Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1

17 May 2023

Zone A afternoon | **Zone B** morning | **Zone C** afternoon

45 minutes

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.
- The maximum mark for this examination paper is **[30 marks]**.

2223 – 6016

15 pages

1. How would surface area, volume and surface area to volume ratio of a cell change as the cell becomes bigger, if the cell does not change shape?

	Surface area	**Volume**	**Surface area : volume**
A.	Increase	Increase	Increase
B.	Increase	Increase	Decrease
C.	Increase	Decrease	Decrease
D.	Decrease	Increase	Increase

2. What cell component is found in eukaryotic cells but not in prokaryotic cells?

A. Mitochondria for respiration

B. DNA containing genetic information

C. Ribosomes for protein synthesis

D. Cell wall to maintain shape

3. The drawings are from two original papers that proposed a structure of the cell membrane.

Removed for copyright reasons

For what reason is the Singer–Nicolson model considered a better representation of the cell membrane than the Davson–Danielli model?

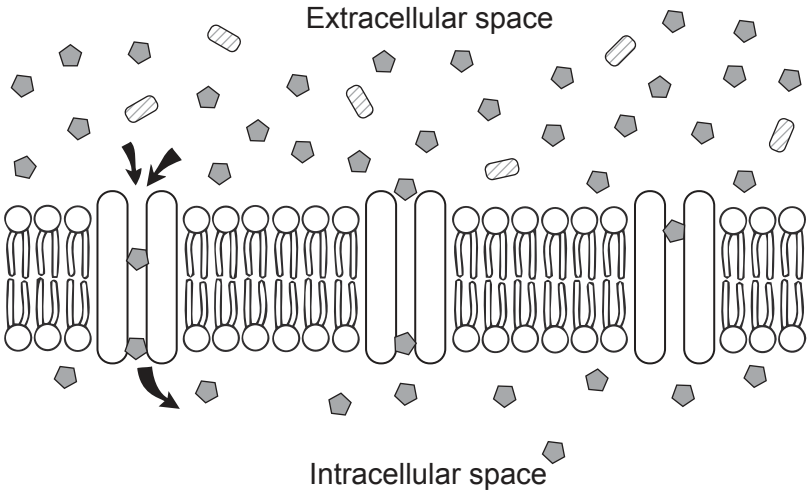
A. It has extrinsic proteins.

B. It shows how the phospholipid bilayer is arranged.

C. It helps in the understanding of the fluidity of the cell membrane.

D. It shows how oxygen can diffuse into the cell.

4. The diagram shows protein channels involved in the passive movement of a substance into the cell across the cell membrane.



What describes this movement?

A. Energy of ATP is used to transport substances into the cell.

B. Substances can move from areas of low to areas of high concentration.

C. The proteins ensure that movement of substances is only in one direction.

D. Net movement occurs until the concentrations in and out of the cell are equal.

5. The image shows a cell from the root tip of an onion (*Allium cepa*) (2n = 16) during late prophase of mitosis.

How many chromatids are present in the cell?

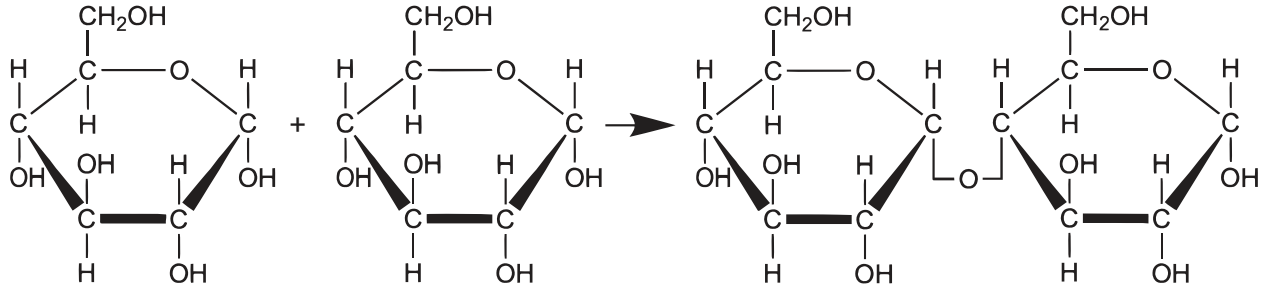
A. 8

B. 16

C. 32

D. 64

6. The diagram shows a chemical reaction taking place.



How would the reaction be described?

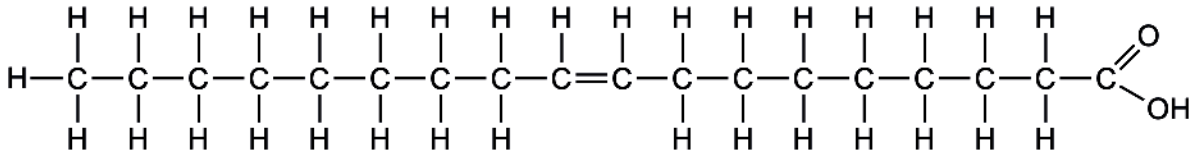
A. Catabolic hydrolysis

B. Catabolic condensation

C. Anabolic hydrolysis

D. Anabolic condensation

7. The image shows a molecule of oleic acid.



oleic acid

What describes oleic acid?

A. Cis polyunsaturated

B. Cis monounsaturated

C. Trans polyunsaturated

D. Trans monounsaturated

8. What is the proteome of an individual?

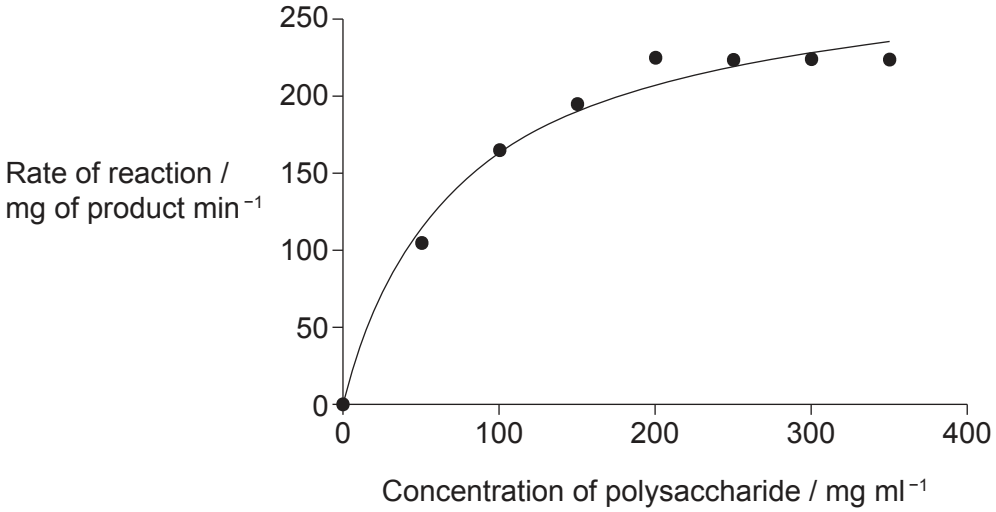
A. The amino acids unique to an individual making up the proteins in cells

B. The way in which an individual's polypeptides are folded into a three-dimensional structure

C. The proteins synthesized as an expression of an individual's genes

D. All possible combinations of amino acids an individual contains

9. In the grass plant *Halopyrum mucronatum*, the enzyme amylase breaks bonds in polysaccharides during germination. The graph shows how the activity of the enzyme varies with the concentration of polysaccharide.



What is the reason for the curve levelling off?

A. There is insufficient substrate for the enzyme to act on.

B. The product acts as an enzyme inhibitor.

C. The enzymes have all been consumed in the reaction.

D. All the enzyme active sites are occupied by substrate.

10. What is bonded to phosphates in a strand of RNA?

A. Only carbohydrates

B. Adenine, guanine, cytosine and thymine

C. Adenine, guanine, cytosine and uracil

D. Pentoses and bases

11. The anticodons of three tRNAs and the amino acids they carry are shown in the table.

tRNA anticodon	**Amino acid**
GCA	Arginine
AAU	Leucine
CAG	Valine

Which base sequence of an mRNA molecule would code for an arginine–leucine–valine tripeptide?

A. GCA AAU CAG

B. GCA AAT CAG

C. CGT TTA GTC

D. CGU UUA GUC

12. Which equation represents a process in yeast that causes bread to rise?

A. Glucose + oxygen → ethanol + carbon dioxide

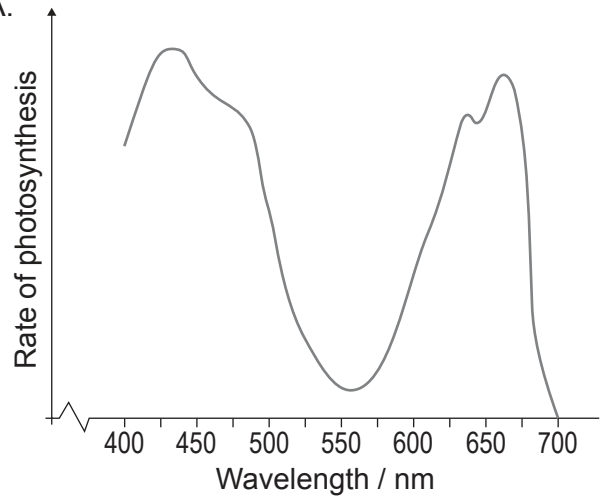
B. Glucose → carbon dioxide + water

C. Glucose + oxygen → carbon dioxide + water

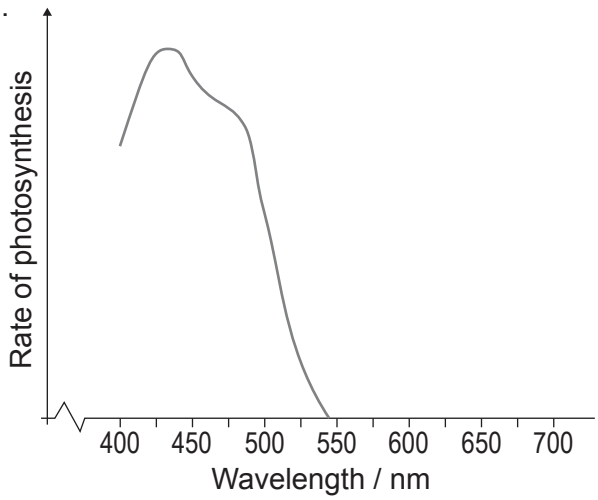
D. Glucose → ethanol + carbon dioxide

13. Which graph represents the action spectrum for a green plant receiving only blue light?

A.



B.



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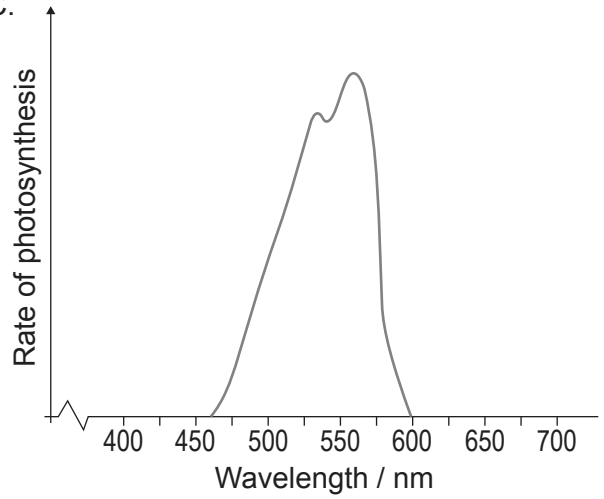
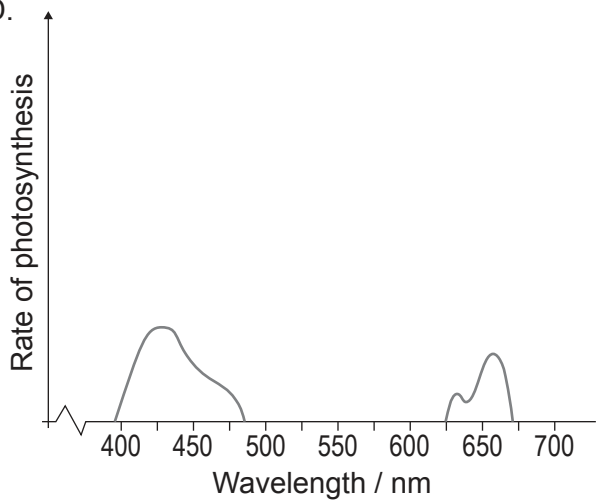


D.



14. What change causes sickle cell anemia?

A. One amino acid less in a polypeptide of hemoglobin

B. A mutation leading to an extra codon in the genome

C. Thymine replacing adenine in DNA

D. Failure of tRNA to correctly transcribe the sequence of codons from mRNA

15. The image shows a human karyogram.

From which person was the karyogram obtained?

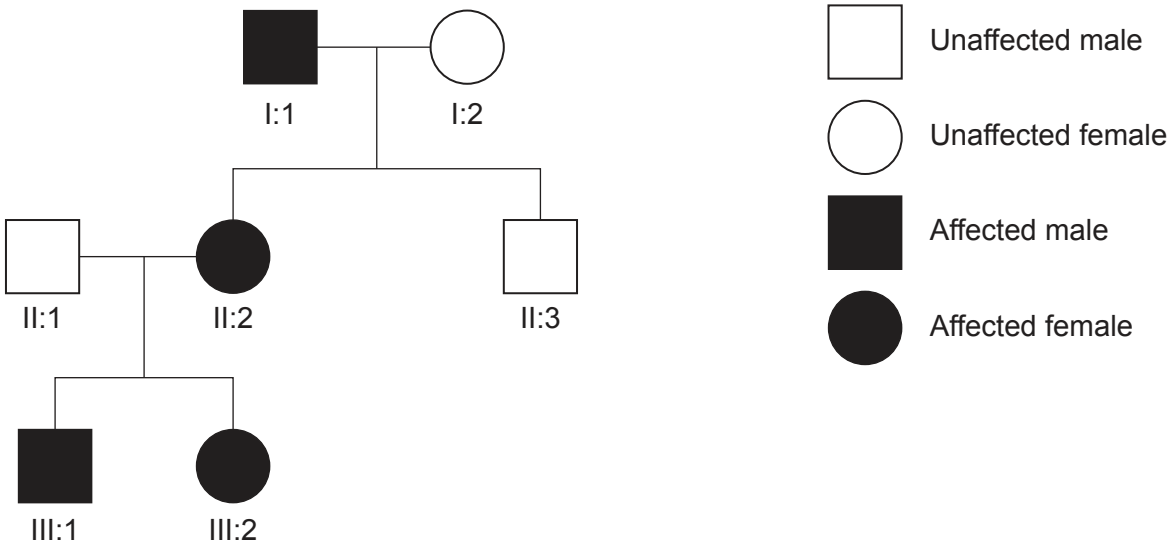
A. A female with Down syndrome

B. A female without Down syndrome

C. A male with Down syndrome

D. A male without Down syndrome

16. The pedigree chart shows the inheritance of three generations of Duane syndrome, a condition caused by a dominant allele that affects alignment of the eyes.



If individuals II:1 and II:2 had a third child, what is the probability that the child would have Duane syndrome?

A. 25 %

B. 50 %

C. 75 %

D. 100 %

17. What is combined in the production of cloned embryos by somatic-cell nuclear transfer?

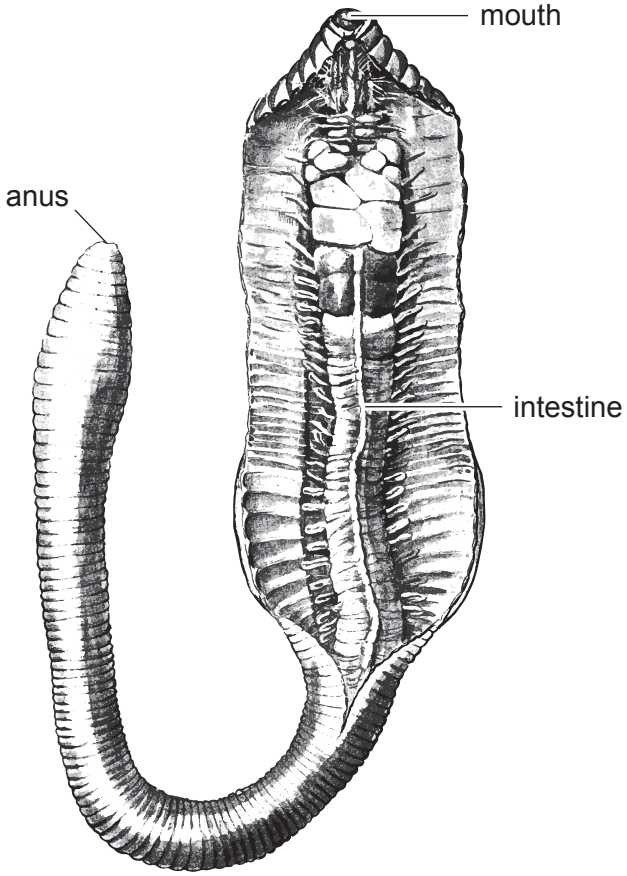
A. An egg cell without a nucleus and the nucleus of a somatic cell

B. An egg cell nucleus and a somatic cell without a nucleus

C. An egg cell with a nucleus and a somatic cell with a nucleus

D. An egg cell nucleus and a somatic cell nucleus

18. The diagram shows the digestive system of an earthworm (*Lumbricus terrestris*). It feeds by ingesting dead organic matter.



What is the mode of nutrition of the earthworm?

A. Heterotrophic detritivore

B. Autotrophic decomposer

C. Heterotrophic consumer

D. Heterotrophic saprophyte

19. Which statement applies to transfers in an ecosystem?

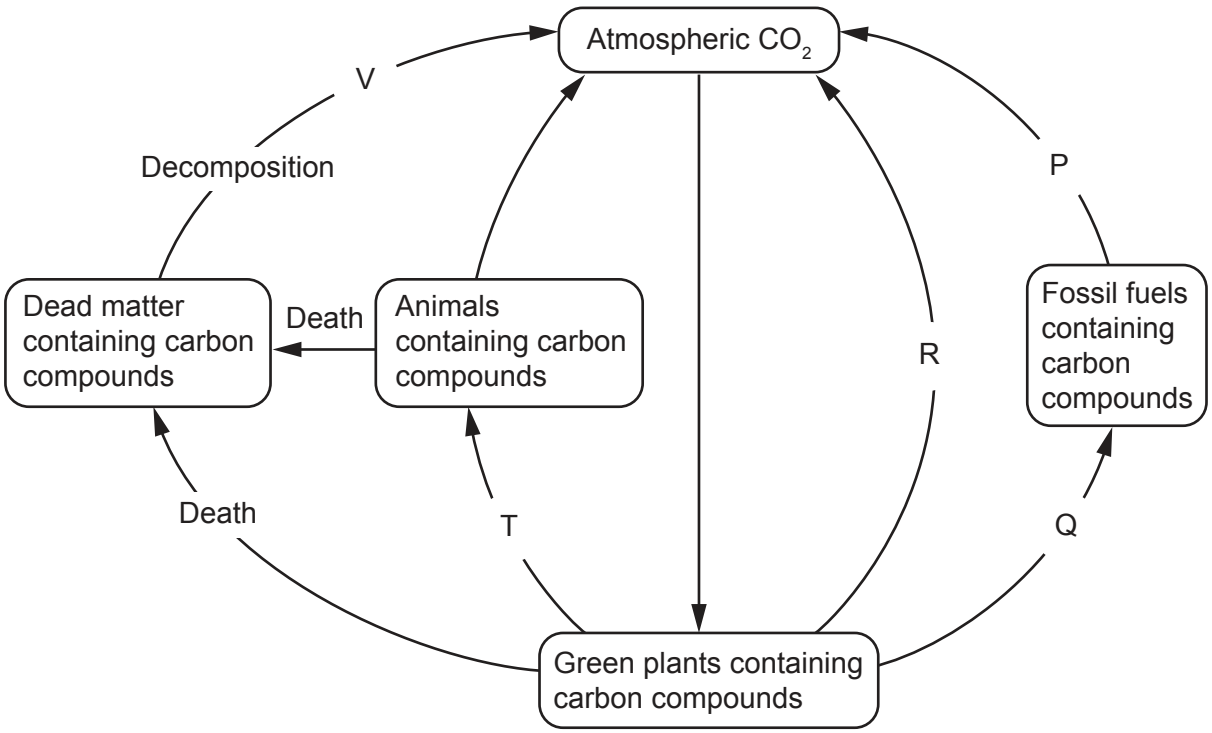
A. Green plants can transfer heat energy from the sun into chemical energy.

B. The greatest loss of energy occurs towards the end of a food chain.

C. Production of carbon dioxide by respiration results in loss of biomass in a food chain.

D. Both energy and nutrients are finite and must be recycled.

20. The diagram shows the carbon cycle.



Which letters represent respiration?

A. R and T

B. P and V

C. Q and R

D. R and V

21. A student wanted to know whether the density of buttercup (*Ranunculus*) flowers in two fields was the same. He used a quadrat to estimate the number of flowers in equal-sized areas of each field. The table shows the results.

Number of flowers	**Field 1**	**Field 2**
Observed	75	51
Expected	63	63

A chi-squared test was carried out to determine whether the density of buttercups was the same in both areas. The chi-squared calculated value was 4.571.

Probability level						
Degrees of freedom (df)	**0.5**	**0.10**	**0.05**	**0.02**	**0.01**	**0.001**
1	0.455	2.706	3.841	5.412	6.635	10.827
2	1.386	4.605	5.991	7.824	9.210	13.815

With reference to the probability table, what conclusion can be drawn about the null hypothesis with 95 % confidence?

A. It is rejected as 4.571 is less than 5.991.

B. It is rejected as 4.571 is greater than 3.841.

C. It is rejected as 4.571 is greater than 0.455.

D. It is rejected as 4.571 is greater than 1.386.

22. Which is an example of evolution by selective breeding?

A. Selection of prey animals that can run faster than their predators

B. The variation in the size of different breeds of dogs

C. The tendency, during breeding, for birds to produce more offspring than will survive

D. Some female spiders only breeding with males which make the right signals

23. Which statement best describes how evolution occurs?

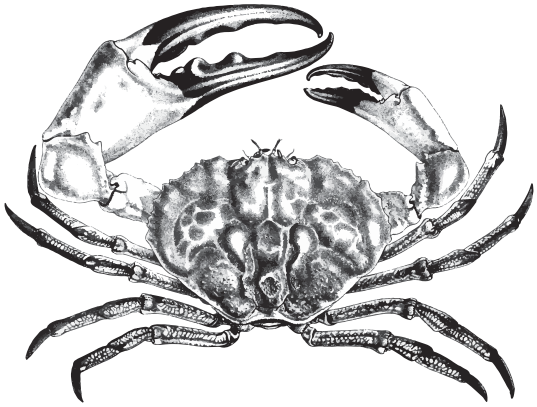
A. Species which produce the most offspring are favoured by natural selection.

B. Mutations in somatic cells are passed on to offspring.

C. Natural selection decreases the frequency of unfavourable characteristics.

D. Changes in species lead towards greater complexity over time.

24. The image shows a Tasmanian giant crab (*Pseudocarcinus gigas*) found off the coast of Australia.



What phylum does it belong to?

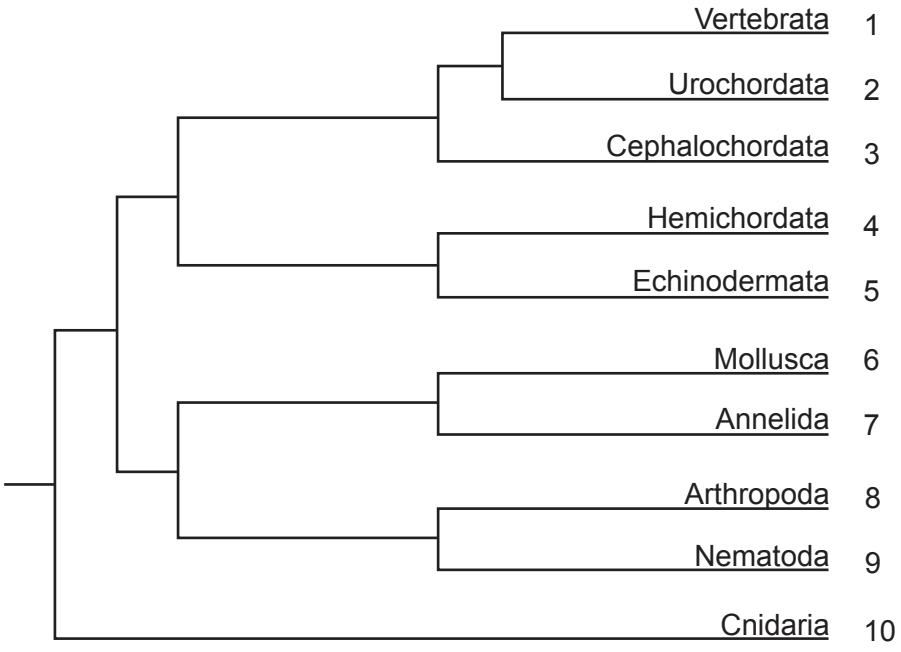
A. Annelida

B. Arthropoda

C. Cnidaria

D. Mollusca

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



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

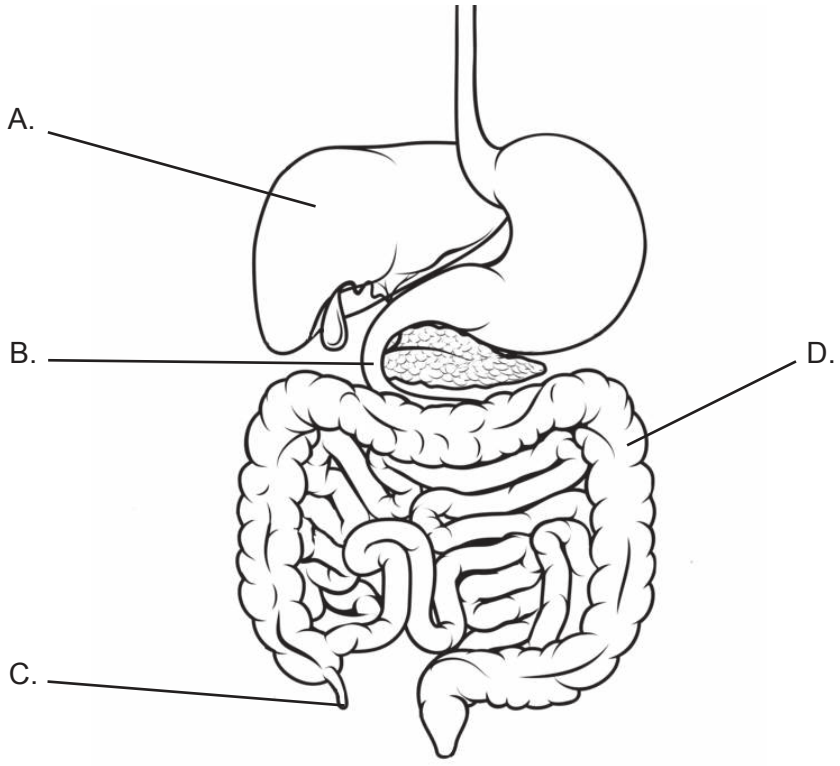
A. 1 to 3

B. 1 to 5

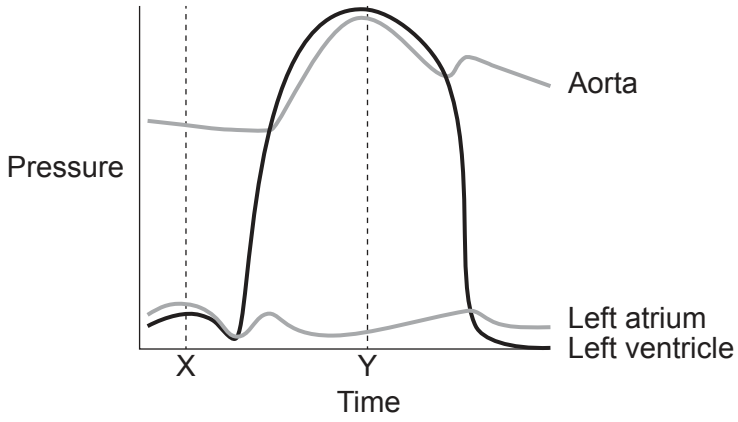
C. 4 to 7

D. 1 to 10

26. The diagram shows the human digestive system. Where does lipid digestion begin?



27. The diagram shows the pressure changes in the left atrium, left ventricle and aorta during part of the cardiac cycle.



Are the valves between the atria and the ventricles open or closed at time X and time Y?

	Time X	**Time Y**
A.	open	open
B.	open	closed
C.	closed	open
D.	closed	closed

Turn over

28. Which sequence represents the reaction leading to the formation of a blood clot?

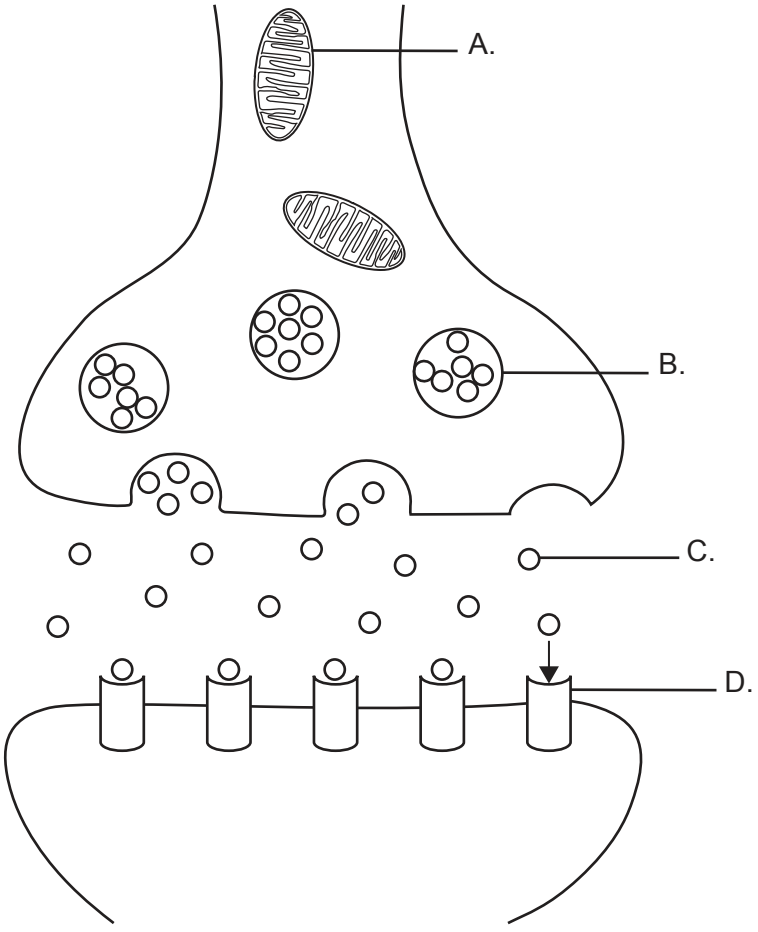
A. Prothrombin → Thrombin → Fibrin → Fibrinogen

B. Prothrombin → Thrombin → Fibrinogen → Fibrin

C.
Prothrombin
↓
Thrombin
↓
Fibrin → Fibrinogen

D.
Prothrombin
↓
Thrombin
↓
Fibrinogen → Fibrin

29. The diagram represents transmission across a cholinergic synapse. Where would a neonicotinoid pesticide act to prevent synaptic transmission?



30. For what reason are daily FSH injections given during IVF treatment?

A. To suppress the natural menstrual cycle

B. To induce the ovary to produce more eggs than normal

C. To prepare the lining of the ovary for embryo transfer

D. To prevent the development of multiple embryos

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References:

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