

**BIOLOGY
HIGHER LEVEL
PAPER 1**

Friday 14 November 2003 (afternoon)

1 hour

INSTRUCTIONS TO CANDIDATES

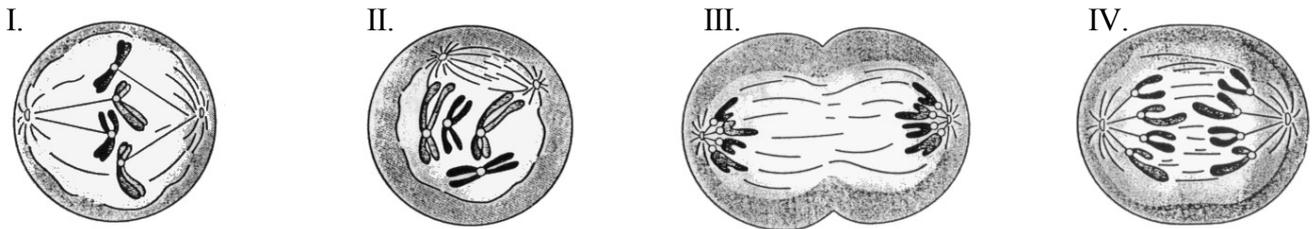
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. Which cellular structure(s) is (are) found in both a plant cell and an animal cell?

- I. Cell wall
- II. Chloroplast
- III. Mitochondrion

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

2. What is the correct sequence for the following phases of mitosis?



- A. I, II, III, IV
- B. III, II, I, IV
- C. IV, II, I, III
- D. II, I, IV, III

3. Which raw material is utilized by ribosomes?

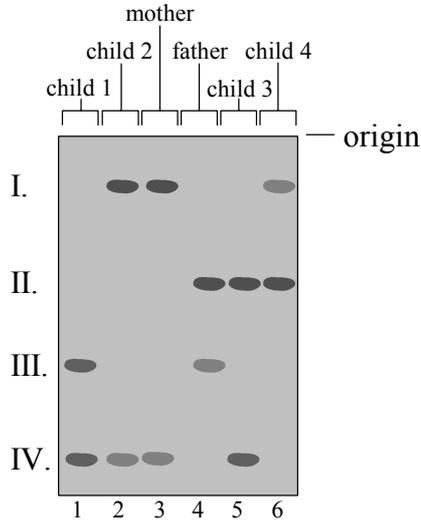
- A. Nucleotides
- B. Amino acids
- C. Glycogen
- D. Phospholipids

4. What is the composition of the backbone of DNA?
- A. Alternating sugar and phosphate molecules
 - B. Complementary base pairs
 - C. Alternating sugar and base molecules
 - D. A polysaccharide
5. What would be the effect if an enzyme with an optimum pH of 8.0 was added to a solution with a pH of 5.0?
- A. The enzyme would be denatured.
 - B. The enzyme activity would be greater at pH 5.0 than pH 8.0.
 - C. The enzyme activity would be the same at both pH values.
 - D. The enzyme activity would be lower at pH 5.0 than pH 8.0.
6. A strand of mRNA codes for a polypeptide and has the sequence:
- AUGGCAACCGGU
- what is the complementary strand of DNA?
- A. ATGGCAACCGGT
 - B. UACCGUUGGCCA
 - C. TACCGTTGGCCA
 - D. TUCCGUUGGCCA
7. A certain gene codes for a polypeptide that is 120 amino acids long. Approximately how many nucleotides long is the mRNA that codes for this polypeptide likely to be?
- A. 30
 - B. 40
 - C. 360
 - D. 480

8. Of the following products, which is produced by both anaerobic respiration and aerobic respiration in humans?
- I. Pyruvate
 - II. ATP
 - III. Lactate
- A. I only
 - B. I and II only
 - C. I, II and III
 - D. II and III only
9. A woman who is heterozygous for colour blindness marries a man who is colour blind. What is the probability they will have a colour blind child?
- A. 0 %
 - B. 25 %
 - C. 50 %
 - D. 100 %
10. A cell with a diploid number of 12 chromosomes undergoes meiosis. What will be the product at the end of meiosis?
- A. 2 cells each with 12 chromosomes
 - B. 4 cells each with 6 chromosomes
 - C. 2 cells each with 6 chromosomes
 - D. 4 cells each with 12 chromosomes

Use the information below to answer questions 11 and 12.

The following is a DNA gel. The results are from a single probe showing a DNA profile for a man, a woman and their four children.



[Source: *The Biology Project*, University of Arizona]

11. Which fragment of DNA is the smallest?
- A. I
 - B. II
 - C. III
 - D. IV
12. Which child is least likely to be the biological offspring of the father?
- A. Child 1
 - B. Child 2
 - C. Child 3
 - D. Child 4

13. 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 is heterozygous for the trait.
 - B. The trait being inherited is polygenic.
 - C. The parent is homozygous dominant for the trait.
 - D. The parent is homozygous recessive for the trait.
14. Carbon dioxide enters the carbon cycle of an ecosystem through which group of organisms?
- A. Decomposers
 - B. Detritus feeders
 - C. Producers
 - D. Secondary consumers
15. Which of the following gases contribute to the greenhouse effect?
- I. CO_2
 - II. CH_4
 - III. CFCs
- A. I only
 - B. I and II only
 - C. II and III only
 - D. I, II and III
16. Which process results in the greatest genetic variation in a population?
- A. Meiosis
 - B. Mitosis
 - C. Cytokinesis
 - D. Natural selection

17. A researcher captures 100 sparrows (a small bird), tags them and then releases them. One week later, the researcher recaptures 50 sparrows, 20 of which have tags on them. What is the size of the sparrow population?
- A. 50 birds
 - B. 100 birds
 - C. 250 birds
 - D. 500 birds
18. Which organ secretes enzymes that are active at a low pH?
- A. Mouth
 - B. Pancreas
 - C. Stomach
 - D. Liver
19. Which vessel carries deoxygenated blood?
- A. The pulmonary artery
 - B. The coronary artery
 - C. The aorta
 - D. The pulmonary vein
20. How do the levels of oxytocin and progesterone change immediately prior to birth?

	Oxytocin	Progesterone
A.	decreases	decreases
B.	decreases	increases
C.	increases	decreases
D.	increases	increases

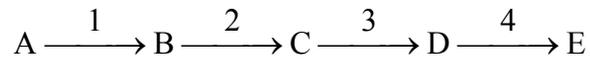
21. What name is given to the molecules that bind to foreign proteins that enter the body?

- A. Antigens
- B. Antibodies
- C. Allergens
- D. Antibiotics

22. Which enzyme removes the RNA primer during replication?

- A. RNA primase
- B. DNA polymerase I
- C. DNA ligase
- D. Helicase

23. Consider the metabolic pathway shown below.



If there is end-product inhibition, which product (B to E) would inhibit which enzyme (1 to 4)?

	Product	Enzyme
A.	C	4
B.	B	3
C.	B	4
D.	E	1

24. Which is **not** a primary function of protein molecules?
- A. Hormones
 - B. Energy storage
 - C. Transport
 - D. Structure
25. Which two colours of light does chlorophyll absorb most?
- A. Red and yellow
 - B. Green and blue
 - C. Red and green
 - D. Red and blue
26. Which is **not** a product of the Krebs cycle?
- A. CO_2
 - B. $\text{NADH} + \text{H}^+$
 - C. Pyruvate
 - D. ATP
27. How many ATP molecules (net yield) are produced per molecule of glucose as a direct result of glycolysis?
- A. 2
 - B. 4
 - C. 10
 - D. 38

28. The allele for red flower colour (R) in a certain plant is co-dominant with the allele for white flowers (R'). Thus a plant with the genotype RR' has pink flowers. Tall (D) is dominant to dwarf (d). What would be the expected phenotypic ratio from a cross of RR'dd plants with R'R'Dd plants?

- A. 9:3:3:1
- B. 50 % pink 50 % white, and all tall
- C. 1:1:1:1, in which 50 % are tall, 50 % dwarf, 50 % pink and 50 % white
- D. 3:1

29. Two genes A and B are linked together as shown below.

$$\begin{array}{c} \underline{A \quad b} \\ \hline a \quad B \end{array}$$

If the genes are far enough apart such that crossing over between the alleles occurs occasionally, which statement is true of the gametes?

- A. All of the gametes will be Ab and aB.
- B. There will be 25 % Ab, 25 % aB, 25 % ab and 25 % AB.
- C. There will be approximately equal numbers of Ab and ab gametes.
- D. The number of Ab gametes will be greater than the number of ab gametes.

30. What is the outcome for each of the following processes?

	Spermatogenesis	Oogenesis
A.	4 gametes	4 gametes
B.	4 gametes	1 gamete and 3 polar bodies
C.	2 gametes and 2 polar bodies	2 gametes and 2 polar bodies
D.	1 gamete and 3 polar bodies	4 gametes

31. Which is **not** true of active immunity?
- A. It can be produced by exposure to a disease causing organism.
 - B. It can be produced artificially.
 - C. It can be produced by a virus.
 - D. It can be transferred via the colostrum.
32. Under anaerobic conditions, muscle cells produce which compound?
- A. Ethanol
 - B. Acetaldehyde (ethanal)
 - C. Lactate
 - D. Citrate
33. What happens during muscle contraction?
- A. Both actin and myosin filaments shorten.
 - B. Na^+ ions are taken up by the sarcoplasmic reticulum.
 - C. The actin and myosin filaments slide over each other.
 - D. Cross bridges remain attached to the filaments.
34. Which of the following plasma components is **not** normally removed from the blood by ultrafiltration in the kidney?
- A. Urea
 - B. Salts
 - C. Water
 - D. Proteins

35. Anti-diuretic hormone has its main effect on which part of the nephron?

- A. Proximal tubule
- B. Bowman's capsule
- C. Loop of Henle
- D. Collecting duct

36. Which would be an adaptation of xerophytes?

- A. Large air spaces
- B. Large numbers of stomata
- C. Hairs on the leaves
- D. Reduced roots

37. Which statement(s) is (are) true of translocation in plants?

- I. Sucrose moves in two directions in the phloem.
- II. Energy is required for sucrose transport.
- III. Water is transported during sucrose transport.

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

38. Which is true of stomata?
- A. They are open at night in most plants.
 - B. They are open when the guard cells are turgid.
 - C. They close when the turgor pressure increases in the guard cells.
 - D. They are covered by a waxy cuticle to prevent water loss.
39. Which of the following represents the correct sequence of events when the body is responding to a bacterial infection?
- I. Antigen presentation by macrophages
 - II. Activation of B-cells
 - III. Activation of helper T-cells
- A. I, II, III
 - B. I, III, II
 - C. III, II, I
 - D. II, III, I
40. What is the function of Sertoli cells?
- A. They nourish sperm.
 - B. They produce testosterone.
 - C. They nourish interstitial cells.
 - D. They form the basement membrane.
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