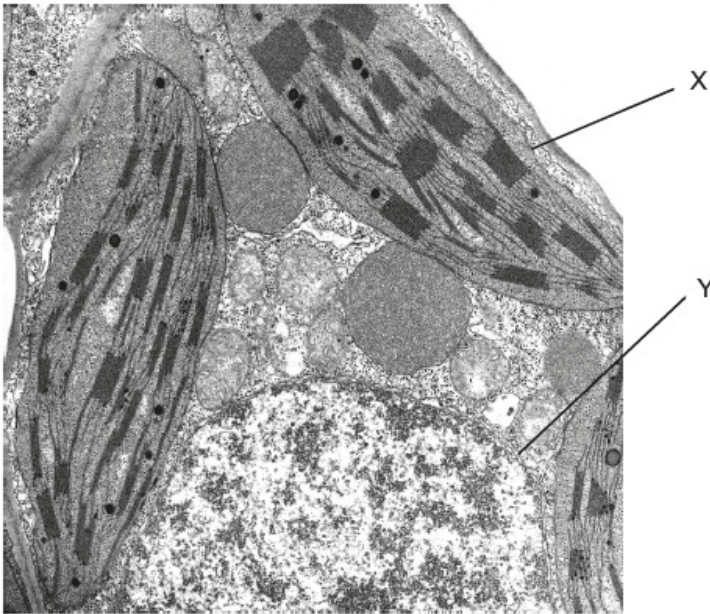


Exam Prep Multiple choice [90 marks]

The electron micrograph shows a section through a cell.

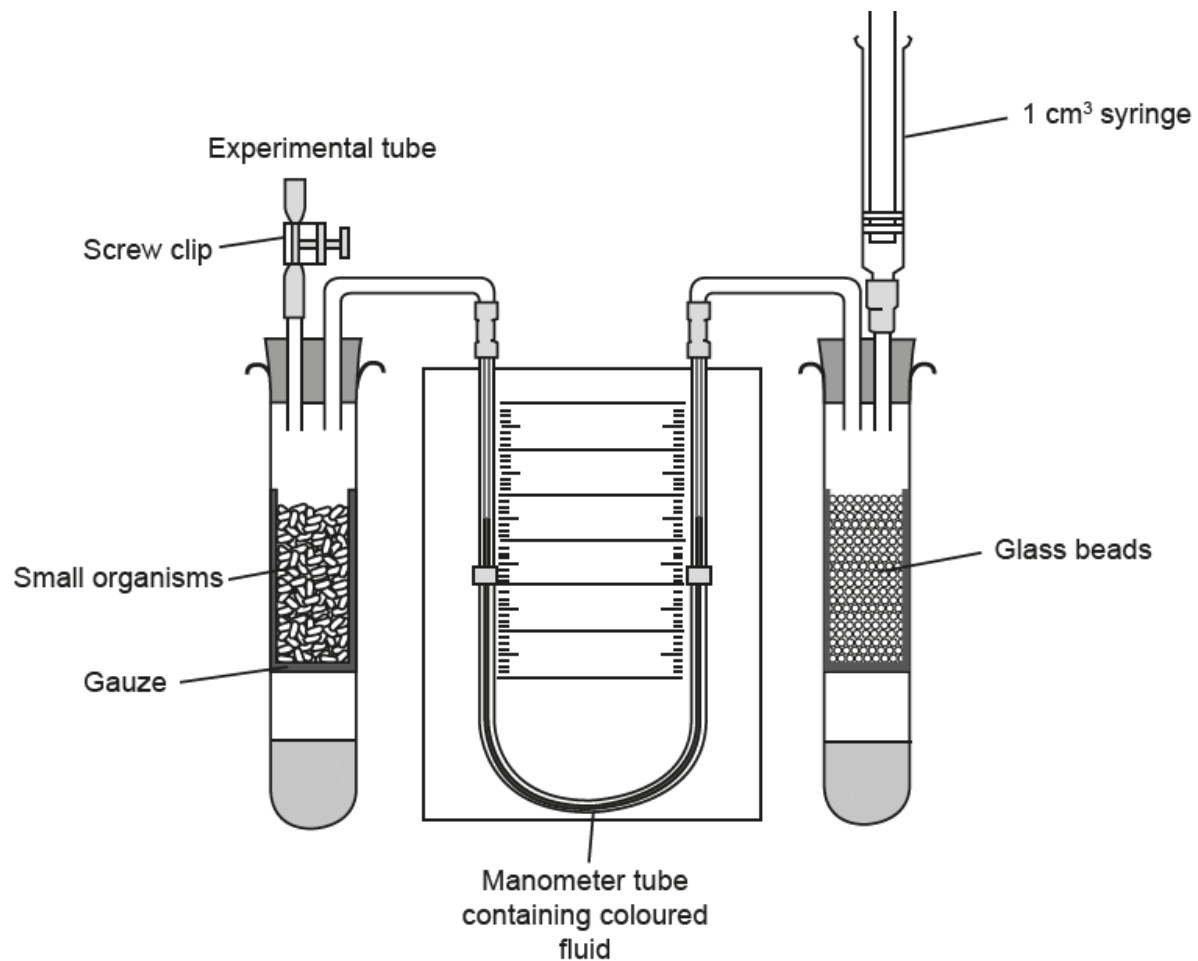


[Source: Photo © E. Newcomb. Nucleus, glyoxisomes, chloroplasts, and mitochondria - magnification at 13,900x - UWDC - UW-Madison Libraries (wisc.edu) (<https://search.library.wisc.edu/digital/AE2SBIWRVTRR5T87>).]

1. What is the name of the cell component labelled Y? [1 mark]
 - A. Golgi apparatus
 - B. Nucleus
 - C. Cytoplasm
 - D. Vacuole
2. What is the reason for Taq DNA polymerase being used in the polymerase chain reaction (PCR)? [1 mark]
 - 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.

3. The diagram shows a respirometer.

[1 mark]

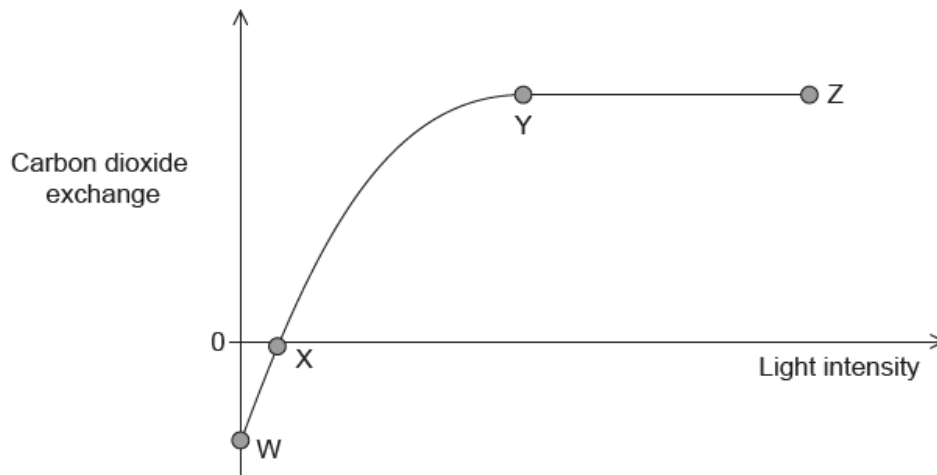


[Source: Courtesy The Royal Society of Biology.]

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

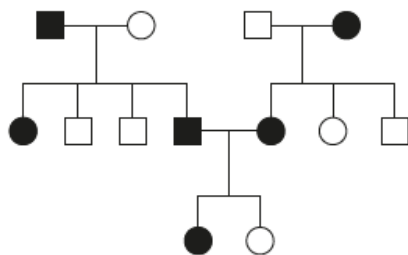
	Solution placed in the bottom of each tube	Direction of movement of fluid in the manometer
A.	acid	up on the left side
B.	alkali	down on the right side
C.	acid	up on the right side
D.	alkali	down on the left side

4. 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. [1 mark]



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.
5. In the pedigree chart, individuals affected by a genetic disease are shown [1 mark] as shaded symbols. Squares represent males and circles females.



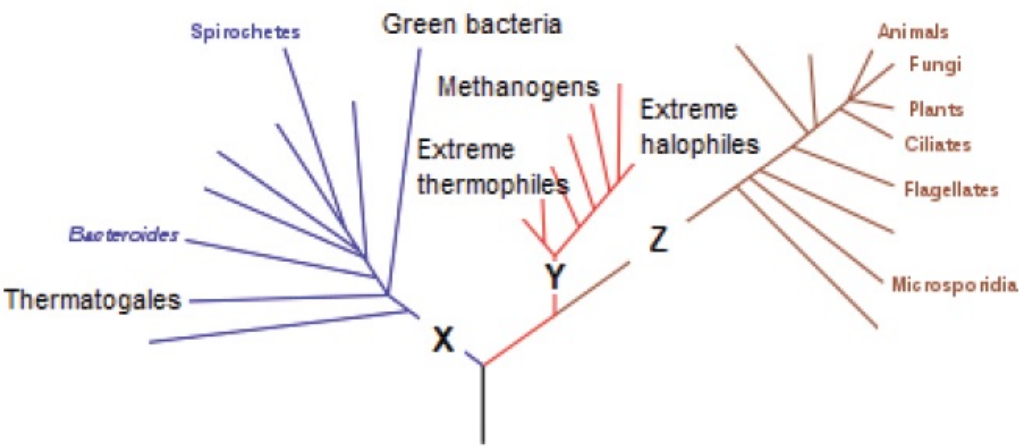
What is the mode of inheritance of the genetic disease?

- 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

6. Tall heterozygous pea plants were crossed and the resulting seeds grown. *[1 mark]*
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.
-
7. What are all the possible phenotypes of children born to a mother with blood group AB and a father with blood group A? *[1 mark]*
- A. AB only
 - B. A and B
 - C. AB, A and B
 - D. AB, A and O
-
8. Which level(s) of ecological complexity involve(s) biotic factors but not abiotic factors? *[1 mark]*
- I. Community
 - II. Ecosystem
 - III. Population
- A. I only
 - B. II only
 - C. I and II only
 - D. I and III only
-
9. How can a chi-squared test be used in ecological research? *[1 mark]*
- 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
-
10. Under certain conditions, living organisms on Earth produce and release methane. What favours the production of methane? *[1 mark]*
- A. Forest fires
 - B. High light intensity
 - C. Anaerobic conditions
 - D. Dry conditions

11. 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? *[1 mark]*
- 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.
-
12. Which feature of the cell in the micrograph is consistent with the endosymbiotic theory? *[1 mark]*
- A. X has a single membrane.
 - B. Y has a double membrane.
 - C. X contains 70S ribosomes.
 - D. Y contains 80S ribosomes.
-
13. What process best explains the formation of different pentadactyl limbs? *[1 mark]*
- A. Adaptive radiation
 - B. Interbreeding
 - C. Selective breeding
 - D. Convergence
-
14. What would restrict evolution by natural selection, if a species only reproduced by cloning? *[1 mark]*
- 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.
-
15. An animal has the following characteristics: bilateral symmetry, mouth but no anus, ribbon shape. Which phylum does the animal belong to? *[1 mark]*
- A. Mollusca
 - B. Cnidaria
 - C. Annelida
 - D. Platyhelmintha

16. The cladogram shows some of the groups in the three domains.[1 mark]

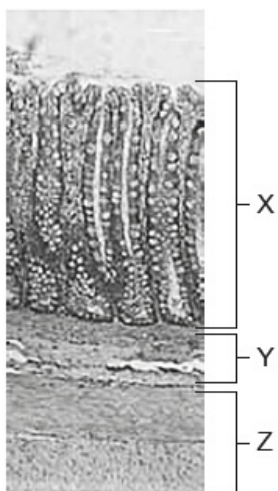


[Source: Adapted from Eric Gaba (Sting, fr:Sting), Cherkash, Public domain, via Wikimedia Commons.
https://commons.wikimedia.org/wiki/File:Phylogenetic_tree.svg.]

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	

17. The photomicrograph shows a section through a human small intestine. [1 mark]



[Source: 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.](https://doi.org/10.1371/journal.pone.0134382)]

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

18. What feature of arteries is most important in maintaining sufficiently high [1 mark]
blood pressure?

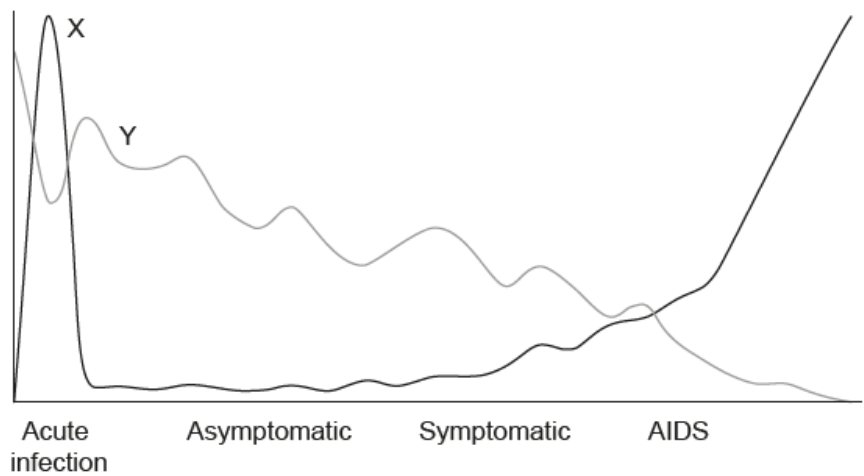
- A. A wide lumen
- B. Elastic fibres in the wall
- C. Valves at intervals
- D. A thin wall

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

[1 mark]

- A. Stimulate blood clotting
- B. Found only in the circulatory system
- C. Form part of non-specific immunity
- D. Produce antibodies

20. The graph shows the results of measuring two factors in the blood of patients with HIV/AIDS. [1 mark]



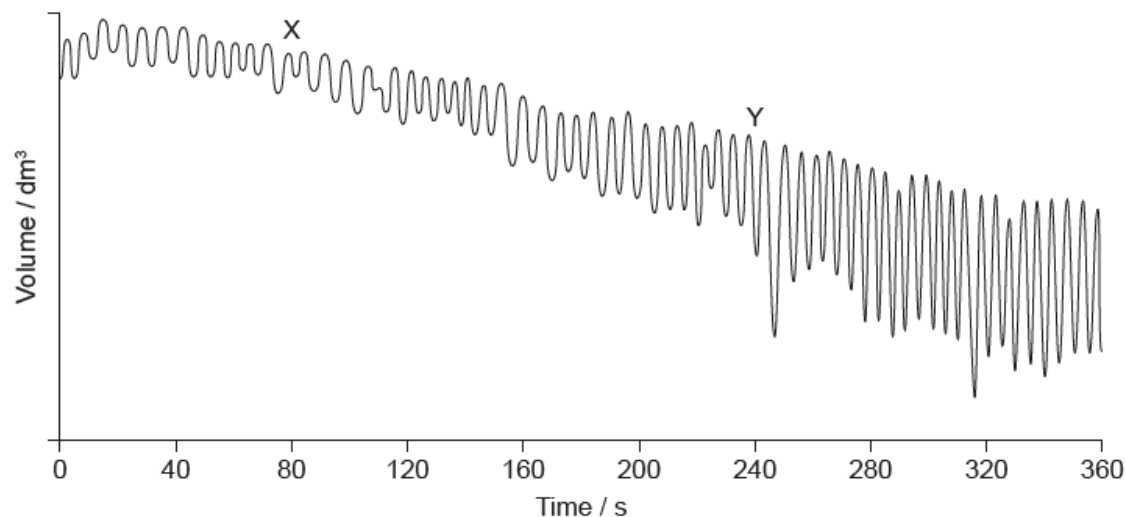
[Source: Courtesy ACRIA.]

What do X and Y represent?

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

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

[1 mark]



[Source: Courtesy of Dr. Dafang Wang for his work at University of Utah.]

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.

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

[1 mark]

- 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

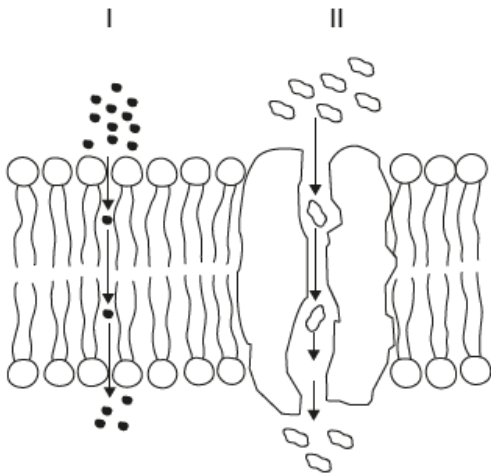
23. Which sequence has the cells arranged according to their ability to differentiate, starting from the least able?

[1 mark]

- A. bone marrow, neuron, embryonic, umbilical
- B. neuron, bone marrow, umbilical, embryonic
- C. umbilical, embryonic, bone marrow, neuron
- D. embryonic, umbilical, bone marrow, neuron

24. 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? [1 mark]
- A. Estrogen and FSH
 - B. LH and thyroxin
 - C. Insulin and glucagon
 - D. Epinephrine and leptin

25. The diagram shows a section through a membrane. What are the modes of transport in the diagram? [1 mark]

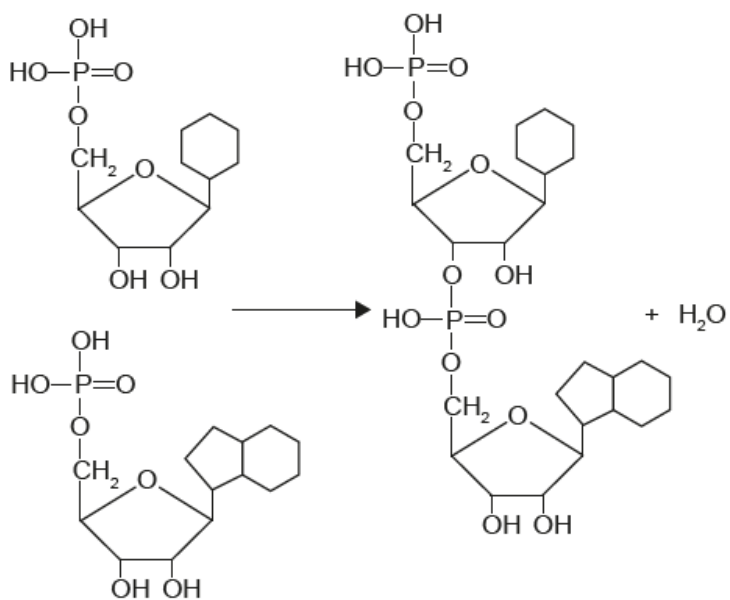


[Source: © International Baccalaureate Organization 2020.]

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

26. How many chromosomes are there in a cell during anaphase of mitosis, if the diploid number of the cell is 20? [1 mark]
- A. 10
 - B. 20
 - C. 40
 - D. 80

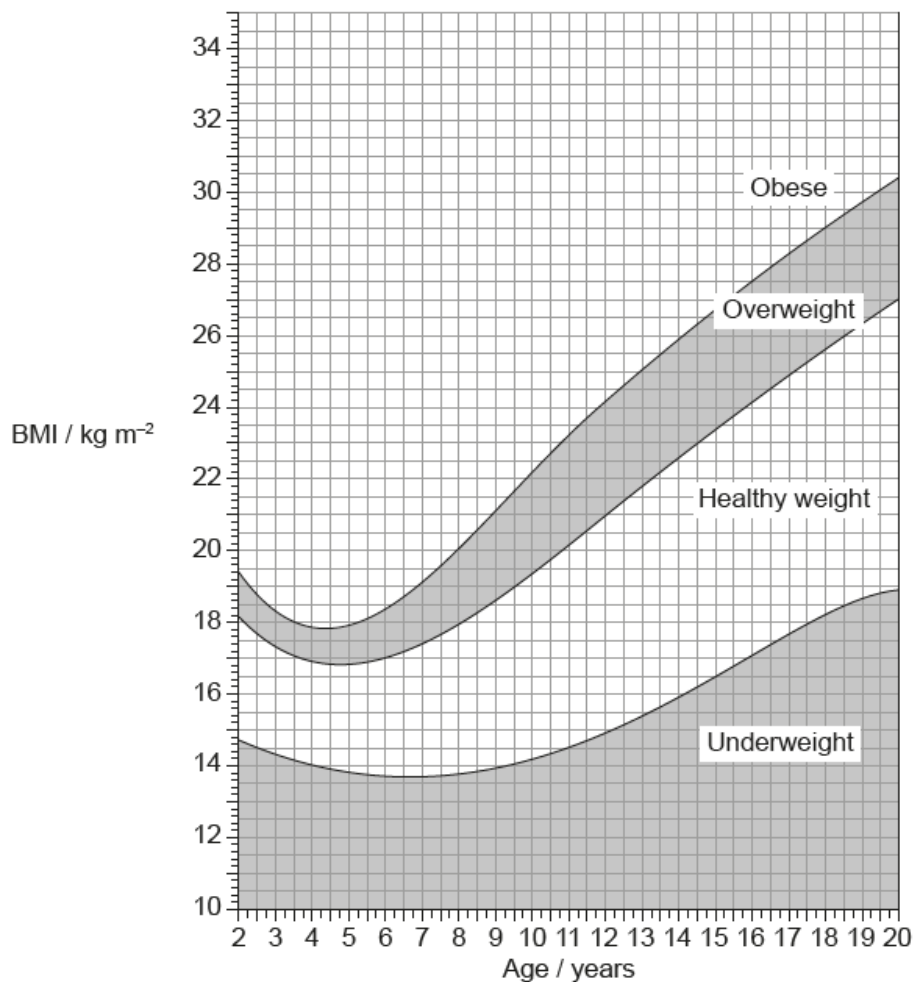
27. What are the type of reaction and the product(s) shown in this reaction? [1 mark]



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

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

[1 mark]



[Source: Centers for Disease Control and Prevention, *About Child & Teen BMI*.

Available at:

https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi

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

29. The genetic code is shown.

[1 mark]

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

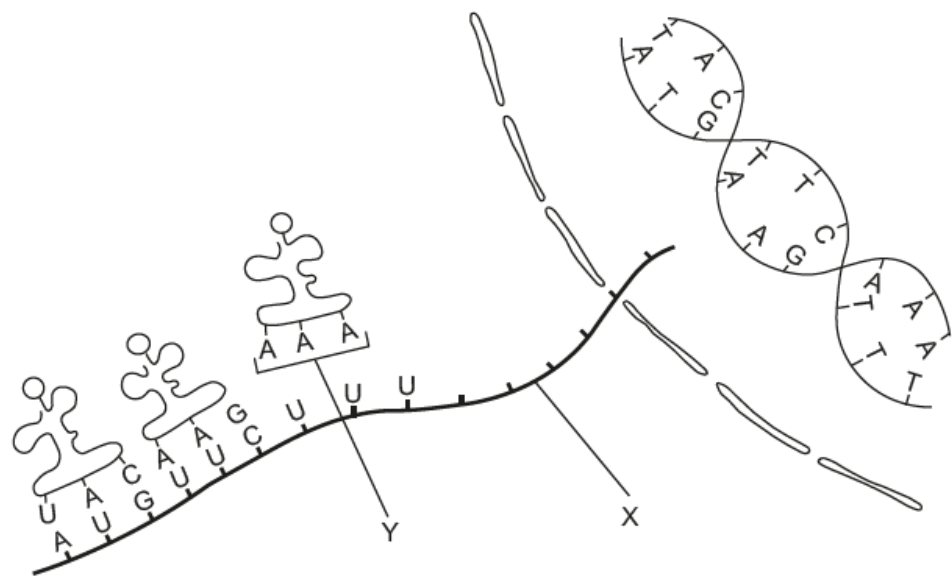
In a coding gene, the DNA triplet in the transcribed strand is changed from AGG to TCG.

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

30. The diagram represents transcription and translation.

[1 mark]

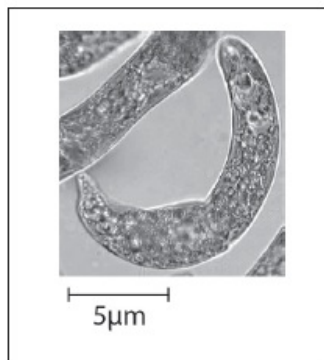


[Source: © International Baccalaureate Organization 2020.]

What structures do the letters X and Y represent?

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

31. The electron micrograph shows a thin section through a plant mesophyll cell. [1 mark]

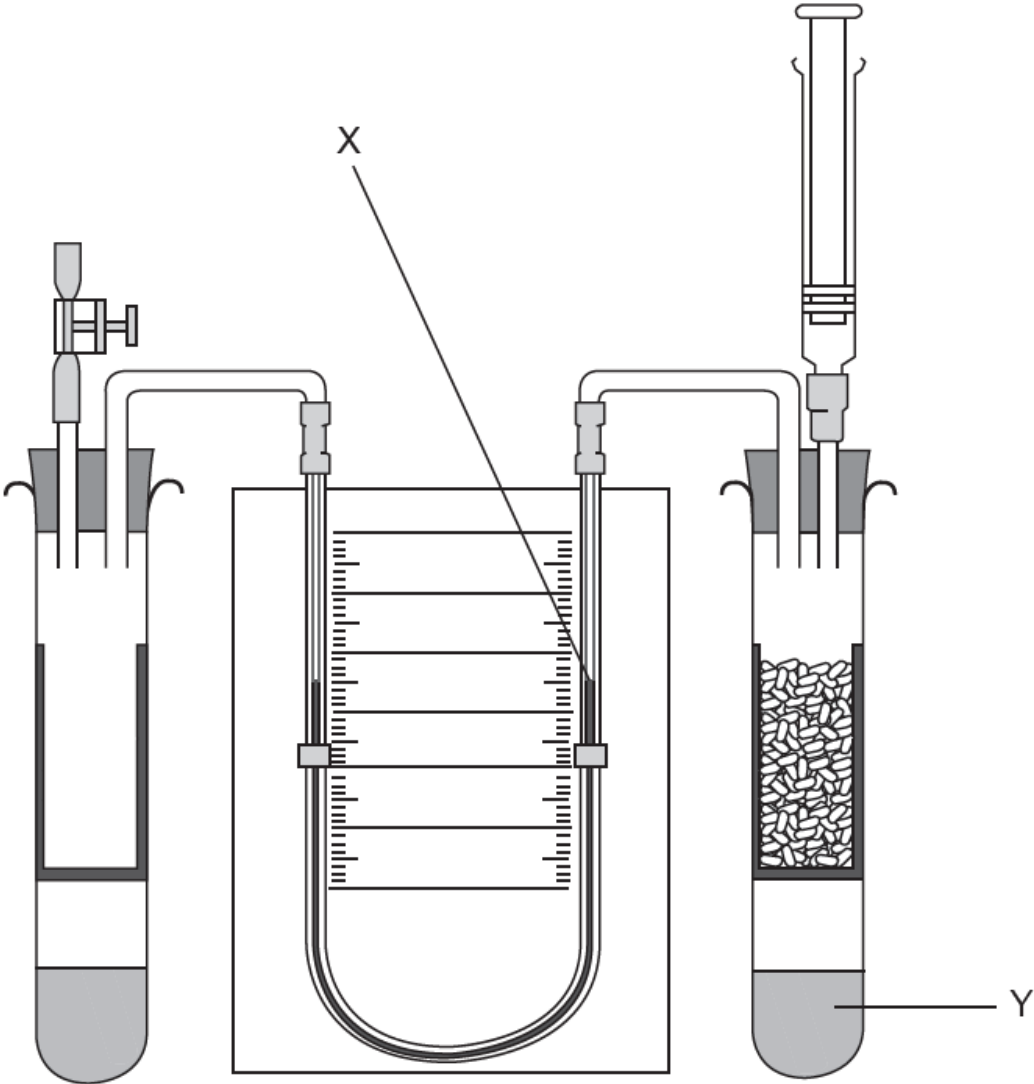


[Source: https://commons.wikimedia.org/wiki/File:Euglena_sp.jpg, by Deuterostome
<https://creativecommons.org/licenses/by-sa/3.0/legalcode>]

What is the magnification of the image?

- A. $\times 75$
 - B. $\times 300$
 - C. $\times 3000$
 - D. $\times 7500$
-
32. What effect do changes in pH have on enzymes? [1 mark]
- A. All enzymes increase in activity as pH increases.
 - B. The activity of all enzymes is reduced by a pH below or above 7.
 - C. Low pH causes reversible denaturation in all enzymes.
 - D. Extreme pH can alter the active site of all enzymes.
-
33. For what did Meselson and Stahl's work provide evidence? [1 mark]
- A. The abiotic origin of organic molecules
 - B. The cell theory
 - C. The fluid mosaic model of membrane structure
 - D. The semi-conservative replication of DNA
-
34. Which compound is a waste product of anaerobic respiration in humans? [1 mark]
- A. Carbon dioxide
 - B. Ethanol
 - C. Lactate
 - D. Pyruvate

35. The diagram shows a respirometer used to measure respiration rate in germinating seeds. [1 mark]

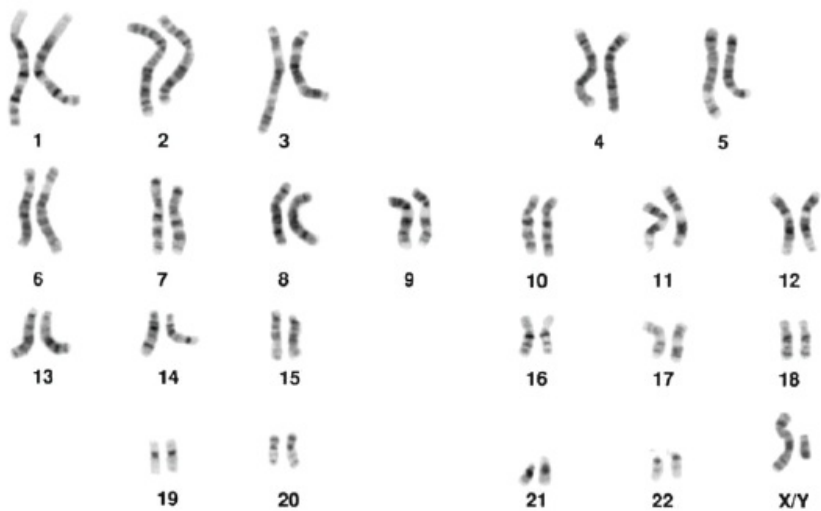


[Source: used with the kind permission of the Nuffield Foundation and the Royal Society of Biology]

What is the expected direction of movement of the fluid at X and the function of the fluid at Y?

	Movement of fluid at X	Function of fluid at Y
A.	Down	Absorb CO ₂
B.	Down	Produce O ₂
C.	Up	Absorb CO ₂
D.	Up	Produce O ₂

36. A pregnant woman had fetal cells removed by chorionic villus sampling and tested. The following karyogram was produced. [1 mark]



[Source: Mediscan / Alamy Stock Photo]

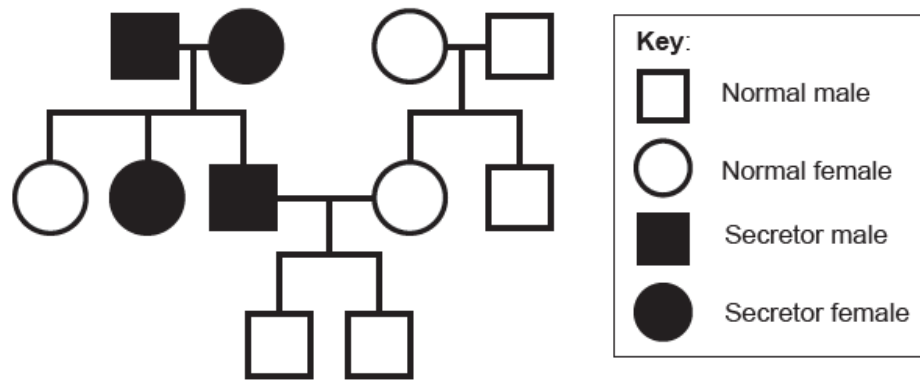
What does this show?

- A. The child is female with Down syndrome.
- B. The child is female without Down syndrome.
- C. The child is male with Down syndrome.
- D. The child is male without Down syndrome.

37. A variety of *Pelargonium* has yellow leaves. When plants of this variety are crossed, the resulting seeds produce green, yellow and white seedlings in the ratio 1 : 2 : 1. If plants with yellow leaves are crossed with plants with green leaves, what would the expected ratio of phenotypes in the offspring be? [1 mark]

	Green	Yellow	White
A.	1	2	1
B.	3	1	0
C.	2	2	0
D.	2	1	1

38. A pair of alleles controls the secretion of antigens corresponding to blood group in saliva. Examine the pedigree chart. *[1 mark]*



[Source: © International Baccalaureate Organization 2019]

Based on this pedigree chart, which best describes the allele conferring antigen secretion in saliva?

- A. Dominant
- B. Recessive
- C. Sex-linked
- D. Co-dominant

39. What is PCR used for?

[1 mark]

- A. Separate fragments of DNA by size
- B. Amplify small amounts of DNA
- C. Compare DNA samples
- D. Genetically modify organisms' DNA

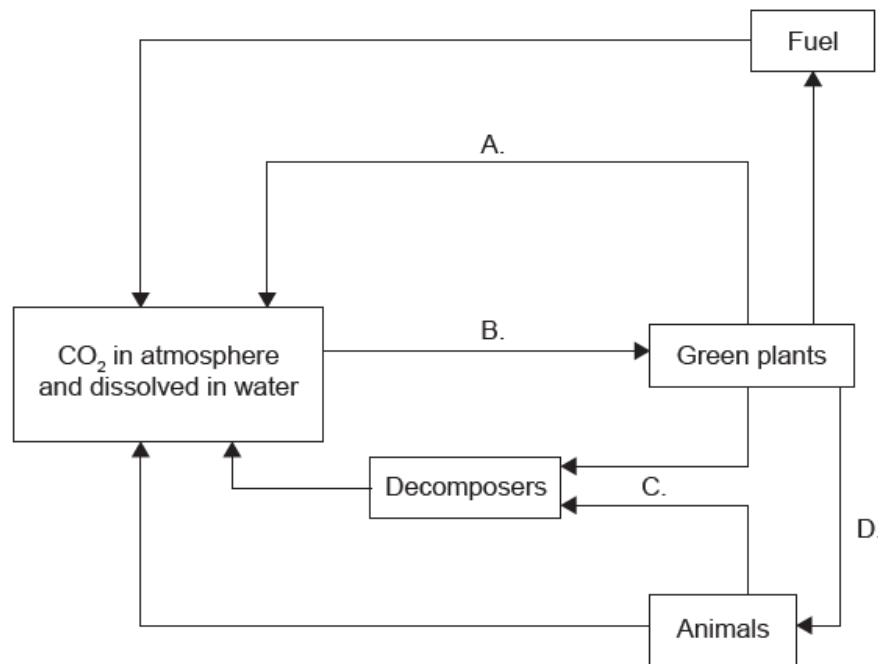
40. What is the ecological term for a group of different types of organisms that live together and interact with each other?

[1 mark]

- A. Community
- B. Domain
- C. Ecosystem
- D. Population

41. In the diagram, which of the processes labelled A to D transfers the largest mass of carbon per year in a woodland ecosystem?

[1 mark]



[Source: © International Baccalaureate Organization 2019]

42. By which process do potassium ions move through potassium channels in axons? [1 mark]

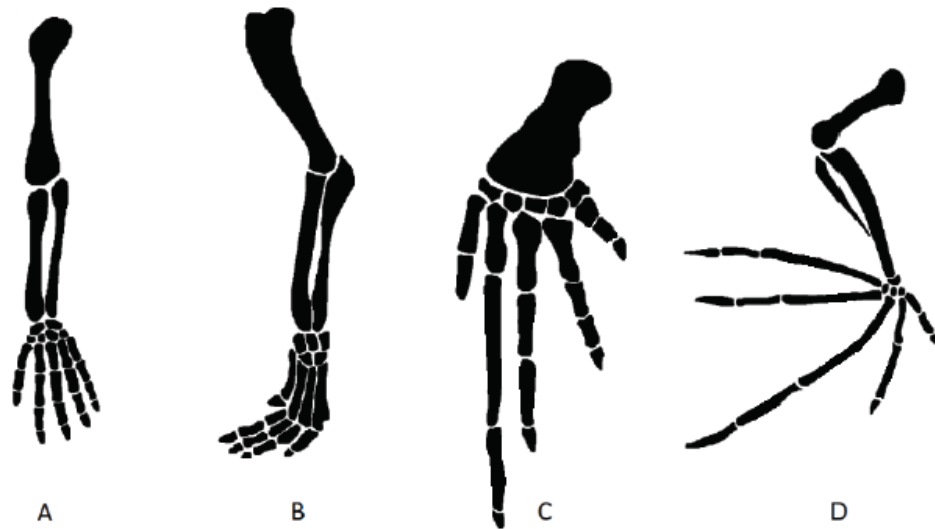
- A. Active transport
- B. Exocytosis
- C. Facilitated diffusion
- D. Simple diffusion

43. What material is formed when organic matter is not fully decomposed in acidic waterlogged soils? [1 mark]

- A. Coal
- B. Hydrogen
- C. Oil
- D. Peat

44. Which pentadactyl limb is adapted for flight?

[1 mark]



[Source: adapted from Volkov Vladislav Petrovich, [https://en.wikipedia.org/wiki/Homology_\(biology\)#/media/File:Homology_vertebrates-en.svg](https://en.wikipedia.org/wiki/Homology_(biology)#/media/File:Homology_vertebrates-en.svg) and Zebra.element, https://en.wikipedia.org/wiki/File:Bat_mouse_forelimbs.png]

45. An organism has the following characteristics:

[1 mark]

- single opening for ingestion and egestion
- radial symmetry
- tentacles with stinging cells.

In what phylum would it most likely be classified?

- A. Annelida
- B. Cnidaria
- C. Platyhelminthes
- D. Porifera

46. Which organism is a member of the filicinophyta? (*Note that these are not[1 mark] to scale*)



A



B



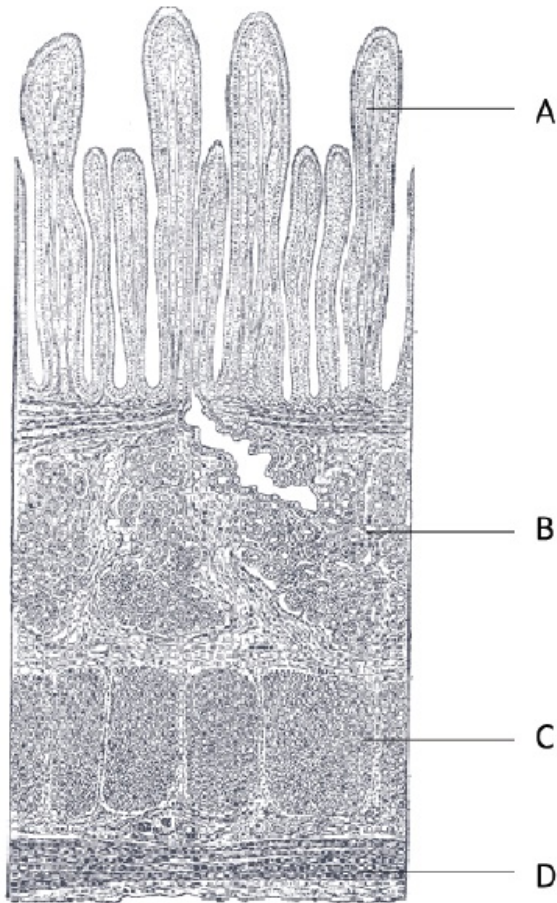
C



D

[Source: A: Sanjay ach/<https://creativecommons.org/licenses/by-sa/3.0/deed.en>
B: Vaelta/<https://creativecommons.org/licenses/by-sa/3.0/deed.en>
C: Andrey Zharkikh/<https://creativecommons.org/licenses/by/2.0/deed.en>
D: courtesy of Caroline Needham]

47. The micrograph is of a longitudinal section through the small intestine. [1 mark]
Which letter represents the circular muscle layer?

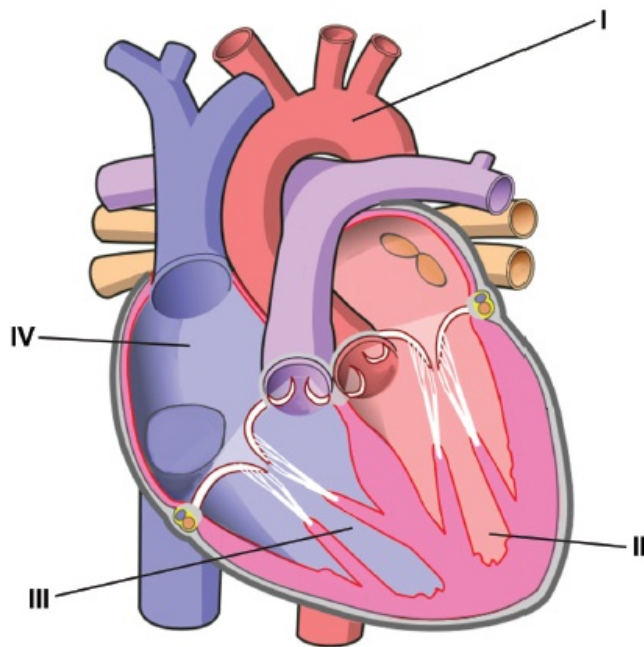


[Source: Henry Gray (1918) *Anatomy of the Human Body*]

48. Which part of the body secretes amylase, lipase and endopeptidase for use in the digestion of food? [1 mark]
- A. Mouth
 - B. Pancreas
 - C. Stomach
 - D. Small intestine

49. The diagram shows the human heart.

[1 mark]



[Source: adapted to remove labels and arrows, recoloured and relabelled from Wapcaplet/

[https://commons.wikimedia.org/wiki/File:Diagram_of_the_human_heart_\(cropped\).svg](https://commons.wikimedia.org/wiki/File:Diagram_of_the_human_heart_(cropped).svg)

After a red blood cell picks up oxygen in the lungs, which sequence shows the path it could take when passing through the heart during its circuit of the body?

- A. I → II → III → IV
- B. II → I → IV → III
- C. IV → III → I → II
- D. IV → III → II → I

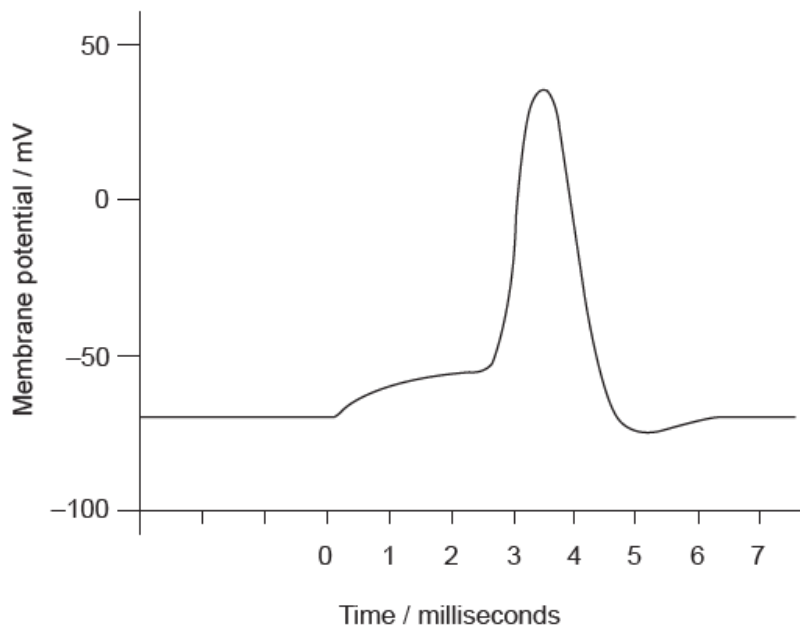
50. What is non-specific immunity to disease?

[1 mark]

- A. Blocking prokaryotic metabolism with antibiotics
- B. Production of antibodies by lymphocytes
- C. Endocytosis of pathogens by white blood cells
- D. Production of cloned plasma cells

51. The graph shows an action potential.

[1 mark]



What is the threshold potential for this cell?

- A. -80 mV
- B. -70 mV
- C. -55 mV
- D. 40 mV

52. What is the role of the hormone leptin?

[1 mark]

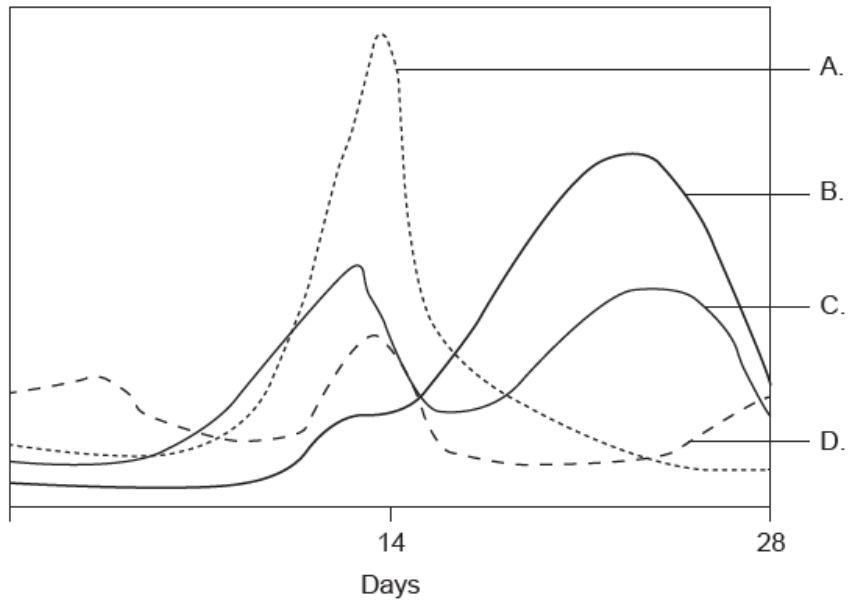
- A. To regulate the metabolic rate
- B. To inhibit appetite
- C. To control circadian rhythms
- D. To increase blood sugar concentration

53. Which statement provides evidence for endosymbiosis?

[1 mark]

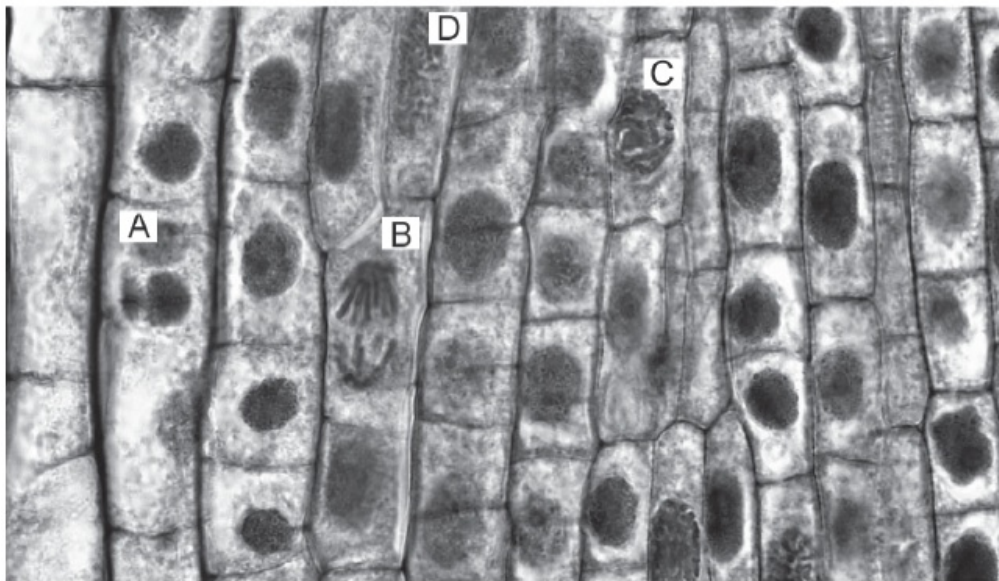
- A. Early prokaryotes contributed to a large increase in oxygen in the atmosphere.
- B. Eukaryotic mitochondria and chloroplasts have their own circular DNA.
- C. Certain groups of ancient prokaryotes developed mechanisms to carry out aerobic respiration.
- D. Experiments by Miller and Urey produced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

54. On the graph, which curve represents the change in FSH levels during the [1 mark] menstrual cycle?



55. In the micrograph, which letter points to a cell in anaphase?

[1 mark]



[Source: Berkshire Community College Bioscience Image Library, https://commons.wikimedia.org/wiki/File:Mitotic_Stages_in_Apical_Meristem_of_Allium licensed under Creative Commons CC0 1.0 Universal Public Domain Dedication]

56. Students examined micrographs and counted cells in the different stages [1 mark] of mitosis as well as those cells with no visible chromosomes. The table shows their results.

Stage	Prophase	Metaphase	Anaphase	Telophase	Interphase
Number of cells	10	3	2	5	30

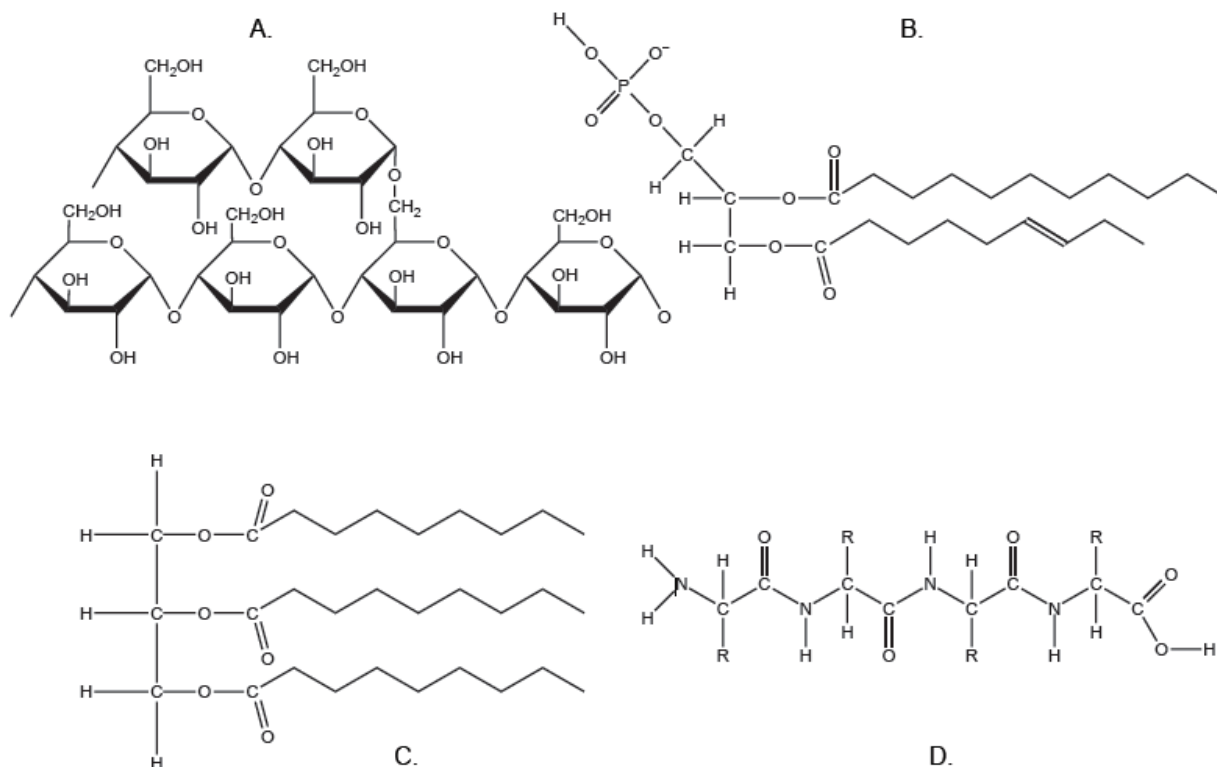
What is the mitotic index?

- A. 0.2
- B. 0.4
- C. 0.6
- D. 0.7

57. In which processes are macromolecules broken down into monomers? [1 mark]

- A. Anabolism and catabolism
- B. Catabolism and hydrolysis
- C. Hydrolysis and reduction
- D. Reduction and anabolism

58. Which of the molecules shown would be most suitable for long-term energy storage in humans? [1 mark]



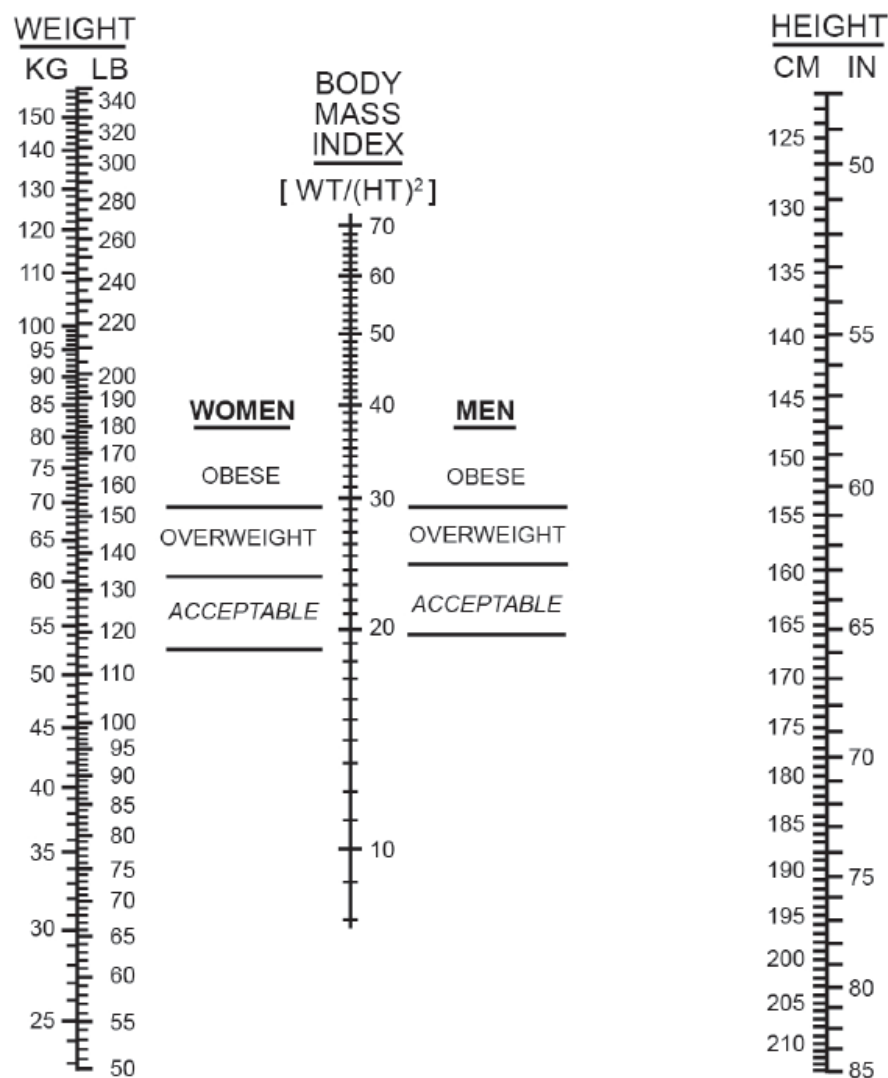
59. What is a property of water?

[1 mark]

- A. Water has a low specific heat capacity so large increases in heat energy cause a small temperature change.
- B. Water is an excellent solvent for non-polar substances.
- C. Covalent bonds between adjacent water molecules are responsible for its unique properties.
- D. Water molecules are highly cohesive which is important for transport in xylem.

60. Using the nomogram, what is the minimum mass at which a woman of height 165 cm would be considered overweight?

[1 mark]

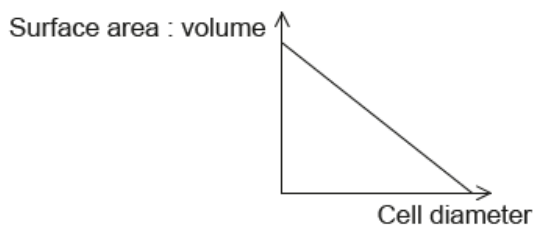


[Source: Copyright 1978, George A. Bray. Used by permission]

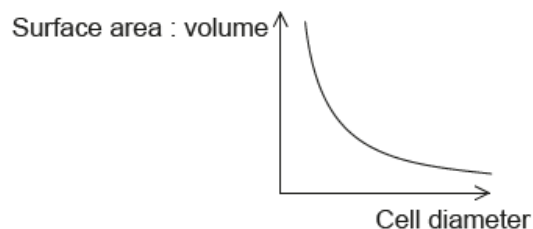
- A. 72
- B. 67
- C. 64
- D. 61

61. Which graph represents the change in cell surface area to volume ratio with increasing cell diameter? [1 mark]

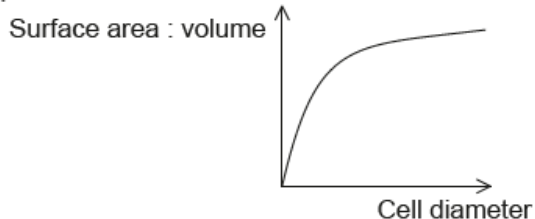
A.



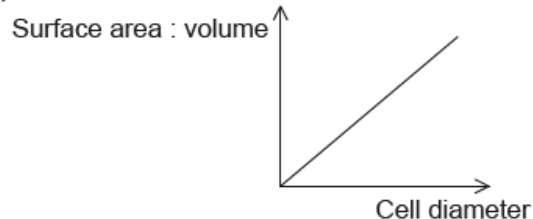
B.



C.



D.



[Source: © International Baccalaureate Organization 2019]

62. The gene that codes for a particular polypeptide includes the base sequence shown. [1 mark]

GAGTACCCT

What is the base sequence of the mRNA molecule which is complementary to this sequence?

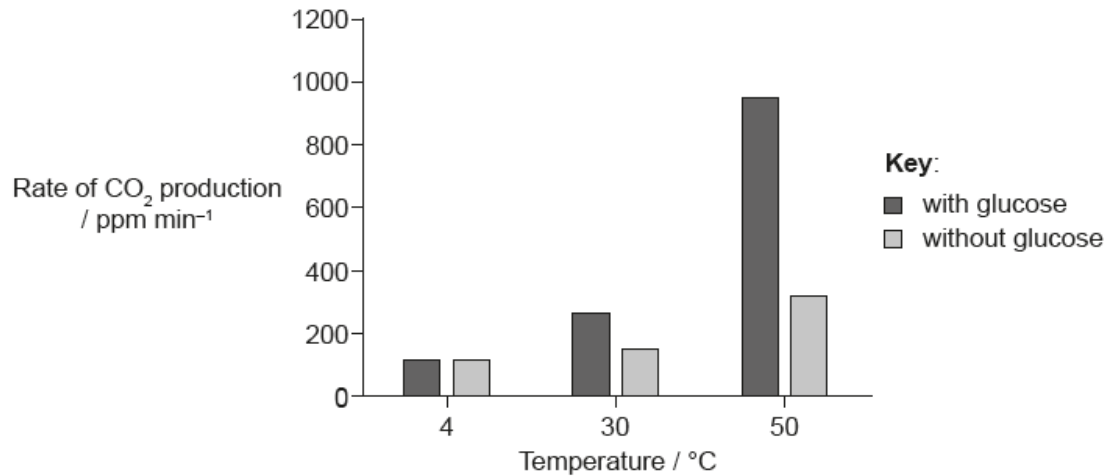
A. GAGTACCCT

B. CTCATGGGA

C. GUGTUCCCT

D. CUCAUGGGA

63. Yeast cells, *Saccharomyces cerevisiae*, were incubated with and without glucose at three different temperatures for a period of four minutes, during which the rate of CO₂ production was measured with a CO₂ sensor. [1 mark]

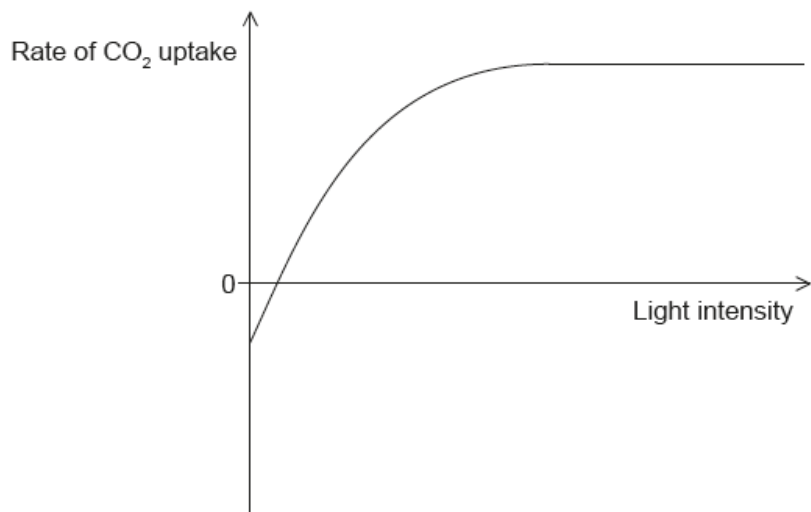


[Source: © International Baccalaureate Organization 2019]

What conclusion can be drawn from the results of this experiment?

- A. Yeast uses lipids rather than glucose in respiration at low temperatures.
- B. Addition of glucose has a greater impact on rates of cell respiration at lower temperatures.
- C. Rates of cell respiration increase with temperature.
- D. More glucose is produced at higher temperatures.

64. The graph shows the effect of increasing light intensity on the rate of CO₂ [1 mark]
uptake by a species of green plant maintained in conditions of constant
temperature and CO₂ concentration.



[Source: © International Baccalaureate Organization 2019]

Which statement is consistent with the graph?

- A. Photosynthesis stops at high light intensity.
- B. Rates of photosynthesis increase with temperature.
- C. Cell respiration leads to net production of CO₂ at low light intensity.
- D. There is a negative correlation between CO₂ uptake and light intensity.

65. The system of sex determination in chimpanzees (*Pan troglodytes*) is the [1 mark]
same as in other mammals. A chimpanzee has 48 chromosomes in the
nuclei of its body cells.

What can be deduced from this information?

- A. The sex of the chimpanzee
- B. The number of genes in each chromosome
- C. Whether non-disjunction has occurred
- D. The number of autosomes in a diploid cell

66. At which stage of meiosis are bivalents formed?

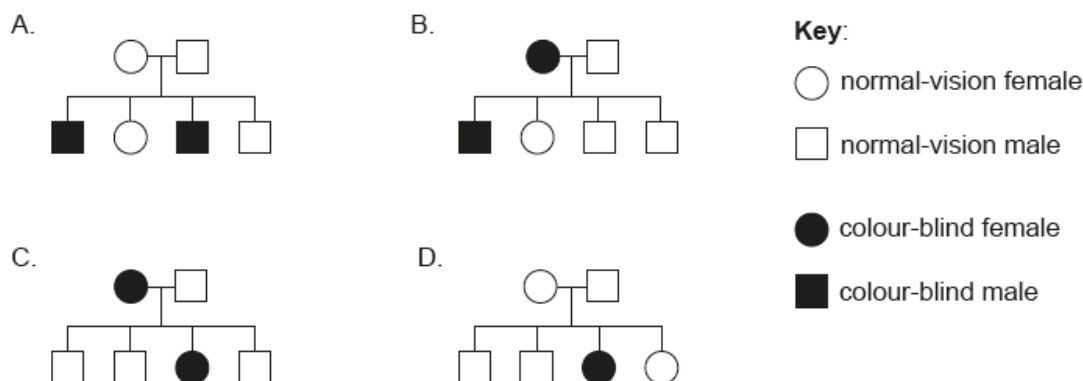
[1 mark]

- A. Interphase
- B. Prophase I
- C. Prophase II
- D. Metaphase II

67. Creeper in chickens is a condition in which the chickens are born with very short legs. The creeper allele (C) is dominant over the normal allele (c). Embryos which are homozygous for the dominant allele fail to develop into viable chickens and die before they hatch. What phenotypic ratio would you expect in the live offspring of a cross between two creeper chickens? [1 mark]

- A. All creeper
- B. 1 creeper; 2 normal
- C. 2 creeper; 1 normal
- D. 3 creeper; 1 normal

68. Which pedigree chart is consistent with the inheritance of red-green colour blindness? [1 mark]



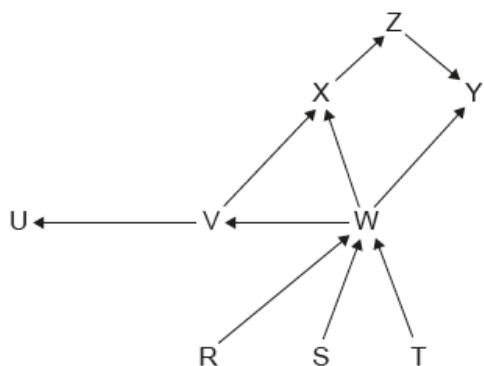
[Source: © International Baccalaureate Organization 2019]

69. Which organism can best be described as a saprotroph? [1 mark]

- A. A fungus that digests its food externally and absorbs the products of digestion
- B. A beetle that feeds by ingesting the dung of other animal species and digesting its food internally
- C. A single-celled eukaryote that is able to photosynthesize and consumes smaller organisms by endocytosis
- D. A giraffe that feeds by ingesting leaves from an acacia tree

70. The diagram shows the food web for an aquatic ecosystem in which letters R–Z represent individual species.

[1 mark]



[Source: © International Baccalaureate Organization 2019]

Which organism is a tertiary consumer?

- A. Organism T
- B. Organism U
- C. Organism W
- D. Organism Y

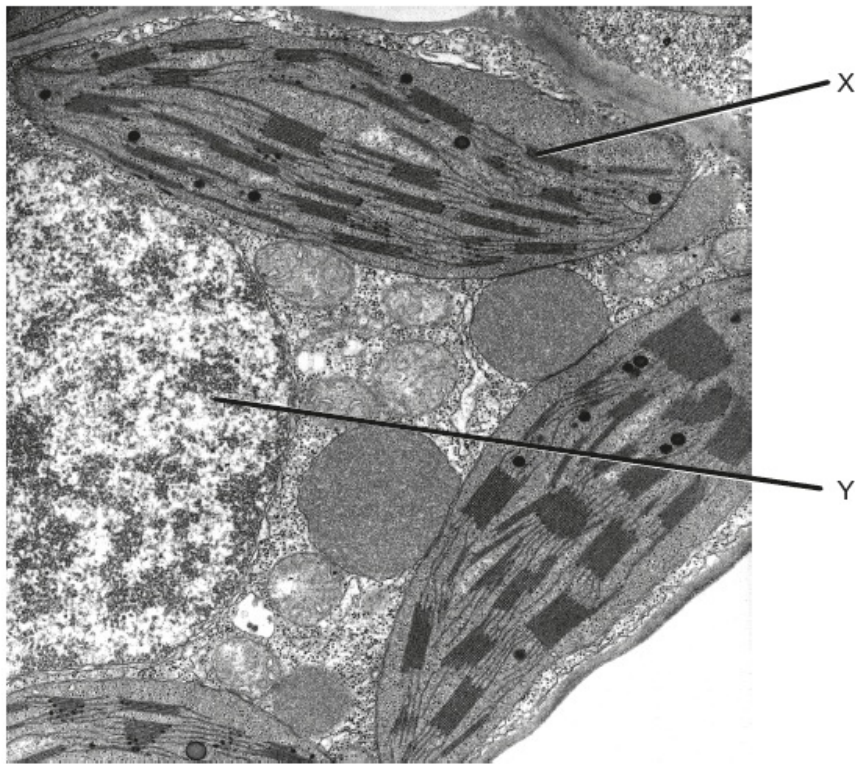
71. Which organisms produce methane in anaerobic environments such as waterlogged soils?

[1 mark]

- A. Archaea
- B. Fungi
- C. Eukaryotes
- D. Eubacteria

72. The image shows an electron micrograph of part of a cell.

[1 mark]



[Source: Dr. Eldon Newcomb – Emeritis Professor at The University of Wisconsin – Madison.]

Which features do the two structures labelled X and Y have in common?

- A. They are surrounded by a double membrane.
- B. They contain 70S ribosomes.
- C. They contain naked DNA.
- D. They are only found in leaf cells.

73. Which are examples of homologous structures?

[1 mark]

- A. The wings of bats and butterflies
- B. The fins of fish and whales
- C. The hindlimbs of frogs and grasshoppers
- D. The forelimbs of primates and penguins

74. Which is an example of natural selection?

[1 mark]

- A. A giraffe stretching its neck to reach higher leaves
- B. A juvenile bird learning to sing
- C. Development of antibiotic resistance in bacteria
- D. Selective breeding of tail-less cats

75. The image shows an organism belonging to the Kingdom Animalia.

[1 mark]



[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

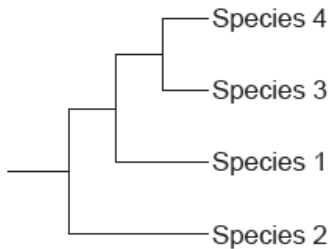
76. The DNA base sequences in a gene coding for a particular protein in four different species are shown. Locations where mutations have occurred resulting in changes to the base sequences are outlined in boxes. [1 mark]

Species 1	TATA	GC	T	A	CGG	ATGGCT
Species 2	TATA	CA	T	C	CGG	TAA GCT
Species 3	TATA	CC	T	C	CGG	TAA GCT
Species 4	TATA	GA	T	C	CGG	TAGGCT

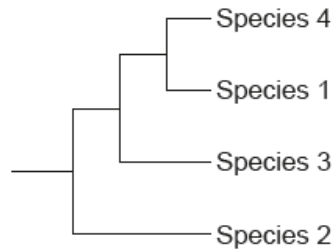
[Source: © International Baccalaureate Organization 2019]

Which cladogram shows the most likely phylogenetic relationship between the four species, based on the data provided?

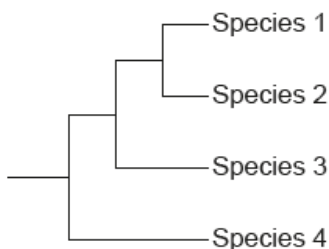
A.



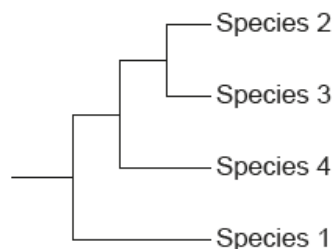
B.



C.



D.



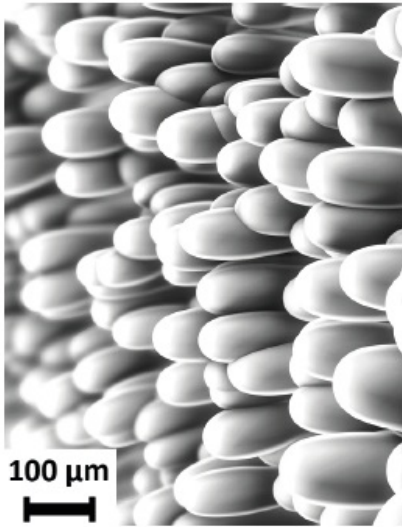
77. Where in the human body is lipase produced?

[1 mark]

- A. Stomach
- B. Pancreas
- C. Gall bladder
- D. Liver

78. What are these structures?

[1 mark]



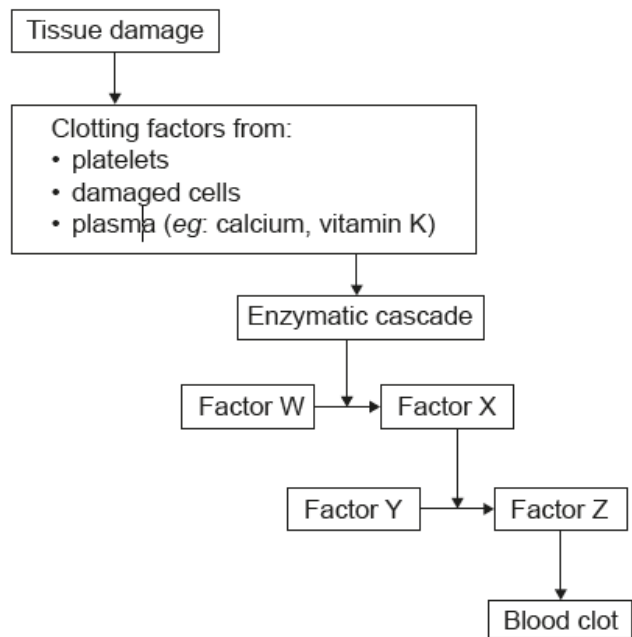
[Source: Burgstedt | Dreamstime.com]

- A. Fatty acids in the small intestine
- B. Bacteria in the large intestine
- C. Villi in the small intestine
- D. Feces egested from the large intestine

79. Which feature of capillaries distinguishes them from arteries and veins? [1 mark]

- A. Narrow diameter
- B. Valves to prevent backflow
- C. Thick muscular walls
- D. Elastic tissue

80. The diagram shows the major events involved in the formation of a blood clot. [1 mark]



[Source: © International Baccalaureate Organization 2019]

What is Factor Y?

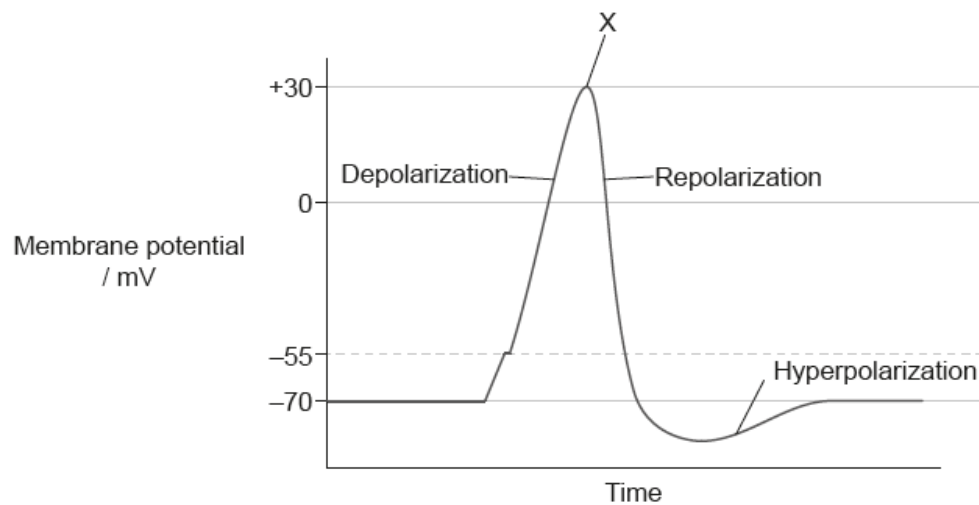
- A. Fibrin
- B. Prothrombin
- C. Fibrinogen
- D. Thrombin

81. Which statement applies to HIV? [1 mark]

- A. HIV infects red blood cells resulting in decreased production of hemoglobin.
- B. HIV can be effectively treated using antibiotics.
- C. HIV can only be transmitted by sexual intercourse.
- D. HIV causes a reduction in production of antibodies.

82. The diagram shows a graph of an action potential.

[1 mark]



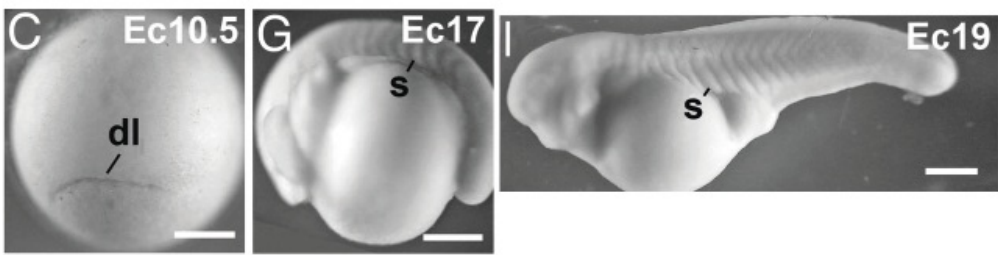
[Source: <https://www.ncbi.nlm.nih.gov/books/NBK538143/figure/article-17127.image.f1/?report=objectonly>
Physiology, Action Potential by Michael H. Grider and Carolyn S. Glaubenslee.
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<https://creativecommons.org/licenses/by/4.0/>]

What is happening at X?

- A. Sodium channels close.
- B. Calcium channels open.
- C. Sodium channels open.
- D. Potassium channels close.

83. The images show a sequence of changes in an organism.

[1 mark]



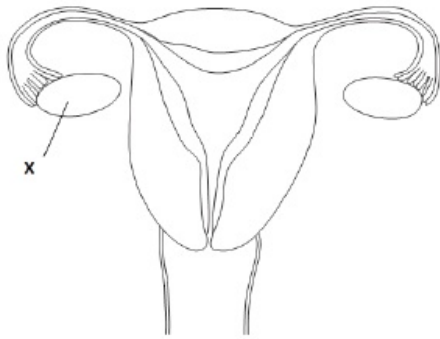
[Source: Copyright (2007) National Academy of Sciences, U.S.A. 'A comparative analysis of frog early development'.
Eugenia M. del Pino, Michael Venegas-Ferrín, Andrés Romero-Carvajal, Paola Montenegro-Larrea, Natalia Sáenz-Ponce, Iván M. Moya, Ingrid Alarcón, Norihiro Sudou, Shinji Yamamoto, and Masanori Taira,
PNAS July 17, 2007 **104** (29) 11882–11888;
<https://doi.org/10.1073/pnas.0705092104>]

What is the change and which process is necessary for it to occur?

	Change occurring	Process necessary
A.	egg production	meiosis
B.	embryonic development	cell differentiation
C.	excretion	exocytosis
D.	feeding	phagocytosis

84. The diagram shows the human female reproductive system.

[1 mark]



[Source: © International Baccalaureate Organization 2019]

What is produced by structure X?

- A. FSH
- B. X chromosomes
- C. Fertilized eggs
- D. Estrogen and progesterone

85. Which process(es) occur(s) by osmosis?

[1 mark]

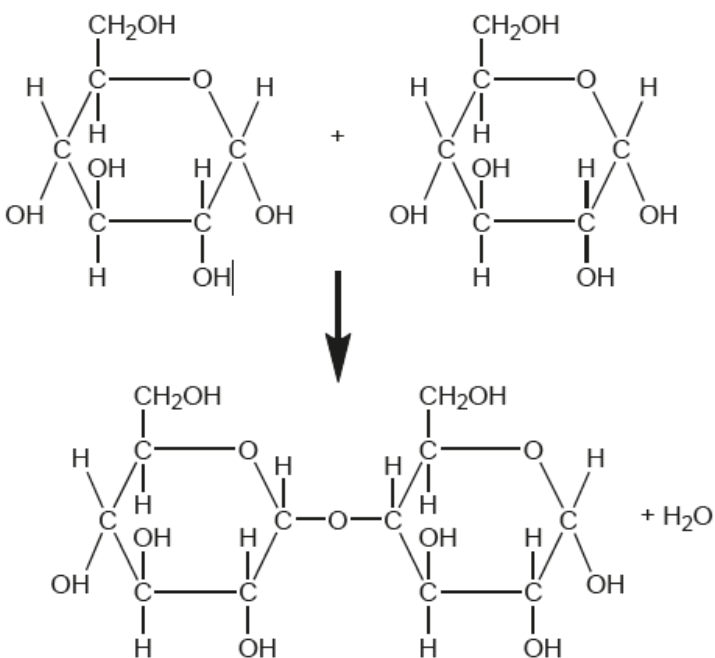
- I. Uptake of water by cells in the wall of the intestine
- II. Loss of water from a plant cell in a hypertonic environment
- III. Evaporation of water from sweat on the skin surface

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

86. The table shows the number of cells in various stages of the cell cycle in four samples of ovarian tissue from different patients. Which tissue sample A, B, C or D has the highest mitotic index? [1 mark]

	Number of cells					
	Interphase	Prophase	Metaphase	Anaphase	Telophase	Total
A.	46	1	1	1	1	50
B.	96	0	1	2	1	100
C.	21	2	0	1	1	25
D.	72	0	1	1	1	75

87. What type of molecule is formed by the chemical reaction shown in the diagram? [1 mark]

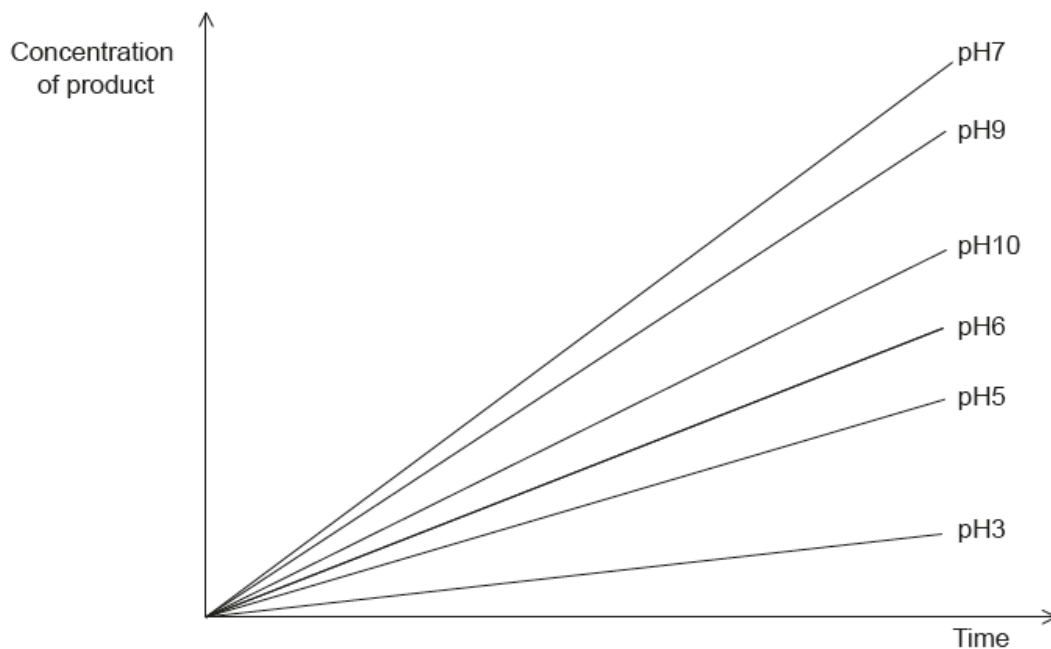


- A. Dipeptide
- B. Disaccharide
- C. Diglyceride
- D. Cellulose

88. Which substance must be transported in the blood by lipoprotein complexes? [1 mark]
- A. Cholesterol
 - B. Oxygen
 - C. Sodium chloride
 - D. Amino acids

89. What is found in insulin molecules? [1 mark]
- A. Phosphates
 - B. Nucleotides
 - C. Peptide bonds
 - D. Glycerol

90. The graph shows the results of an investigation into the activity of turnip peroxidase. The accumulation of the product of the reaction catalysed by the enzyme is shown at different pH values. [1 mark]



[Source: © International Baccalaureate Organization 2019]

Based on the data in the graph, what is most probably the optimum pH for turnip peroxidase?

- A. Between 3 and 5
- B. Between 10 and 11
- C. Between 7 and 8
- D. Between 9 and 10

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