



88096001



International Baccalaureate®  
Baccalauréat International  
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**BIOLOGY  
HIGHER LEVEL  
PAPER 1**

Tuesday 10 November 2009 (afternoon)

1 hour

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**INSTRUCTIONS TO CANDIDATES**

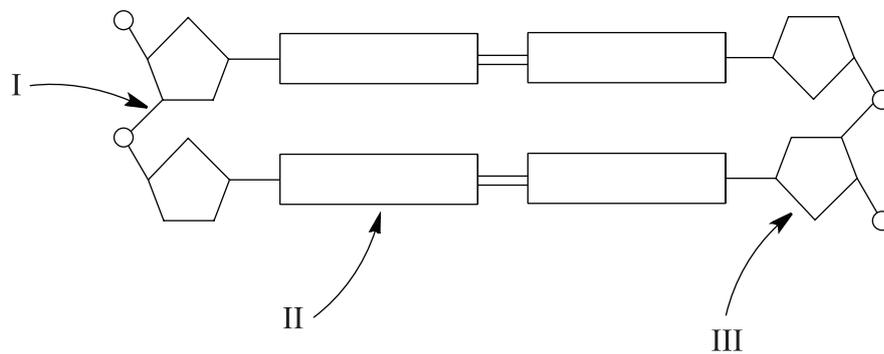
- Do not open this examination paper until instructed to do so.
- Answer all the questions.
- For each question, choose the answer you consider to be the best and indicate your choice on the answer sheet provided.

1. What does the size of the standard deviation indicate about data?
  - A. How accurately the data were measured
  - B. How widely the data are spread above and below the mean
  - C. Whether the mean is larger or smaller than it should be
  - D. Whether the reliability of the data is greater or less than 68 %
  
2. If a *Sequoia sempervirens* tree is 100 m tall and a drawing of it is 100 mm tall, what is the magnification of the drawing?
  - A.  $\times 0.001$
  - B.  $\times 0.1$
  - C.  $\times 1.0$
  - D.  $\times 1000$
  
3. Cells in the adrenal gland produce the hormone epinephrine and store it in vesicles. To release epinephrine these vesicles are carried to the plasma membrane and fuse with it. What process is occurring?
  - A. Expulsion
  - B. Exchange
  - C. Excretion
  - D. Exocytosis
  
4. During which stage of the cell cycle are the numbers of mitochondria increased in a cell?
  - A. Cytokinesis
  - B. Interphase
  - C. Meiosis
  - D. Mitosis

5. Which of the following chemical elements are part of biochemical molecules in living organisms?

- A. nitrogen, sulfur, phosphorus and iron
- B. lead, oxygen, carbon and phosphorus
- C. helium, carbon, sulfur and nitrogen
- D. silicon, helium, oxygen and iron

6. The diagram below represents part of the DNA molecule.



What are the parts labelled I, II and III?

	I	II	III
A.	hydrogen bond	base	deoxyribose
B.	hydrogen bond	deoxyribose	phosphate group
C.	covalent bond	base	deoxyribose
D.	covalent bond	deoxyribose	phosphate group

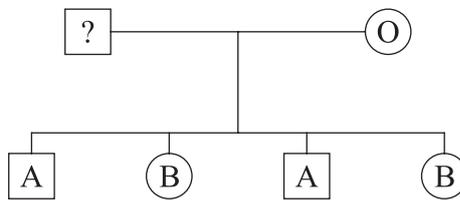
7. What principle is necessary to preserve the sequence of DNA during replication?

- A. Base pairing is complementary.
- B. One gene codes for one polypeptide.
- C. Substrates are specific to enzymes.
- D. The genetic code is universal.

8. What happens during translation?
- A. Copying of DNA to produce DNA
  - B. Copying of DNA to produce mRNA
  - C. Copying of DNA to produce tRNA
  - D. Polypeptide synthesis
9. Which equation shows a chemical reaction that occurs during anaerobic cell respiration?
- A. pyruvate  $\longrightarrow$  lactate
  - B. pyruvate  $\xrightarrow[\text{ADP} \rightarrow \text{ATP}]{} \text{lactate}$
  - C. pyruvate  $\xrightarrow{\hspace{1.5cm}} \text{lactate}$   
 $\hspace{1.5cm} \searrow \text{CO}_2$
  - D. pyruvate  $\xrightarrow{\hspace{1.5cm}} \text{ethanol}$   
 $\hspace{1.5cm} \searrow \text{ATP}$
10. Oxygen is produced during photosynthesis. What is the source of this oxygen inside the plant?
- A. Air spaces in the leaf
  - B. Carbon dioxide
  - C. Glucose
  - D. Water

11. During reproduction in flowering plants an embryo sac is produced, containing one haploid nucleus. This haploid nucleus divides by mitosis three times. What is produced?
- A. One diploid nucleus
  - B. Four diploid nuclei
  - C. Four haploid nuclei
  - D. Eight haploid nuclei

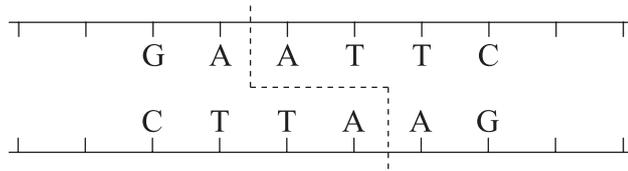
12. The blood groups of a mother and four children are indicated on the pedigree chart below.



What are the possible blood groups of the father?

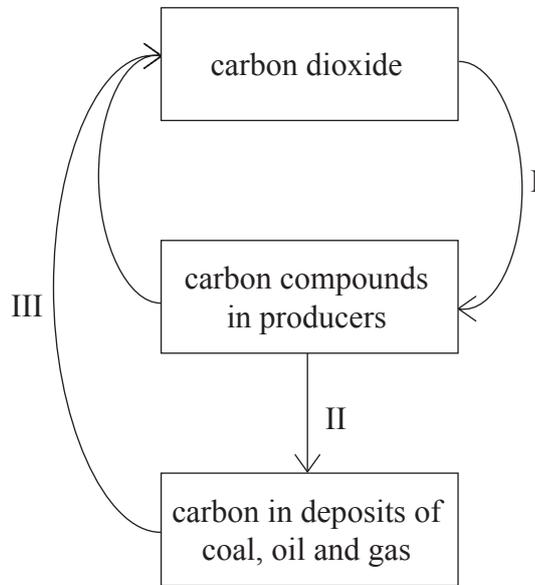
- A. Group A only
  - B. Group A or B only
  - C. Group AB only
  - D. Group A, B or AB only
13. The Human Genome Project allowed the first accurate estimates of the number of different genes in the human genome. What was a typical estimate, based on the results of the Human Genome Project?
- A. 46
  - B. 64
  - C. 25 000
  - D. 1 000 000

14. What type of enzyme could be used to cut a DNA molecule as indicated by the dotted line on the diagram below?



- A. DNA ligase
  - B. DNA polymerase
  - C. Helicase
  - D. Restriction enzyme
15. What does therapeutic cloning involve?
- A. Developing genetically identical cultures of human cells for use in drug testing
  - B. Helping infertile couples to conceive by injecting the father's sperm into the mother's egg
  - C. Producing embryonic stem cells for medical use
  - D. Replacing a mutant allele in an embryo to prevent genetic disease
16. How is energy passed from one trophic level to the next?
- I. Food
  - II. Light
  - III. Heat
- A. I only
  - B. I and II only
  - C. II and III only
  - D. I, II and III

17. The diagram below shows some of the links in the carbon cycle.



What processes are taking place at I, II and III?

	<b>I</b>	<b>II</b>	<b>III</b>
A.	photosynthesis	fossilization	combustion
B.	cell respiration	fossilization	greenhouse effect
C.	photosynthesis	decomposition	combustion
D.	cell respiration	decomposition	greenhouse effect

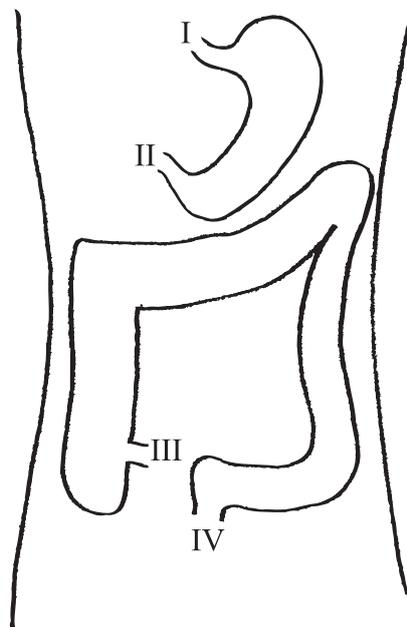
18. Charles Darwin used domesticated animals to provide evidence for evolution by natural selection. What is this evidence?

- A. Differences between breeds show that selection can cause species to change.
- B. The ancestors of domesticated animals can be found in the fossil record.
- C. Some domesticated animals die because the environment cannot support them all.
- D. Variation in domesticated animals is due to sexual reproduction.

19. *Pseudolarix amabilis* produces seeds but not flowers. *Physcomitrella patens* has leaves but not roots. To which groups do they belong?

	<i>Pseudolarix amabilis</i>	<i>Physcomitrella patens</i>
A.	coniferophyta	filicinophyta
B.	filicinophyta	angiospermophyta
C.	coniferophyta	bryophyta
D.	angiospermophyta	coniferophyta

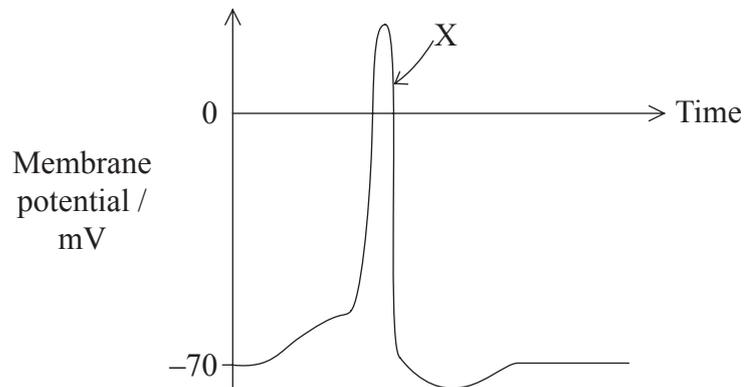
20. The diagram below shows parts of the human digestive system.



Which points are linked by the small intestine?

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

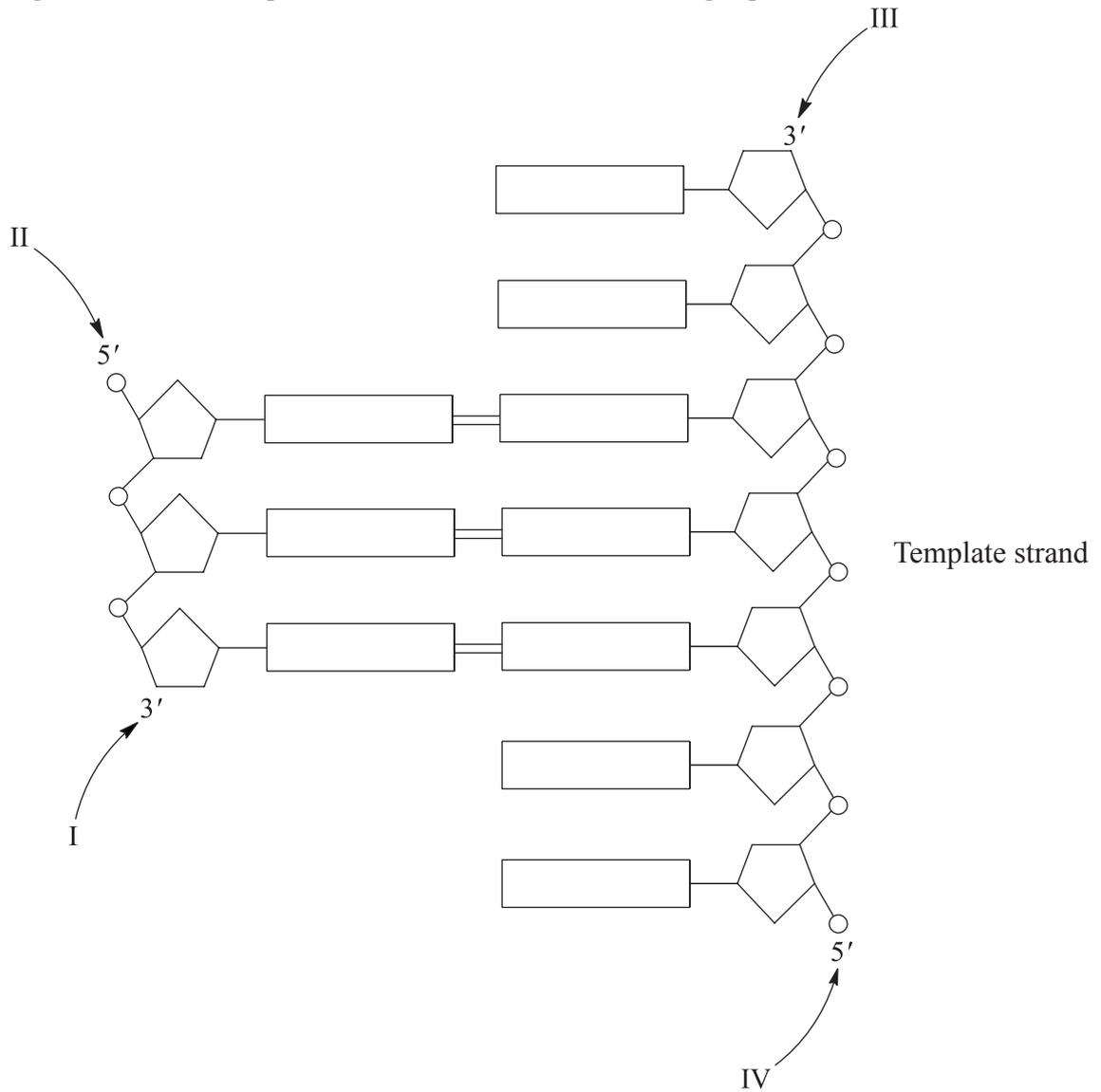
21. What route does blood follow to supply oxygen to heart muscle?
- A. pulmonary vein → left atrium → left ventricle → aorta → coronary artery
  - B. pulmonary vein → right atrium → right ventricle → aorta → coronary artery
  - C. pulmonary artery → left atrium → left ventricle → aorta → coronary artery
  - D. pulmonary artery → right atrium → right ventricle → aorta → coronary artery
22. What change occurs to the pressure and volume of the lungs when the external intercostal muscles contract?
- A. Both pressure and volume increase.
  - B. Pressure increases and volume decreases.
  - C. Pressure decreases and volume increases.
  - D. Both pressure and volume decrease.
23. The graph below shows changes in membrane potential in an axon during the passage of an action potential. What is causing the decrease in membrane potential at point X?



- A. Sodium ions entering the axon
- B. Potassium ions entering the axon
- C. Sodium ions leaving the axon
- D. Potassium ions leaving the axon

24. What is the consequence of insufficient secretion of FSH in women?
- A. Embryo implantation fails because the uterus lining is too thin.
  - B. Mature eggs (oocytes) are not produced.
  - C. Menstruation starts before embryo implantation occurs.
  - D. Progesterone secretion is inhibited.

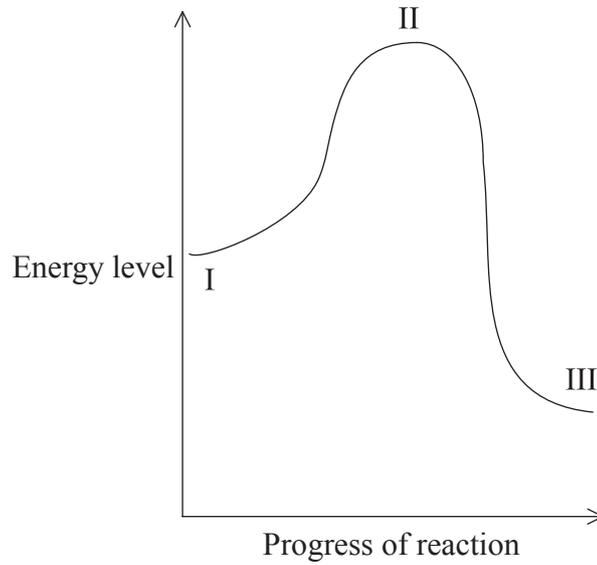
25. The diagram below shows part of a DNA molecule that is being replicated.



Where would DNA polymerase link the next nucleotide during replication?

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

26. The graph below shows energy changes during a chemical reaction that occurs without a catalyst. What would change if the reaction was catalysed by an enzyme?



- A. The initial energy level (I) would be higher, speeding up the reaction.
  - B. The maximum energy level (II) would be higher, speeding up the reaction.
  - C. The maximum energy level (II) would be lower, speeding up the reaction.
  - D. The final energy level (III) would be lower, speeding up the reaction.
27. What is the role of  $\text{NADH} + \text{H}^+$  in aerobic cell respiration?
- A. To transfer hydrogen to the electron transport chain
  - B. To reduce intermediates in the Krebs cycle
  - C. To accept electrons from the electron transport chain
  - D. To combine with oxygen to produce water

28. What reaction, involving glycerate 3-phosphate, is part of the light-independent reactions of photosynthesis?
- A. Glycerate 3-phosphate is carboxylated using carbon dioxide.
  - B. Two glycerate 3-phosphates are linked together to form one hexose phosphate.
  - C. Glycerate 3-phosphate is reduced to triose phosphate.
  - D. Five glycerate 3-phosphates are converted to three ribulose 5-phosphates.
29. What is the advantage of having a small volume inside the thylakoids of the chloroplast?
- A. High proton concentrations are rapidly developed.
  - B. High electron concentrations are rapidly developed.
  - C. Photosynthetic pigments are highly concentrated.
  - D. Enzymes of the Calvin cycle are highly concentrated.
30. What are the main structures in a bulb and their function?
- A. Flowers for sexual reproduction
  - B. Enlarged roots for nutrient absorption from the soil
  - C. Swollen leaf bases for food storage
  - D. Thickened stems for water storage

**31.** What generates new cells in dicotyledonous plants?

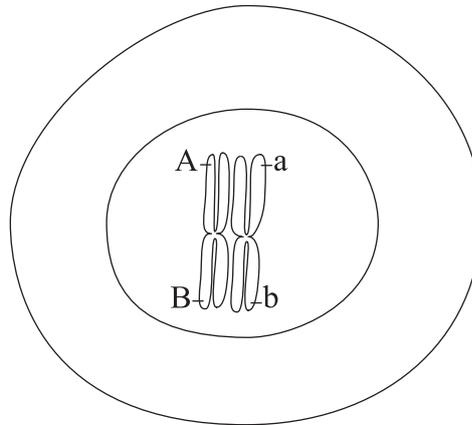
- I. Apical meristems
- II. Lateral meristems
- III. Phloem

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

**32.** What is the effect of abscisic acid on transpiration?

- A. It increases transpiration by causing the stomata to open.
- B. It decreases transpiration by causing the stomata to close.
- C. It increases transpiration by decreasing the humidity inside the leaf.
- D. It decreases transpiration by increasing the humidity inside the leaf.

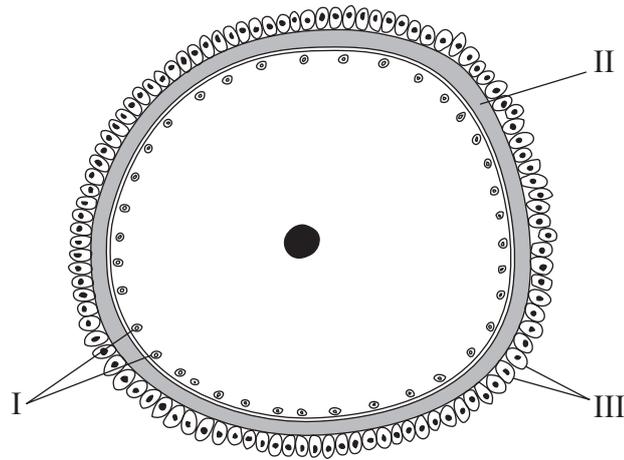
33. The diagram below shows a pair of chromosomes immediately after pairing in prophase I of meiosis in a cell. What combinations of alleles are possible in haploid cells produced by meiosis in this cell?



- A.  $\textcircled{AB}$  or  $\textcircled{ab}$
- B.  $\textcircled{Aa}$  or  $\textcircled{Bb}$
- C.  $\textcircled{Ab}$  or  $\textcircled{aB}$
- D.  $\textcircled{AB}$   $\textcircled{Ab}$   $\textcircled{aB}$  or  $\textcircled{ab}$
34. How many autosomes are there in a human sperm?
- A. 1
- B. 22
- C. 23
- D. 46
35. What is polygenic inheritance?
- A. A character that is controlled by two or more genes
- B. A character that is controlled by more than two copies of a gene
- C. Inheriting more than two alleles of a gene
- D. Inheriting a linked group of genes

- 36.** What is a hypothesis in biology?
- A. An experiment that is used to test a theory
  - B. An idea that cannot be tested experimentally
  - C. A method used to prove a law
  - D. A proposed explanation of observations
- 37.** Which cells activate helper T-cells by antigen presentation?
- A. B-cells
  - B. Bacteria
  - C. Macrophages
  - D. Plasma cells
- 38.** What happens during muscle contraction?
- A. The number of light bands is reduced.
  - B. The width of the dark bands is reduced.
  - C. The lengths of the sarcomeres are reduced.
  - D. Actin and myosin filaments coil up.
- 39.** The Bowman's capsule is a cup-shaped structure that is part of the nephron. What is the source of glucose in the fluid in the Bowman's capsule?
- A. Blood in the glomerulus
  - B. Urine in the renal pelvis
  - C. Filtrate in the distal convoluted tubule
  - D. Interstitial fluid in the medulla

40. The diagram below shows a human egg.



What are the structures labelled I, II and III?

	<b>I</b>	<b>II</b>	<b>III</b>
A.	acrosomes	zona pellucida	follicle cells
B.	acrosomes	cell wall	sperm
C.	cortical granules	cell wall	sperm
D.	cortical granules	zona pellucida	follicle cells