Which term of mitosis describes two centrosomes arranged at opposite poles of the cell?

- A. prophase;
- B. prometaphase;
- C. metaphase;
- D. anaphase;
- E. telophase.

2. A cell containing 92 chromatids at metaphase of mitosis would, at its completion, produce two nuclei each containing how many chromosomes?

- A. 23;
- B. 46;
- C. 48;
- D. 92;
- E. 184.

3. How is most of the carbon dioxide transported by the blood in humans?

- A. Bicarbonate ions in the plasma;
- B. CO₂ attached to hemoglobin;
- C. Carbonic acid in the erythrocytes;
- D. CO₂ dissolved in the plasma;
- E. Bicarbonate attached to hemoglobin;

4. Which of the following catalyzes the linkage between ribonucleotides to form RNA during gene expression?

- A. Ribozyme
- B. Aminoacyl-tRNA synthetase
- C. RNA polymerase
- D. tRNA
- E. Tyrosinase

5. Interactions between individuals of different species that benefit both partners:

- A. Symbiosis
- B. Obligate mutualism
- C. Mutualism
- D. Facultative mutualism
- E. Commensalism

In the tasks 6 – 10 select **several** correct answers or put statements into correct order.

6. Identify the non-membranous organelles from the following list:

- A. Cell wall;
- B. Chloroplast;
- C. Cytoskeleton;
- D. Golgi apparatus;
- E. Lysosome;
- F. Mitochondria;
- G. Nucleus;
- H. Ribosome.

7. Put the levels of hierarchical organization of life from most to least inclusive:

- A. Class _____
- B. Family _____
- C. Genus _____
- D. Kingdom _____
- E. Order _____
- F. Phylum _____
- G. Species _____
- H. Subspecies _____

8. Define the nature of the cause (Virus, Bacteria or Protista) for the following infectious diseases.

- A. AIDS _____
- B. Cholera _____
- C. Influenza _____
- D. Malaria _____
- E. Plague _____
- F. Sleeping sickness _____
- G. Smallpox _____
- H. Tuberculosis _____

9. Match terms with their definitions.

- A. Adrenocorticotrophic hormone _____
- B. Catecholamines _____
- C. Glucocorticoids _____
- D. Melanocyte-stimulating hormone ____
- E. Neuroendocrine signaling _____

- 1. A hormone produced by the anterior pituitary glands that stimulates the adrenal cortex;
- 2. A hormone secreted by the anterior pituitary. It stimulates pigment production in the skin;
- 3. Helps body resist long-term stressors; increases blood glucose levels; controls effects of inflammation from edema;
- 4. Hormones secreted by the adrenal medulla that affect the sympathetic nervous system in stress response;
- 5. Neurohormones diffuse into the bloodstream and trigger responses in target cells anywhere in the body.

10. This is the text about the history of life on Earth. Put the sentences into correct order from ancient to modern times.

- A. Arising of fishes and other Tetrapodes during the Paleozoic Era.
- B. Birds, pterosaurs, dinosaurs, and tiny nocturnal insect-eating mammals became the main terrestrial fauna during Mesozoic Era.
- C. Group of mammals called Primates gave rise to the *Homo Sapience*.
- D. Large mammalian herbivores and carnivores diversified as mammals exploited vacated ecological niches after the preceding mass extinction.
- E. Life on Earth became multicellular.
- F. Life on Earth became single-celled; cells were not able to produce oxygen.
- G. The first arthropods and mollusks appeared during the Cambrian Explosion.
- H. The first eukaryotic organisms appeared.
- I. The first photosynthetic organisms emerged producing a lot of oxygen into the atmosphere.

In the tasks 10 - 15 write the answer in a single or several words.

11. What is the genotype of the individual that produces these gametes? $ABX^h AbX^h ABY AbY$

12. How many gametes does the individual with the following genotype produce? $AaBBRh^+Rh^-I^A I^B X^h Y$

13. In hamsters, the gene for black fur (B) is dominant and the gene for white fur (b) is recessive. What are the possible combinations of genes in the offspring of a white female and a heterozygous black male?

14. Write down the following term. The synthesis of a polypeptide using the genetic information encoded in an mRNA molecule.

15. Write down the following term. Any of a large variety of proteins normally present in the body or produced in response to an antigen which it neutralizes, thus producing an immune response.

In the tasks 16 - 20 write down the full answer in a box. If there is not enough space on this side of the paper use the other side

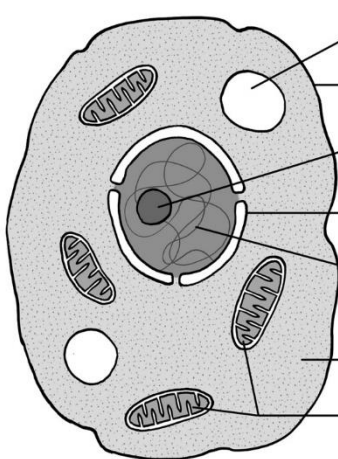
(write the label "check on the other side").

16. Use the genetic code table to find all possible matrix DNA sequences from which the following polypeptide sequence can be translated: Met-Phe-Val-Trp.

		Second Letter									
		U		C		A		G			
1st letter	U	UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys	3rd letter	
		UUC		UCC			UAC		UGC		
		UUA	Leu	UCA			UAA	Stop	UGA		Stop
		UUG		UCG			UAG	Stop	UGG		Trp
C	CUU	Leu	CCU	Pro	CAU	His	CGU	Arg			
	CUC				CCC		CAC			CGC	
	CUA				CCA		CAA		Gln	CGA	
	CUG				CCG		CAG			CGG	
A	AUU	Ile Met	ACU	Thr	AAU	Asn	AGU	Ser			
	AUC				ACC		AAC		AGC		
	AUA				ACA		AAA	Lys	AGA	Arg	
	AUG				ACG		AAG		AGG		
G	GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly			
	GUC				GCC		GAC			GGC	
	GUA				GCA		GAA		Glu	GGA	
	GUG				GCG		GAG			GGG	

polypeptide: Met-Phe-Val-Trp

17. Write down the name of the signed organelles and list the organelles' functions.



1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

20. This is the text about the process of protein synthesis. There are four mistakes in this text.

Write down the number of the wrong sentence and correct the mistake.

1. The process of protein synthesis consists of three stages: transcription, translation and post-synthetic modification in the Golgi apparatus.
2. Transcription occurs in the cytoplasm.
3. The mRNA molecule that was synthesized recently goes through nuclear pores (which consists of polysaccharides called nucleoporins) to the cytoplasm.
4. After that, mRNA meets ribosomes on the smooth Endoplasmic Reticulum.
5. On the ribosomes, the process called translation begins.
6. Ribosomes, consisting of three subunits, contains both our RNA and some proteins.
7. After the protein is synthesized, it is being transported in the Golgi apparatus, where it will be modified, packed and either secreted out of the cell or stored inside.

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() _____

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