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**BIOLOGY**  
**STANDARD LEVEL**  
**PAPER 1**

Wednesday 18 May 2011 (afternoon)

45 minutes

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**INSTRUCTIONS TO CANDIDATES**

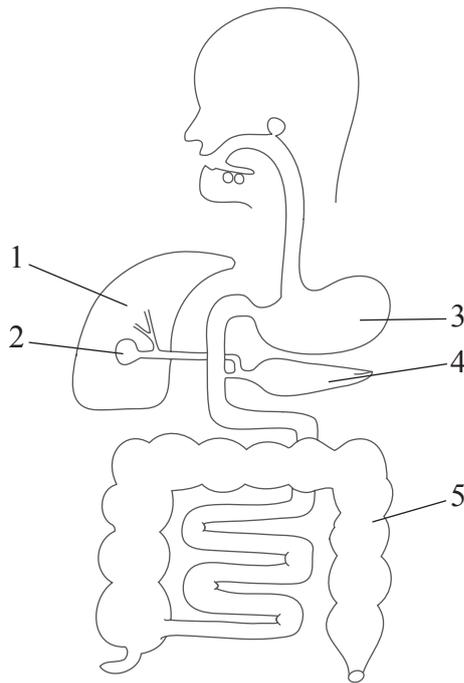
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. Which hypothesis can be tested using the *t*-test?
  - A. The difference in variation between two samples is not significant.
  - B. The difference between observed values and expected values is not significant.
  - C. The change in one variable is not correlated with a change in another variable.
  - D. The difference between the means in two samples is not significant.
  
2. Which of the following characteristics found in a structure necessarily indicates that it is alive?
  - A. The presence of genetic material
  - B. The presence of a lipid bilayer
  - C. Metabolism
  - D. Movement
  
3. Which of the following does **not** occur during interphase?
  - A. Replication
  - B. Translation
  - C. Cytokinesis
  - D. An increase in the number of mitochondria
  
4. Which pair of features is correct for both a human liver cell and an *Escherichia coli* cell?

|    | <b>Human liver cell</b>              | <b><i>Escherichia coli</i> cell</b>  |
|----|--------------------------------------|--------------------------------------|
| A. | contains DNA associated with protein | contains naked DNA                   |
| B. | has 70S ribosomes                    | has 80S ribosomes                    |
| C. | contains mitochondria                | contains mitochondria                |
| D. | contains DNA enclosed by a membrane  | contains DNA associated with protein |

5. What property of water makes it a good evaporative coolant?
- A. High latent heat of evaporation
  - B. Relatively low boiling point
  - C. Volatility
  - D. Transparency
6. If a mitochondrion has a length of 5  $\mu\text{m}$  and a student's drawing of the mitochondrion is 10 mm, what is the magnification of the drawing?
- A.  $\times 0.0005$
  - B.  $\times 0.5$
  - C.  $\times 200$
  - D.  $\times 2000$
7. A number of different proteins are involved in nerve function. Which of the following does **not** require a membrane protein?
- A. Active transport of sodium
  - B. Diffusion of  $\text{K}^+$  into the cell
  - C. Diffusion of the neurotransmitter across the synapse
  - D. Binding of the neurotransmitter to the post-synaptic membrane
8. What is the difference between galactose and lactose?
- A. Lactose is a disaccharide and galactose is a monosaccharide.
  - B. Lactose is the product of anaerobic respiration in humans and galactose is the product of anaerobic respiration in yeast.
  - C. Lactose is an enzyme and galactose is a hormone.
  - D. Galactose is a sugar found in milk but lactose is not found in milk.

Questions 9 and 10 refer to the following diagram of the human digestive system.



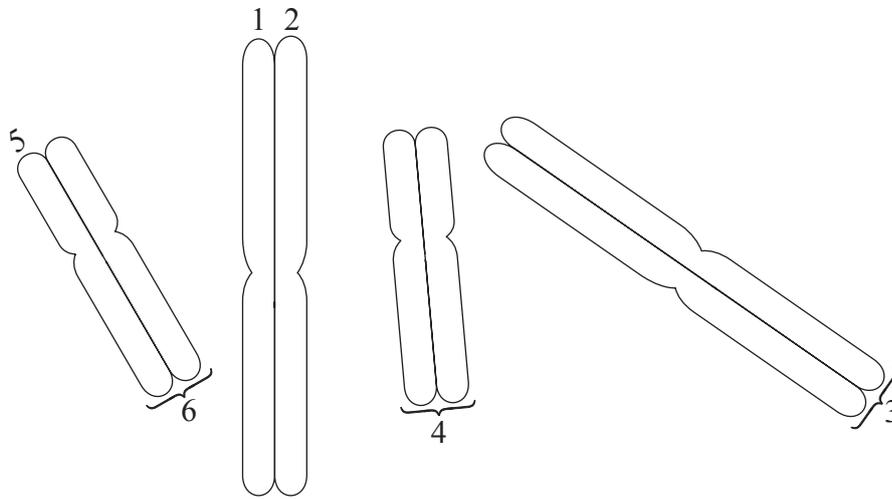
9. Which organs are associated with the transformation of glucose into glycogen?
- A. 1 and 4
  - B. 2 and 3
  - C. 2 and 4
  - D. 1 and 3
10. Which structure produces lipase?
- A. 1
  - B. 2
  - C. 4
  - D. 5

11. Which process produces the most ATP per molecule of glucose?
- A. Anaerobic respiration in a yeast cell
  - B. Aerobic respiration in a bacterial cell
  - C. Glycolysis in a human liver cell
  - D. The formation of lactic acid in a human muscle cell
12. Which type of light is **least** useful for photosynthesis in terrestrial plants?
- A. Blue
  - B. Green
  - C. White
  - D. Red
13. Between which structures do sensory neurons carry nerve impulses?
- A. From receptors to muscles
  - B. From effectors to the central nervous system (CNS)
  - C. From the central nervous system (CNS) to receptors
  - D. From receptors to the central nervous system (CNS)
14. How many molecules of water are required to completely hydrolyse a polypeptide made up of 23 amino acids?
- A. 11
  - B. 22
  - C. 23
  - D. 44

15. A collection of four animal specimens is observed and a dichotomous key is applied. Which specimen is an arthropod?
- 1. Non-segmented body ..... go to 2  
Segmented body ..... go to 3
  - 2. Body is not symmetrical ..... specimen A  
Body is symmetrical ..... specimen B
  - 3. Jointed appendages present ..... specimen C  
Jointed appendages absent ..... specimen D
- A. Specimen A
  - B. Specimen B
  - C. Specimen C
  - D. Specimen D
16. How is the polymerase chain reaction (PCR) used?
- A. To make many copies of a DNA molecule
  - B. To cut DNA at specific sequences
  - C. To splice fragments of DNA together into a plasmid
  - D. To separate fragmented pieces of DNA based on their charge and size
17. Sickle-cell anemia is caused by a mutation. How many changes to the amino acid sequence are caused by this mutation?
- A. 1
  - B. 2
  - C. 3
  - D. 4

18. A human cell has between 20000 and 25000 genes whereas an *E. coli* cell has approximately 4000 genes. Which of the following statements is true?
- A. The human genome is larger than the *E. coli* genome.
  - B. There are more genes on each human chromosome than on the *E. coli* chromosome.
  - C. The human cell and the *E. coli* cell produce approximately the same variety of proteins.
  - D. The DNA in both organisms is associated with histones (proteins).

19. In the following diagram, which pair represents homologous chromosomes?



- A. 1 and 2
  - B. 3 and 4
  - C. 2 and 5
  - D. 4 and 6
20. Which of the following represent homologous features?
- A. Wings in birds and insects
  - B. The appendix in humans and horses
  - C. Fins in fish and wings in birds
  - D. The striped coat of the zebra and the tiger

21. Which of the following ecological units includes abiotic factors?
- A. A community
  - B. An ecosystem
  - C. A population
  - D. A trophic level
22. In the forest zone between Gabon and the Republic of Congo it is estimated that an epidemic of the Zaire strain of the Ebola virus (ZEBOV) killed nearly 5000 gorillas, significantly reducing the population. Which statement is supported by this information?
- A. Natality was greater than mortality.
  - B. Mortality was equal to natality.
  - C. Natality and immigration was greater than mortality and emigration.
  - D. Mortality was greater than immigration and natality.
23. If humans become infected with the Ebola virus it can have devastating effects. Strong, but not certain, evidence suggests that trading in animal products is the main reason for the spread of the Ebola virus to humans. Which statement about the precautionary principle is correct?
- A. In the absence of certainty about cause and effect, people should not be asked to stop trading in animal products.
  - B. The burden of proof regarding a cause and effect relationship lies with scientists.
  - C. Because it is a probable cause, trading in animal products should be banned because of the potentially devastating consequences.
  - D. The precautionary principle is not relevant in this case.

24. A parent organism of unknown genotype is mated in a test cross. Half of the offspring have the same phenotype as the parent. What can be concluded from this result?
- A. The parent of unknown genotype is heterozygous.
  - B. The parent of unknown genotype is homozygous dominant.
  - C. The parent of unknown genotype is homozygous recessive.
  - D. The parent of known genotype is heterozygous.

*Questions 25 and 26 refer to the following information.*

Rhesus factor is an antigen present on the surface of red blood cells of Rhesus positive individuals. Rhesus positive ( $Rh^+$ ) is dominant to Rhesus negative ( $Rh^-$ ). A mother with Rhesus negative blood gives birth to a baby with Rhesus positive blood and there are concerns that subsequent pregnancies will trigger an immune response.

25. What are the genotypes of the mother and her first baby?

|    | <b>Genotype of mother</b> | <b>Genotype of first baby</b> |
|----|---------------------------|-------------------------------|
| A. | $Rh^- Rh^-$               | $Rh^- Rh^-$                   |
| B. | $Rh^- Rh^-$               | $Rh^+ Rh^-$                   |
| C. | $Rh^- Rh^-$               | $Rh^+ Rh^+$                   |
| D. | $Rh^+ Rh^-$               | $Rh^+ Rh^+$                   |

26. What is a possible explanation for why subsequent pregnancies could trigger an immune response?
- A. Exposure to the  $Rh^+$  antigen in the first pregnancy triggered the development of antibodies that could attack the blood of a future  $Rh^+$  baby.
  - B. Exposure to the  $Rh^+$  antigen in the first pregnancy triggered the development of specific phagocytes that could attack the blood of a future  $Rh^+$  baby.
  - C. The mother has developed passive immunity to the  $Rh^+$  factor.
  - D. The mother's immune system has been weakened by pregnancy.

27. Which vessel directly supplies the heart muscle with blood?
- A. The aorta
  - B. The pulmonary artery
  - C. The coronary artery
  - D. The pulmonary vein
28. Which of the following is part of the process of cellular respiration?
- A. Changes in the volume of the thoracic cavity
  - B. Exchange of gases across the surface of the alveoli
  - C. Exchange of gases across the surface of capillaries
  - D. Glycolysis
29. Which group of organisms in the carbon cycle converts carbon into a form that is available to primary consumers?
- A. Decomposers
  - B. Saprotrophs
  - C. Detritus feeders
  - D. Producers
30. Which variable has the **least** effect on enzyme activity?
- A. Temperature
  - B. Light intensity
  - C. pH
  - D. Substrate concentration