EXAM PAPERS PRACTICE

Helping you Achieve Highest Grades in IB

IB Biology HL

Question Paper

Fully in-lined with the First Teaching in 2023 & First Assessment Examinations in 2025 & Beyond

Paper: 1 (Multiple-Choice Questions)
Theme: A - Unity and Diversity

Marks: 35

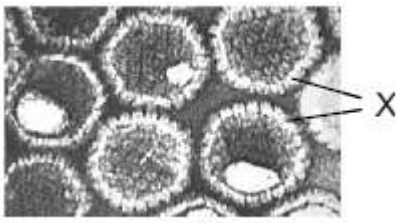
Total Marks: / 35

Suitable for Students sitting the 2026 exams onwards
However, students in HL might find it useful

Questions

SPM.1A.HL.TZ0.14

The image shows a group of enveloped viral particles.



What is the most likely composition of the structure labelled X?

A. Membrane derived from the host cell
B. Viral DNA
C. Viral cell walls
D. Viral enzymes

[1]

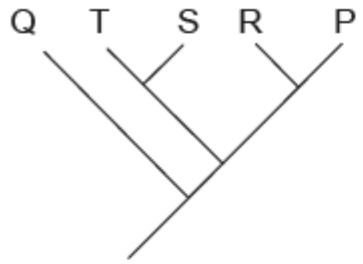
22M.1A.HL.TZ1.23

Data regarding the presence (+) or absence (–) of five traits in several different species are shown in the table.

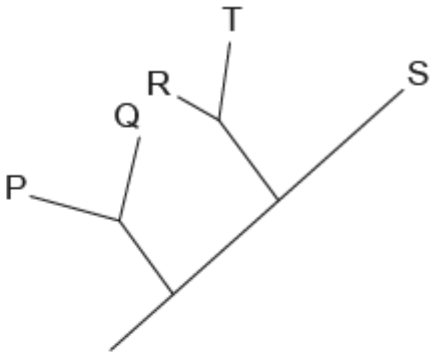
	Traits				
Species	**1**	**2**	**3**	**4**	**5**
P	+	–	–	+	+
Q	–	–	–	–	–
R	+	–	–	–	+
S	+	+	+	–	–
T	+	+	–	–	–

Which cladogram best represents the relationship between the five species?

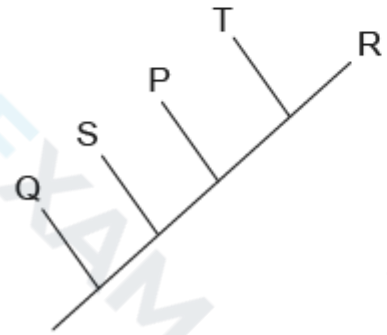
A.



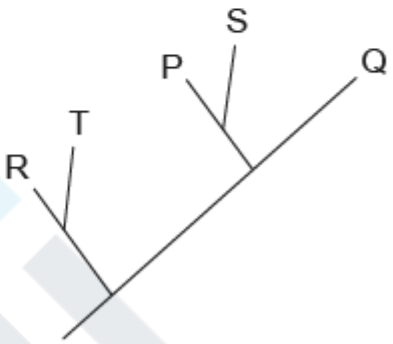
B.



C.



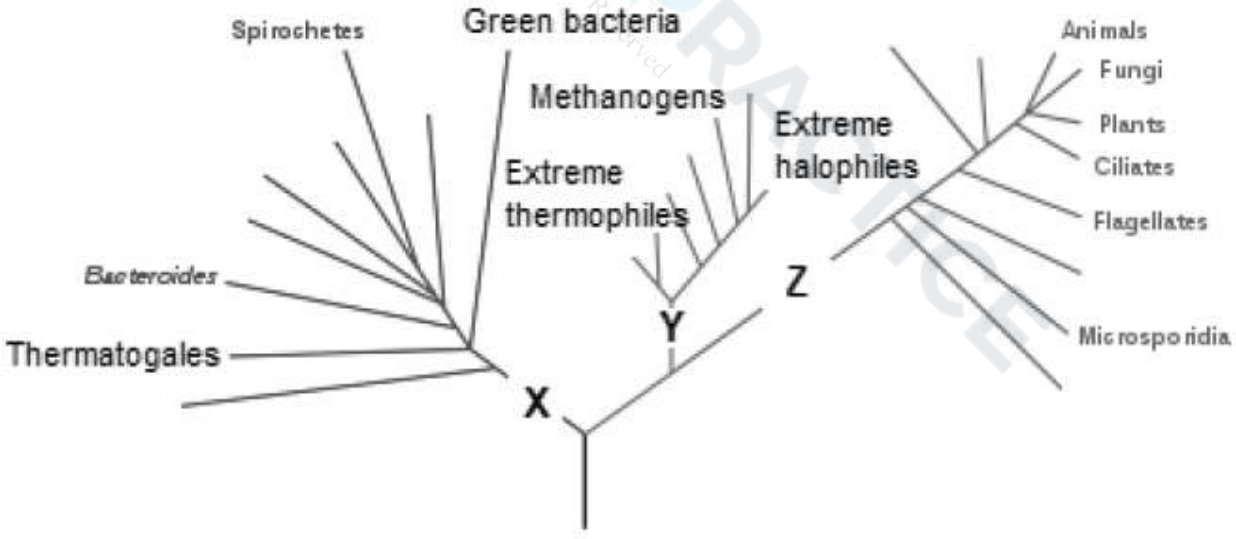
D.



[1]

20N.1A.HL.TZ0.23

The cladogram shows some of the groups in the three domains.



[Source: Adapted from Eric Gaba (Sting, fr:Sting), Cherkash, Public domain, via Wikimedia Commons. https://commons.wikimedia.org/wiki/File:Phylogenetic_tree.svg.]

What domains do X, Y and Z represent?

	Domains		
	X	Y	Z
A.	prokaryote	archaea	eukaryote
B.	archaea	eubacteria	prokaryote
C.	eubacteria	archaea	eukaryote
D.	eubacteria	prokaryote	eukaryote

[1]

SPM.1A.HL.TZ0.13

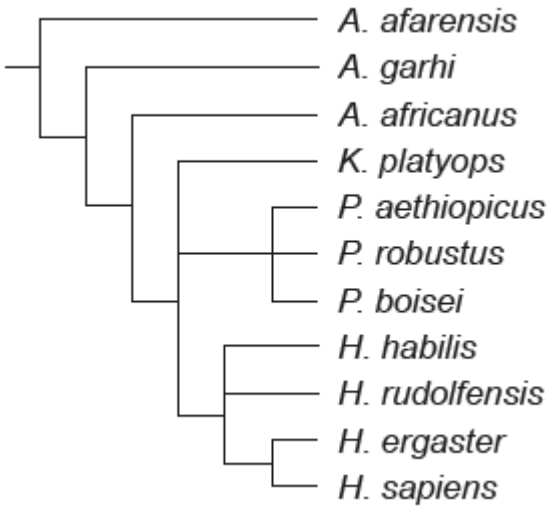
How does the Miller-Urey experiment contribute to an explanation of the origin of life?

A. It shows how phospholipids form protocells in specific laboratory conditions.
B. It explains how organic molecules arise from inorganic ones under certain environmental conditions.
C. It explains the synthesis of RNA, recreating deep sea vent conditions in the laboratory.
D. It shows how the last universal common ancestor (LUCA) evolved from vesicles.

[1]

21N.1A.HL.TZ0.23

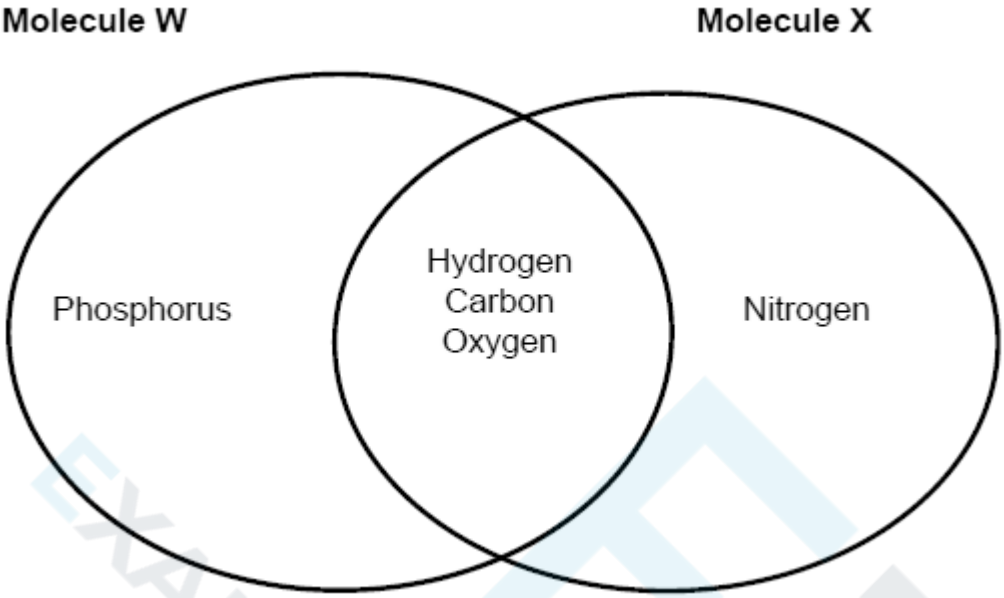
The cladogram shows one theory of how species of hominin evolved. [1]



What can be deduced using the information in the cladogram?
A. The closest species to *K. platyops* is *A. africanus* .
B. *A. afarensis* is extinct.
C. The DNA of *H. sapiens* is the same as that of *H. ergaster* .
D. *H. sapiens* and *P. robustus* shared a common ancestor.

SPM.1A.HL.TZ0.2

The diagram shows the elements present in two organic molecules, W and X. [1]
Which molecules could W and X be?



	Molecule W	Molecule X
A.	monosaccharide	amino acid
B.	nucleic acid	triglyceride
C.	phospholipid	protein
D.	triglyceride	fatty acid

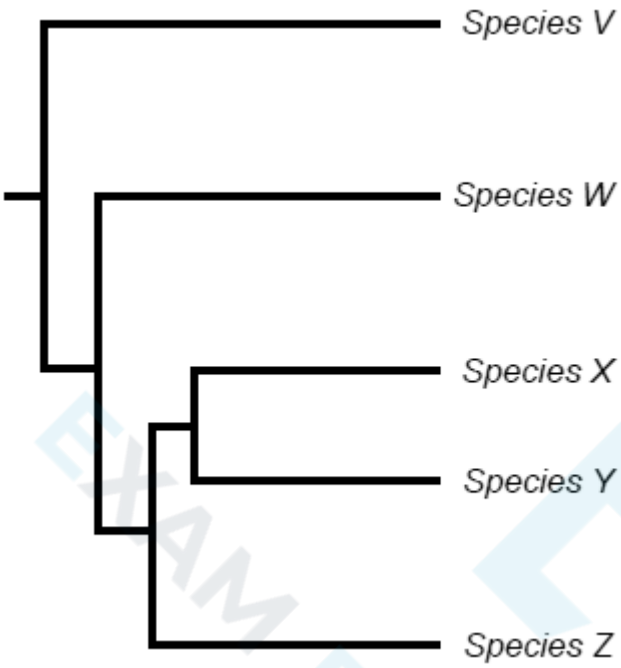
20N.1A.HL.TZ0.2

Which feature of the cell in the micrograph is consistent with the endosymbiotic theory?
A. X has a single membrane.
B. Y has a double membrane.
C. X contains 70S ribosomes.
D. Y contains 80S ribosomes.

[1]

SPM.1A.HL.TZ0.25

Scientists studied differences in the base sequences of a gene found in five animal species in order to determine their evolutionary relationships. A cladogram was constructed based on these differences.



What can be deduced from the cladogram?

A. There are only three clades shown.
B. Morphological differences between V and Z increase with time.
C. There is only one difference between the amino acid sequences of X and Y.
D. Y and Z have a more recent common ancestor than W and X.

[1]

21N.1A.HL.TZ0.4

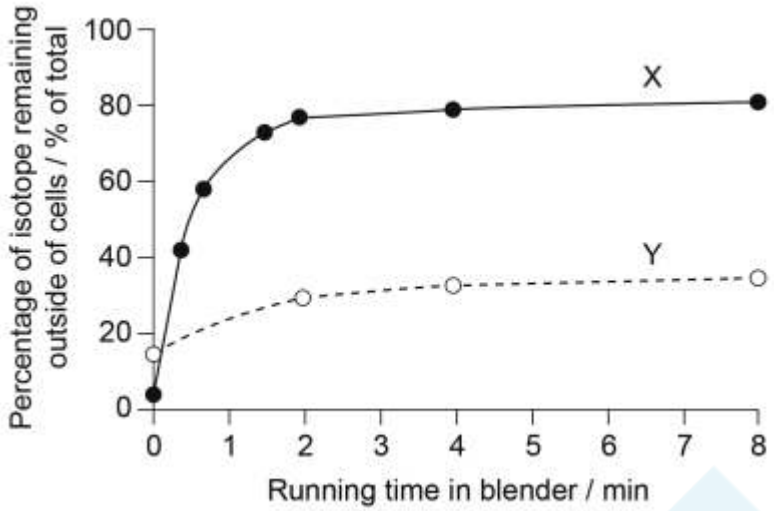
How do both mitochondria and chloroplasts provide evidence for the endosymbiotic theory?
A. They have double membranes.
B. They have 80S ribosomes similar to prokaryotes.
C. They contain the same DNA as the nucleus of the cell.
D. They exist together in eukaryote cells for their mutual benefit.

[1]

21M.1A.HL.TZ2.26

The graph shows results of an experiment by Hershey and Chase in 1952 in which bacteria were infected with a mixture of virus particles labelled with either ^{32}P or ^{35}S. A suspension of the infected bacteria was agitated with a blender, and samples collected

from the suspension were centrifuged to record the percentage of isotope remaining on the outside of the cells.



[Source: Republished with permission of ROCKEFELLER UNIVERSITY PRESS, from Independent functions of protein and nucleic acid in growth of bacteriophage. Hershey, A.D. and Chase, M., 1952. (*Journal of General Physiology* , 36(1), p.47). Society of General Physiologists, Rockefeller Institute for Medical Research, Rockefeller Institute; permission conveyed through Copyright Clearance Center, Inc.]

What do curves X and Y represent?

	Curve X	Curve Y
A.	^{32}P in sediment	^{35}S in supernatant
B.	^{35}S in supernatant	^{32}P in supernatant
C.	^{32}P in supernatant	^{35}S in sediment
D.	^{35}S in sediment	^{32}P in sediment

[1]

SPM.1A.HL.TZ0.3

Which property of DNA explains how genetic information can be replicated accurately?

A. Complementary base pairing
B. The double helical shape
C. 5′ – 3′ bonding in the sugar-phosphate backbone
D. The ability of DNA to bind to histones

[1]

23M.1A.HL.TZ2.4

What is evidence for the endosymbiotic theory? [1]

A. Eukaryote mitochondria contain DNA.
B. Prokaryotes evolved before eukaryotes.
C. Unicellular organisms exist as both prokaryotes and eukaryotes.
D. Prokaryote cells have no double membranes.

SPM.1A.HL.TZ0.1

What allows the movement of water under tension in the xylem? [1]

A. Adhesion of water molecules to dissolved mineral salts
B. Cohesion of water molecules due to hydrogen bonding
C. Adhesion between water molecules due to uneven sharing of charges
D. Cohesion between water molecules and other polar substances

SPM.1A.HL.TZ0.33

Polyploidy has been a cause of rapid speciation in some plant genera, such as *Helianthus*. Which observation is evidence that speciation has occurred?

A. A polyploid plant reproduces asexually.
B. A polyploid plant produces male and female gametes.
C. Fertile offspring are produced when a polyploid plant crosses with a diploid plant.
D. Fertilization can occur between polyploid individuals.

[1]

23M.1A.HL.TZ1.17

The table compares ribosomal RNA (rRNA) sequences of two organisms from each of the three domains by showing an association coefficient. The more similar the rRNA sequences of the organisms, the larger the coefficient.

	S. cerevisiae	***L. minor***	***E. Coli***	***B. firmus***	***M. ruminantium***	***M. barkeri***
S. cerevisiae	—	0.29	0.05	0.08	0.11	0.08
L. minor		—	0.10	0.06	0.10	0.07
E. Coli			—	0.25	0.12	0.12
B. firmus				—	0.13	0.12
M. ruminantium					—	0.24
M. barkeri						—

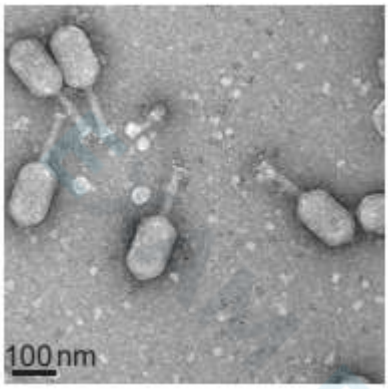
What can be concluded from the data?

A. *L. minor* and *E. coli* are both eubacteria.
B. *S. cerevisiae* and *M. barkeri* are in the same domain.
C. *M. ruminantium* is an archaean, therefore so is *B. firmus* .
D. *E. coli* and *B. firmus* are in the same domain.

[1]

21M.1A.HL.TZ2.1

The image shows an electron micrograph of virus particles known to infect the bacterium *Vibrio parahaemolyticus* , which is associated with gastroenteritis, wound infections and septicemia in humans and animals.



[Source: Lin, Y. and Lin, C., 2012. Transmission electron micrograph of phage ϕpp2 particles with several structural proteins. [micrograph] (*BMC Genomics* , 13:224).]

What does a virus have in common with a living cell?
A. 70S ribosomes
B. Genetic material
C. Reproduction by binary fission
D. Anaerobic respiration

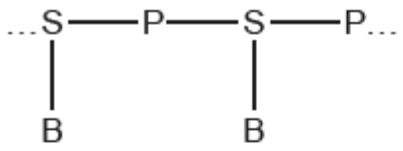
[1]

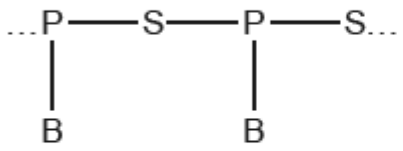
22M.1A.HL.TZ1.35

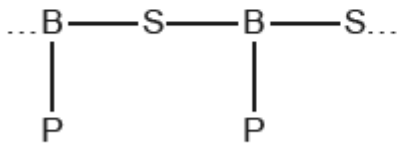
What is polyploidy? [1]
A. Having an extra set of chromosomes
B. Having an extra sex chromosome
C. Having an extra autosome
D. Having two or more nuclei

22N.1A.HL.TZ0.7

What is the arrangement of the components of nucleotides in a single DNA strand? [1]

A. 

B. 

C. 

D. 

Key:

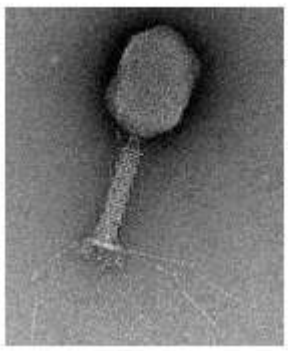
S – sugar

P – phosphate group

B – organic base

19M.1A.HL.TZ2.11

Hershey and Chase used a bacteriophage (a virus that infects bacteria) to investigate the chemical nature of genes. The diagram shows a bacteriophage.



[Source: Graham Knott and Christel Genoud, 'Commentary: is EM dead?', *Journal of Cell Science* (2013), **126** : 4545–4552, reproduced with permission. http://jcs.biologists.org/content/126/20/4545.figures-only doi: 10.1242/jcs.124123 http://www.biologists.com/journal-of-cell-science]

The sulphur in the protein and the phosphorus in the DNA of the bacteriophage were radioactively labelled. The data obtained after bacterial infection and centrifugation are shown in the table.

Sample source	Supernatant	Pellet
Radioactive sulphur	80 %	20 %
Radioactive phosphorus	30 %	70 %

What did Hershey and Chase conclude from their experiment?

A. DNA was mainly outside the bacterial cells.

B. Viruses infect bacterial cells with proteins.

C. Viral DNA was found within the bacterial cells.

D. Neither protein nor DNA were chemicals making up genes in viruses.

[1]

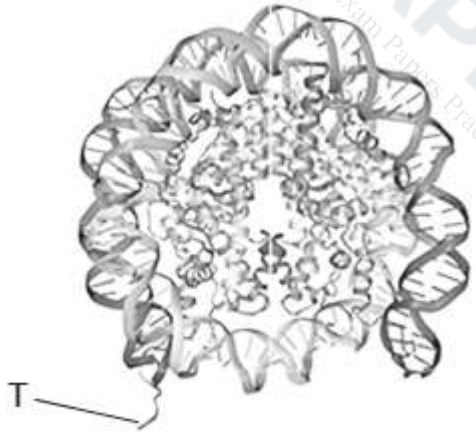
23M.1A.HL.TZ1.4

What is evidence for the endosymbiotic theory in eukaryotic cells? [1]

A. Mitochondrion with DNA
B. Golgi complex in cytoplasm
C. Single nuclear membrane
D. Ribosomes in cytoplasm

22M.1A.HL.TZ2.26

The diagram shows the structure of a nucleosome.



[Source: Zephyris. Nucleosome 1KX5 colour coded. Available at https://en.wikipedia.org/wiki/Nucleosome#/media/File:Nucleosome_1KX5_colour_coded.pn
This file is licensed under the Creative Commons Attribution-Share Alike 3.0 Unported license (https://creativecommons.org/licenses/by-sa/3.0/deed.en).]

What is the structure labelled T?
A. 5′ end of RNA
B. 5′ end of uncoiled DNA
C. N-terminal tail of one DNA strand
D. N-terminal tail of one histone

[1]

21M.1A.HL.TZ1.24

A dichotomous key can be used to distinguish four types of plant. Which of the plants could be a bryophyte?

1.	Vascular tissue present	go to 2
	Vascular tissue not present	Plant A.
2.	Produces seeds	go to 3
	Does not produce seeds	Plant B.
3.	Seeds found in cones	Plant C.
	Seeds found in fruit	Plant D.

[1]

22N.1A.HL.TZ0.36

Two kinds of wolf spider rub specialized body parts together in order to produce distinct sounds to attract females. Females of both groups will only allow a male of the same kind to mate with them. It has been found through experimentation, however, that offspring can be produced from crossings between the two groups. What can be hypothesized?

I. The groups are reproductively isolated.
II. They could be the same species.
III. This is an example of behavioural isolation.

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

[1]

19M.1A.HL.TZ1.22

The image shows an organism belonging to the Kingdom Animalia.

[Source: Titan beetle male. Locality: "RK4,5 route Cacao", French Guiana © 2011, Didier Descouens https://creativecommons.org/licenses/by-sa/4.0/]

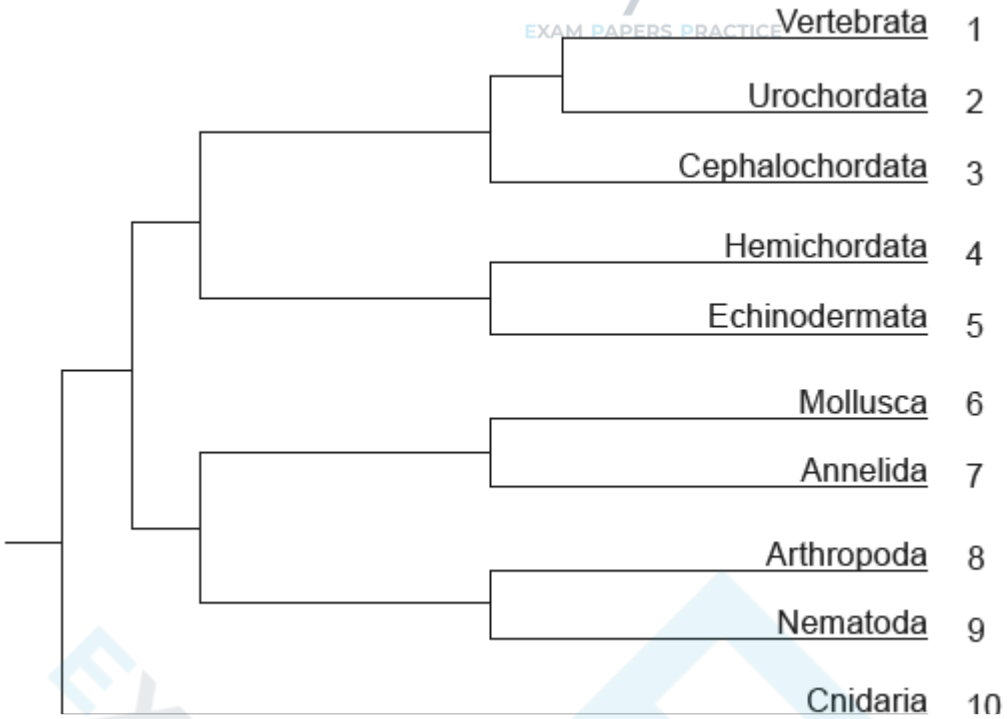
What feature does this organism have in common with all members of the phylum chordata?

A. Legs and wings
B. Mouth but no anus
C. Bilateral symmetry
D. Chitinous exoskeleton

[1]

23M.1A.HL.TZ2.25

The diagram shows a cladogram for part of the animal kingdom.



Which group does **not** represent a clade?

A. 1 to 3
B. 1 to 5
C. 4 to 7
D. 1 to 10

[1]

19M.1A.HL.TZ2.23

Which is the hierarchy of taxa in order of decreasing numbers of species? [1]
A. domain, phylum, order, family
B. phylum, order, family, class
C. domain, phylum, order, class
D. phylum, class, family, order

19N.1A.HL.TZ0.3

Which statement provides evidence for endosymbiosis?
A. Early prokaryotes contributed to a large increase in oxygen in the atmosphere.
B. Eukaryotic mitochondria and chloroplasts have their own circular DNA.
C. Certain groups of ancient prokaryotes developed mechanisms to carry out aerobic respiration.
D. Experiments by Miller and Urey produced simple organic molecules in abiotic conditions.

[1]

19M.1A.HL.TZ2.28

Which is the hierarchy of taxa in order of increasing numbers of species? [1]
A. genus, family, order, class
B. class, order, genus, family
C. genus, family, class, order
D. class, order, family, genus

21M.1A.HL.TZ2.5

Which statement is evidence for the endosymbiotic theory? [1]
A. Chloroplasts contain 70S ribosomes.
B. Protein synthesis occurs in the cytoplasm.
C. Organic molecules can be synthesised abiotically.
D. RNA is self-replicating.

23M.1A.HL.TZ1.5

What is evidence for the endosymbiotic theory in eukaryotic cells? [1]

A. Mitochondrion with DNA
B. Golgi complex in cytoplasm
C. Single nuclear membrane
D. Ribosomes in cytoplasm

21M.1A.HL.TZ2.23

What information can be deduced from the sequence of nodes in a cladogram?
A. The geological period in which the species in the clade diverged from their common ancestor
B. The probable sequence of divergence among the species in the clade
C. The number of characteristics the species have in common
D. The number of mutations that have occurred since the species shared a common ancestor

[1]