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Biology
Standard level
Paper 1

Wednesday 11 May 2022 (afternoon)

45 minutes

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.
- The maximum mark for this examination paper is **[30 marks]**.

1. A cell contains chloroplasts, plasma membrane and 80S ribosomes. What type of cell could it be?
 - A. Bryophyte
 - B. Lymphocyte
 - C. Prokaryote
 - D. Neuron

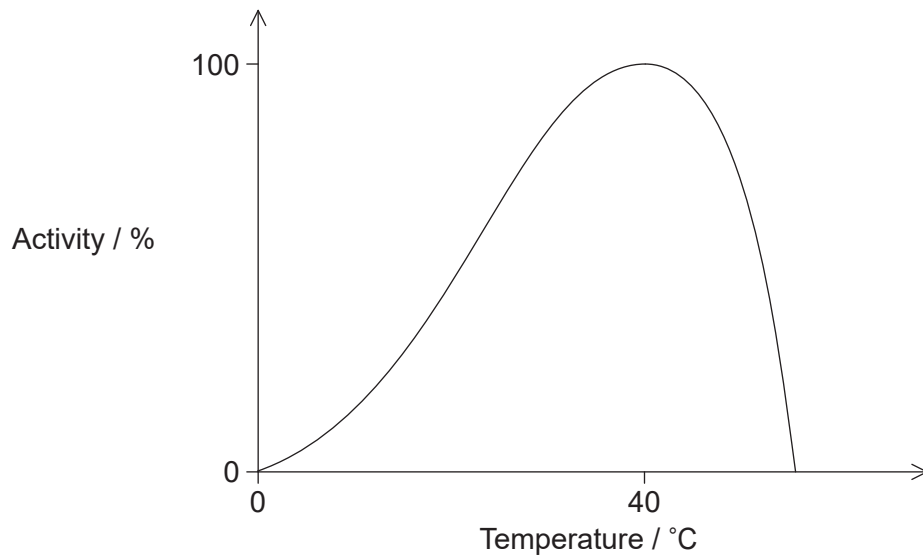
2. More than 90% of cellular cholesterol is located in the cell's plasma membrane. What is the main role of cholesterol in the plasma membranes of mammalian cells?
 - A. To regulate membrane fluidity
 - B. To increase membrane solubility
 - C. To increase membrane permeability
 - D. To regulate membrane temperature

3. What is/are required for facilitated diffusion?
 - I. A concentration gradient
 - II. ATP
 - III. A channel protein
 - A. I only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

4. Which cell component arose first during the formation of the earliest cells?
 - A. Chloroplast
 - B. Plasma membrane
 - C. Mitochondria
 - D. Cell wall

5. In the chimpanzee (*Pan troglodytes*), the haploid number of chromosomes is 24. How many sister chromatids are present in the G2 phase of a somatic cell, such as a cell in the bone marrow of the chimpanzee?
- A. 12
 - B. 24
 - C. 48
 - D. 96
6. What are linked by hydrogen bonds?
- A. Hydrogen and oxygen within a water molecule
 - B. Phosphate and sugar within a DNA molecule
 - C. Base and sugar between DNA nucleotides
 - D. Hydrogen and oxygen in different water molecules
7. Which reaction occurs when a dipeptide is formed from amino acids?
- A. Hydrolysis
 - B. Condensation
 - C. Transcription
 - D. Oxidation

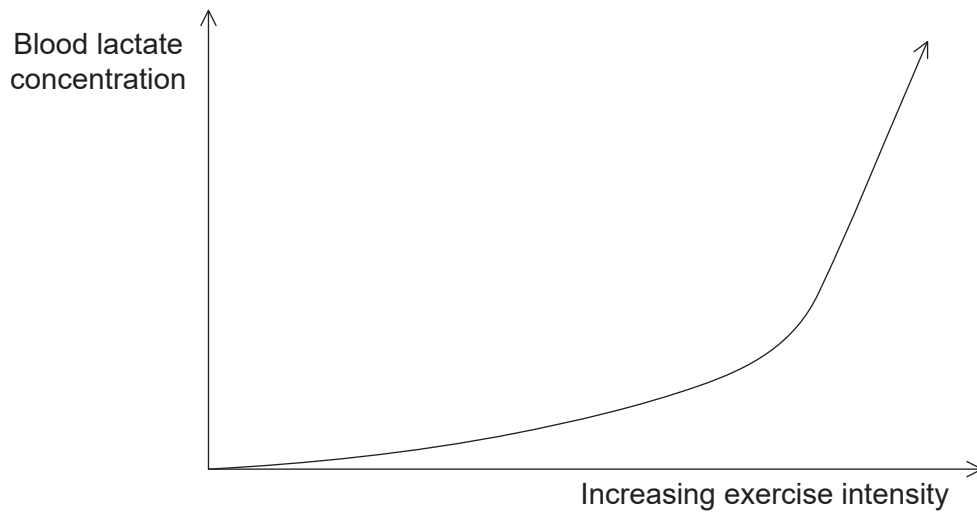
8. The graph shows enzyme activity plotted against temperature.



What is the reason for the drop in enzyme activity above 40 °C?

- A. A decrease in the enzyme concentration
 - B. Reaction is saturated because active sites are occupied
 - C. Insufficient activation energy for the reaction to proceed
 - D. Changes to the conformation of the enzyme
9. A molecule of DNA is found to contain 200 guanine bases, representing 25% of the total number of bases. How many phosphate groups does this molecule of DNA contain?
- A. 50
 - B. 200
 - C. 800
 - D. 1000
10. What is the minimum number of nucleotides needed to code for a polypeptide composed of 210 amino acids?
- A. 70
 - B. 210
 - C. 420
 - D. 630

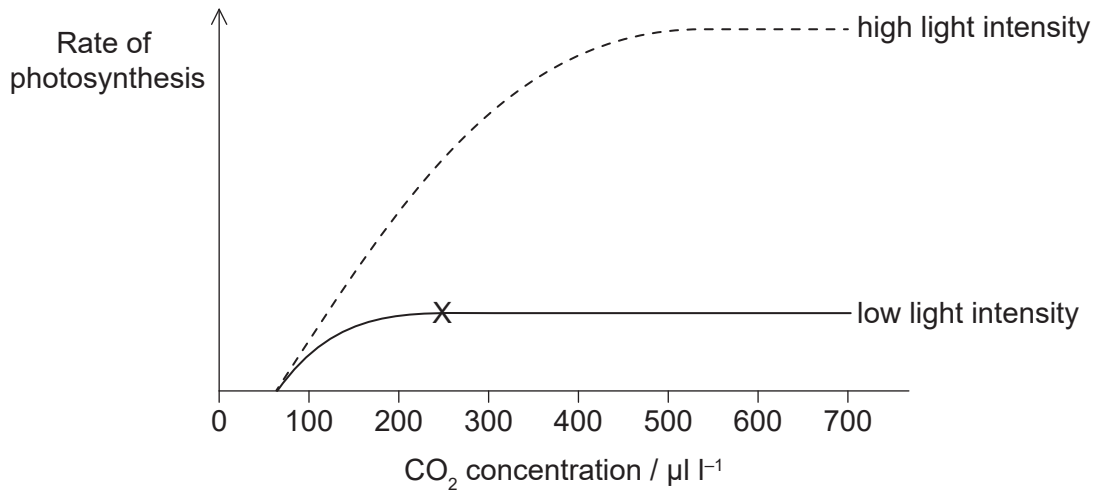
11. The graph shows the changes in lactate measured in an athlete's blood during exercise.



Which hypothesis provides the most likely explanation for the curve?

- A. As exercise intensity increases, lactate is converted back to glucose.
- B. Anaerobic exercise results in high levels of lactate.
- C. Lactate provides energy for intense exercise.
- D. Under anaerobic conditions the body produces less lactate.

12. The graph shows how the rate of photosynthesis of a green plant varies with CO₂ concentration at two different light intensities. The temperature is kept constant at 20 °C.



What is the limiting factor at X?

- A. Chlorophyll
 - B. Light intensity
 - C. Temperature
 - D. CO₂ concentration
13. The table shows the estimated total number of genes in several organisms.

Species	Estimated number of genes
<i>Saccharomyces cerevisiae</i> (a yeast)	6000
<i>Escherichia coli</i> (a bacterium)	3200
<i>Drosophila melanogaster</i> (fruit fly)	14 000
<i>Canis familiaris</i> (domestic dog)	19 000
<i>Oryza sativa</i> (rice)	51 000
<i>Homo sapiens</i> (human)	25 000

What can be deduced from the information in this table?

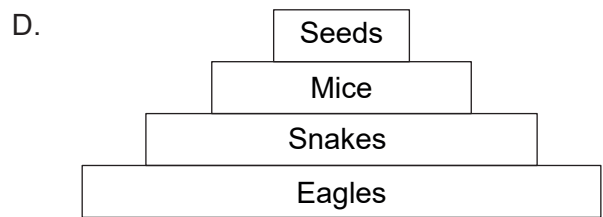
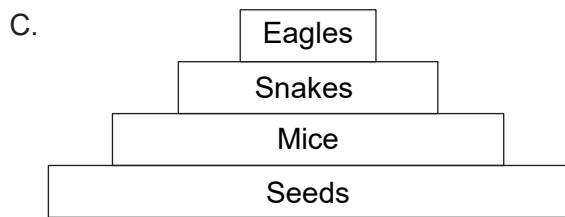
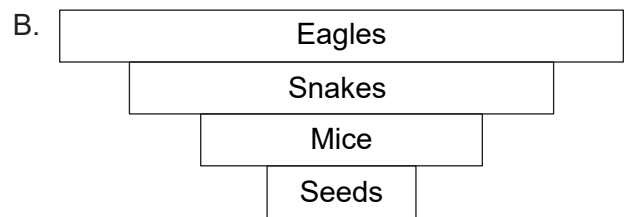
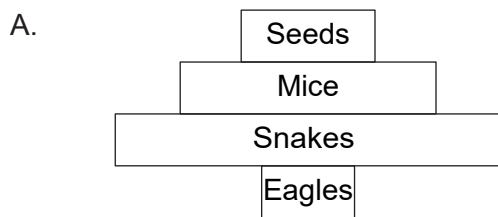
- A. Throughout evolution, the number of genes increases.
- B. The domestic dog is more closely genetically related to the fruit fly than to the human.
- C. The number of genes does not determine evolutionary success.
- D. Humans produce about half as many proteins as rice.

14. Chromosome numbers vary between species. Which statement refers to humans?
- A. An egg cell has 22 autosomes.
 - B. A sperm cell has 23 autosomes.
 - C. An egg cell has two X chromosomes.
 - D. A zygote has two autosomes.
15. What is produced by meiosis in a cell of a male animal?
- A. Four gametes, each with the same number of chromosomes
 - B. Two gametes, each with the same number of chromosomes
 - C. Four gametes, each with different numbers of chromosomes
 - D. Two gametes, each with different numbers of chromosomes
16. Huntington's disease is an autosomal dominant genetic disease. What are the chances of two parents that are heterozygous for the gene having a child with Huntington's disease?
- A. 25 %
 - B. 50 %
 - C. 75 %
 - D. 100 %
17. What is a community?
- A. A group of individuals of the same species in a given area
 - B. A group of animals that interact socially
 - C. A group of organisms interacting with the abiotic environment
 - D. A group of populations interacting with each other within a given area

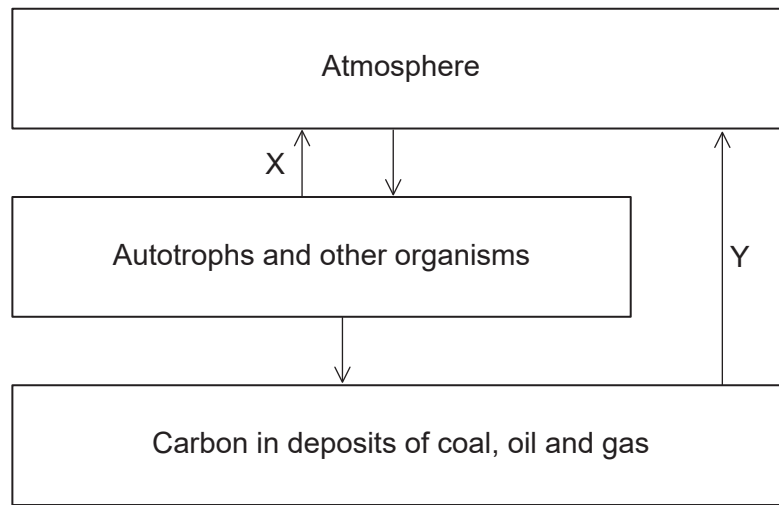
18. The table contains information about the diet of some animals.

Animal	Diet
Snakes	Mice
Eagles	Snakes
Mice	Seeds

Which pyramid of energy represents this information?



19. The diagram shows a simplified carbon cycle.



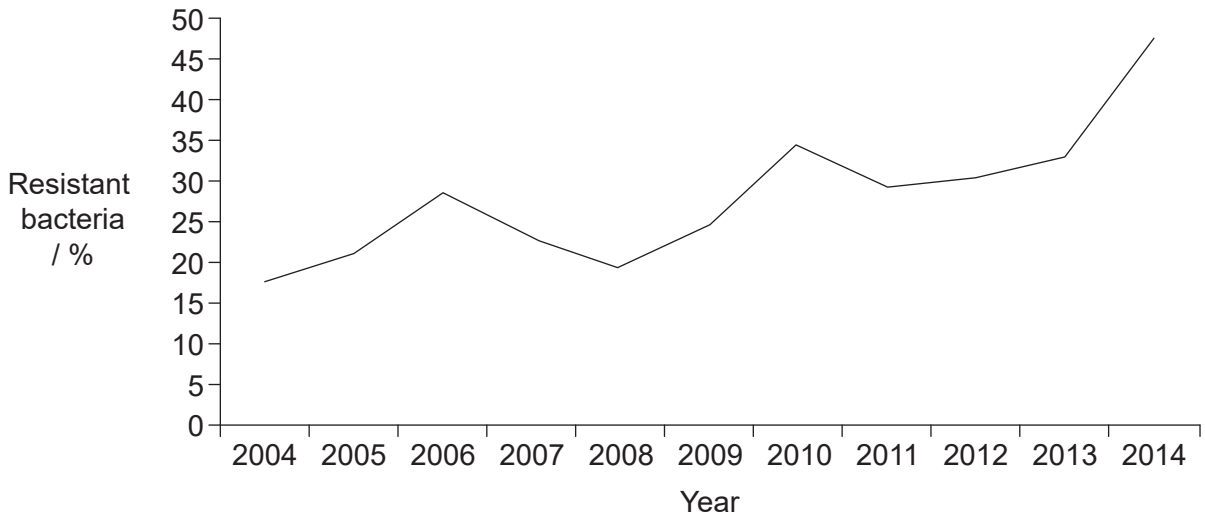
Which processes are taking place at X and Y?

	X	Y
A.	photosynthesis	fossilization
B.	respiration	fossilization
C.	photosynthesis	combustion
D.	respiration	combustion

20. Mammals, birds and reptiles have an embryonic tail that may disappear during development. What is the most likely explanation?

- A. Mammals have lost their tail by evolution.
- B. All vertebrates have a common ancestor.
- C. Mammals, birds and reptiles are identical when they are embryos.
- D. Some physical similarities of vertebrates are analogous.

21. The graph shows the proportion of a bacterial population of *Neisseria gonorrhoeae*, displaying resistance to the antibiotic tetracycline.



What can be deduced from this graph?

- A. Bacteria with beneficial adaptations survive and pass on their genes.
 - B. Immunity to tetracycline is triggered by over-use of the antibiotic.
 - C. Genetic variation in this bacterial population is increasing.
 - D. Use of tetracycline inhibits the growth of antibiotic-resistant *N. gonorrhoeae*.
22. The plant in the diagram has vascular tissue and reproduces by spores.



To which phylum does the plant belong?

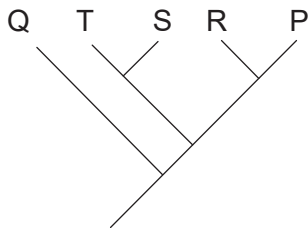
- A. Bryophyta
- B. Filicinophyta
- C. Coniferophyta
- D. Angiospermophyta

23. Data regarding the presence (+) or absence (-) of five traits in several different species are shown in the table.

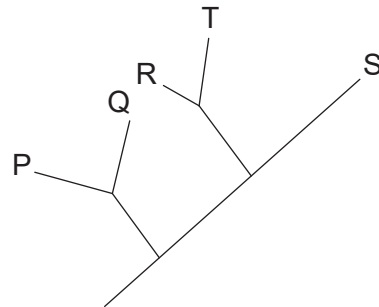
Species	Traits				
	1	2	3	4	5
P	+	-	-	+	+
Q	-	-	-	-	-
R	+	-	-	-	+
S	+	+	+	-	-
T	+	+	-	-	-

Which cladogram best represents the relationship between the five species?

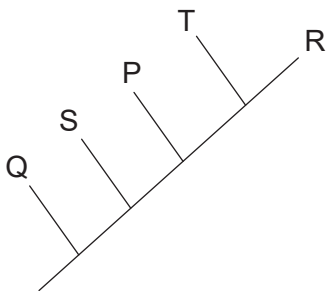
A.



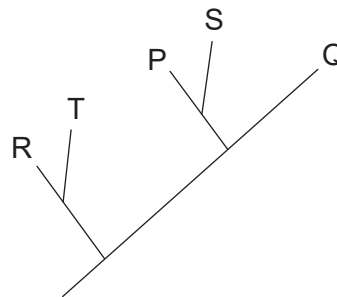
B.



C.



D.



24. Which process describes starch metabolism in humans?

- A. Starch is digested by amylase in the mouth, stomach and small intestine.
- B. Amylase digests starch into monomers of sucrose.
- C. Glucose produced by the digestion of starch can be stored as glycogen.
- D. Optimal activity of amylase occurs in the stomach at pH 2.

25. Which structures are part of the walls of both capillaries and veins?

- I. Cells
 - II. Pores
 - III. Elastic fibres
- A. I only
 - B. I and II
 - C. I and III
 - D. I, II and III

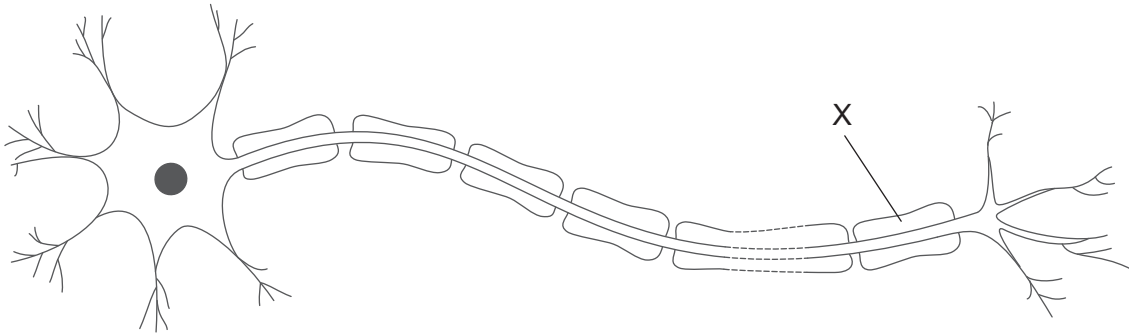
26. What is a method of transmission of HIV and its effect on the immune system?

	Method of transmission	Effect on the immune system
A.	Breastfeeding	Decrease in number of active lymphocytes
B.	Blood transfusion	Overall, a general increase in antibody production
C.	Waterborne	Overall, a general reduction in antibody production
D.	Mosquito bites	Increase in number of active lymphocytes

27. A cell from the lungs, observed under the microscope, contains a large number of secretory organelles. Which conclusion can be drawn about the cell?

- A. It is a type I pneumocyte.
- B. It is a type II pneumocyte.
- C. It could be either a type I or type II pneumocyte.
- D. It is a red blood cell.

28. The image shows a neuron.



What is the function of X?

- A. Increases the speed of transmission along the axon
 - B. Increases the rate of exchange of sodium and potassium ions
 - C. Holds bundles of neurons together to form a nerve
 - D. Determines the direction of the action potential
29. Leptin helps to regulate body mass in humans and mice. The image shows an obese mouse (O) and a normal mouse (N).



What hypothesis could account for the differences between the mice?

- A. The hypothalamus of mouse O stopped producing leptin.
- B. Adipose cells of mouse O are continuously producing leptin.
- C. Mouse N has a defective leptin receptor.
- D. Leptin binds to receptors in the hypothalamus of mouse N.

30. What is most likely to increase in the presence of insulin?
- A. The rate of anaerobic respiration
 - B. The chances of Type I diabetes
 - C. The uptake of glucose by muscles
 - D. The concentration of glucagon
-

References:

21. © All rights reserved. *Canadian Antimicrobial Resistance Surveillance System Report, 2016*. Public Health Agency of Canada. Adapted and reproduced with permission from the Minister of Health, 2022.
22. Auer, A., 2007. Nature print, Alois Auer. [image online] Available at: https://commons.wikimedia.org/wiki/File:Nature_print_Alois_Auer.jpg [Accessed 10 October 2019].
29. [Obesity in mice]. [image online] Available at: <https://commons.wikimedia.org/wiki/File:Fatmouse.jpg> Oak Ridge National Laboratory, U.S. Department of Energy.