

88056001

**BIOLOGY
HIGHER LEVEL
PAPER 1**

Thursday 10 November 2005 (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.

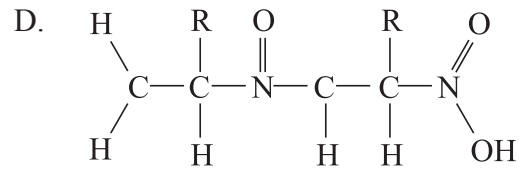
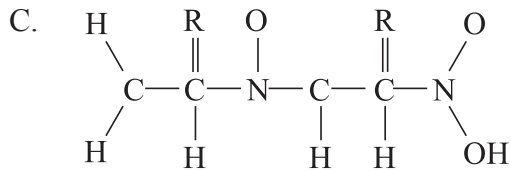
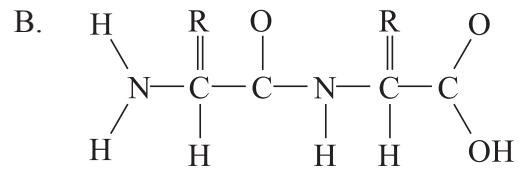
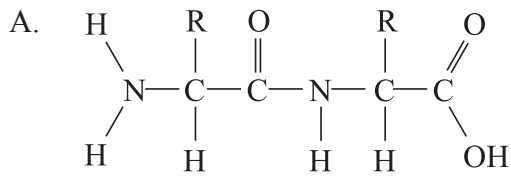
1. In an electron micrograph, a DNA molecule appears 1 mm wide. The magnification of the micrograph is 500 000. What is the width of the DNA molecule?
 - A. 0.5 nm
 - B. 2 nm
 - C. 0.5 μm
 - D. 2 μm

2. What is a function of the bacterial cell wall?
 - A. Absorption of glucose by active transport
 - B. Exchange of plasmids between cells
 - C. Increasing the surface area for oxygen diffusion
 - D. Preventing internal pressures from bursting the cell

3. Colchicine is a chemical substance that prevents the formation of microtubules. What stage of mitosis would be prevented, if dividing cells were treated with colchicine?
 - A. Breaking down of the nuclear membrane
 - B. Replication of DNA
 - C. Separation of genetically identical chromosomes (chromatids)
 - D. Supercoiling of chromosomes

4. What is a consequence of hydrogen bonding **between** water molecules?
 - A. Water is able to evaporate easily.
 - B. Water is transparent.
 - C. Water can dissolve carbohydrates, lipids and proteins.
 - D. Ice melts and water boils at relatively high temperatures.

5. Which is the structure of a dipeptide?



6. Which substance is a base that is found in DNA?

- A. Adenosine
- B. Cytokinin
- C. Guanine
- D. Uracil

7. Which processes involve the unwinding (uncoiling) of the DNA double helix and its separation into two strands of nucleotides?

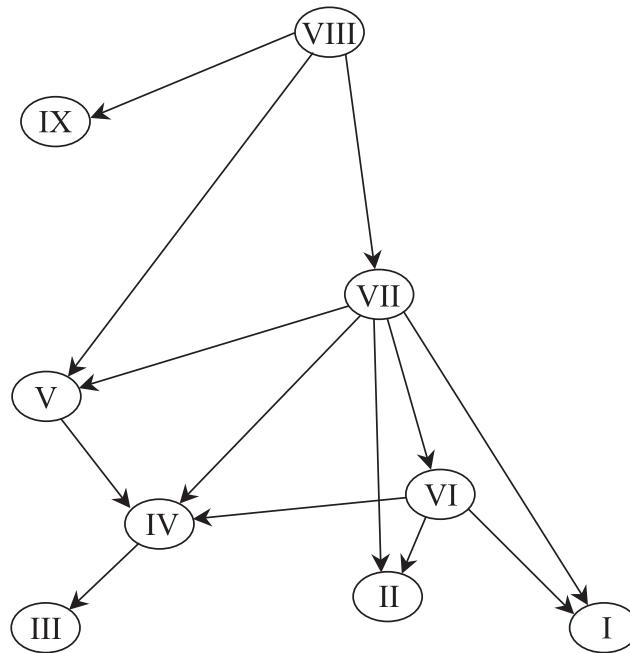
- A. Replication and telophase of mitosis
- B. Telophase of mitosis and translation
- C. Translation and transcription
- D. Transcription and replication

8. What is a possible consequence of two base substitution mutations occurring in the same gene?

- A. Two amino acids coded for by the gene are changed.
- B. Amino acids in two polypeptides coded for by the gene are changed.
- C. All of the codons between the two mutations are changed.
- D. All of the codons from the first mutation onward are changed.

9. If a person inherited an allele with the same base substitution mutation from both parents, what sequences could be altered from normal in the person's cells?
- A. One mRNA base sequence only
 - B. Two mRNA base sequences only
 - C. One mRNA base sequence and one polypeptide amino acid sequence only
 - D. Two mRNA base sequences and two polypeptide amino acid sequences only
10. What is Mendel's Law of Segregation?
- A. Alleles of a gene become separated from each other during gamete formation.
 - B. The number of chromosomes in a cell is halved during meiosis.
 - C. Male and female gametes are kept apart at the time of fertilization.
 - D. F_1 and F_2 plants must be grown separately during crossing experiments.
11. What is the locus of a gene?
- A. The proportion of the population that have the gene
 - B. The part of the phenotype that is affected by the gene
 - C. The position of a gene on a chromosome
 - D. The predicted effect of natural selection on the frequency of the gene
12. Many genetic screening tests have been developed for use in humans. What do these tests show?
- A. If a particular gene is present or not.
 - B. If the chromosome number is abnormal.
 - C. If any abnormal chromosomes are present.
 - D. If a fetus is male or female.

13. The diagram below is a simplified version of a food web from Chesapeake Bay. The arrows indicate the direction of energy flow and the numbers indicate species within the food web.



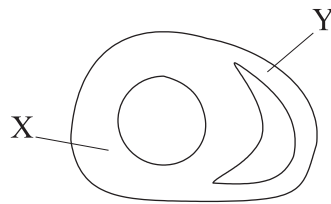
Which of the species feed both as secondary consumers and as tertiary consumers?

- A. I, II and IV only
 - B. I, III and V only
 - C. I, IV and V only
 - D. III, IV and V only
14. The percentage of bacteria showing antibiotic resistance in *Neisseria gonorrhoeae* and other species of disease-causing bacteria has risen considerably since antibiotics were introduced.

What has caused this increase?

- A. When a bacterium detects an antibiotic, it changes its metabolism so that it becomes resistant.
- B. When people do not complete courses of antibiotic, bacteria that were partly resistant become more resistant.
- C. When a bacterium is treated with an antibiotic, it increases its resistance to the antibiotic and passes on increased resistance to its offspring.
- D. When an antibiotic is used, only bacteria that are resistant to it survive and these bacteria pass on resistance to their offspring.

15. *Parus major* is a species of bird which is widely distributed throughout Europe and Asia. If a population of this species migrated to a small, isolated island and over many generations became a different species, what would be a suitable name?
- A. *Parus majorette*
 B. *Imparus major*
 C. *Imparus minor*
 D. *Parus major insulae*
16. Attempts are being made in some countries to reduce the impact of global warming in the future by building wind turbines for electricity generation. How could wind turbines reduce the impact of global warming?
- A. Wind is a renewable resource.
 B. Wind turbines have a cooling effect.
 C. Less fossil fuel needs to be burned to generate electricity.
 D. Wind turbines disperse greenhouse gases and so reduce the greenhouse effect.
17. The diagram below shows a section through the lower part of the heart, with two of the heart's four chambers visible.

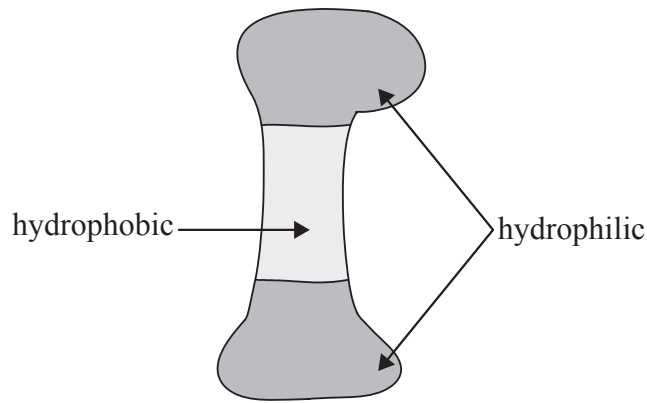


Labels X and Y show the walls of two chambers of the heart. Which two chambers are they?

| | X | Y |
|----|-----------------|-----------------|
| A. | Right ventricle | Right atrium |
| B. | Left atrium | Right atrium |
| C. | Left ventricle | Right ventricle |
| D. | Right ventricle | Left ventricle |

18. AIDS has developed in a wide variety of people. What factor links all of these people?
- A. They are from economically deprived areas.
 - B. HIV is present in their blood system.
 - C. They have had more than one sexual partner.
 - D. They have touched someone infected with HIV.
19. What is the role of the internal intercostal muscles during ventilation of the lungs?
- A. Increasing the pressure in the thorax
 - B. Increasing the volume in the thorax
 - C. Increasing the surface area of the alveoli
 - D. Increasing the diameter of the bronchioles
20. Which hormones cause the wall of the follicle to develop after ovulation and to secrete more progesterone?
- A. FSH and LH
 - B. LH and HCG
 - C. HCG and oxytocin
 - D. Oxytocin and FSH
21. How does the amniotic fluid help the fetus during pregnancy?
- I. Supplies food to allow the fetus to grow rapidly
 - II. Supports the fetus so that no part of it is under excess pressure
 - III. Protects the fetus by acting as a shock absorber
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

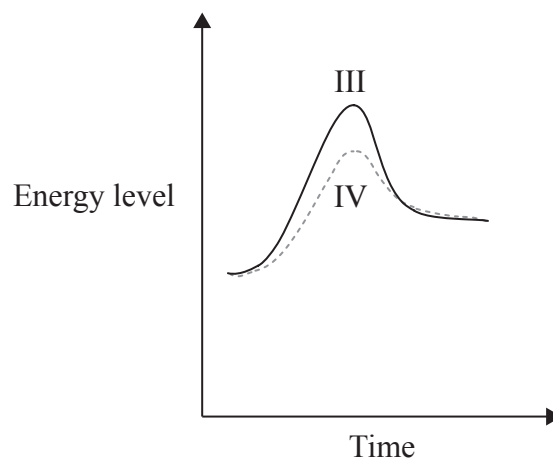
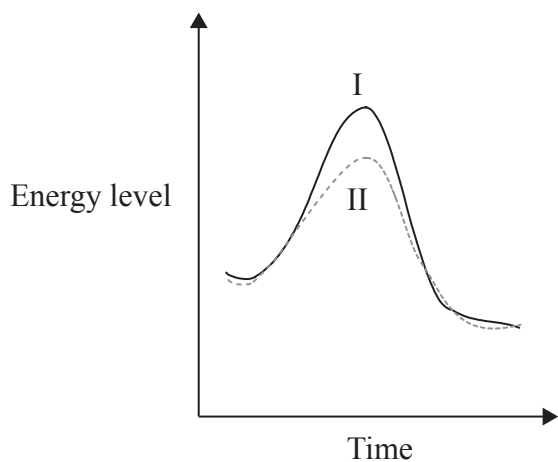
22. What is a difference between the sense and antisense strands of DNA?
- A. Nucleotides are linked to the sense strand by hydrogen bonding during transcription, but not to the antisense strand.
 - B. The sense strand has the same base sequence as tRNA, but the antisense strand does not.
 - C. Nucleotides are linked to the antisense strand by hydrogen bonding during transcription, but not to the sense strand.
 - D. The antisense strand has the same base sequence as mRNA but the sense strand does not.
23. The diagram below shows which areas on the surface of a protein are composed of hydrophobic amino acids and which areas of hydrophilic amino acids.



Where in a cell would the protein be located?

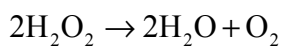
- A. In a nuclear pore
- B. In the space between the inner and outer mitochondrial membranes
- C. In the matrix of a mitochondrion
- D. In a phospholipid bilayer

24. The graphs below show the energy changes during endergonic and exergonic reactions, with and without enzymes.



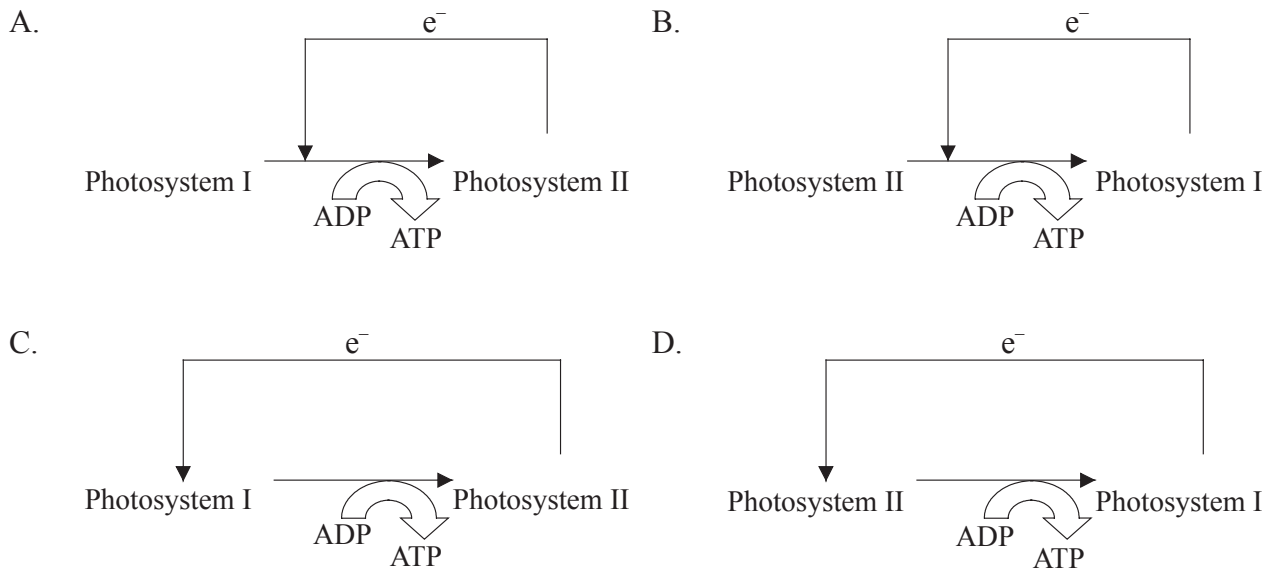
Which line represents an endergonic reaction, without an enzyme?

- A. I
 - B. II
 - C. III
 - D. IV
25. What process converts hydrogen peroxide into water as shown in the equation below?



- A. Chemiosmosis
- B. Hydrolysis
- C. Oxidation
- D. Reduction

26. Which diagram represents the process of cyclic photophosphorylation?



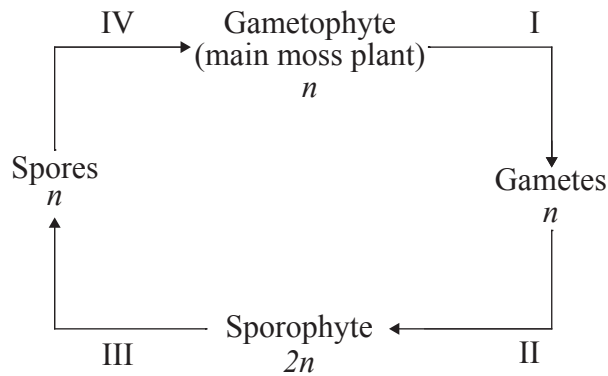
27. What is the advantage of having a small volume inside the thylakoids of the chloroplast?

- A. A high proton concentration is rapidly developed.
- B. A high electron concentration is rapidly developed.
- C. Photosynthetic pigments are highly concentrated.
- D. Enzymes of the Calvin cycle are highly concentrated.

28. Which processes always occur in meiosis but not normally in mitosis?

- I. Chiasmata formation
 - II. Recombination of genes
 - III. Separation of homologous chromosomes
- A. I and II only
 - B. II and III only
 - C. I and III only
 - D. I, II and III

29. The diagram below shows the life cycle of a moss. The haploid chromosome number is shown as n and the diploid number as $2n$. At which stage in the life cycle does meiosis take place?



- A. I
 B. II
 C. III
 D. IV
30. Mendel crossed pure breeding (homozygous) tall pea plants that had coloured flowers with pure breeding dwarf pea plants that had white flowers. All of the resulting F_1 plants were tall and had coloured flowers.

If Mendel had crossed these F_1 plants with a pure breeding strain of dwarf pea plants with coloured flowers, what proportion of tall coloured plants would be expected in the offspring?

- A. $\frac{1}{4}$
 B. $\frac{3}{8}$
 C. $\frac{1}{2}$
 D. $\frac{9}{16}$

- 31.** What part of spermatogenesis in humans takes place while spermatids are associated with Sertoli cells?
- A. Cell differentiation
 - B. First division of meiosis
 - C. Second division of meiosis
 - D. Testosterone production
- 32.** Which substance is at a higher concentration in the blood of a fetus compared with the blood of the mother?
- A. Antibodies
 - B. Glucose
 - C. Amino acids
 - D. Urea
- 33.** What is the role of thrombin in the process of blood clotting?
- A. Captures blood cells which accumulate to form a blood clot.
 - B. Catalyses the conversion of fibrinogen into fibrin.
 - C. Causes the release of clotting factors from platelets.
 - D. Converted into prothrombin by platelets.

34. What substance enters the presynaptic neuron during synaptic transmission and what substance leaves it?

| | Substance entering presynaptic neuron | Substance leaving presynaptic neuron |
|----|----------------------------------------------|---------------------------------------------|
| A. | Neurotransmitter | Calcium ions (Ca^{2+}) |
| B. | Neurotransmitter | Sodium ions (Na^+) |
| C. | Sodium ions (Na^+) | Neurotransmitter |
| D. | Calcium ions (Ca^{2+}) | Neurotransmitter |

35. What is the difference between locomotion in bony fish and locomotion in earthworms?

- A. Earthworms use their intestines for locomotion and fish use their tails.
- B. Fish use muscle to generate force for locomotion and earthworms use fluid.
- C. The muscles used for locomotion are attached to bones in fish but not in earthworms.
- D. Fish control the direction of swimming but earthworms move in random directions.

36. The walls of blood capillaries in the kidney are fenestrated. How does the fenestration of these capillaries help in the production of urine?

- A. A larger volume of fluid can be filtered out of the blood per minute.
- B. Small molecules are allowed through but not large ones.
- C. Higher blood pressures can be tolerated without damage to the capillaries.
- D. Phagocytes are able to escape from the capillaries and prevent kidney infections.

37. How are excretory products removed from the blood during kidney dialysis, without removing glucose?
- A. The dialysis membrane allows excretory products to pass through, but not glucose.
 - B. A potential difference across the dialysis membrane draws through excretory products only.
 - C. Excretory products dissolve in dialysis fluid but glucose does not.
 - D. The dialysis fluid contains glucose but not excretory products.

38. Which structures are found in coniferophytes? (✓ = present and × = absent)

| | Roots | Stems | Leaves | Flowers | Seeds |
|----|--------------|--------------|---------------|----------------|--------------|
| A. | ✓ | ✓ | ✓ | × | ✓ |
| B. | ✓ | ✓ | ✓ | × | × |
| C. | ✓ | ✓ | ✓ | ✓ | ✓ |
| D. | × | × | × | × | × |

39. What is the apoplastic route for water from the soil to the endodermis of roots?
- A. cell walls of epidermis → cell walls of cortex → endodermis
 - B. cell walls of root hair cells → cytoplasm of cortex → endodermis
 - C. cytoplasm of root hair cells → cytoplasm of cortex → endodermis
 - D. cell walls of root hair cells → cell walls of epidermis → endodermis
40. What conditions will cause the highest rate of transpiration in a well-watered, mesophytic plant?
- A. hot, humid with bright sunshine and still air
 - B. low humidity, hot, bright sunshine and windy
 - C. windy, hot, cloudy and humid
 - D. windy, bright sunshine, humid and cool