Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Standard level
Paper 1

22 October 2024

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

45 minutes

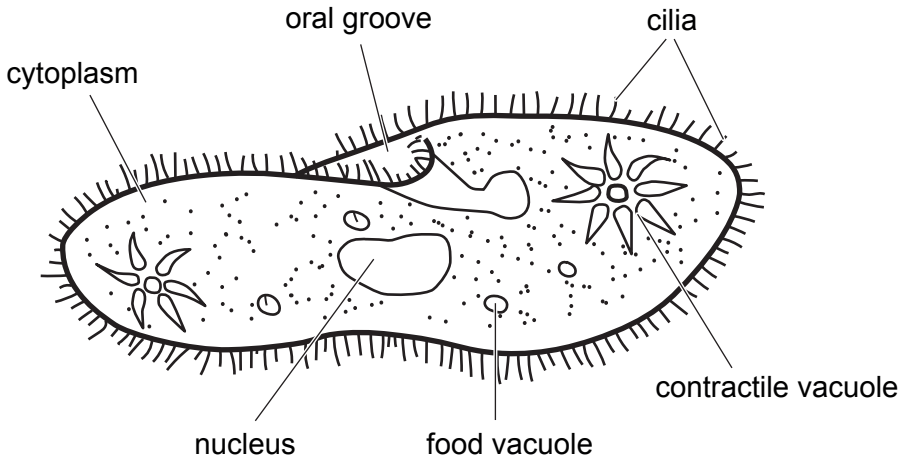
Instructions to candidates

- 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]**.

8824 – 6004

21 pages

1. Single-celled organisms of the genus *Paramecium* carry out all functions of life.



Which functions of life are performed by the contractile vacuole?

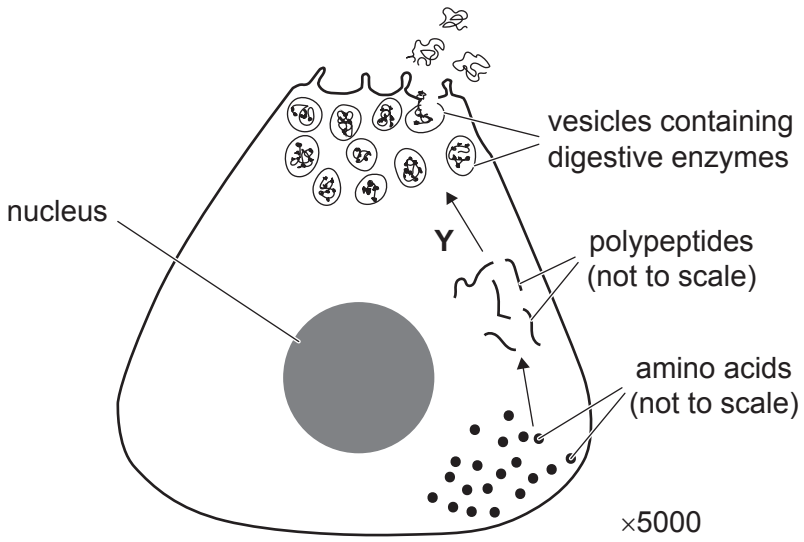
A. Nutrition

B. Reproduction

C. Homeostasis

D. Metabolism

2. The diagram summarizes the production and secretion of digestive enzymes in an exocrine gland cell of the pancreas.



Which cell organelle is involved at **Y**?

A. Rough endoplasmic reticulum

B. Golgi apparatus

C. Lysosome

D. Ribosome

3. What is a piece of evidence that all living organisms share a common ancestor?

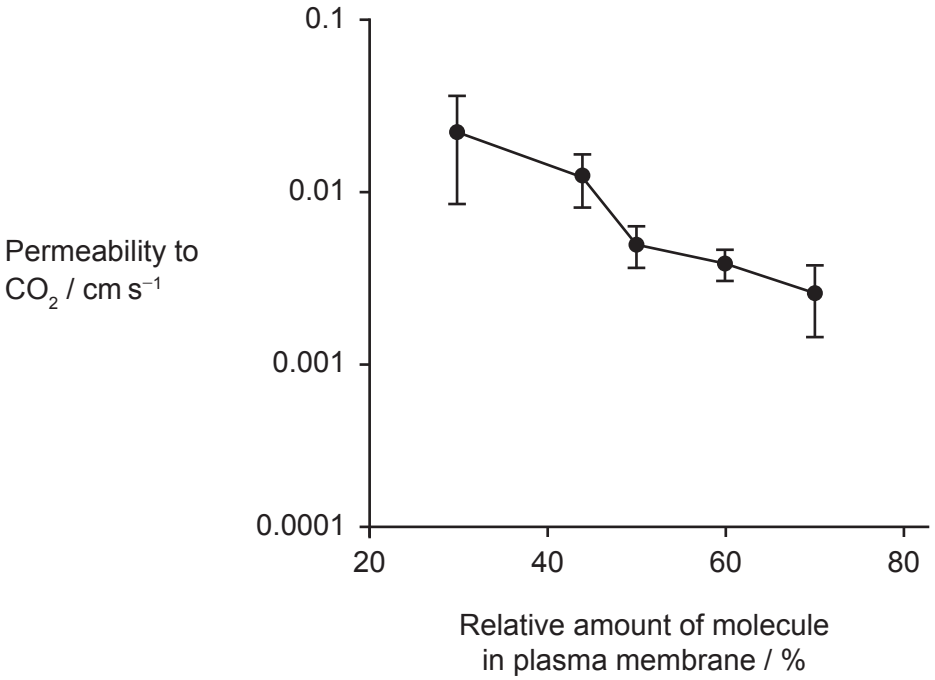
A. They manufacture the same proteins.

B. They obtain energy from glucose.

C. DNA triplets code for the same amino acids.

D. Cells can synthesise all the amino acids.

4. The permeability of plasma membranes to carbon dioxide (CO_2) was investigated in mammalian cells. Plasma membranes had different relative amounts of one component molecule.



Which membrane component could this molecule be?

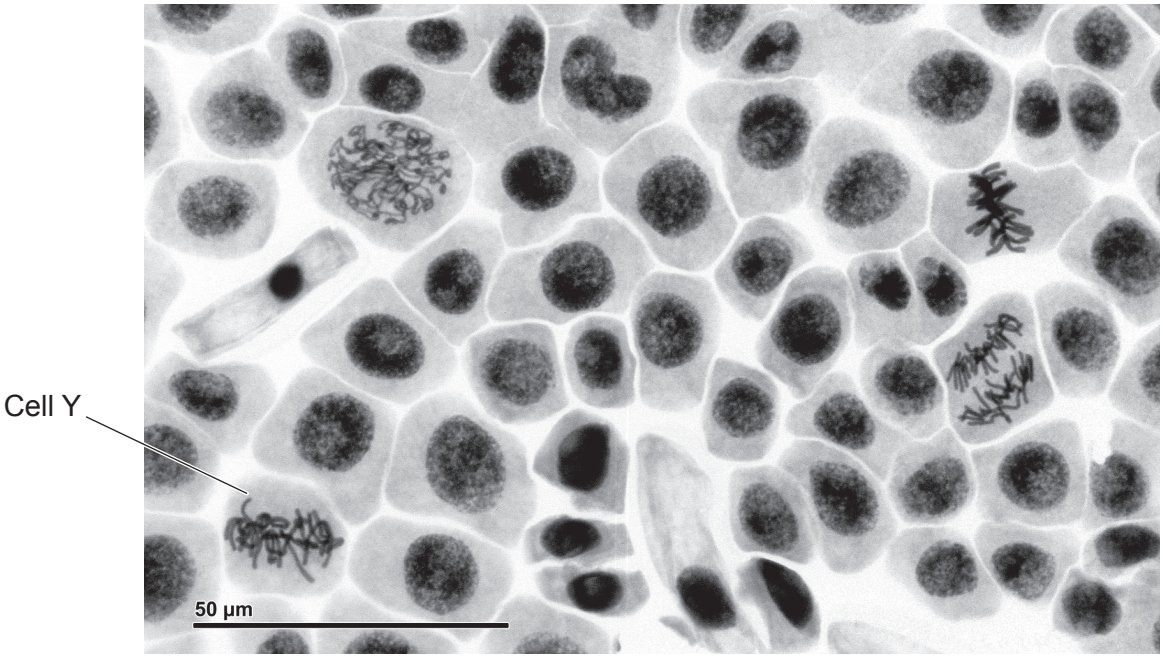
A. Cholesterol

B. Glycoproteins

C. Unsaturated fatty acids

D. Phospholipids

5. The micrograph shows cells dividing by mitosis in the root tip of an onion (*Allium cepa*).



Which change would take place in cell Y if mitosis was allowed to continue?

A. Splitting of centromeres

B. Formation of spindle fibres

C. Supercoiling of chromosomes

D. Separation of homologous pairs

6. Which protein deficiency would be most likely to cause poor vision in humans?

A. Rhodopsin

B. Thrombin

C. Collagen

D. Immunoglobulin

7. The antibiotic rifampicin is widely used to treat bacterial infections. It kills bacterial cells by interfering with transcription during protein synthesis. Which process would be directly prevented by rifampicin?

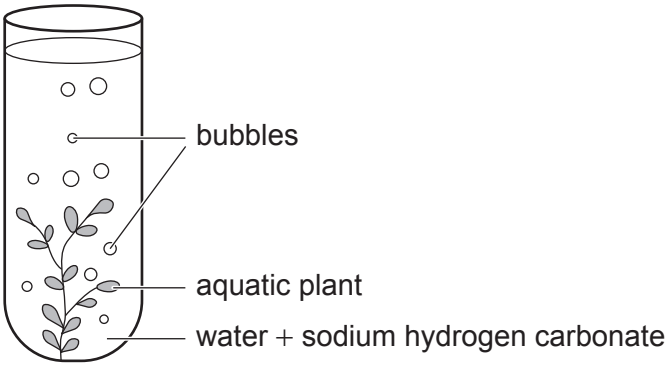
A. Base pairing between mRNA codons and tRNA anticodons

B. Bonding between amino acids

C. Movement of tRNA to the ribosome

D. Synthesis of mRNA from DNA

8. A photosynthesis experiment was carried out using an aquatic plant. The image shows the contents of the test tube after being exposed to light and room temperature for 30 minutes.



What explains the presence of bubbles?

A. Oxygen is formed when carbon dioxide combines with chlorophyll.

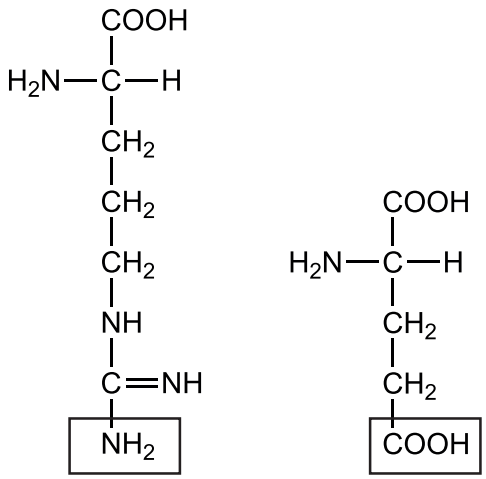
B. Carbon dioxide is formed during the light-dependent reaction.

C. Oxygen is released when light splits water molecules in chloroplasts.

D. Carbon dioxide is released from dissociation of sodium hydrogen carbonate.

9. The diagrams show the structure of the amino acids arginine and glutamic acid. Which groups highlighted in boxes may bond to form a dipeptide?

A.



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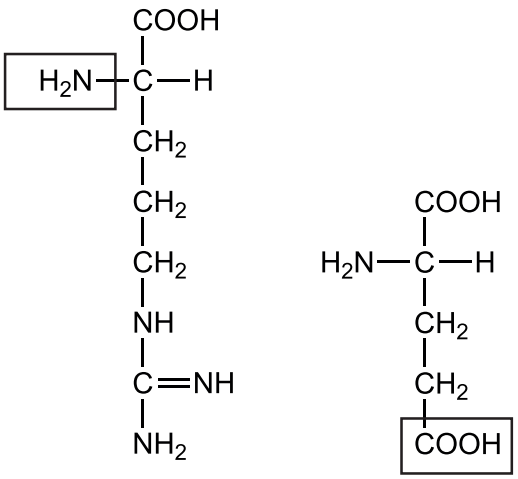

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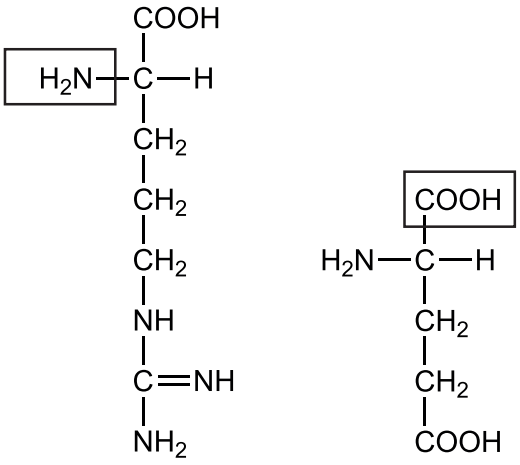

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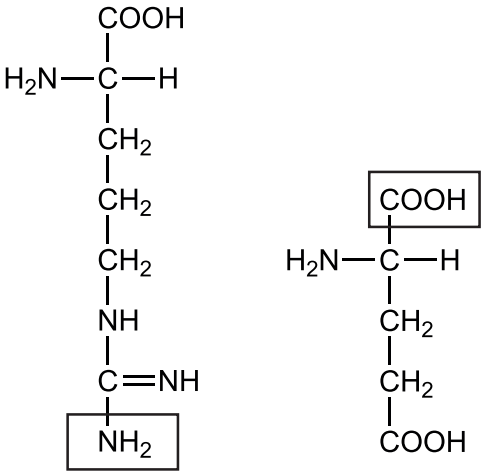
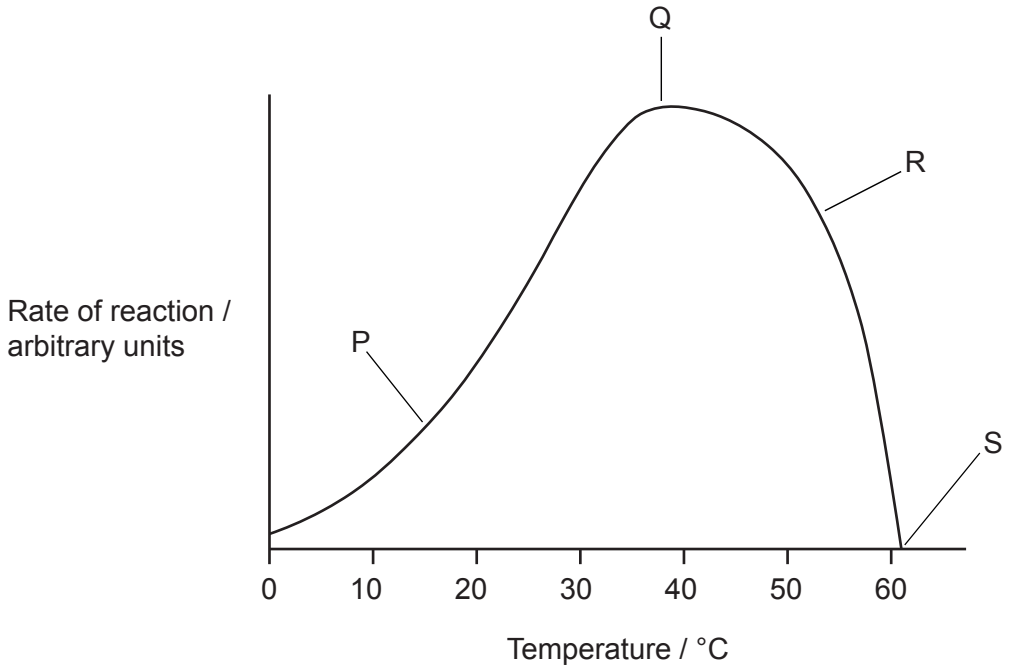


10. The graph shows the effect of temperature on the rate of a chemical reaction catalysed by enzymes.



What is a valid statement about a labelled point in the graph?

A. At P, substrate concentration is limiting the rate of reaction.

B. At Q, substrate and enzyme molecules achieve their highest kinetic energy.

C. At R, some active sites have changed shape.

D. At S, all substrate molecules have formed product.

11. Which codon would be found in RNA but not in DNA?

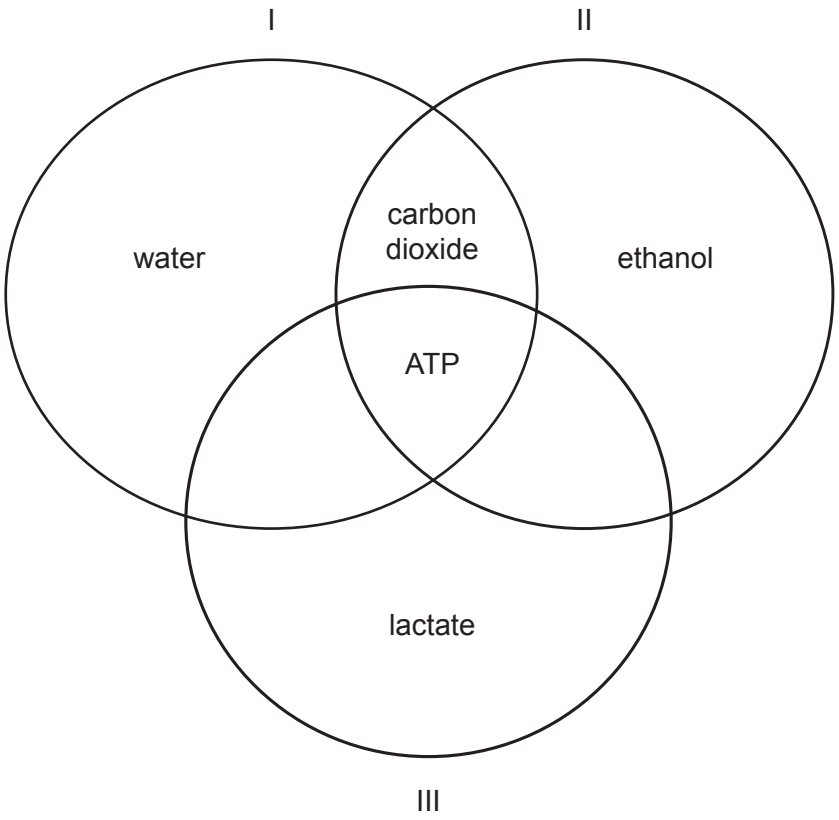
A. GTU

B. UCA

C. ATC

D. CGC

12. The diagram shows the products of three types of cell respiration.



Which part(s) of the diagram contain(s) the products of respiration in skeletal muscle cells of a person during exercise?

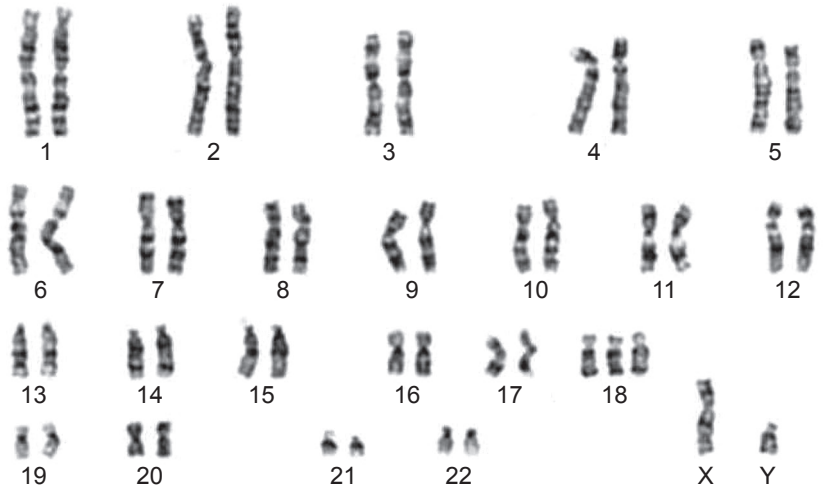
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

13. The karyogram belongs to a child with Edward's syndrome, a chromosome abnormality due to an error during the formation of gametes in one parent.



What explains this chromosome abnormality in the child?

A. Homologous chromosomes fail to separate completely during meiosis I.

B. An extra chromosome has replicated during anaphase.

C. Non-disjunction of sister chromatids may occur during meiosis I.

D. Pairs of chromosomes move to the same pole during anaphase II.

14. Blue Andalusian chickens (*Gallus gallus domesticus*), mostly found in the South of Spain, have blue-laced feathers.

A pair of blue-laced chickens were crossed on several occasions. A total of 20 offspring inherited the parents' phenotypes, 11 had black feathers only and 8 had white feathers only. Which explanation is correct for the inheritance of feather colour in this breed of chickens?

A. There are three co-dominant alleles for feather colour in chickens.

B. The allele for blue-laced feathers is dominant over white and black feathers.

C. The alleles for white and black feathers are co-dominant.

D. Most gametes carry the allele for blue-laced feathers.

15. What is DNA ligase used for in the production of genetically modified bacteria?

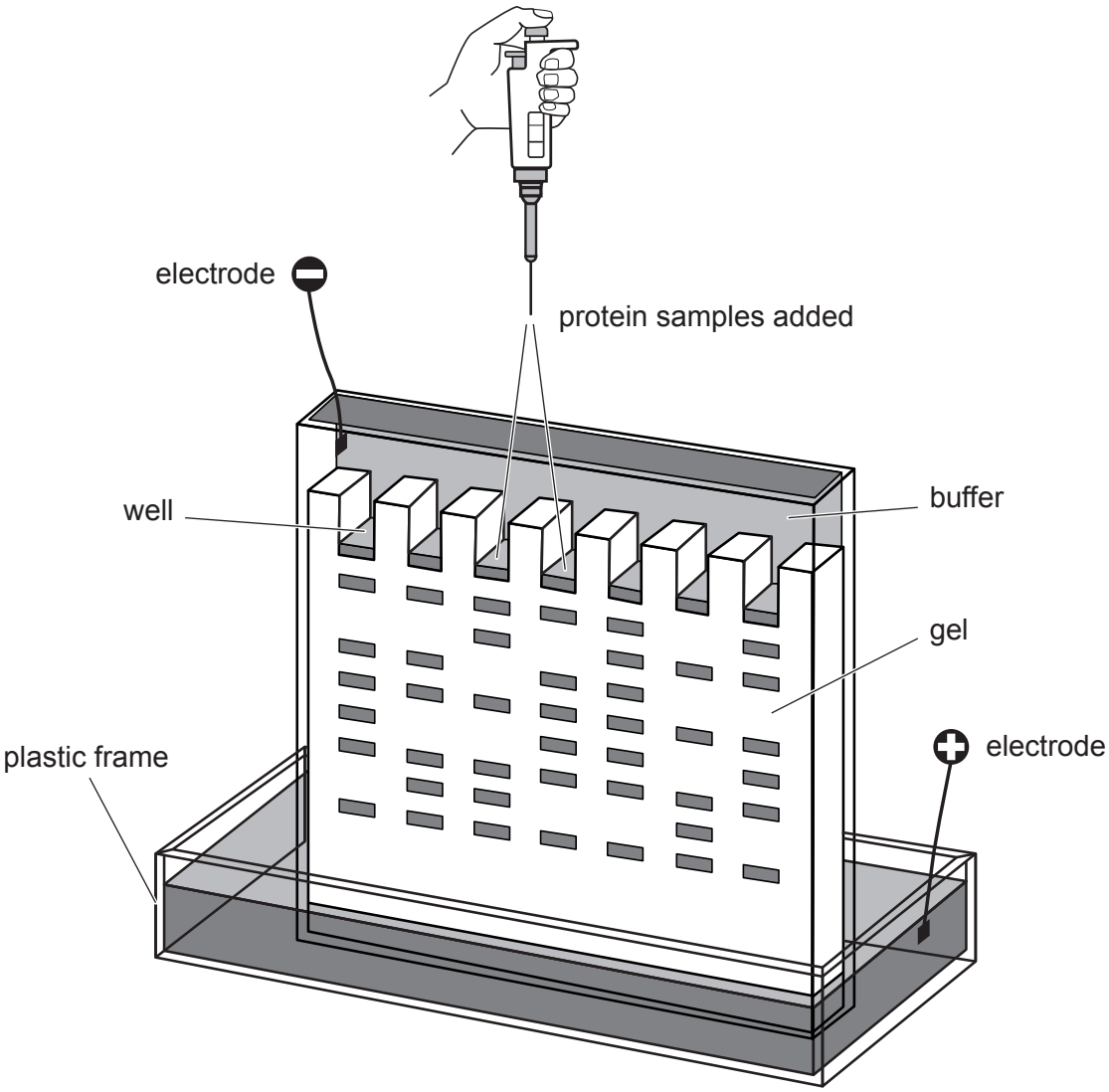
A. To form bonds between complementary bases in a human gene and a plasmid

B. To form bonds between a DNA fragment and a plasmid

C. To isolate a desired gene

D. To cut open bacterial plasmids

16. Proteins with the same charges were separated using gel electrophoresis.



What can be deduced about the proteins that have moved the longest distance?

A. They have the highest density.

B. They are the least soluble.

C. They are the smallest in size.

D. They have the greatest mass.

17. What is a common feature of saprotrophs and detritivores?

A. They are producers.

B. They feed on the remains of plants and animals.

C. They are found at the end of food chains.

D. They secrete enzymes for external digestion.

18. A simple sealed terrestrial mesocosm was set up to demonstrate that natural ecosystems can be sustainable over long periods of time.

What indicates that the mesocosm is still sustainable after several months?

A. Wastes are constantly recycled.

B. The diversity of living organisms increases.

C. Energy is conserved.

D. The mass of carbon increases.

19. Methane is one atmospheric gas that contributes to the greenhouse effect and global warming. What are reasons for this?

I. It absorbs long wave radiation.

II. It is converted to carbon dioxide in the atmosphere.

III. It allows more heat to leave the Earth's atmosphere.

A. II only

B. I and II only

C. II and III only

D. I, II and III

20. Jersey (*Bos taurus*) is a breed of cattle. Cows of this breed produce higher milk yields than cows from other cattle breeds.

What has caused this breed to produce higher milk yields than other cattle breeds?

A. Natural selection

B. Selective breeding

C. Adaptive radiation

D. Random mutations

21. Living organisms belong to one of three domains: Archaea, Eubacteria or Eukaryotes. What could be present in cells of all three domains?

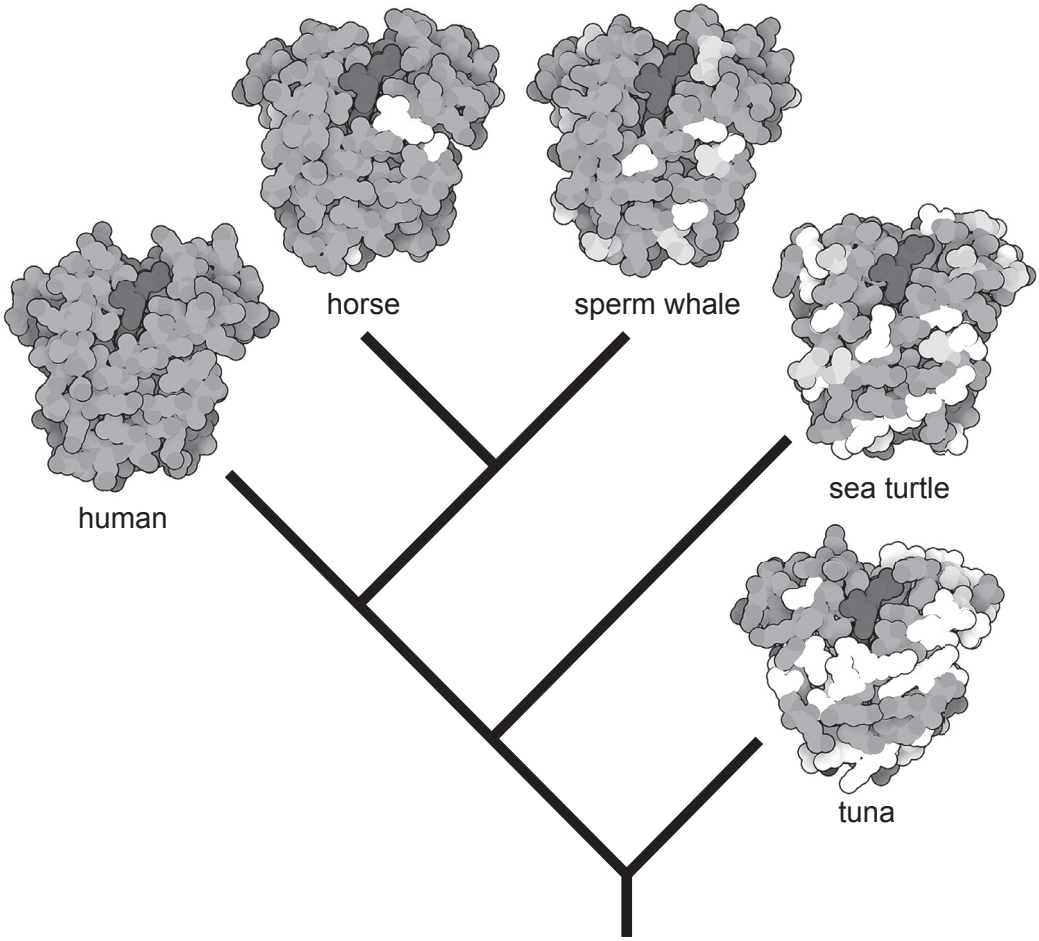
A. Pili

B. Genetic material bound to proteins

C. Single-stranded DNA

D. Cell walls

22. The cladogram shows the evolutionary relationships between humans and four other vertebrate species based on the comparison of the protein myoglobin.



Which feature of the myoglobin molecules might have been compared to produce the cladogram?

A. Differences in their 3D shape

B. Differences in amino acid composition

C. Similarities in base sequences

D. Similarities in function

23. A simple dichotomous key was designed to classify some invertebrate animals with bilateral symmetry into one of the following phyla: arthropoda, platyhelmintha, annelida and mollusca. Which letter corresponds to the phylum annelida?

1. Only mouth present ..... A.
   Mouth and anus present ..... go to 2

2. Segmented body ..... go to 3
   Body not segmented ..... B.

3. Exoskeleton absent ..... C.
   Exoskeleton present ..... D.

24. What will **always** cause an increase in heart rate?

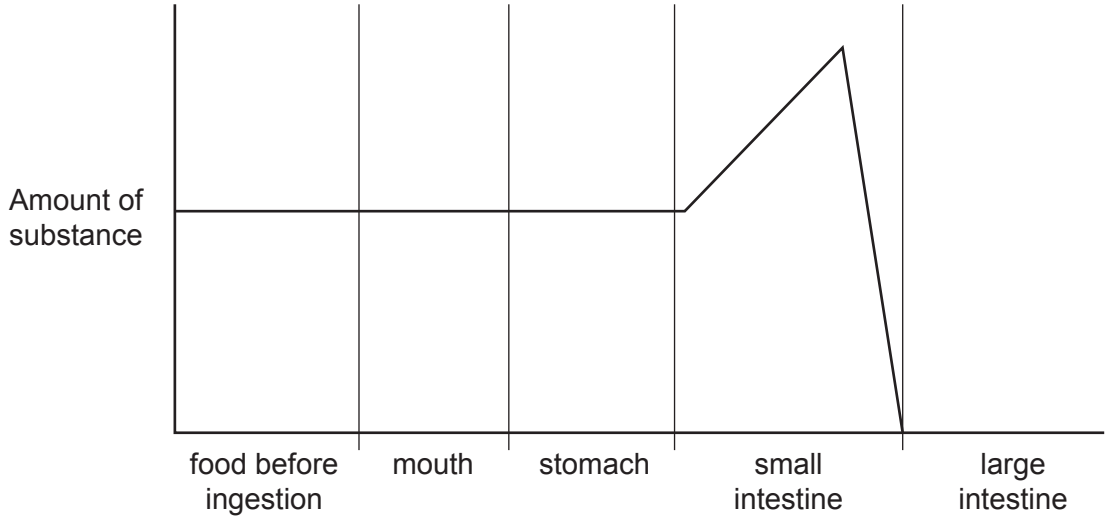
A. Nerve impulses from the medulla

B. Signals from the sinoatrial node

C. Secretion of epinephrine (adrenaline)

D. High levels of leptin

25. The graph shows the amount of a substance found in food and the changes that occur after ingestion, as it moves along the human alimentary canal.



Which substance could this be?

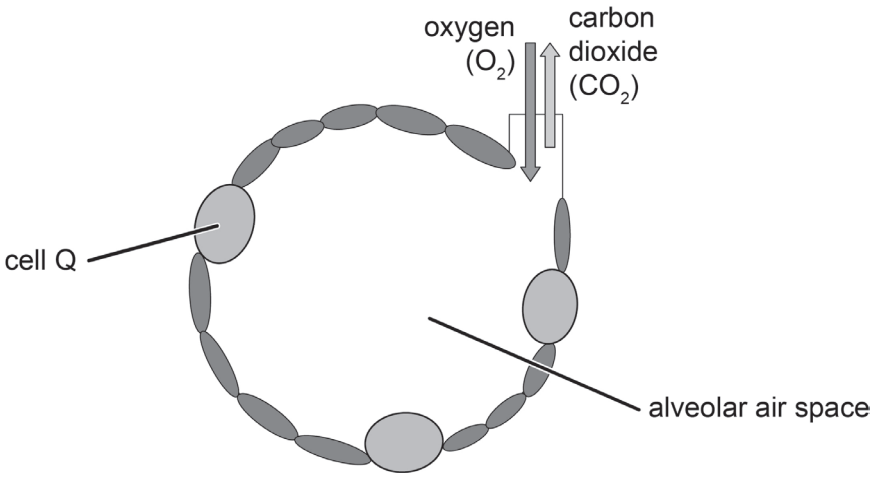
A. Glucose

B. Starch

C. Lipids

D. Cellulose

26. Some lung conditions cause the destruction of cells that are essential for normal alveolar function.



What would be a consequence of the destruction of cell Q?

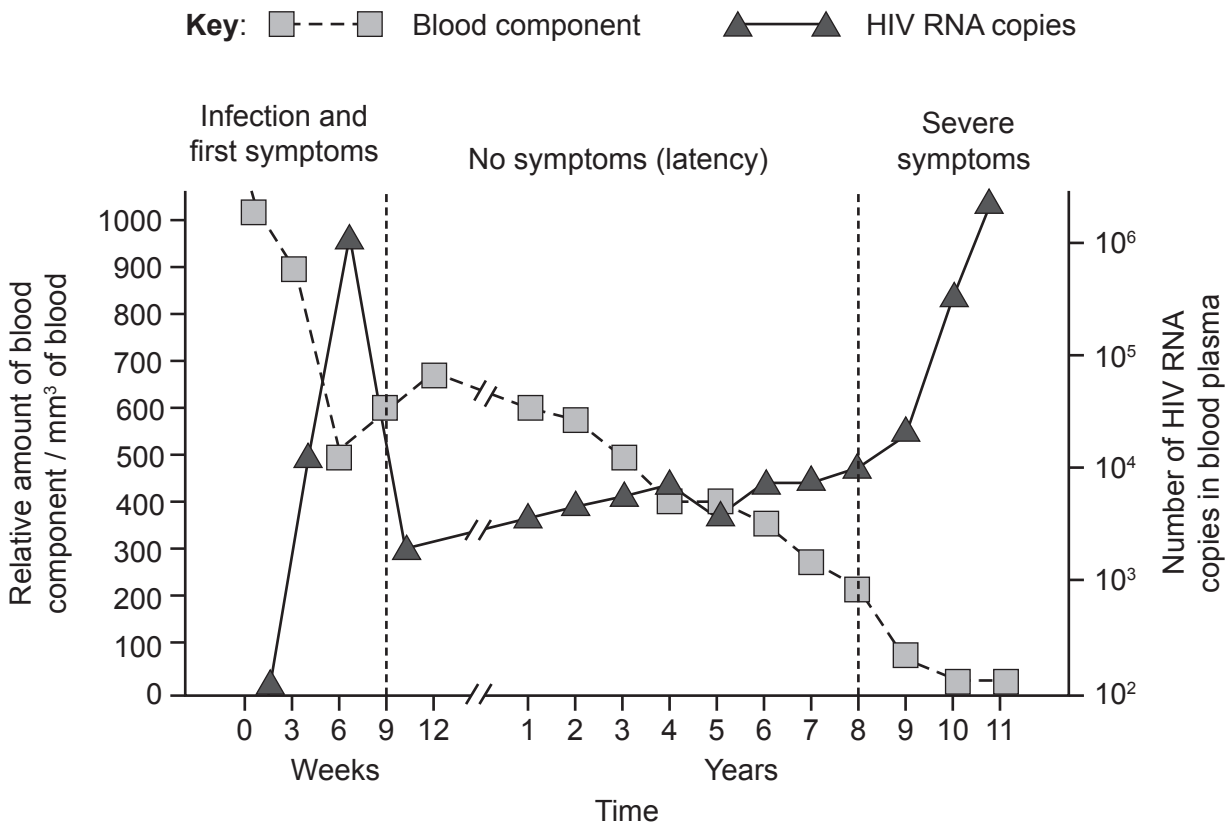
A. Emphysema

B. Bursting of alveoli

C. Lack of mucus secretion

D. Adhesion of alveolar walls

27. The graph shows changes in the relative amount of one blood component and the number of HIV RNA copies in blood plasma of an infected person over time.



Which statement explains a likely symptom nine years after the initial infection?

A. The patient feels tired, as there would be fewer red blood cells to transport oxygen.

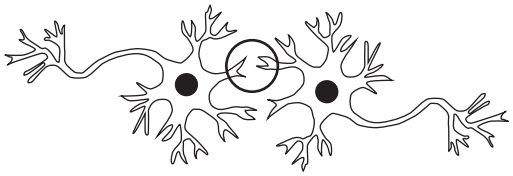
B. The patient has difficulty recovering from infectious diseases due to a lack of antibodies.

C. The risk of bleeding and blood infections increases due to a lack of clotting factors.

D. Opportunistic infections spread, as there are few phagocytes to destroy bacteria.

28. Which encircled area shows a region where the chemical transmission of nerve impulses is most likely to occur between neurons?

A.



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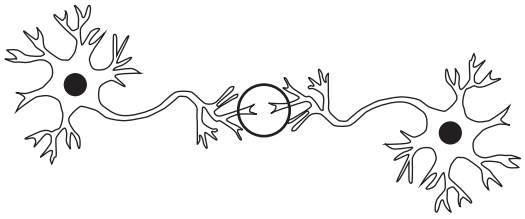

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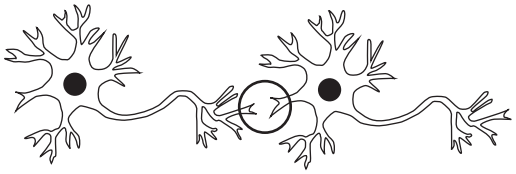

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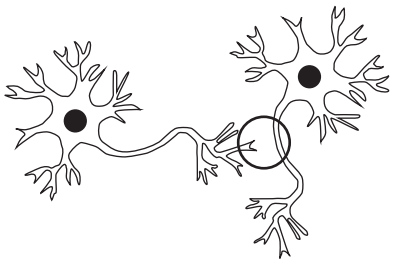
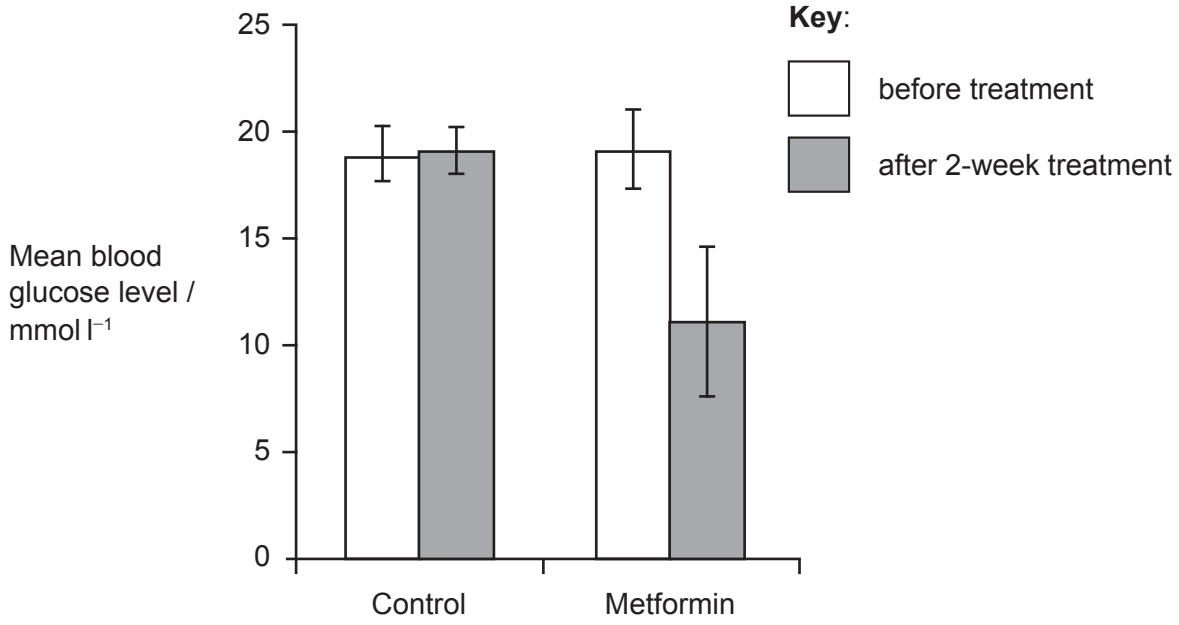


29. Metformin is widely used to treat type II diabetes in humans, as it reduces the responsiveness of liver cells to glucagon. The graph compares mean blood glucose levels in a control group and a group of diabetic animals before and after a two-week treatment with metformin.



Using the information provided, what can be deduced about the effect of metformin?

A. It reduces glucagon secretion.

B. It decreases the breakdown of glycogen in liver cells.

C. It stimulates the secretion of insulin.

D. It enhances aerobic respiration in liver cells.

30. In preparation for IVF, women are first treated with drugs, followed by artificial doses of hormones. What is the purpose of each step?

	Initial drug treatment	Artificial doses of hormones
A.	stop menstrual cycles	facilitate fertilization of eggs
B.	initiate endometrium development	allow multiple implantation
C.	prevent FSH secretion	induce multiple ovulation
D.	induce multiple ovulation	initiate endometrium development

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References:

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26. Katherinebutler1331, May 30, 2018. https://commons.wikimedia.org/wiki/File:An_annotated_diagram_of_an_alveolus.svg. Licensed under CC BY-SA 4.0: https://creativecommons.org/licenses/by-sa/4.0/deed.en.

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