Helping you Achieve Highest Grades in IB

IB Biology HL First Assesment 2025

Question Paper

Multiple Choice and Short Answer Questions

Theme: A- Unity & Diversity

Sub Topic - Water, Nuclic Acid, Cell Structure

Marks: 179

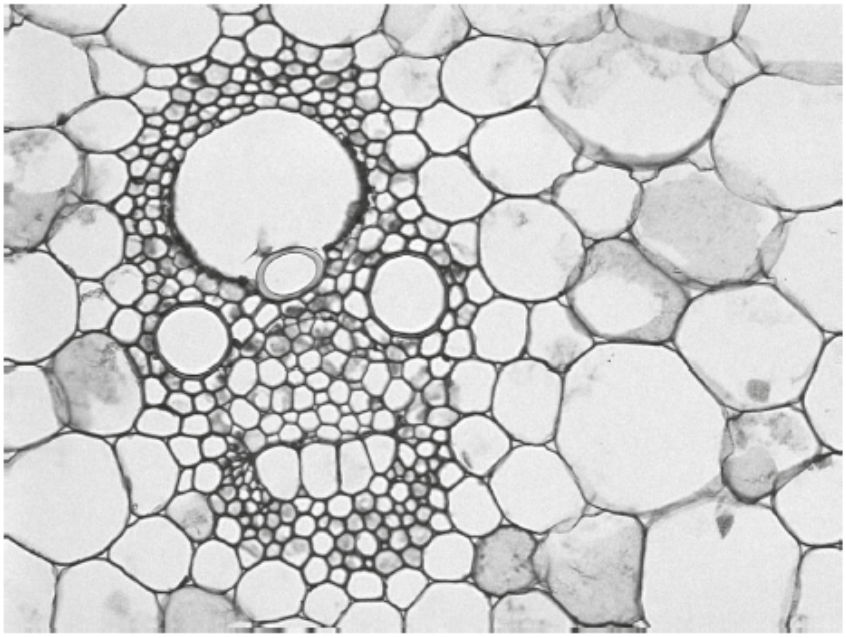
Total Marks: / 179

Suitable for HL Students sitting exams 2025+ onwards. However, SL Students will also find this useful

Questions

19M.2.HL.TZ1.4

The micrograph shows a vascular bundle from the stem of a barley plant.



Source: Copyright Carolina Biological Supply Company. Used by permission only.]
a. Xylem and phloem contain structures that are adapted for transport.
Outline the differences between these structures in xylem and phloem [2]
b.
Explain how the properties of water allow it to move through xylem vessels. [2]
c.
Outline how the structure of cellulose makes it suitable as a component of cell walls. [2]

20N.2.HL.TZ0.7

Water is the medium of life.
a. Outline how hydrogen bonds form in water. [3]
b. Describe the processes that cause water to move from the roots of plants to their leaves [4]
c. Explain the role of the kidney in osmoregulation. [8]

Questions

21N.2.HL.TZ0.7

Plants have developed efficient methods for transport and for synthesis of foods.
a. Outline how the properties of water make it an ideal transport medium in plants. [4]
b. Distinguish between the xylem and phloem of plants. [4]
c. Explain how the light-independent reactions of photosynthesis rely on the light-dependent reactions. [7]

19N.2.HL.TZ0.6

a. Draw the structure of a section of DNA showing all possible bases. [4]
b. Outline the structural and genetic characteristics of eukaryotic chromosomes. [4]
c. Explain how a polypeptide chain is synthesized in a eukaryotic cell. [7]

21M.2.HL.TZ2.7

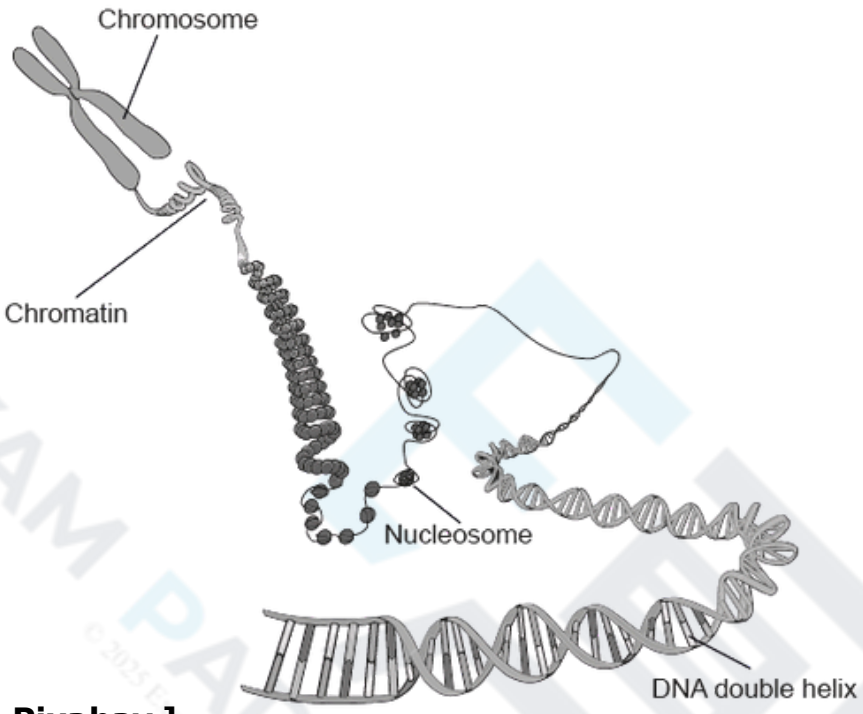
1. Describe the structure of the DNA molecule. [5]
2. Outline the role of three enzymes used in the replication of DNA. [3]
3. Insulin is produced in β cells of the pancreas and not in other cells of the human body. Explain how differentiation of cells and regulation of gene expression allow proteins such as insulin to be produced in only certain types of body cell. [7]

21N.2.HL.TZ0.6

RNA molecules play numerous roles in gene expression and so contribute to variation.
1. Draw labelled diagrams to show the structure of RNA nucleotides and how they are linked together to form a molecule of RNA. [4]
2. Explain transcription. [7]
3. Distinguish between continuous and discrete variation, using examples. [4]

Questions

22M.2.HL.TZ2.5



[Source: Pixabay.]

People can be analysed genetically for risks of specific diseases before they actually develop. One of these is type I diabetes.
a .i. Describe the structure of nucleosomes.[1]
a.ii. Explain how the two strands of the DNA double helix are held together.[2]
a.iii. There are multiple tandem repeats of nucleotide segments of DNA found in the non-coding DNA between genes. Outline how tandem repeats are used for DNA profiling. [3]
b.i. Explain what happens in a person when they develop type I diabetes. [2]
b.ii. State how type I diabetes should be treated to avoid harmful health consequences of the condition. [1]

SPM.2.HL.TZ0.10

RNA molecules play numerous roles in gene expression and so contribute to variation.
(a) Outline the role of UV radiation as a mutagen. [4]
(b)Explain how the function of DNA is linked to its molecular structure. [7]
© Describe the use of gene knockout technology in research. [4]

Questions

19M.2.HL.TZ1.2

The karyogram shown is for the African marsh rat (Dasymys incomtus). In this species, sex is determined by X and Y chromosomes. Females are XX and males are XY.

[Source: adapted from https://embryology.med.unsw.edu.au]

Thomas Hunt Morgan established that genes for body colour and wing size in Drosophila are autosomally linked. The allele for grey body (b+) is dominant over that for black body (b) and the allele for normal wing size (vg+) is dominant over that for vestigial wing (vg).

a. Distinguish between the structure of the chromosomes of prokaryotes and eukaryotes. [2]

b. Outline the causes of sickle cell anemia. [2]

c.i. Identify, with a reason, the sex of this individual. [1]

c.ii. State the haploid number for this nucleus. [1]

d.i. A fly that is homozygous dominant for both body colour and wing size mates with a fly that is recessive for both characteristics. In the table, draw the arrangement of alleles for the offspring of this mating and for the homozygous recessive parent. [2]

Heterozygous offspring (grey body, normal wings)	Homozygous recessive parent (black body, vestigial wings)

Questions

d.ii. The offspring, which were all heterozygous for grey body and normal wings, were crossed with flies that were homozygous recessive for both genes. The table shows the percentages of offspring produced.
Explain these results, based on the knowledge that the genes for body colour and wing size are autosomally linked.

grey body, normal wings	48 %
grey body, vestigial wings	3 %
black body, normal wings	2 %
black body, vestigial wings	47 %

[2]

19M.2.HL.TZ1.3

The electron micrographs show a typical prokaryote and a mitochondrion.

Prokaryote

[Source: Pradana Aumars, https://commons.wikimedia.org/wiki/Category:Bacteria#/media/File:Bacteria_cell_division.jpg]

Mitochondrion

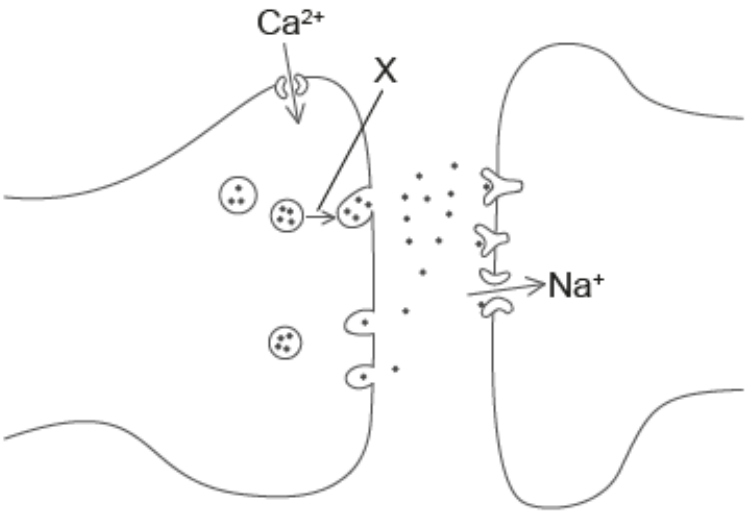
[Source: republished with permission of McGraw-Hill Education, from *Harrison's Principles of Internal Medicine*, J L Jameson *et al.*, 16th edition, 2004; permission conveyed through Copyright Clearance Center, Inc]

a. Compare and contrast the structure of a typical prokaryotic cell with that of a mitochondrion. [4]
b. Explain how mitochondria could have been formed from free living prokaryotes. [2]

Questions

20N.2.HL.TZ0.2

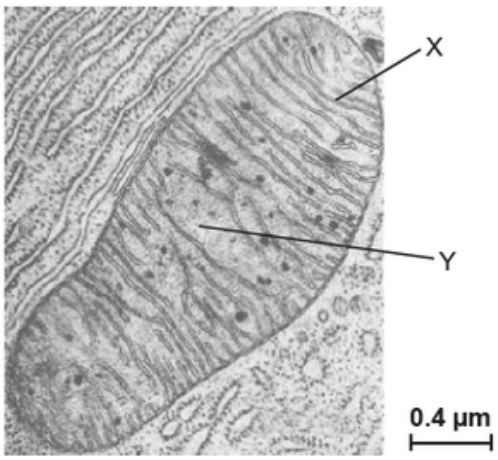
The diagram shows part of two neurons.



[Source: © International Baccalaureate Organization 2020.]
a.i. Outline how the amphipathic properties of phospholipids play a role in membrane structure. [2]
a.ii. State the role of cholesterol in animal cell membranes. [1]
b. Describe what happens to the membranes of an animal cell during mitosis. [2]
c.i. State the name of the structure shown. [1]
c.i. X indicates the movement of a structure in the neuron. Explain what events trigger this movement and what happens next. [3]

20N.2.HL.TZ0.3

The electron micrograph shows part of a cell including a mitochondrion.



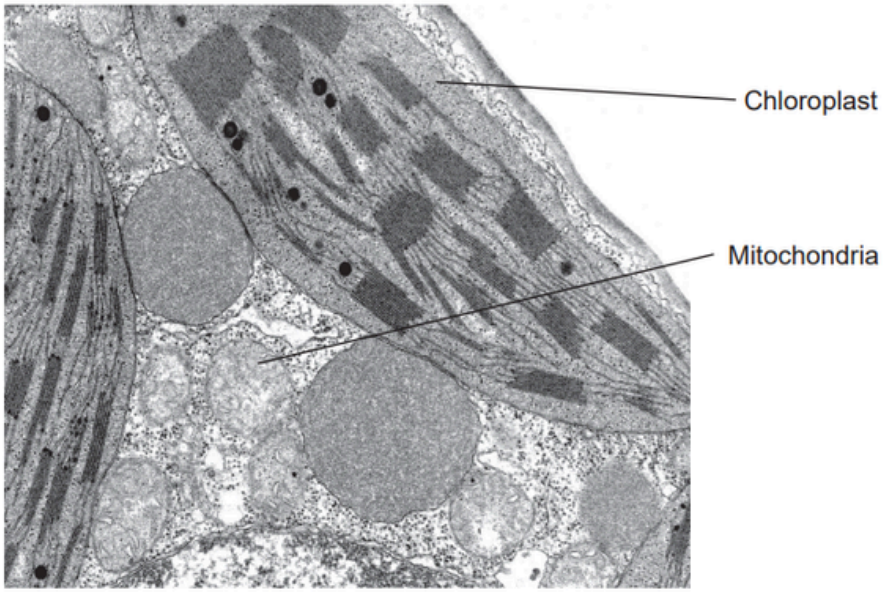
Questions

[Source: Used with permission of McGraw-Hill Education, from Harrison's Principles of Internal Medicine,
J L Jameson et al., 16th edition, 2004; permission conveyed through Copyright Clearance Center, Inc.]

a. Outline how the structures labelled X and Y are adapted to carry out the function of the mitochondrion. X: Y: [2]
b. Explain how ATP is generated in mitochondria by chemiosmosis. [4]

21M.2.HL.TZ1.2

The image shows part of a plant cell with a chloroplast in close proximity to mitochondria.



[Source: Photo © E. Newcomb.]

a. State two structural similarities between mitochondria and chloroplasts. 1.2. [2]
b. Compare and contrast mitochondria and chloroplasts in terms of the substrates they use and the products they produce. [2]
c. Outline how the compounds produced by chloroplasts are distributed throughout the plant.
[3]

Questions

21M.2.HL.TZ2.5

a. Autosomal genes are located in chromosomes that are not sex chromosomes. The inheritance of autosomal genes is affected by whether the genes are linked or unlinked. Explain the two types of inheritance, using the example of parents that are heterozygous for two genes A and B. [7]
b. Outline how sperm are produced from diploid cells in the testis and how this production can be sustained over many decades of adult life. [4]
c. Testis cells are eukaryotic cells. Identify the structures seen under the electron microscope in testis cells that are not present in prokaryotic cells. [4]

21M.2.HL.TZ2.7

a. Describe the structure of the DNA molecule. [5]
b. Outline the role of three enzymes used in the replication of DNA. [3]
c. Insulin is produced in β cells of the pancreas and not in other cells of the human body. Explain how differentiation of cells and regulation of gene expression allow proteins such as insulin to be produced in only certain types of body cell. [7]

21N.2.HL.TZ0.6

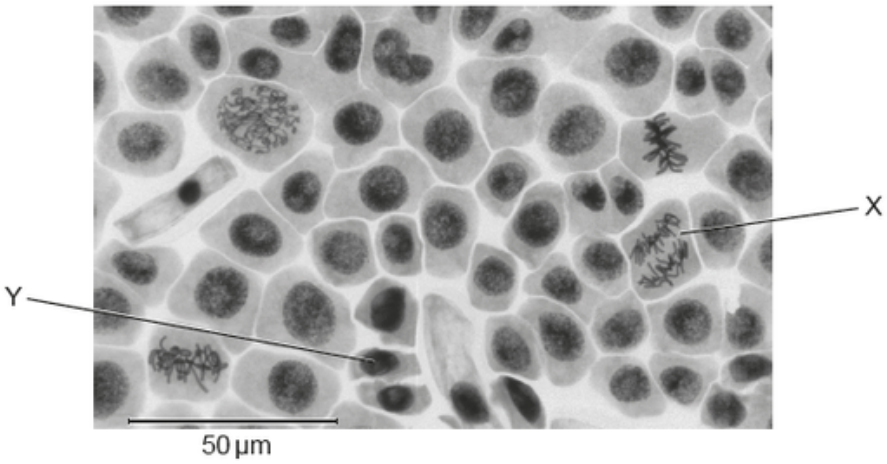
RNA molecules play numerous roles in gene expression and so contribute to variation.

a. Draw labelled diagrams to show the structure of RNA nucleotides and how they are linked together to form a molecule of RNA [4]
b. Explain transcription. [7]
c. Distinguish between continuous and discrete variation, using examples. [4]

Questions

22M.2.HL.TZ2.2

The onion (Allium cepa) root cells shown in the micrograph are in different stages of mitosis.



[Source: Reischig, J., 2014. Mitosis (261 13) [Pressed; root meristem of onion]. [image online] Available at https://commons.wikimedia.org/wiki/File:Mitosis_(261_13)_Pressed;_root_meristem_of_onion_(cells_in_prophase,_metaphase,_anaphase,_telophase).jpg This file is licensed under the Creative Commons Attribution -ShareAlike 3.0 Unported (CC BY-SA 3.0) https://creativecommons.org/licenses/by-sa/3.0/deed.en [Accessed 3 December 2019].]

a.i. Identify, with a reason, the stage shown at X.
[2]
a.ii. Calculate the length of the entire cell labelled Y, showing your working.
[1]
a.iii. State the role of cyclins in the cell cycle.
[1]
Db.i.istinguish between the structure of chromosomes in prokaryotes and eukaryotes.
[2]
b.ii.Explain Cairns’s technique to measure the length of the DNA molecule.
[2]