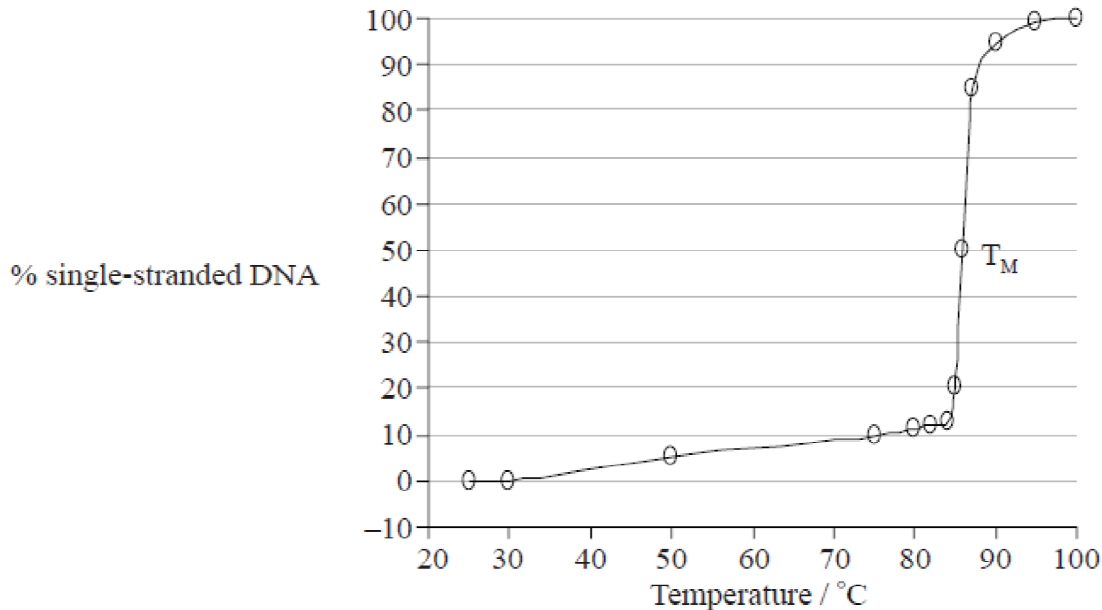


**IB HL Biology Test: Topics 1 and 3****Multiple Choice**

Identify the choice that best completes the statement or answers the question.

- \_\_\_\_\_ 1. What conditions must be met for the *t*-test to be applied?
- I. Population sampled must have a normal distribution
  - II. Variable measured is continuous
  - III. Sample size must be >30
- a. I, II and III
  - b. I only
  - c. II and III only
  - d. I and II only
- \_\_\_\_\_ 2. The graph below shows the effect of temperature on the separation of the strands in DNA to form single strands. The temperature at which 50 % of the DNA is single-stranded is called the melting temperature ( $T_M$ ).



What do the

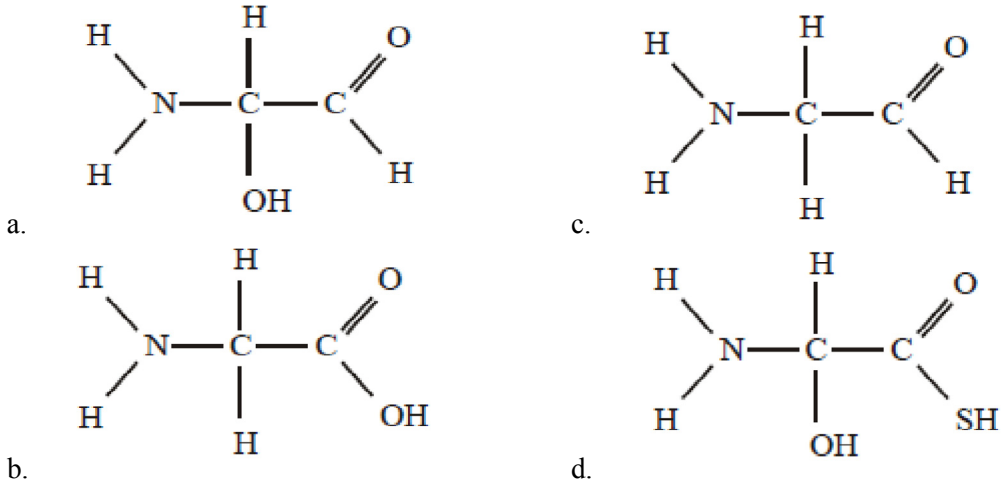
results show?

- a. When the temperature reaches 85 °C the DNA strands start separating rapidly.
  - b. When the temperature reaches 85 °C there are no more double-stranded DNA molecules.
  - c. A  $T_M$  of 85 °C means that DNA is not stable at room temperature (25 °C).
  - d. The separation of the DNA strands is directly proportional to the increase in temperature.
- \_\_\_\_\_ 3. What does the universal nature of the genetic code allow?
- a. Formation of clones
  - b. Change of genetic code in the same species
  - c. Infection by bacteria
  - d. Transfer of genes between species

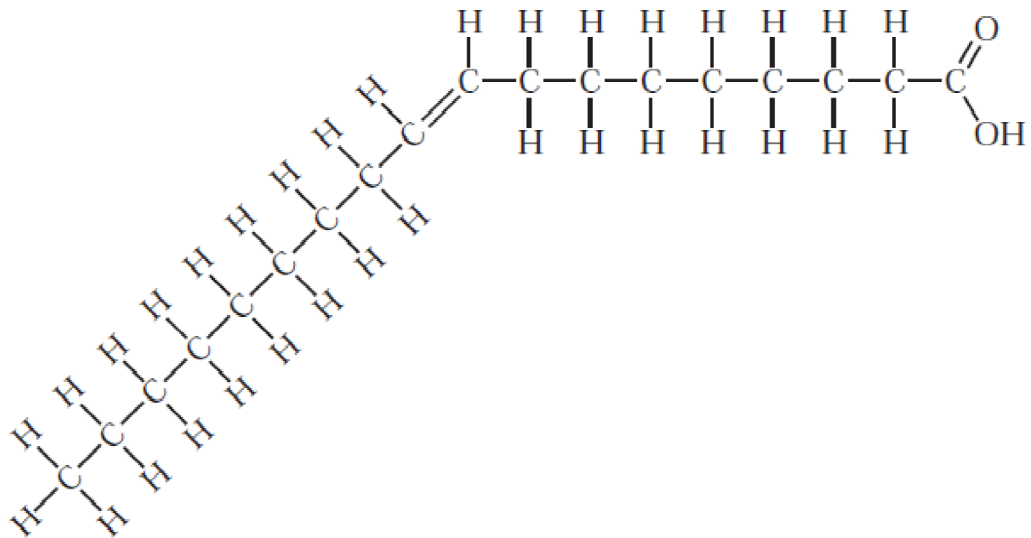
Name: \_\_\_\_\_

- \_\_\_\_\_ 4. Which of the following are connected by a hydrogen bond?
- a. A base pair of a DNA molecule
  - b. Two amino acid molecules of a dipeptide
  - c. Two glucose molecules in a disaccharide
  - d. The hydrogen and oxygen atoms of a water molecule

- \_\_\_\_\_ 5. Which structure represents an amino acid?



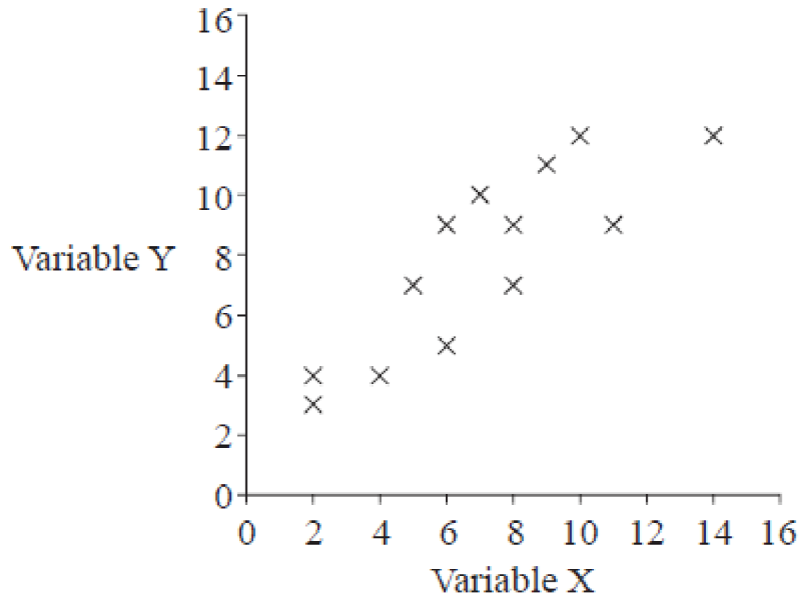
- \_\_\_\_\_ 6. What is light energy used for during photosynthesis?
- a. To produce water molecules
  - b. To break down sugar molecules
  - c. To produce ATP
  - d. To produce carbon dioxide
- \_\_\_\_\_ 7. The lengths of a sample of tiger canines were measured. 68 % of the lengths fell within a range between 15 mm and 45 mm. The mean was 30 mm. What is the standard deviation of this sample?
- a. 7.5 mm
  - b. 15 mm
  - c. 5 mm
  - d. 30 mm
- \_\_\_\_\_ 8. Which chemical is shown in the diagram below?



- a. Triglyceride
- b. Monosaccharide
- c. Amino acid
- d. Fatty acid

Name: \_\_\_\_\_

9. What happens during the pathway of glycolysis?
- a. Glucose is broken down into pyruvate.
  - b. Carbon dioxide is produced.
  - c. More ATP is consumed than is produced.
  - d. Lactic acid is produced.
10. What does the following scatter graph show?



- a. Strong negative correlation between these variables
- b. Weak negative correlation between these variables
- c. No correlation between these variables
- d. Strong positive correlation between these variables

Name: \_\_\_\_\_

11. The table below shows the codons that determine different amino acids in protein translation.

First base in codon	Second base in codon				Third base in codon
	U	C	A	G	
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	—	—	A
	Leu	Ser	—	Trp	G
C	Leu	Pro	His	Arg	U
	Leu	Pro	His	Arg	C
	Leu	Pro	Gln	Arg	A
	Leu	Pro	Gln	Arg	G
A	Ile	Thr	Asn	Ser	U
	Ile	Thr	Asn	Ser	C
	Ile	Thr	Lys	Arg	A
	Met	Thr	Lys	Arg	G
G	Val	Ala	Asp	Gly	U
	Val	Ala	Asp	Gly	C
	Val	Ala	Glu	Gly	A
	Val	Ala	Glu	Gly	G

What is the sequence of the amino acids that is being translated from the following mRNA sequence?

5' AUGGGUGCUUAUUGGUA 3'

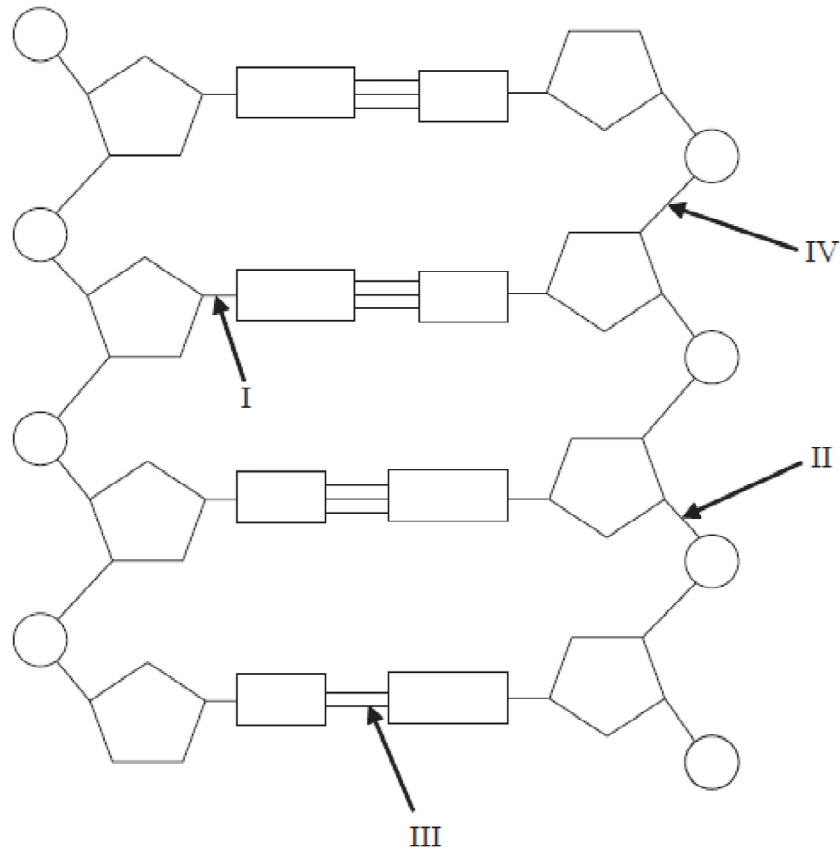
- a. Met-Gly-Tyr-Ala-Thr
  - b. Met-Cys-Ser-Tyr-Trp
  - c. Met-Gly-Ala-Tyr-Trp
  - d. Met-Pro-Arg-Ile-Thr
12. A certain gene codes for a polypeptide that is 120 amino acids long. Approximately how many nucleotides long is the mRNA that codes for this polypeptide likely to be?
- a. 360
  - b. 40
  - c. 30
  - d. 480
13. Which of the following is the cause of sickle-cell anemia?
- a. Leucine is replaced by valine.
  - b. Lysine is replaced by glutamic acid.
  - c. Glutamic acid is replaced by valine.
  - d. Tryptophan is replaced by leucine.

Name: \_\_\_\_\_

- \_\_\_\_\_ 14. What is the composition of the backbone of DNA?
- a. A polysaccharide
  - b. Alternating sugar and base molecules
  - c. Alternating sugar and phosphate molecules
  - d. Complementary base pairs
- \_\_\_\_\_ 15. Which of the following reactions occurs when a dipeptide is formed from amino acids?
- a. Oxidation
  - b. Denaturation
  - c. Hydrolysis
  - d. Condensation
- \_\_\_\_\_ 16. Which of the following is **true** about a polar amino acid and cellulose?
- a. Both contain nitrogen.
  - b. Both contain hydrogen atoms.
  - c. Both are polysaccharides.
  - d. Both are hydrophobic.
- \_\_\_\_\_ 17. Which of the following is a function of cellulose in plants?
- a. Formation of cell walls
  - b. Storage of energy
  - c. Formation of mitochondria
  - d. Storage of fat
- \_\_\_\_\_ 18. What does a small standard deviation signify?
- a. The data shows a close relationship between two variables.
  - b. The data is clustered closely to the mean value.
  - c. The data is widely spread around the mean.
  - d. The data is not correlated.
- \_\_\_\_\_ 19. Blood is a water-based transport medium. Which property of water makes it a good transport medium?
- a. It has its greatest density at 4° C
  - b. High specific heat
  - c. Versatility as a solvent
  - d. Transparency

Name: \_\_\_\_\_

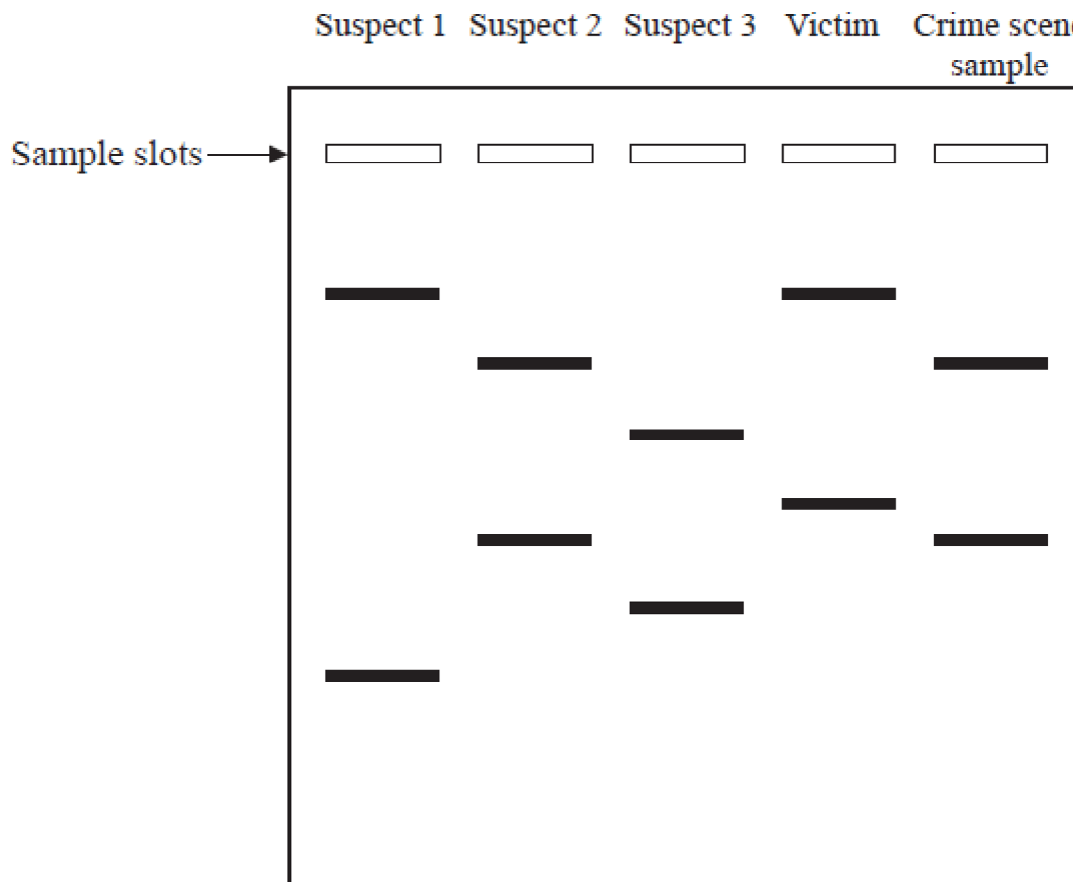
\_\_\_ 20. In the model of the DNA molecule shown below, which arrows point to covalent bonds?



- |                       |                        |
|-----------------------|------------------------|
| a. I, II and III only | c. II, III and IV only |
| b. I, III and IV only | d. I, II and IV only   |
- \_\_\_ 21. What is the function of helicase?
- |  |                              |
|--|------------------------------|
| a. It forms bonds between DNA nucleotides.   | c. It forms the DNA helix.   |
| b. It adds new nucleotides to the DNA helix. | d. It separates DNA strands. |
- \_\_\_ 22. Which of the following could cause denaturation of an enzyme?
- |                           |                            |
|---------------------------|----------------------------|
| a. Low salt concentration | c. Substrate concentration |
| b. High temperature       | d. A competitive inhibitor |
- \_\_\_ 23. The *t*-test is used to test the statistical significance of a difference. What is that difference?
- |  |                                     |
|--|-------------------------------------|
| a. Between observed and expected results         | c. Between the size of two samples  |
| b. Between the standard deviation of two samples | d. Between the means of two samples |

Name: \_\_\_\_\_

24. The diagram below represents the results obtained in a DNA profile from a crime scene.

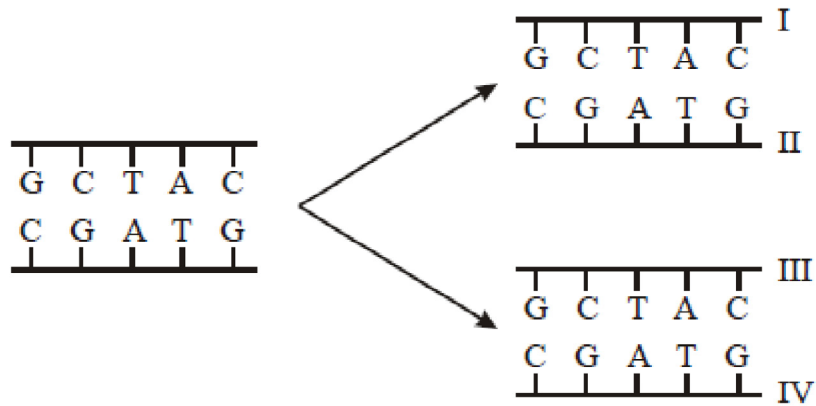


Suspect 2 is **most** likely to be the criminal because the band pattern coincides with that of the crime scene sample. What do these bands represent?

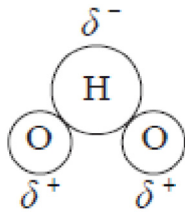
- a. Chromosomes
- b. Chromatids
- c. DNA fragments
- d. Genes

Name: \_\_\_\_\_

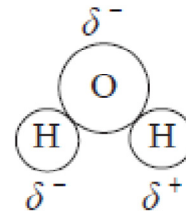
25. The diagram below shows a short section of DNA molecule before and after replication. If the nucleotides used to replicate the DNA were radioactive, which strands in the replicated molecules would be radioactive?



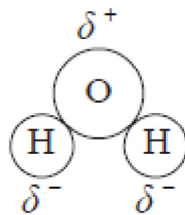
- a. I and III only  
b. I and II only  
c. II and III only  
d. I, II, III and IV
26. Which diagram represents the polarity of a water molecule?



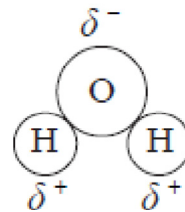
a.



c.



b.



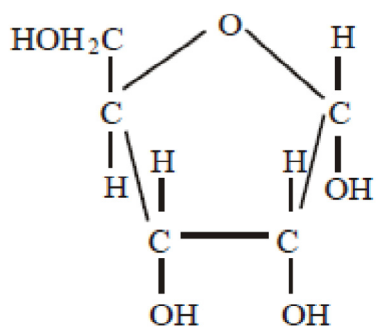
d.

27. What is a role of sulfur in living organisms?
- a. Formation of proteins  
b. Formation of teeth  
c. Formation of carbohydrates  
d. Transmission of nerve impulses

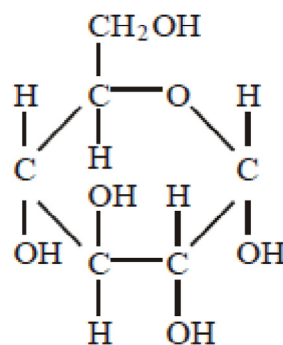


Name: \_\_\_\_\_

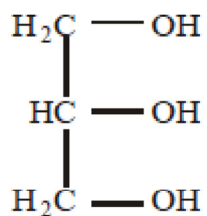
28. Which molecule represents ribose?



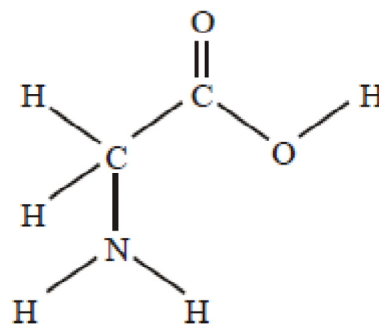
a.



c.



b.

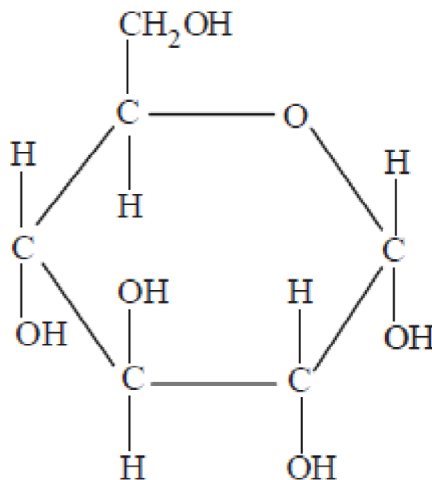


d.

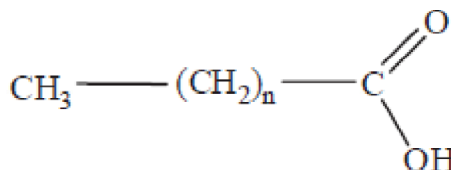
Name: \_\_\_\_\_

\_\_\_ 29. Which describes these molecules correctly?

I.



II.



- |                                |                                |
|--------------------------------|--------------------------------|
| a. ribose (I) amino acid (II)  | c. ribose (I) fatty acid (II)  |
| b. glucose (I) amino acid (II) | d. glucose (I) fatty acid (II) |
- \_\_\_ 30. Why is light important in photosynthesis?
- |   |  |
|---|--|
| a. To activate carbon dioxide molecules     | c. To activate the enzymes that fix carbon dioxide |
| b. To produce ATP and split water molecules | d. To produce ADP needed to fix carbon dioxide     |

Name: \_\_\_\_\_

**Short Answer**

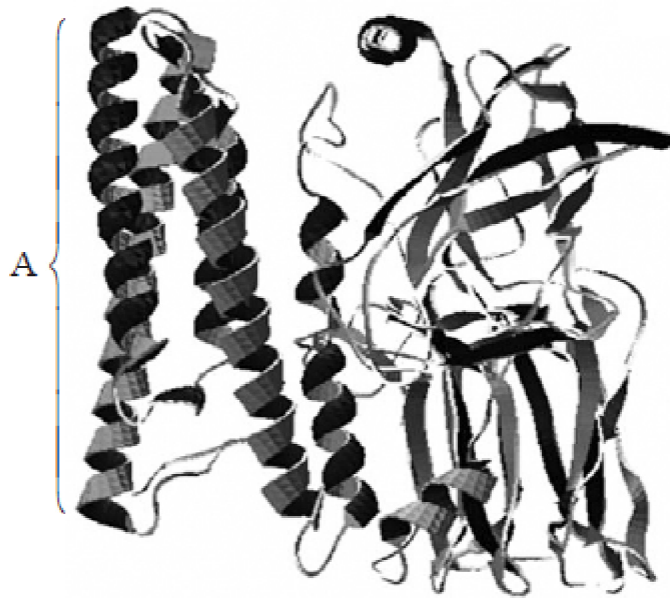
31. (a) Outline the bonding between DNA nucleotides.

(b) Explain how chemical bonding between water molecules makes water a valuable coolant in living organisms.

(c) State a word equation for anaerobic cell respiration in humans.

Name: \_\_\_\_\_

*Bacillus thuringiensis* proteins act as toxins to insects, primarily by destroying epithelial cells in the insect's digestive system. Below is the three-dimensional structure of one such protein.



[Source: Reprinted from Mario Soberón, "Mode of action of mosquitocidal *Bacillus thuringiensis* toxins", *Toxicon*, Volume 49, Issue 5, pp. 597-600, © (2007) with permission from Elsevier]

32. (i) State the type of structure shown in the region marked A in the diagram above.

(ii) Outline how this structure is held together.

Name: \_\_\_\_\_

(iii) Region A inserts into the membrane. Deduce, with a reason, the nature of the amino acids that would be expected to be found in this region.

33. a. Distinguish between RNA and DNA.

b. Explain the process of DNA replication.

c. Outline how enzymes catalyse reactions.

## IB HL Biology Test: Topics 1 and 3

### Answer Section

#### MULTIPLE CHOICE

1. ANS: D REF: IB HL Bio Paper 1 TZ 1 May 2009 #2
2. ANS: A REF: IB HL Bio Paper 1 TZ 2 May 2010 #7
3. ANS: D REF: IB HL Bio Paper 1 TZ 2 May 2010 #13
4. ANS: A
5. ANS: B
6. ANS: C REF: IB HL Bio Paper 1 TZ 1 May 2009 #10
7. ANS: B REF: IB HL Bio Paper 1 TZ 1 May 2010 #1
8. ANS: D REF: IB HL Bio Paper 1 TZ 2 May 2009 #36
9. ANS: A REF: IB HL Bio Paper 1 TZ 1 May 2009 #9
10. ANS: D REF: IB HL Bio Paper 1 TZ 1 May 2009 #1
11. ANS: C REF: IB HL Bio Paper 1 TZ 2 May 2010 #8
12. ANS: A
13. ANS: C REF: IB HL Bio Paper 1 TZ 2 May 2010 #11
14. ANS: C
15. ANS: D
16. ANS: B REF: IB HL Bio Paper 1 TZ 2 May 2009 #6
17. ANS: A REF: IB HL Bio Paper 1 TZ 2 May 2010 #9
18. ANS: B REF: IB HL Bio Paper 1 TZ 2 May 2010 #1
19. ANS: C REF: IB HL Bio Paper 1 TZ 2 May 2009 #9
20. ANS: D REF: IB HL Bio Paper 1 TZ 1 May 2009 #8
21. ANS: D
22. ANS: B
23. ANS: D REF: IB HL Bio Paper 1 TZ 2 May 2009 #1
24. ANS: C REF: IB HL Bio Paper 1 TZ 2 May 2010 #12
25. ANS: C
26. ANS: D REF: IB HL Bio Paper 1 TZ 1 May 2009 #7
27. ANS: A REF: IB HL Bio Paper 1 TZ 2 May 2010 #6
28. ANS: A
29. ANS: D REF: IB HL Bio Paper 1 TZ 1 May 2010 #7
30. ANS: B REF: IB HL Bio Paper 1 TZ 2 May 2010 #10

## SHORT ANSWER

31. ANS:

- (a) hydrogen bonds between nucleotides on opposite strands/  
complementary bases/adenine and thymine and cytosine and  
guanine; } *(reject letters instead  
of base names)*  
covalent bonds between nucleotides within strands/between sugar/deoxyribose  
and phosphate; [2]
- (b) hydrogen bonding between water molecules;  
breaking (hydrogen bonds) needs/removes energy/heat;  
hydrogen bonds must break when water evaporates/vaporizes; [2 max]
- (c) pyruvate/pyruvic acid → lactate/lactic acid;  
glucose → (pyruvate/pyruvic acid) → lactate/lactic acid; [1 max]  
*Accept correct chemical equation with formulae.*

REF: IB HL Bio Paper 2 TZ 2 May 2010 #3

32. ANS:

- (i) α helix / alpha helix [1]
- (ii) hydrogen bonds;  
between the turns of the helix (rather than between R-groups);  
bonds between carboxyl and NH groups/C-O---H-N; [2 max]
- (iii) non-polar amino acids/R-groups;  
(inner part of phospholipid) bilayer is hydrophobic/non-polar; [2]

REF: IB HL Bio Paper 2 TZ 1 May 2009 #1i

33. ANS:

- (a) DNA is double-stranded while RNA is single-stranded;  
DNA contains deoxyribose while RNA contains ribose;  
the base thymine found in DNA is replaced by uracil in RNA;  
one form of DNA (double helix) but several forms of RNA (tRNA, mRNA and rRNA); [3 max]
- (b) occurs during (S phase of) interphase/in preparation for mitosis/cell division;  
DNA replication is semi-conservative;  
unwinding of double helix / separation of strands by helicase (at replication origin);  
hydrogen bonds between two strands are broken;  
each strand of parent DNA used as template for synthesis;  
synthesis continuous on leading strand but not continuous on lagging strand;  
leading to formation of Okazaki fragments (on lagging strand);  
synthesis occurs in 5' → 3' direction;  
RNA primer synthesized on parent DNA using RNA primase;  
DNA polymerase III adds the nucleotides (to the 3' end)  
added according to complementary base pairing;  
adenine pairs with thymine and cytosine pairs with guanine; (*Both pairings required. Do not accept letters alone.*)  
DNA polymerase I removes the RNA primers and replaces them with DNA;  
DNA ligase joins Okazaki fragments;  
as deoxynucleoside triphosphate joins with growing DNA chain, two phosphates broken off releasing energy to form bond; [8 max]  
*Accept any of the points above shown on an annotated diagram.*
- (c) they increase rate of (chemical) reaction;  
remains unused/unchanged at the end of the reaction;  
lower activation energy;  
activation energy is energy needed to overcome energy barrier that prevents reaction;  
annotated graph showing reaction with and without enzyme;  
substrate joins with enzyme at active site;  
to form enzyme-substrate complex;  
active site/enzyme (usually) specific for a particular substrate;  
enzyme binding with substrate brings reactants closer together to facilitate chemical reactions (such as electron transfer);  
induced fit model / change in enzyme conformation (when enzyme-substrate/ES complex forms);  
making the substrate more reactive; [7 max]

*(Plus up to [2] for quality)*



REF: IB HL Bio Paper 2 TZ 1 May 2009 #6