

**Biology**  
**Higher level**  
**Paper 1**

Friday 4 November 2016 (morning)

1 hour

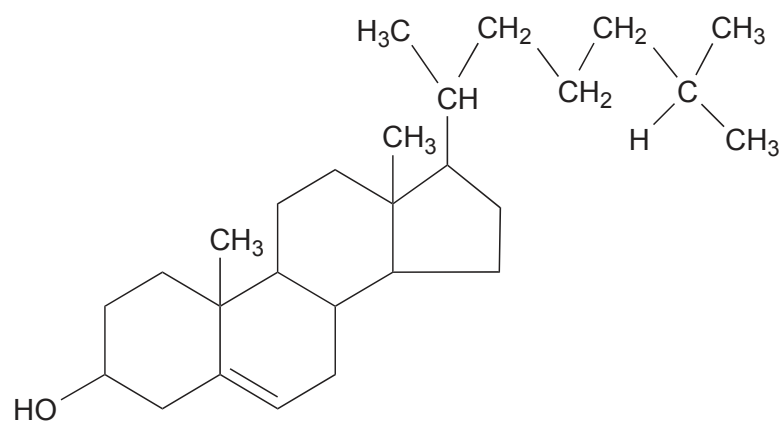
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**Instructions to candidates**

- 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.
- The maximum mark for this examination paper is **[40 marks]**.

1. Which feature of striated muscle cells allows them to be considered as a possible exception to the cell theory?
  - A. They are found in multicellular organisms.
  - B. They contain more than one nucleus.
  - C. They are specialized for movement.
  - D. They do not carry out mitosis.
  
2. Which characteristic of stem cells makes them useful for treating Stargardt's disease?
  - A. They can differentiate into retinal cells.
  - B. They are readily available from especially created embryos.
  - C. They transport white blood cells to the eyes.
  - D. They divide by binary fission so provide sufficient cells.
  
3. The cell membrane model proposed by Davson–Danielli was a phospholipid bilayer sandwiched between two layers of globular protein. Which evidence led to the acceptance of the Singer–Nicolson model?
  - A. The orientation of the hydrophilic phospholipid heads towards the proteins
  - B. The formation of a hydrophobic region on the surface of the membrane
  - C. The placement of integral and peripheral proteins in the membrane
  - D. The interactions due to amphipathic properties of phospholipids
  
4. The giant marine alga *Halicystis ovalis* is able to move sodium ions from vacuoles to the surrounding seawater through active transport. Which condition or feature is required for this mode of transport?
  - A. Movement from a region of higher sodium concentration to a region of lower sodium concentration
  - B. A partially permeable surface
  - C. Membrane fluidity
  - D. Transmembrane proteins

5. The diagram shows a molecular structure.



Which type of molecule is shown?

- A. Amino acid
  - B. Lipid
  - C. Carbohydrate
  - D. Nucleotide
6. Which properties explain the ability of water to dissolve solutes?
- I. Polarity of water molecules
  - II. High specific heat capacity of water
  - III. Hydrogen bonding
- A. I and II only
  - B. I and III only
  - C. II and III only
  - D. I, II and III

Turn over

7. Olive oil may reduce the risk of coronary heart disease. What is/are the compound(s) responsible for the health benefits of olive oil?
- I. Cis unsaturated fatty acids
  - II. Trans unsaturated fatty acids
  - III. Saturated fatty acids
- A. I only
  - B. I and II only
  - C. II and III only
  - D. I, II and III
8. A fever in a normally healthy adult during an illness is not usually a problem and can be regarded as a defence mechanism. However, a fever higher than 41 °C might be dangerous. What is the cause of the possible damage due to a high fever?
- A. Loss of body mass
  - B. Muscle damage due to shivering
  - C. Overactive metabolic enzymes
  - D. Spread of infection
9. It is possible to attach  $\beta$ -galactosidase to alginate beads for use in the production of lactose-free milk. What are enzymes that have been attached in this way called?
- A. Inhibited
  - B. Immobilized
  - C. Catalysed
  - D. Activated
10. What is produced by somatic-cell nuclear transfer?
- A. Adult sheep
  - B. Cloned embryos
  - C. Rooted stem-cuttings
  - D. Genetically modified food

11. What is the major health issue resulting from the Chernobyl nuclear accident in 1986?
- A. Coronary thrombosis
  - B. Cholera
  - C. Sex-linked diseases
  - D. Thyroid cancer
12. The diploid number of chromosomes in humans (*Homo sapiens*) is 46 and the diploid number of chromosomes in rice (*Oryza sativa*) is 24. What does this indicate about diploid chromosome numbers?
- A. Plant species have a lower diploid number of chromosomes than animals.
  - B. Members of a species have the same diploid number of chromosomes.
  - C. The evolutionary progress of species is determined by the diploid number of chromosomes.
  - D. The complexity of the organisms is correlated to the diploid number of chromosomes.

13. What description is matched with the correct phase in meiosis I?

A.	Prophase I	recombination occurs only between sister chromatids
B.	Metaphase I	homologous chromosomes join together at each end of the cell
C.	Anaphase I	homologous chromosomes are pulled apart
D.	Telophase I	two diploid nuclei are produced

14. What is the classification of an organism that is able to make organic compounds from inorganic nutrients?
- A. Autotroph
  - B. Consumer
  - C. Detritivore
  - D. Saprotroph

Turn over

- 15.** How is peat formed?
- A. From methanogenic archaeans under anaerobic and acidic conditions in deep sea vents
  - B. From partially decomposed organic matter under anaerobic and acidic conditions in waterlogged soils
  - C. From porous limestone under high pressure, aerobic and alkaline conditions in ocean beds
  - D. From bituminous coal under high pressure, anaerobic and acidic conditions below ground
- 16.** What contributes to rising atmospheric concentrations of carbon dioxide and increases in average global temperature?
- A. An increase in the shorter wavelength radiation emitted by Earth
  - B. An increase in longer wavelength radiation emitted by Earth
  - C. An increase in the combustion of fossilized organic matter
  - D. The depletion of ozone in the stratosphere
- 17.** Which evidence for evolution do the common features in the bone structure of vertebrate limbs provide?
- A. Adaptive radiation
  - B. Divergent radiation
  - C. Convergent evolution
  - D. Discontinuous variation
- 18.** What is the major contributor to the increase in antibiotic resistance in bacteria?
- A. Sexual reproduction
  - B. Mutation
  - C. Natural selection
  - D. New antibiotics

19. The scientific name of the great egret has recently been changed from *Casmerodius albus* to *Ardea alba*.



[Source: <http://images.freeimages.com/images/previews/218/ardea-alba-2-1250856.jpg>, by sxc]

What is a possible reason for the reclassification of egrets?

- A. Allopatric speciation
  - B. Discovery of different ancestry
  - C. A change in the mating behaviours
  - D. Change in habitat and geographic range
20. What is the main method of transport of monosaccharides such as fructose across the intestinal epithelium?
- A. Osmosis
  - B. Facilitated diffusion
  - C. Endocytosis
  - D. Active transport
21. What is the position of heart valves when blood pressure is highest in the aorta?

	<b>Atrioventricular valves</b>	<b>Semilunar valves</b>
A.	open	closed
B.	closed	open
C.	closed	closed
D.	open	open

Turn over

22. In Florey and Chain’s experiment, eight mice were infected with lethal doses of *Streptococcus* bacteria. The four mice given penicillin survived, but the untreated mice died. What can be concluded from these results?

- A. The experiment should be repeated with more mice.
- B. There is a causal relationship between the use of penicillin and antibiotic resistance in bacteria.
- C. Penicillin can be used to treat bacterial infections in humans.
- D. Penicillin may have played a role in the recovery of the four mice.

23. Which conditions are correct for inspiration?

	<b>Muscles contracted</b>	<b>Pressure in thorax</b>
A.	external intercostal	decreases
B.	internal intercostal	increases
C.	diaphragm	increases
D.	abdominal	decreases

24. The decline in European honeybee (*Apis mellifera*) populations may be linked to neonicotinoid pesticides. What effect do these pesticides have on the nervous system of insects?

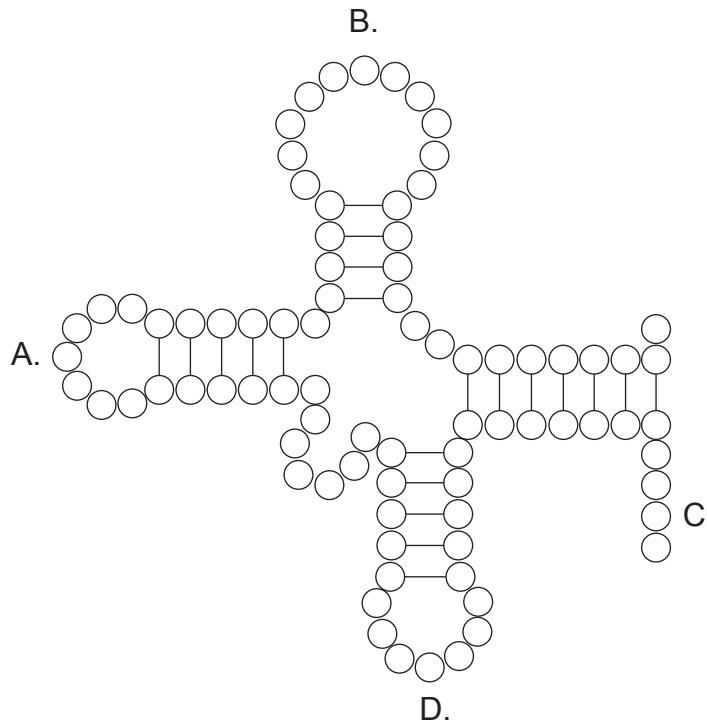
- A. They prevent acetylcholinesterase from breaking down acetylcholine.
- B. They inhibit depolarization in the presynaptic neuron which increases the levels of acetylcholine.
- C. They produce an inhibitor that promotes the binding of acetylcholine.
- D. They block synaptic transmission by binding with postsynaptic acetylcholine receptors.

25. Which hormone controls circadian rhythms?

- A. Thyroxin
- B. Melatonin
- C. Leptin
- D. Glucagon



26. Where does a tRNA-activating enzyme attach the appropriate amino acid to the tRNA molecule?



27. What does post-transcriptional modification of eukaryotic mRNA include?

- I. Introns are removed from mRNA.
- II. Exons are joined together to form mature mRNA.
- III. A 5' cap and 3' poly-A tail are added to mRNA.

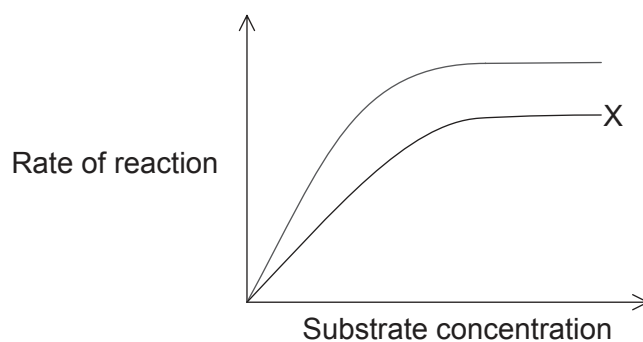
- A. I only
- B. I and III only
- C. II and III only
- D. I, II and III

28. Variations in the types of antibodies are produced by mRNA splicing. What is an advantage of this process?

- A. Reduces the size of mRNA required for the translation of antibodies
- B. Increases the number of different antibodies that can be synthesized
- C. Ensures that one gene codes for one antibody
- D. Speeds up transcription of antibodies

Turn over

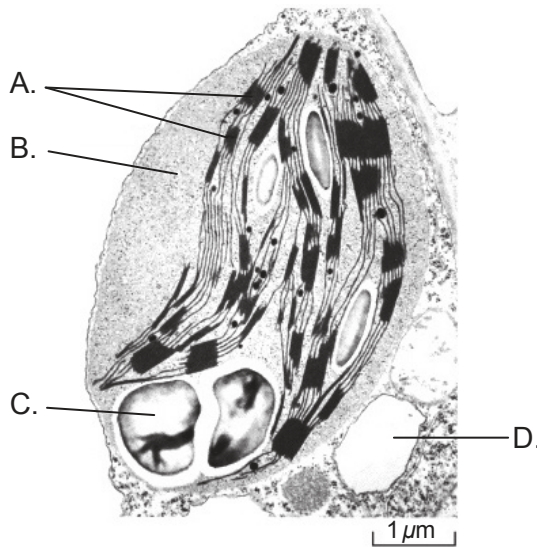
29. The graph shows an example of an enzyme-catalysed reaction.



What does the curve labelled X represent?

- A. No inhibition
  - B. Competitive inhibition
  - C. Non-competitive inhibition
  - D. Reversible inhibition
30. Which process requires oxygen in aerobic cell respiration?
- A. Oxidation of triose phosphate
  - B. Reduction of hydrogen carriers
  - C. Maintaining an oxygen concentration gradient in mitochondria
  - D. Accepting electrons at the end of the electron transport chain

31. The electron micrograph shows part of a plant cell. Where do the light-independent reactions of photosynthesis take place?



[Source: adapted from <http://themicroscopicplant.weebly.com>]

32. Excessive irrigation can cause increased salinity in the soil. What effect does this have on water transport in the plant roots?
- A. Decreases movement of water from soil into the root
  - B. Absorption of water with a higher solute concentration
  - C. Increases movement of water from soil into the root
  - D. Absorption of water with a lower solute concentration
33. Chrysanthemums are an important commercial flower. As a short-day plant, how can growers induce chrysanthemums to flower out of season?
- A. Expose plants to short bursts of light for 24 hours
  - B. Expose plants to 15 hours of continuous light
  - C. Expose plants to 12 hours of light and 12 hours of darkness
  - D. Expose plants to 15 hours of continuous darkness

Turn over

34. What is/are the effect(s) of auxin in plants?
- I. Increasing the rate of cell elongation in stems
  - II. Changing the pattern of gene expression in shoot cells
  - III. Detecting the direction of light
- A. I only
  - B. I and II only
  - C. II and III only
  - D. I, II and III
35. Some of the ratios that Morgan investigated in genetic crosses did not correspond with expected Mendelian ratios. What was the cause?
- A. The genetic crosses used insects rather than plants.
  - B. The results were counted more reliably than Mendel's.
  - C. The genes in the genetic crosses were linked.
  - D. *Drosophila* has more genes than plants.
36. Fossil records show that black bears increased in size during the Ice Age and decreased in size with warmer temperatures. What type of selection do these changes in size represent?
- A. Allopatric
  - B. Directional
  - C. Disruptive
  - D. Stabilizing

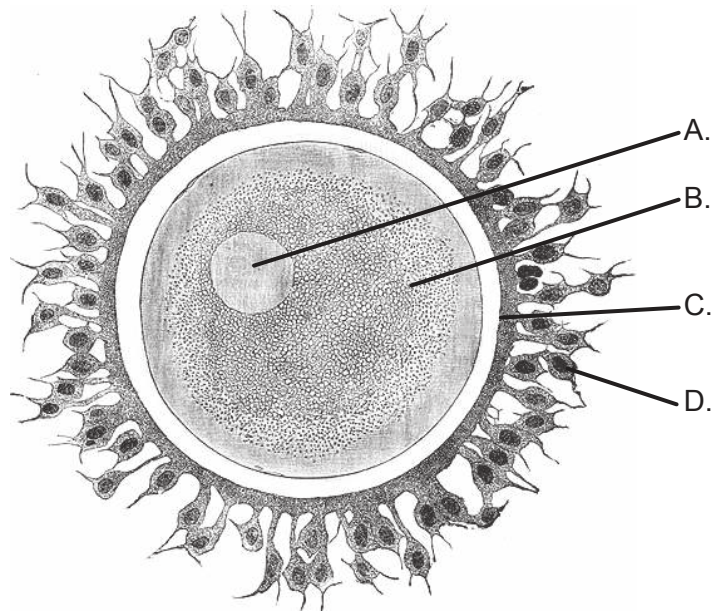
37. What is **directly** responsible for allergic symptoms, including a runny nose or itchy eyes?
- A. Pathogens
  - B. Histamine
  - C. T-lymphocytes
  - D. Antigens
38. What is required for a skeletal muscle to exert force?
- A. Extensor and flexor muscles
  - B. Synovial joints
  - C. Attachment to bones
  - D. Ligaments
39. Which kidney adaptation would be expected in the desert kangaroo rat (*Dipodomys deserti*)?

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- A. Increased nephron density
- B. Longer proximal convoluted tubule
- C. Longer loop of Henle
- D. Increased ADH receptors on the collecting duct

Turn over

40. Where does the acrosome reaction occur?



[Source: Adapted from <http://upload.wikimedia.org/wikipedia/commons/8/81/Gray3.png>]