Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1

Wednesday 11 November 2020 (afternoon)

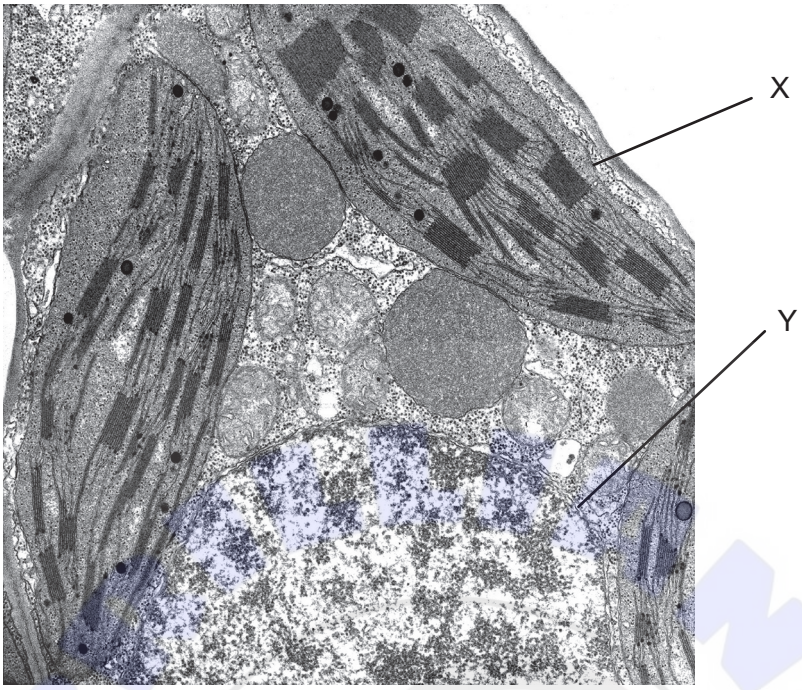
45 minutes

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]**.

8820 – 6004

The electron micrograph shows a section through a cell and refers to questions 1 and 2.



1. What is the name of the cell component labelled Y?

A. Golgi apparatus

B. Nucleus

C. Cytoplasm

D. Vacuole

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.

3. Which sequence has the cells arranged according to their ability to differentiate, starting from the least able?

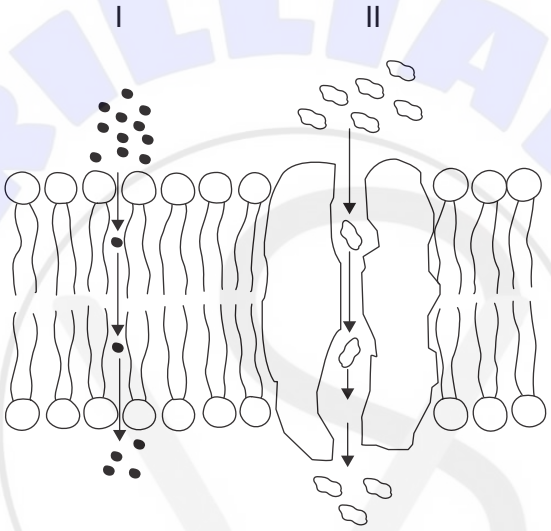
A. bone marrow, neuron, embryonic, umbilical

B. neuron, bone marrow, umbilical, embryonic

C. umbilical, embryonic, bone marrow, neuron

D. embryonic, umbilical, bone marrow, neuron

4. The diagram shows a section through a membrane. What are the modes of transport in the diagram?



	I	II
A.	simple diffusion	osmosis
B.	active transport	facilitated diffusion
C.	simple diffusion	facilitated diffusion
D.	facilitated diffusion	active transport

5. How many chromosomes are there in a cell during anaphase of mitosis, if the diploid number of the cell is 20?

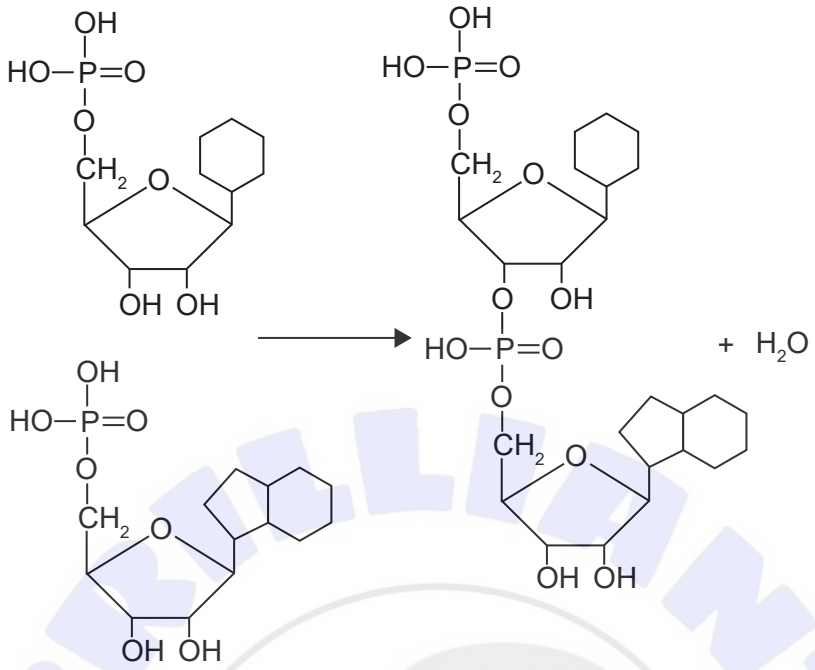
A. 10

B. 20

C. 40

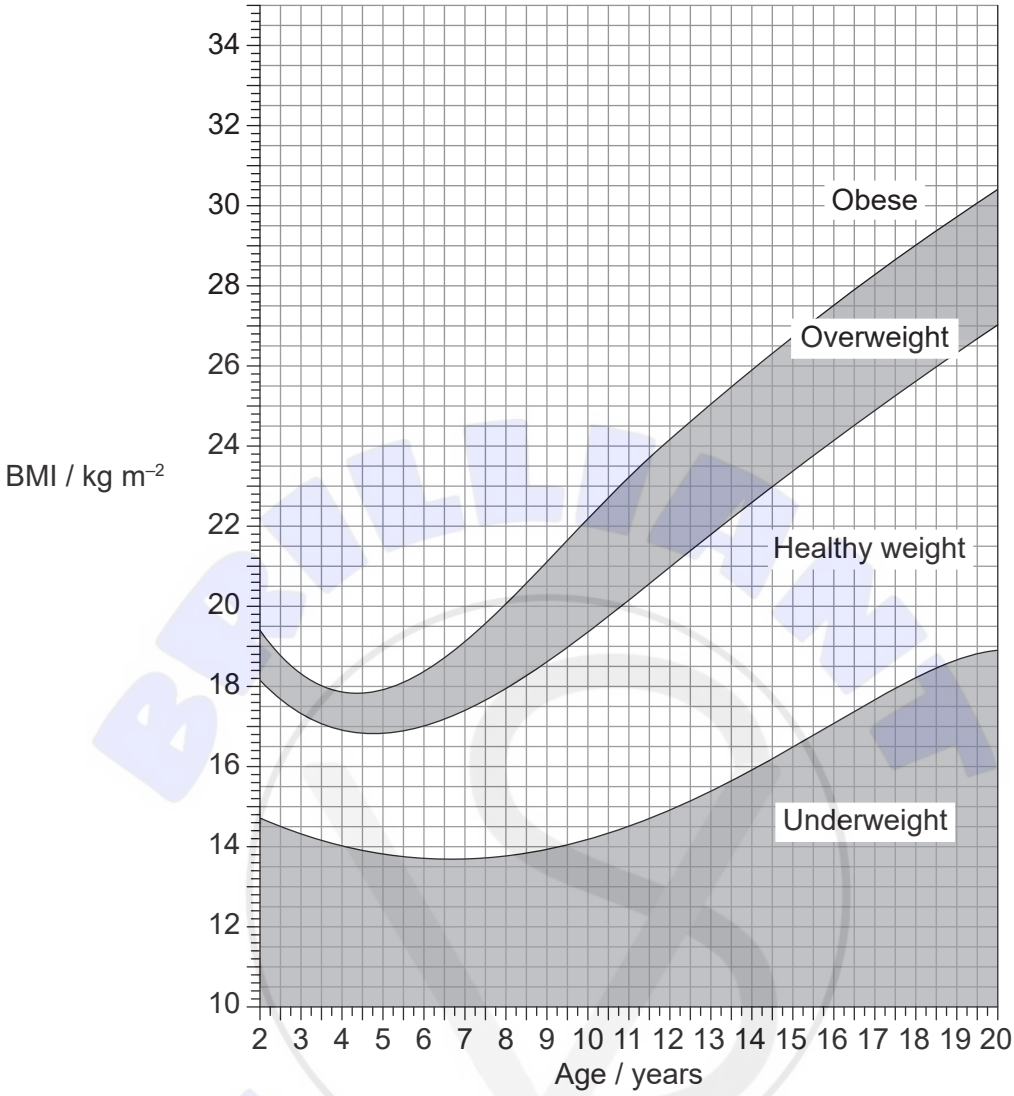
D. 80

6. What are the type of reaction and the product(s) shown in this reaction?



	Reaction	Product(s)
A.	condensation	two nucleotides
B.	condensation	one dinucleotide
C.	hydrolysis	two nucleotides
D.	hydrolysis	one dinucleotide

7. The chart shows ranges of body mass index (BMI) for children and teenagers.



A 9-year-old boy has a height of 120 cm and weighs 28.8 kg. What weight category is he in according to his BMI?

A. Underweight

B. Healthy

C. Overweight

D. Obese

8. The genetic code is shown.

1st base	2nd base: U	2nd base: C	2nd base: A	2nd base: G	3rd base
U	Phe	Ser	Tyr	Cys	U
	Phe	Ser	Tyr	Cys	C
	Leu	Ser	STOP	STOP	A
	Leu	Ser	STOP	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

In a coding gene, the DNA triplet in the transcribed strand is changed from AGG to TCG. What would be the result of this change in the genome?

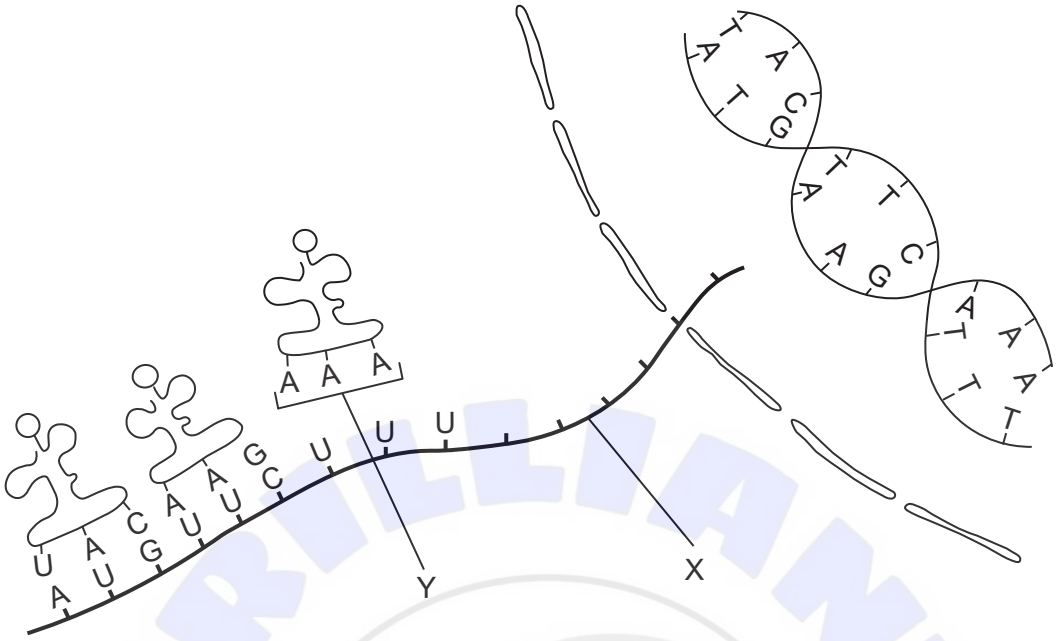
A. A non-functional protein

B. A different but functional protein

C. No change in the protein

D. Termination of the polypeptide

9. The diagram represents transcription and translation.



What structures do the letters X and Y represent?

	X	Y
A.	DNA	anticodon
B.	mRNA	anticodon
C.	DNA	codon
D.	mRNA	codon

10. What is the reason for Taq DNA polymerase being used in the polymerase chain reaction (PCR)?

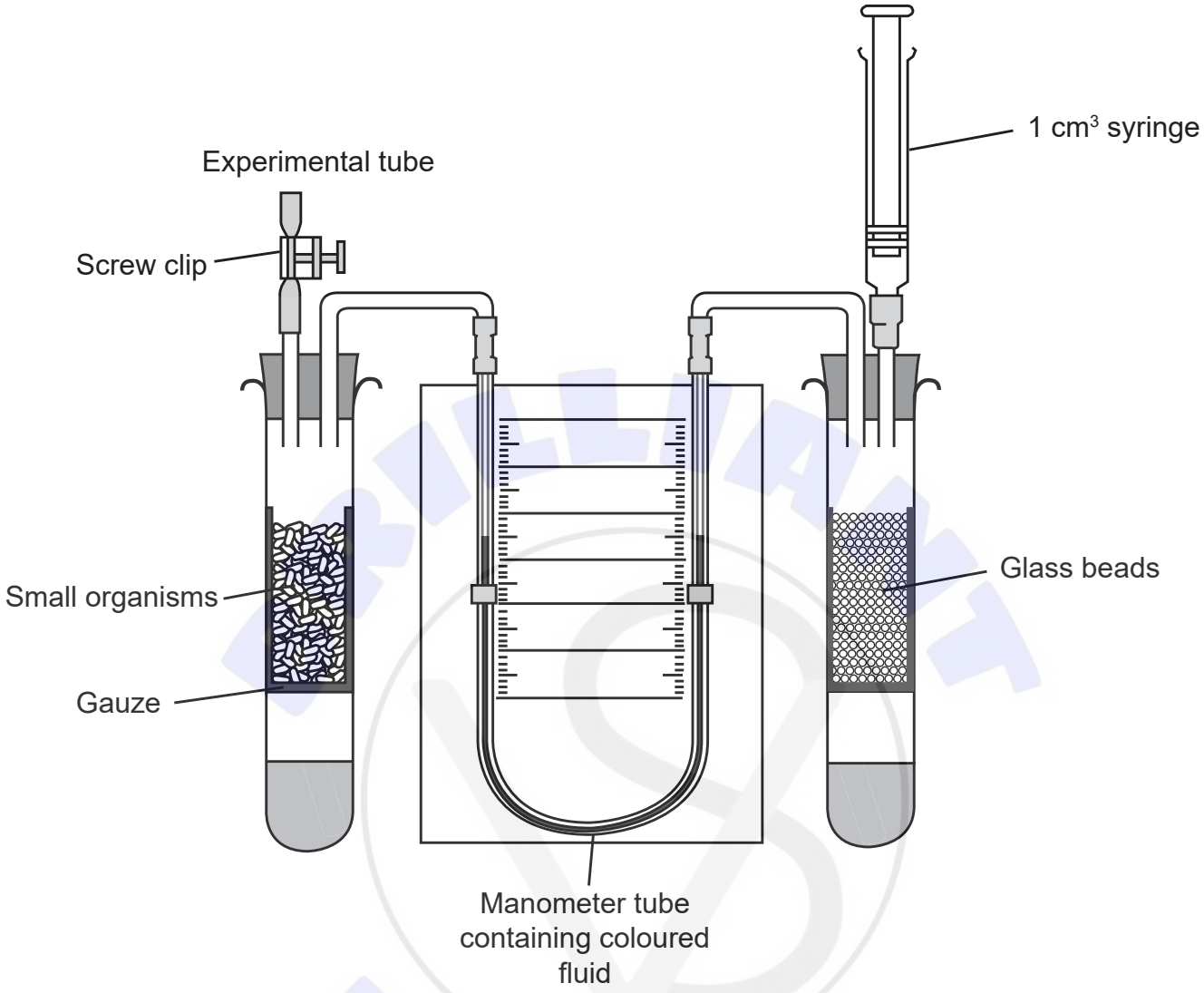
A. It does not denature at high temperatures.

B. It produces Okazaki fragments more rapidly.

C. It allows translation to proceed rapidly.

D. It works efficiently with helicase in PCR.

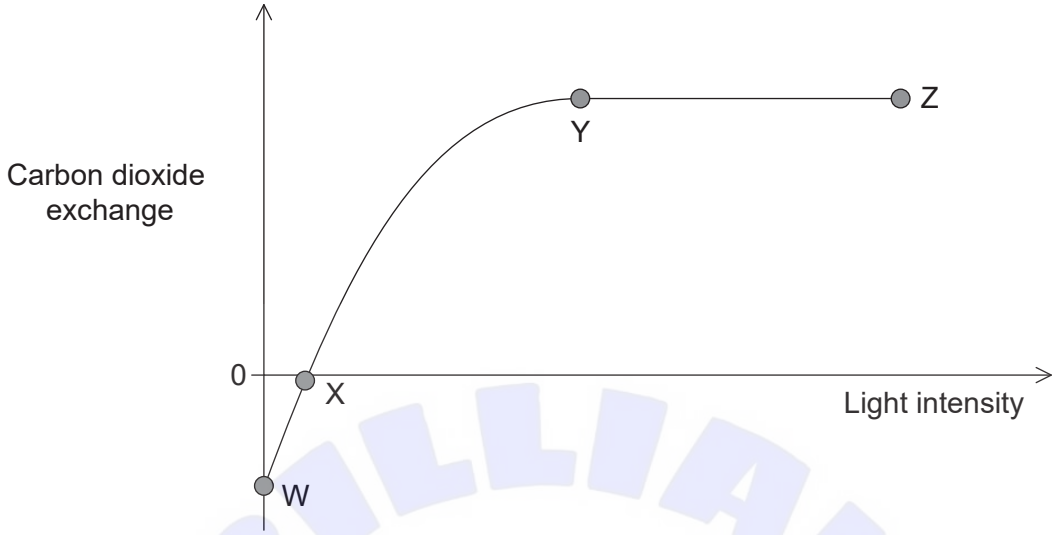
11. The diagram shows a respirometer.



What solution should be in the bottom of each tube and in which direction will the manometer fluid move?

	Solution placed in the bottom of each tube	Direction of movement of fluid in the manometer
A.	acid	up on the left side
B.	alkali	down on the right side
C.	acid	up on the right side
D.	alkali	down on the left side

12. Plants produce carbon dioxide in respiration and use carbon dioxide in photosynthesis. The graph shows the volume of carbon dioxide exchanged in a plant at different light intensities.



What is shown by the graph?

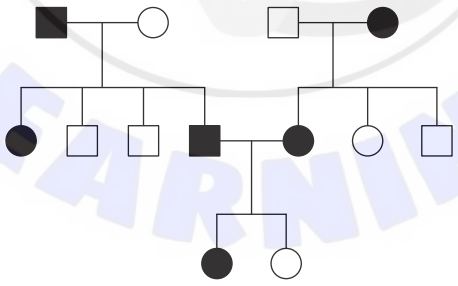
A. There is no photosynthesis between W and X.

B. There is no photosynthesis between Y and Z.

C. There is more respiration than photosynthesis between Y and Z.

D. There is more respiration than photosynthesis between W and X.

13. In the pedigree chart, individuals affected by a genetic disease are shown as shaded symbols. Squares represent males and circles females.



What is the mode of inheritance of the genetic disease?

A. Inherited as a dominant autosomal allele

B. Inherited as a recessive autosomal allele

C. Inherited as a recessive sex-linked allele

D. Inherited as a dominant sex-linked allele

14. Tall heterozygous pea plants were crossed and the resulting seeds grown. Out of 360 plants, 270 were tall and 90 dwarf. What describes the expected genotypes resulting from the cross?

A. All 270 tall plants were heterozygous.

B. All 270 tall plants were homozygous.

C. Only 90 plants were homozygous.

D. All dwarf plants were homozygous.

15. What are all the possible phenotypes of children born to a mother with blood group AB and a father with blood group A?

A. AB only

B. A and B

C. AB, A and B

D. AB, A and O

16. Which level(s) of ecological complexity involve(s) biotic factors but not abiotic factors?

I. Community
II. Ecosystem
III. Population

A. I only

B. II only

C. I and II only

D. I and III only

17. How can a chi-squared test be used in ecological research?

A. To test the effect of an abiotic factor on one plant species

B. To test whether two species tend to live together

C. To test whether one population of plants is taller than another

D. To test whether one species is more tolerant to heavy metals than another

18. Under certain conditions, living organisms on Earth produce and release methane. What favours the production of methane?

A. Forest fires

B. High light intensity

C. Anaerobic conditions

D. Dry conditions

19. The oceans absorb much of the carbon dioxide in the atmosphere. The combustion of fossil fuels has increased carbon dioxide ocean concentrations. What adverse effect does this have on marine life?

A. Heterotrophs consume more phytoplankton.

B. Phytoplankton have increased rates of photosynthesis.

C. Corals deposit less calcium carbonate to form skeletons.

D. Increased pH reduces enzyme activity in marine organisms.

20. What process best explains the formation of different pentadactyl limbs?

A. Adaptive radiation

B. Interbreeding

C. Selective breeding

D. Convergence

21. What would restrict evolution by natural selection, if a species only reproduced by cloning?

A. Too few offspring would be produced.

B. Mutations could not occur.

C. The offspring would show a lack of variation.

D. The offspring would be the same sex as the parent.

22. An animal has the following characteristics: bilateral symmetry, mouth but no anus, ribbon shape. Which phylum does the animal belong to?

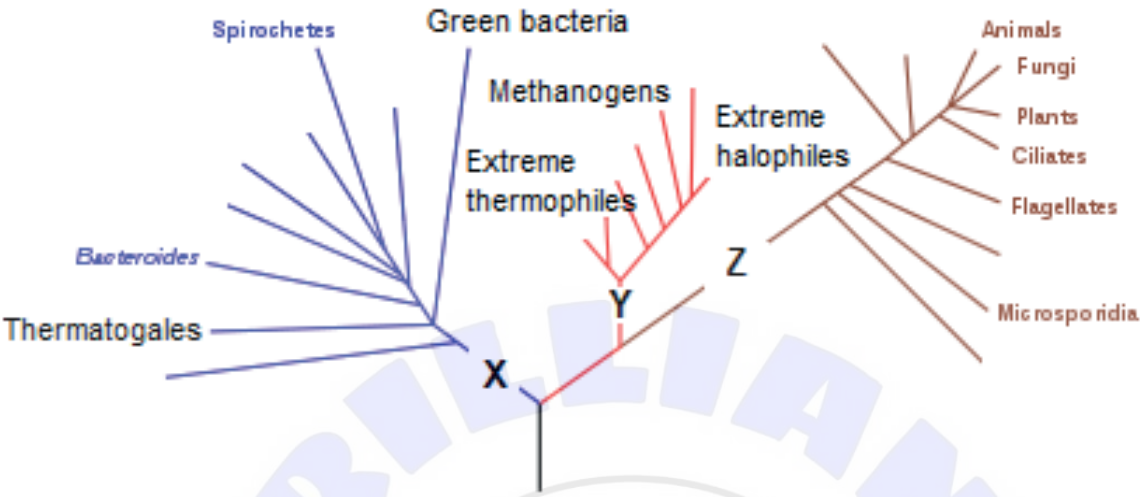
A. Mollusca

B. Cnidaria

C. Annelida

D. Platyhelmintha

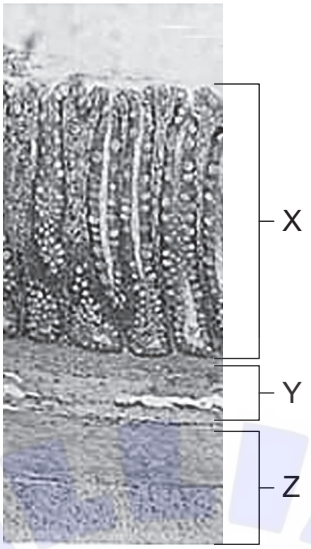
23. The cladogram shows some of the groups in the three domains.



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

24. The photomicrograph shows a section through a human small intestine.



Which statement corresponds to the labelled structures?

A. X moves food along the intestine.

B. Y is the mucosa.

C. Y contains lacteals.

D. Z causes peristalsis

25. What feature of arteries is most important in maintaining sufficiently high blood pressure?

A. A wide lumen

B. Elastic fibres in the wall

C. Valves at intervals

D. A thin wall

26. What is a feature of phagocytic white blood cells?

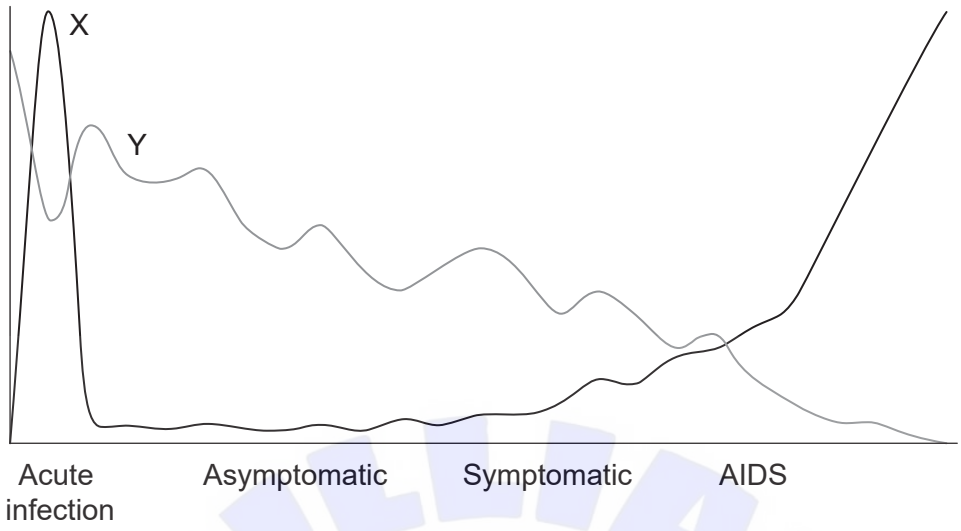
A. Stimulate blood clotting

B. Found only in the circulatory system

C. Form part of non-specific immunity

D. Produce antibodies

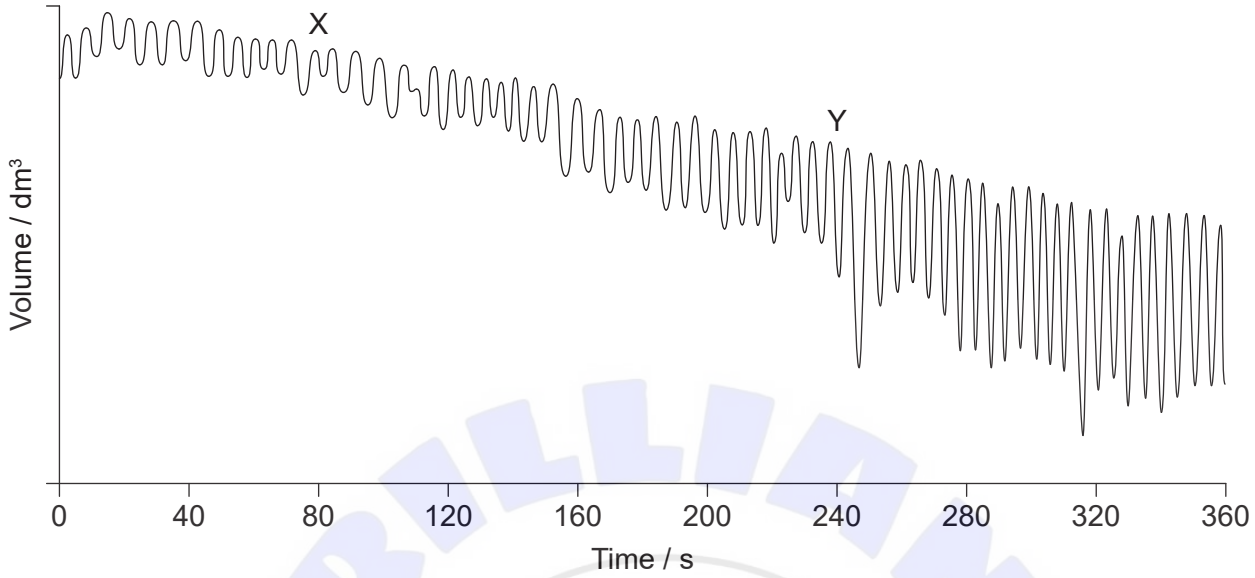
27. The graph shows the results of measuring two factors in the blood of patients with HIV/AIDS.



What do X and Y represent?

	X	Y
A.	virus	lymphocytes
B.	antibodies	virus
C.	virus	red blood cells
D.	lymphocytes	antibodies

28. The graph shows a spirometer trace of oxygen consumption when breathing at rest and during exercise.



What explains the difference between the traces at regions X and Y on the graph?

A. At X, the internal intercostal muscles contract more than the external intercostal muscles.

B. At Y, the ribcage moves up and out more than at X.

C. At X, the diaphragm flattens more per breath than at Y.

D. At Y, the intercostal muscles contract more slowly than at X.

29. How do neonicotinoid pesticides cause paralysis and death in insects?

I. Acetylcholine receptors are blocked.
II. Cholinesterase fails to break down the pesticide.
III. The pesticides bind to presynaptic receptors.

A. I only

B. I and II only

C. I and III only

D. I, II and III

30. A female is overweight, feels cold and tired, and often fails to ovulate during the menstrual cycle. Which two hormones are probably secreted at insufficient levels?

A. Estrogen and FSH

B. LH and thyroxin

C. Insulin and glucagon

D. Epinephrine and leptin

References:

1–2. [**Electron micrograph**] Photo © E. Newcomb. Nucleus, glyoxisomes, chloroplasts, and mitochondria - magnification at 13,900x - UWDC - UW-Madison Libraries (wisc.edu) (https://search.library.wisc.edu/digital/AE2SBIWRVTRR5T87).

4. [**diagram: membrane**] © International Baccalaureate Organization 2020.

7. [**chart: BMI**] Centers for Disease Control and Prevention, *About Child & Teen BMI*. Available at: https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html.

9. [**diagram: transcription and translation**] © International Baccalaureate Organization 2020.

11. [**diagram: respirometer**] Courtesy The Royal Society of Biology.

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

24. [**photomicrograph: human small intestine**] Chiodini RJ, Dowd SE, Chamberlin WM, Galandiuk S, Davis B, Glassing A (2015) Microbial Population Differentials between Mucosal and Submucosal Intestinal Tissues in Advanced Crohn's Disease of the Ileum. *PLoS ONE* 10(7): e0134382. https://doi.org/10.1371/journal.pone.0134382.

27. [**graph: factors in the blood of patients with HIV/AIDS**] Courtesy ACRIA.

28. [**graph: spirometer trace of oxygen consumption**] Courtesy of Dr. Dafang Wang for his work at University of Utah.