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Biology
Standard level
Paper 1

Wednesday 11 May 2022 (afternoon)

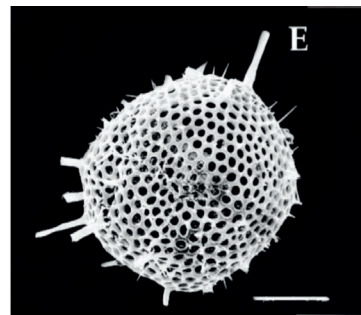
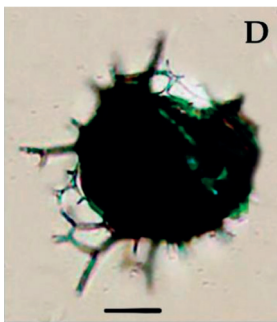
45 minutes

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]**.

1. Cell metabolism involves anabolic and catabolic reactions. Which process directly involves anabolism?
 - A. Active transport of ions
 - B. Release of energy from glucose
 - C. Production of intracellular enzymes
 - D. Breakdown of worn-out cell organelles by lysosomes

2. The images of the radiolarian, a single-celled marine organism, were produced using a light microscope (left) and a scanning electron microscope (right).

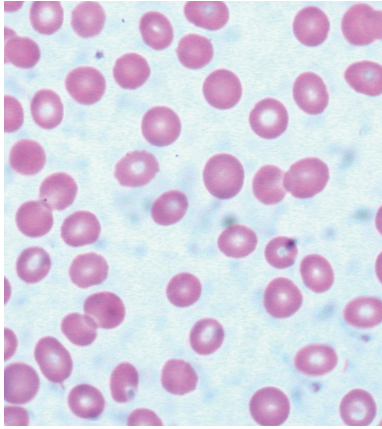


What is a reason for the difference in quality of these images?

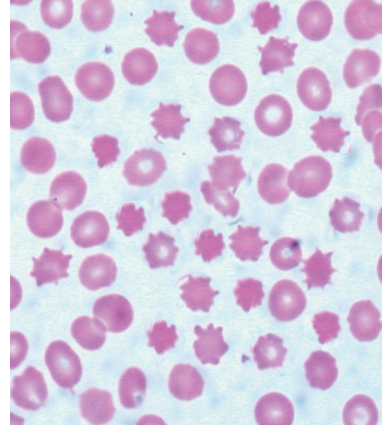
- A. Light cannot pass through the specimen.
- B. Higher magnification can be achieved with the electron microscope.
- C. The resolution of the electron microscope is higher.
- D. Samples are stained with methylene blue when viewed with the light microscope.

3. In an experiment on osmosis, red blood cells were immersed in a salt solution for two hours. The micrographs show the appearance of these cells before and after immersion in the salt solution.

before immersion



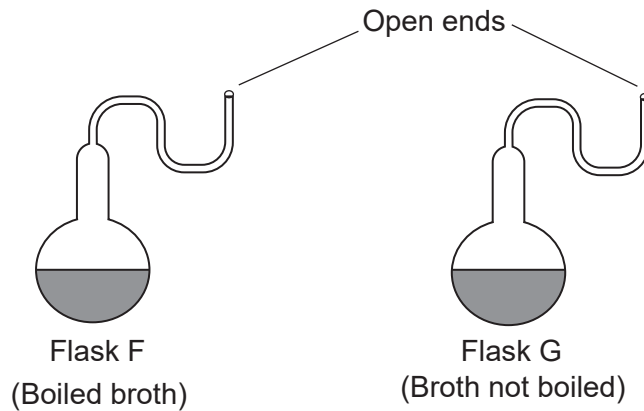
after immersion



What explains the observed changes?

- A. The salt solution was hypertonic and entered the red blood cells.
- B. The salt solution was hypotonic and disrupted the membranes of the red blood cells.
- C. The salt solution was hypertonic and water moved into it from the red blood cells.
- D. The salt solution was hypotonic and mineral salts were lost from the red blood cells.

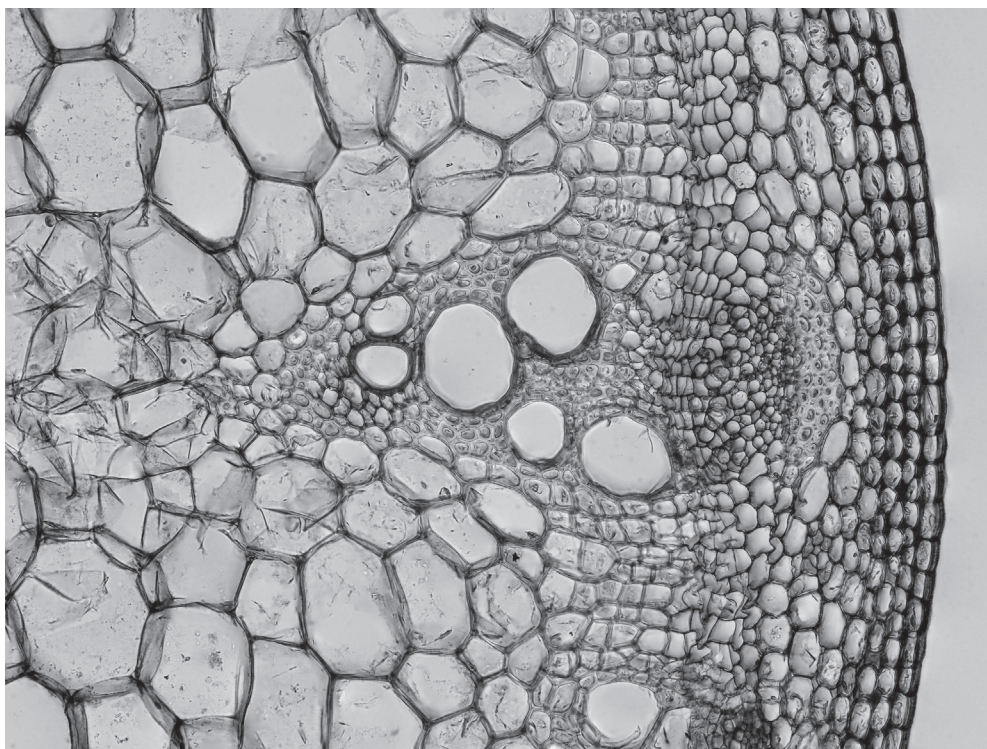
4. Pasteur used swan-necked flasks and a nutrient broth to demonstrate that spontaneous generation of organisms does not occur on Earth. Some students performed a similar experiment using two swan-necked flasks, one containing broth which had been previously boiled and another containing broth which had not been boiled.



The flasks were left in the school laboratory and observed after one week. What is the evidence against the spontaneous generation theory?

- A. Microorganisms died in flask F due to high temperatures.
 - B. No microorganisms grew in either flask.
 - C. Microorganisms grew in flask G.
 - D. No microorganisms grew in flask F but many grew in flask G.
5. Cisplatin is an anti-cancer drug that prevents tumour cells from dividing by mitosis as it inhibits cell processes at stage S of interphase. How does cisplatin prevent cancer cells from dividing?
- A. It inhibits the replication of DNA.
 - B. It inhibits the growth of the spindle fibres.
 - C. It prevents the breakdown of the nuclear membrane.
 - D. It prevents the condensation of chromosomes.

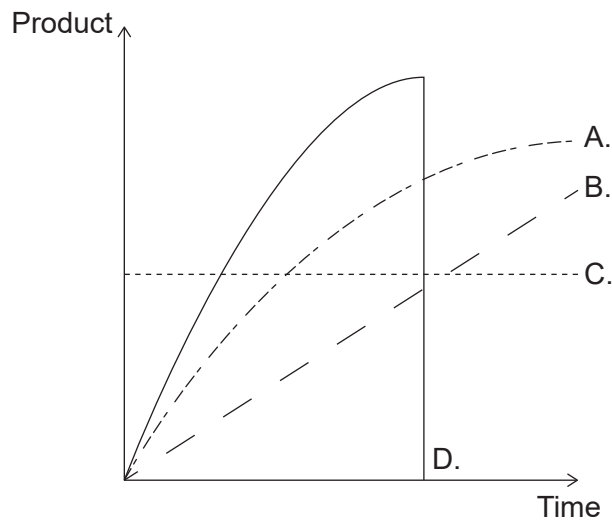
6. The micrograph of a section through a plant stem shows at least ten different types of cells.



What explains the differences between these cells?

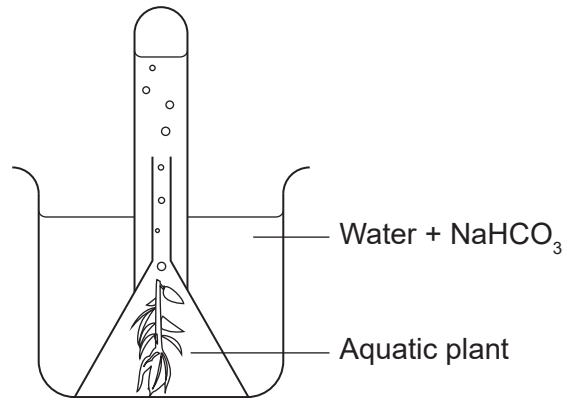
- A. Only one gene is expressed in each cell type.
 - B. Different genes are expressed in each cell type.
 - C. Only useful genes remain in the DNA of each cell type.
 - D. Changes in the DNA sequence take place when these cells develop.
7. Which feature(s) allow(s) transport of glucose in blood plasma?
- I. It is hydrophobic.
 - II. It is polar.
 - III. Its solubility is low at 37°C.
- A. I only
 - B. II only
 - C. I and II only
 - D. II and III only

8. Lipids are more efficient energy stores than carbohydrates. What is a reason for this?
- A. Lipids are bigger molecules than carbohydrates.
 - B. Lipids release more energy per gram than carbohydrates.
 - C. Lipids can be more easily mobilized than carbohydrates when needed.
 - D. Lipids can be used in aerobic and anaerobic respiration when needed.
9. People who suffer from night blindness cannot see well at night because their retinal cells produce an abnormal form of a protein pigment. Which protein is this?
- A. Fibrin
 - B. Myosin
 - C. Rhodopsin
 - D. Immunoglobulin
10. Which curve shows the concentration of product during the course of an enzyme-catalysed reaction?



11. What is a function of the enzyme helicase?
- A. It coils DNA up into a double helical shape.
 - B. It links DNA nucleotides in a new DNA strand.
 - C. It breaks hydrogen bonds between the DNA strands.
 - D. It forms temporary hydrogen bonds to produce messenger RNA.

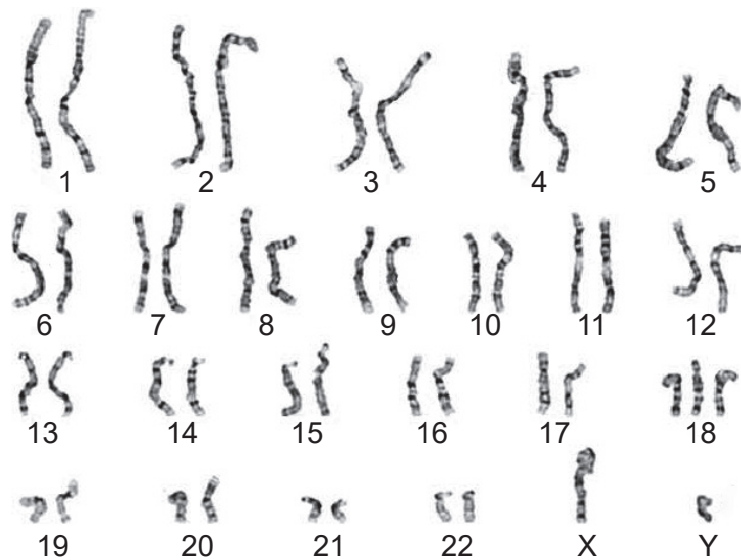
12. The apparatus shown was used to investigate the effect of varying carbon dioxide concentration on the rate of photosynthesis. Carbon dioxide concentrations were varied by adding different amounts of sodium hydrogen carbonate (NaHCO_3) to water.



What is the dependent variable in this investigation?

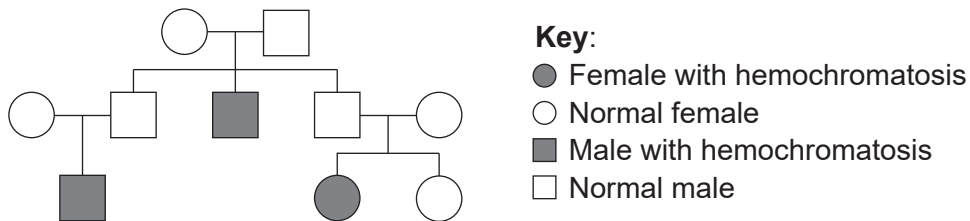
- A. Temperature
 - B. Light intensity
 - C. Amount of NaHCO_3 added
 - D. Volume of oxygen produced
13. Which statement defines alleles?
- A. They are the different forms of a gene that have the same effect on the phenotype.
 - B. They are the similar forms of a gene in different positions of a chromosome.
 - C. They are the various forms of a gene with slight differences in their base sequences.
 - D. They are the different forms of a gene coding for identical polypeptide chains.

14. The karyogram shown belongs to a human being.



What can be deduced from this karyogram?

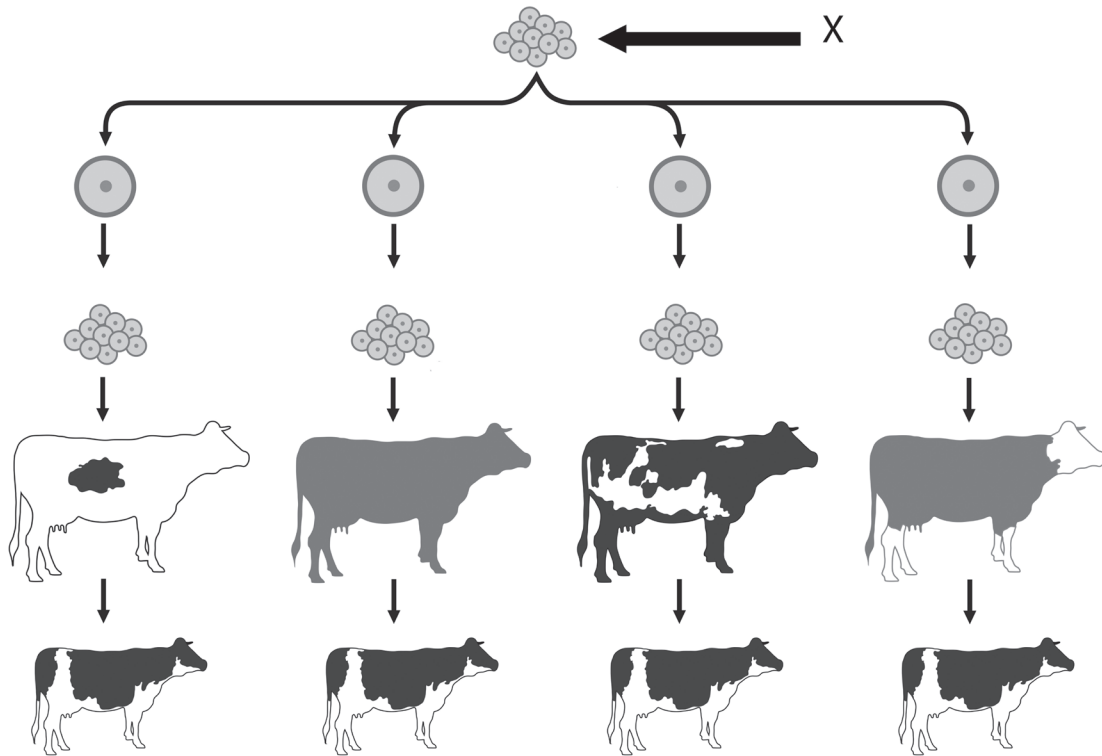
- A. The person is a male with Down syndrome.
 - B. The person is a female with Down syndrome.
 - C. The person is a male with a genetic disorder.
 - D. The person is a female with a missing chromosome.
15. The pedigree chart shows the inheritance of hemochromatosis, a genetic disease which causes an excessive accumulation of iron in the body.



What can be deduced about this genetic disease from the pedigree chart?

- A. It is sex-linked.
- B. It is autosomal dominant.
- C. It is autosomal co-dominant.
- D. It is autosomal recessive.

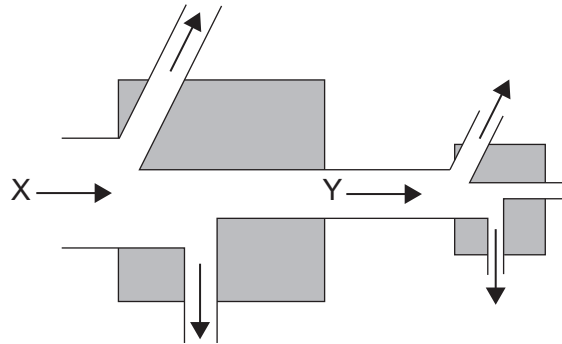
16. A cloning method used for livestock involves in vitro fertilization (IVF) with selected male and female gametes. The diagram shows the steps followed after in vitro fertilization.



What does X represent?

- A. A group of eggs
 - B. An embryo
 - C. A follicle
 - D. A group of zygotes
17. A group of students used quadrat sampling to gather data on the presence of two plant species in an area. They performed a chi-squared test to assess whether the distribution of the two species was associated. The calculated value of the chi-squared test was below the critical value. What can be deduced from the results of the chi-squared test?
- A. The alternative hypothesis is accepted.
 - B. The distribution of one species is independent from the other.
 - C. Both species are evenly distributed in the grassland ecosystem.
 - D. The distribution of both species is correlated with abiotic factors.

18. The diagram shows part of a food chain. The left box represents producers and the right box primary consumers. Arrows show energy flows.

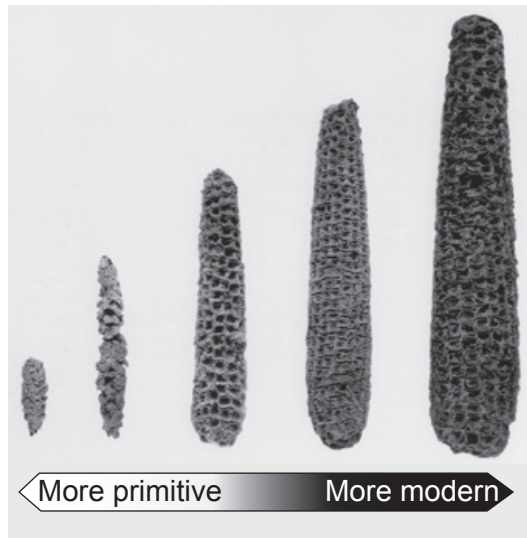


Which forms of energy are represented by X and Y?

	X	Y
A.	heat	kinetic
B.	heat	chemical
C.	light	heat
D.	light	chemical

19. Which activity directly contributes the most to recent increases in atmospheric CO₂ concentrations?
- A. Landfills
 - B. Planting trees
 - C. Cattle rearing
 - D. Burning of fossil fuels

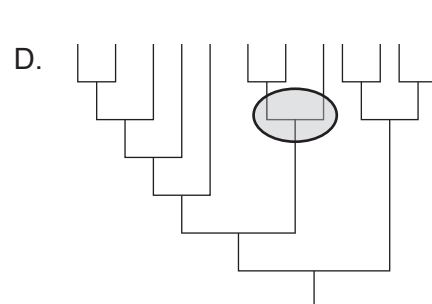
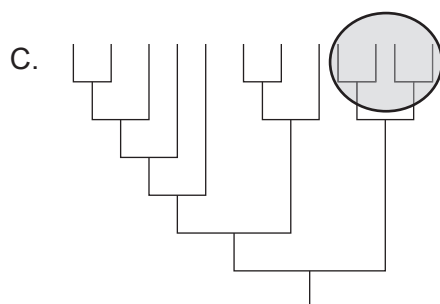
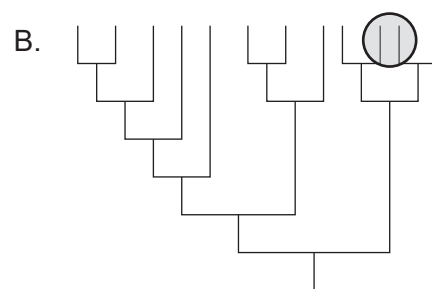
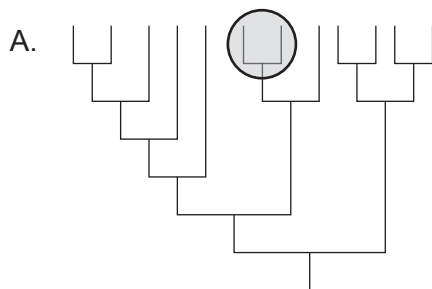
20. Humans have been improving crop species for thousands of years by cross-breeding plants with desirable characteristics. The photograph shows the changes in dry cobs of corn (*Zea mays*) over 10 000 years.



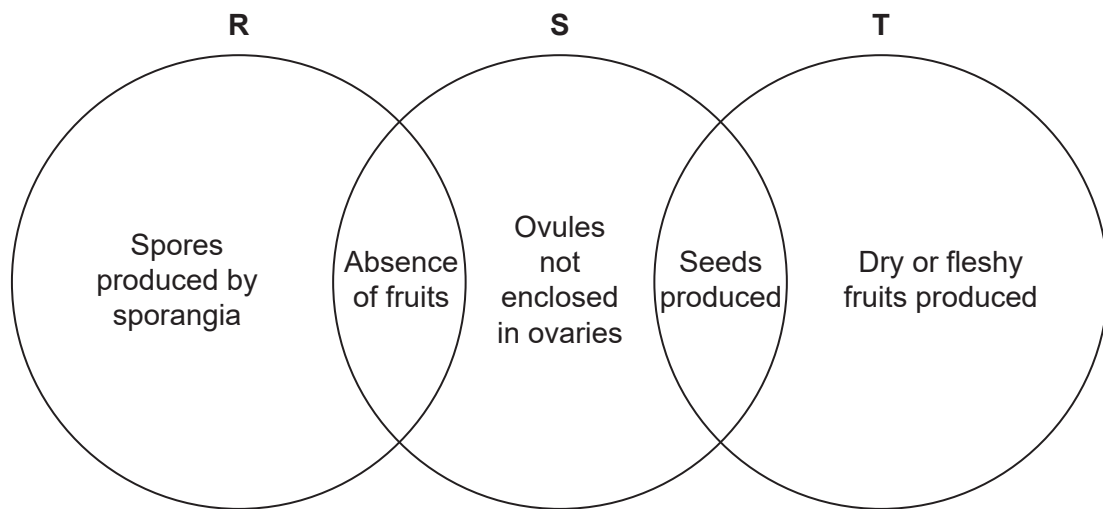
[Source: Evolution of Maize Cobs © Robert S. Peabody Institute of Archaeology, Phillips Academy, Andover, Massachusetts. All Rights Reserved.]

What is the name of the process that was used to produce modern corn?

- A. Selective breeding
 - B. Adaptive radiation
 - C. Discontinuous variation
 - D. Natural selection
21. Which encircled area shows a clade?



22. The diagram shows features of three plant phyla.



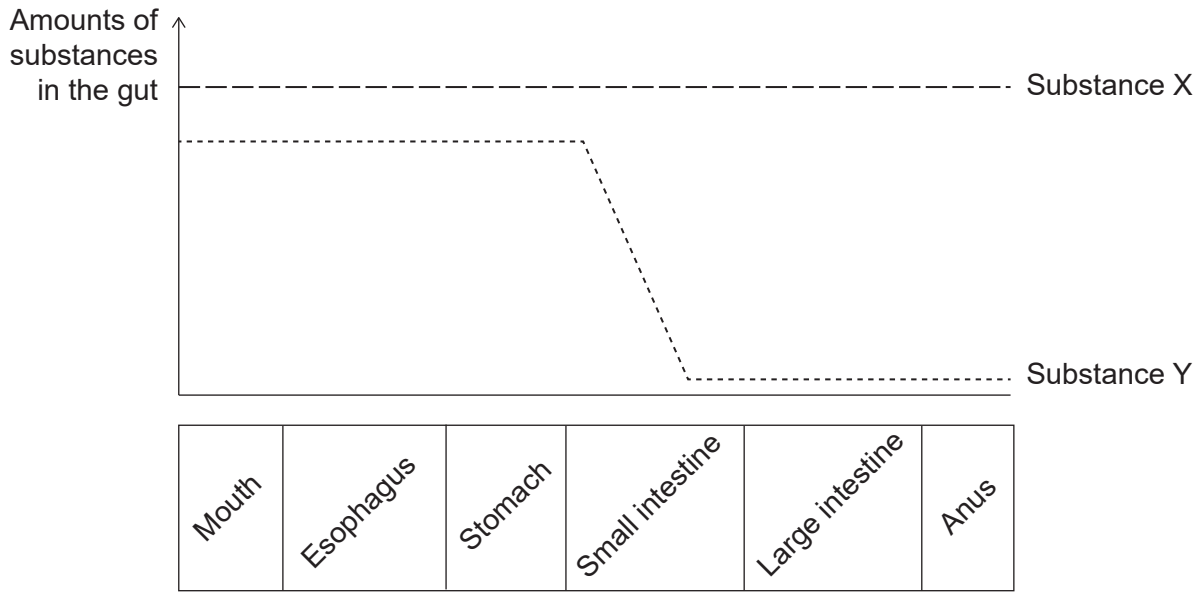
Which phyla are represented by R, S and T?

	R	S	T
A.	filicinophyta	bryophyta	coniferophyta
B.	bryophyta	angiospermophyta	coniferophyta
C.	bryophyta	filicinophyta	angiospermophyta
D.	filicinophyta	coniferophyta	angiospermophyta

23. Which factor(s) would favour evolution by natural selection?

- I. Long lifespans
 - II. Favourable characteristics acquired by individuals during their lifetime
 - III. Variation within a species
- A. II only
 - B. III only
 - C. I and II
 - D. I and III

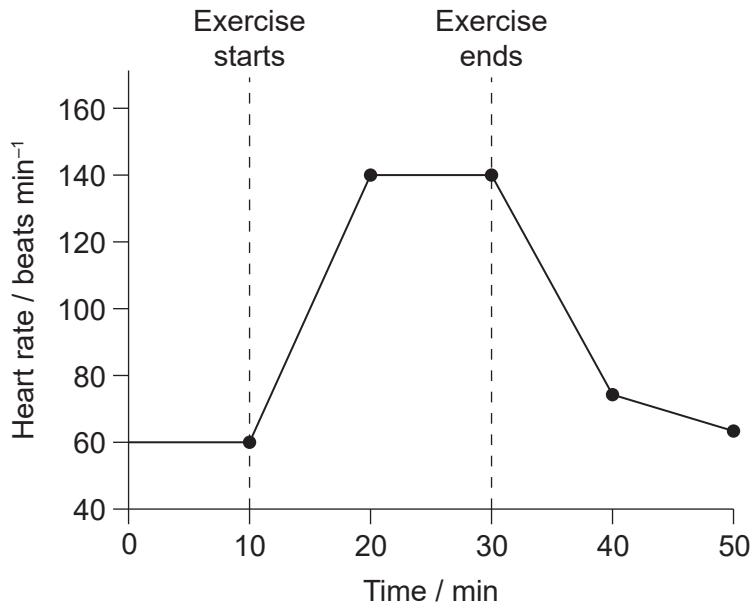
24. The graph shows the amounts of two substances present in food ingested by a healthy person as it moves along the gut.



Which substances could X and Y be?

	Substance X	Substance Y
A.	amylose	glucose
B.	glucose	cellulose
C.	water	amylose
D.	cellulose	vitamin C

25. Changes in heart rate occur during and after a period of exercise.



Which structure sends messages to the sinoatrial node of the heart to cause changes in heart rate?

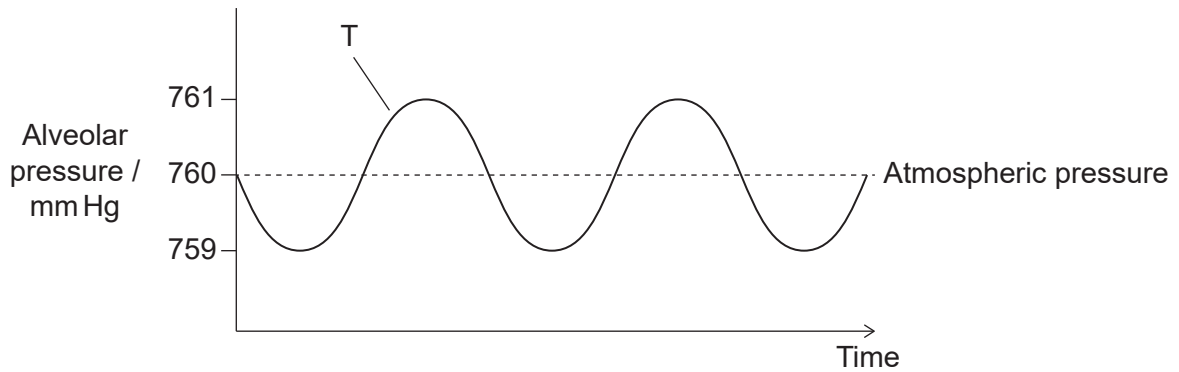
- A. Adipose tissue
 - B. Medulla of the brain
 - C. Pineal gland
 - D. Thyroid gland
26. The light micrograph shows two blood vessels, an artery and a vein, in transverse section.



What explains the different shapes of these blood vessels?

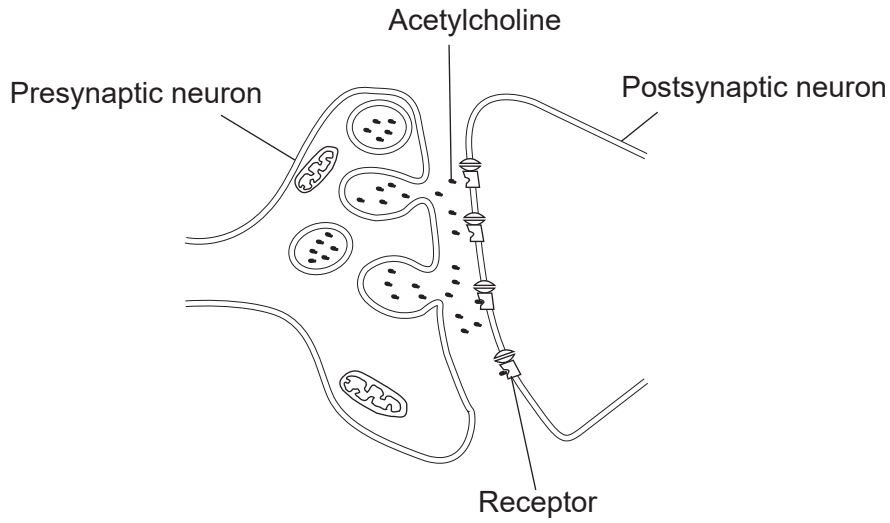
- A. Arteries do not have valves.
- B. Muscle cells are found only in the walls of veins.
- C. Arteries have a larger lumen-to-wall thickness ratio.
- D. There are fewer elastic fibres in the walls of veins.

27. Pressure changes inside the thorax cause the movement of air in and out of the lung alveoli during ventilation. Alveolar pressure correlates to thoracic pressure. The diagram shows pressure changes in lung alveoli during ventilation in relation to normal atmospheric pressure. What causes forced movement of air out of the lungs at T?



A.	external intercostal muscles contract	diaphragm relaxes
B.	internal intercostal muscles contract	abdominal muscles contract
C.	internal intercostal muscles contract	diaphragm contracts
D.	external intercostal muscles relax	abdominal muscles relax

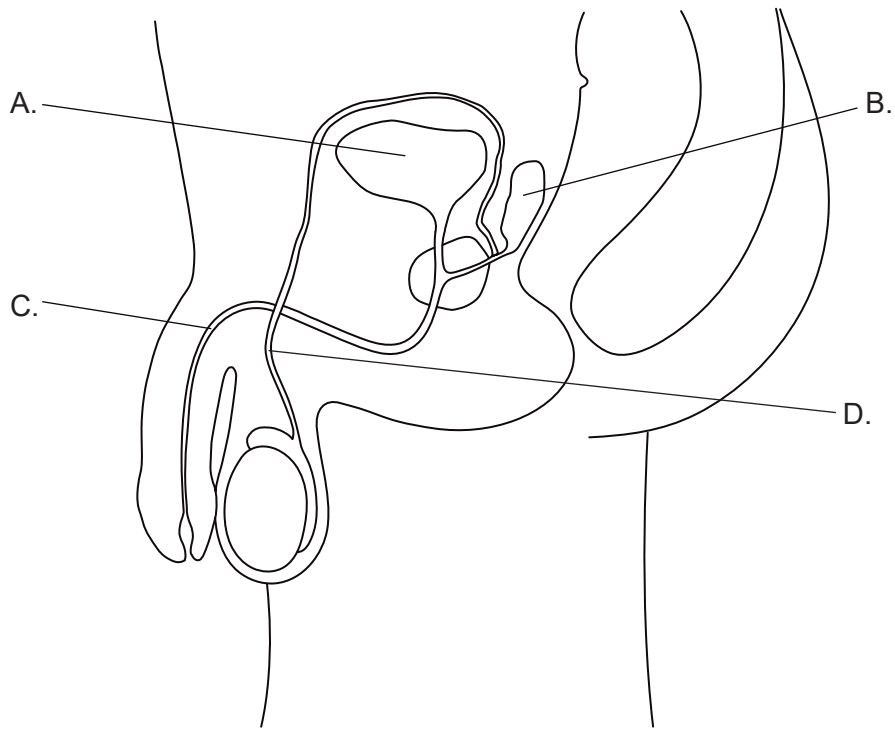
28. The diagram shows the synaptic transmission of nerve impulses by the neurotransmitter acetylcholine.



What is the fate of acetylcholine immediately after binding to the receptor?

- A. It is pumped into the postsynaptic neuron.
 - B. It diffuses into the presynaptic neuron.
 - C. It is broken down in the synaptic cleft.
 - D. It binds to another receptor in the postsynaptic neuron.
29. What is an example of negative feedback in the menstrual cycle?
- A. High levels of estrogen inhibit FSH secretion.
 - B. High levels of LH stop progesterone secretion.
 - C. High levels of FSH delay ovulation.
 - D. High levels of progesterone make follicles less receptive to FSH.

30. Which labelled structure of the male reproductive system contributes to formation of semen?



References:

2. Munir,S.;Sun,J.;Morton, S.L. The First Record and Classification of Planktonic Radiolarian (*Phylum Retaria*) and Phaeodarian (*Phylum Cercozoa*) in the Eastern Indian Ocean. *Biology* 2021, 10, 202. <https://doi.org/10.3390/biology10030202> Copyright: © 2021 by the authors. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).
3. Ed Uthman, Acanthocytes, from peripheral blood [image online] Available at: [https://en.wikipedia.org/wiki/Acanthocyte#/media/File:Acanthocytes_Peripheral_Blood_\(3884092551\).jpg](https://en.wikipedia.org/wiki/Acanthocyte#/media/File:Acanthocytes_Peripheral_Blood_(3884092551).jpg) This file is licensed under the Creative Commons Attribution 2.0 Generic (CC BY 2.0) <https://creativecommons.org/licenses/by/2.0/> Source adapted.
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