Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Higher level
Paper 1

22 October 2024

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

1 hour

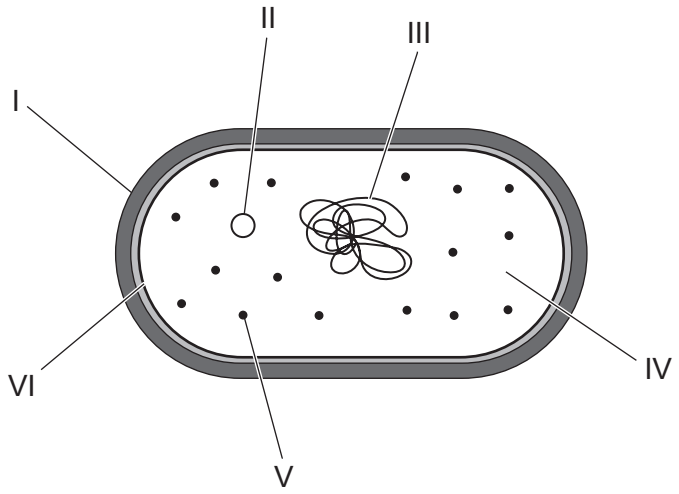
Instructions to candidates

- 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 **[40 marks]**.

8824 – 9500

20 pages

1. The diagram shows a prokaryotic cell.



Which two structures are correctly identified?

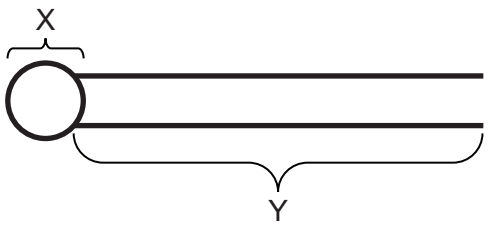
A. I is the cell wall and II is a vesicle.

B. III is a chromosome and IV is the matrix.

C. V is a ribosome and VI is the plasma membrane.

D. III is the nucleus and V is a vesicle.

2. The diagram shows a phospholipid molecule.



What are properties of X and Y?

	X	**Y**
A.	hydrophilic	negatively charged
B.	hydrophilic	non-polar
C.	hydrophobic	non-polar
D.	hydrophobic	negatively charged

3. Cells use a variety of methods to move particles across membranes. What is a similarity between facilitated diffusion and active transport?

A. Both are carried out by proteins in the membrane.

B. Both move particles against the concentration gradient.

C. Both use ATP.

D. Both move non-polar ions across the membrane.

4. Leaf cells in spinach (*Spinacia oleracea*) have ribosomes in their cytoplasm with a relative molecular mass of 3 847 000 and smaller ribosomes inside their chloroplasts with a relative molecular mass of 2 448 000. What is an explanation for spinach leaf cells having ribosomes of two different sizes?

A. The chloroplasts of plant cells evolved from a photosynthetic prokaryote.

B. Proteins inside chloroplasts are all smaller than proteins in the cytoplasm.

C. Ribosomes in the cytoplasm are attached to endoplasmic reticulum, whereas ribosomes in chloroplasts are free.

D. Ribosomes in the cytoplasm synthesize proteins, whereas ribosomes in chloroplasts absorb light.

5. Which processes occur during the development of secondary tumours?

I. Cytokinesis

II. Metastasis

III. Mitosis

A. I and II only

B. II and III only

C. I and III only

D. I, II and III

6. Insulin is a protein. In human insulin, there are a total of 51 amino acids, in two polypeptides. How many peptide bonds are there in a molecule of human insulin?

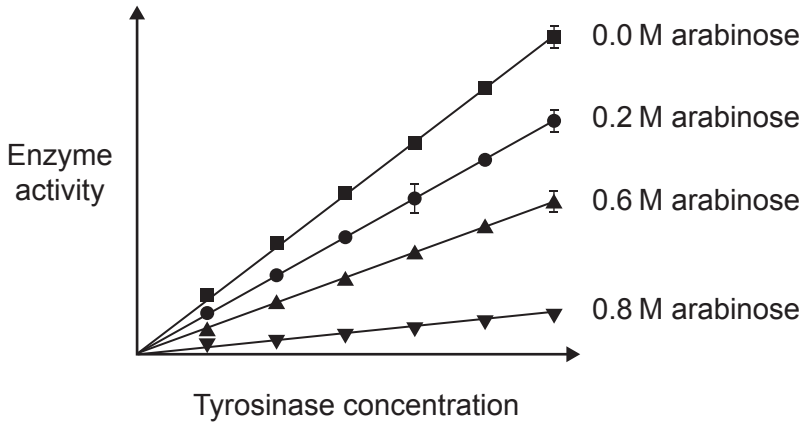
A. 48

B. 49

C. 50

D. 51

7. The graph shows the activity of the enzyme tyrosinase at different concentrations of tyrosinase and arabinose.



Which hypothesis is consistent with the data in the graph?

A. Arabinose is the substrate for tyrosinase.

B. Arabinose and tyrosine are the substrates for tyrosinase.

C. Arabinose prevents binding of the substrate to the active site of tyrosinase.

D. Arabinose concentration is negatively correlated with tyrosinase concentration.

8. Which of the following complementary base pairs is/are found in a DNA double helix?

I. Cytosine – guanine

II. Thymine – adenine

III. Adenine – uracil

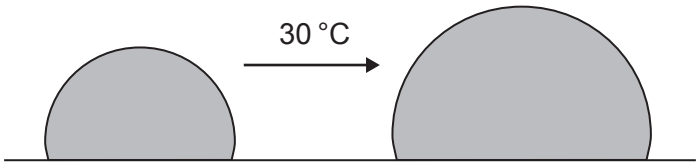
A. I only

B. I and II only

C. II and III only

D. I, II and III

9. Bread dough is made by mixing flour, water and yeast. If the dough is then kept at about 30 °C, it expands.



What is the main reason for choosing this temperature?

A. Carbon dioxide expands at this temperature.

B. This is the optimum temperature for the enzymes used in aerobic cell respiration.

C. Lactate produced by anaerobic cell respiration causes the release of carbon dioxide at this temperature.

D. At this temperature, yeast produces carbon dioxide rapidly by anaerobic cell respiration.

10. How is a new allele produced?

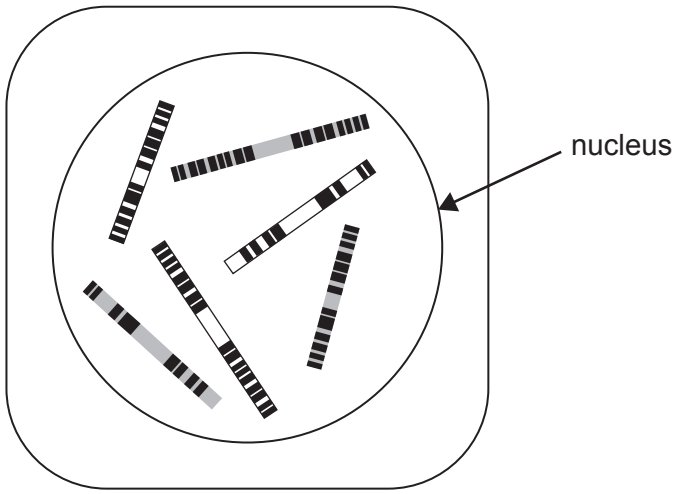
A. Cloning

B. Mutation

C. Differentiation

D. Natural selection

11. What type of cell is represented in the diagram?



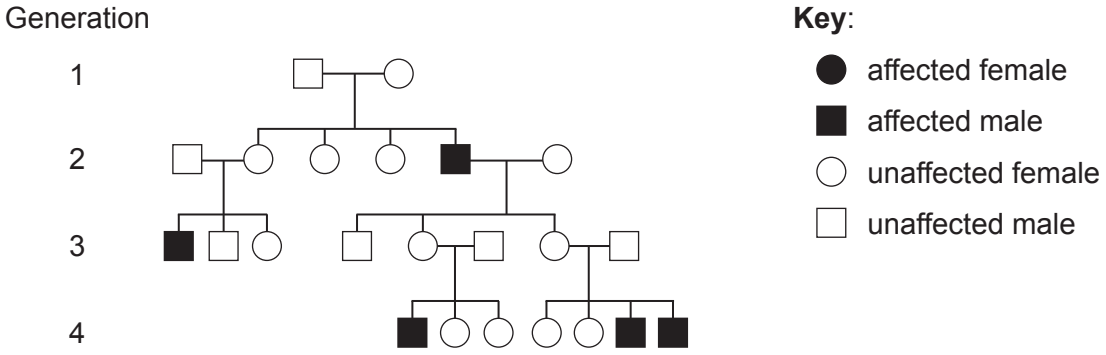
A. Haploid gamete

B. Haploid somatic cell

C. Diploid gamete

D. Diploid somatic cell

12. The pedigree chart shows the incidence of Becker muscular dystrophy, a sex-linked condition.



What conclusion can be drawn?

A. The parents in the first generation are both carriers of the allele for Becker muscular dystrophy.

B. People with Becker muscular dystrophy die before they are old enough to have children.

C. Any of the females in the fourth generation could be carriers.

D. The chance of daughters inheriting Becker muscular dystrophy is 1 in 4.

13. What causes DNA to move during gel electrophoresis?

A. DNA is negatively charged, so it is attracted towards the positive electrode.

B. DNA is positively charged, so it is repelled by the positive electrode.

C. DNA is negatively charged, so it is attracted towards positive charges in the gel.

D. DNA is positively charged, so it is attracted towards negative charges in the gel.

14. What is the difference between a detritivore and a saprotroph?

A. Detritivores are animals, and saprotrophs are plants.

B. Detritivores feed on dead organic matter, and saprotrophs feed on living organisms.

C. Detritivores digest food internally, and saprotrophs digest it externally.

D. Detritivores are autotrophic, and saprotrophs are heterotrophic.

15. Which of these energy conversions is/are possible in living organisms?

I. Light to chemical
II. Chemical to heat
III. Heat to light

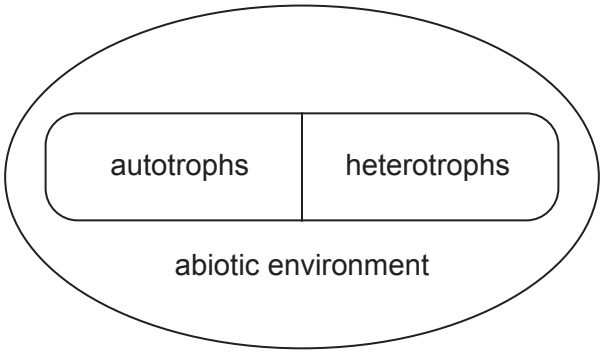
A. I only

B. I and II only

C. II and III only

D. I, II and III

16. What is represented by everything inside the oval area in the diagram?



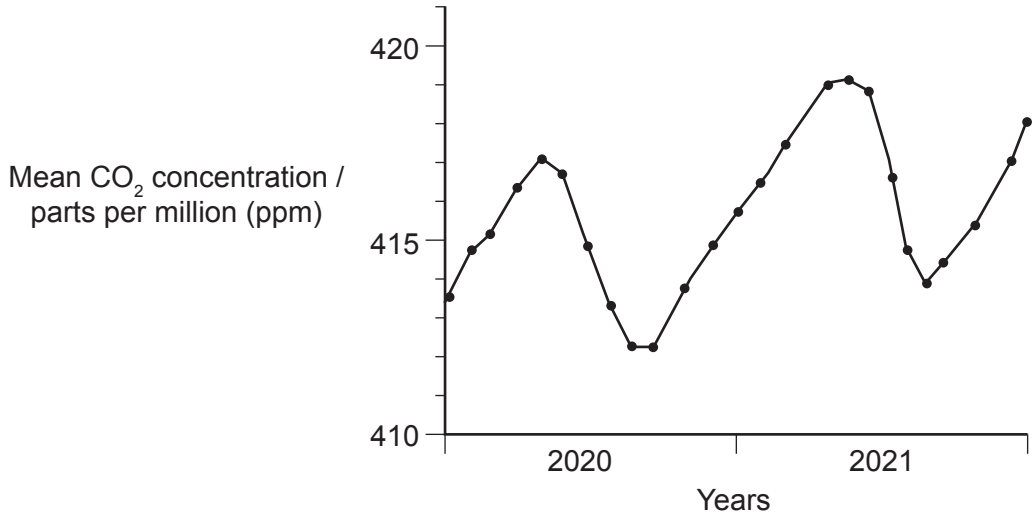
A. A community

B. An ecosystem

C. A food web

D. A habitat

17. The graph shows monthly mean atmospheric carbon dioxide concentrations measured at Mauna Loa Observatory, Hawaii in 2020 and 2021.



Which processes contribute to changes in monthly mean atmospheric carbon dioxide concentrations?

A. Combustion of coal, forest fires, ozone depletion

B. Photosynthesis, respiration, burning of fossil fuels

C. Emissions of carbon dioxide, methane and nitrogen oxides

D. Peat formation, drainage of wetlands, loss of coral reefs

18. What is evolution?

A. Change in the heritable characteristics of a species

B. Change in the phenotype of a species

C. Speciation due to geographical separation

D. Survival of the fittest

19. In a natural population, what is a feature of individuals that are better adapted?

A. They start to produce offspring at a younger age than less well adapted individuals.

B. They produce identical offspring by cloning that are also better adapted.

C. They tend to produce more offspring during their lifetime than less well adapted individuals.

D. They do not produce more offspring than the environment can support.

20. *Aurelia aurita* are multicellular organisms that have stinging cells and a single opening to their digestive system.

To which phylum does *Aurelia aurita* belong?

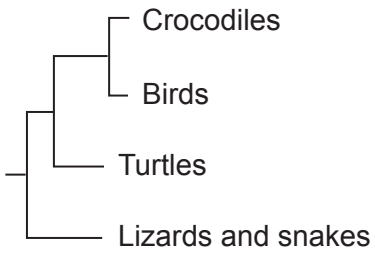
A. Animals

B. Cnidaria

C. Mollusca

D. Porifera

21. The cladogram shows four clades.



What conclusion can be drawn from the cladogram?

A. Crocodiles are more closely related to birds than to other reptiles.

B. Birds are not reptiles.

C. Turtles are more closely related to lizards than to crocodiles.

D. Snakes evolved from lizards.

22. In arteries, what are the functions of the lumen and the elastic fibres in the wall?

	Lumen	**Elastic fibres**
A.	Allows unobstructed flow of blood	Prevent excessively high blood pressure when the semilunar valves in the heart are open
B.	Allows unobstructed flow of blood	Maintain blood pressure when the semilunar valves in the heart are closed
C.	Regulates rate of blood flow	Increase blood flow to organs that are active
D.	Regulates rate of blood flow	Decrease blood flow to organs that are inactive

23. What causes blood clots to form?

A. Adhesion between blood cells

B. Cohesion between blood cells and the rough surfaces of a cut

C. Secretion of fibrinogen by platelets

D. Trapping of blood cells in fibrin

24. The graph shows the incidence of mouth cancer in men in Ahmedabad, India in 1985 and 2007.

Removed for copyright reasons

What is a possible cause of the change between 1985 and 2007?

A. Improvements to cancer screening programmes

B. Longer life expectancy

C. Increases in deaths due to other causes

D. Health advice to avoid smoking

25. What is the sequence of events during an action potential?

A. Depolarization → opening of Na^+ channels → repolarization → opening of K^+ channels

B. Opening of Na^+ channels → depolarization → opening of K^+ channels → repolarization

C. Opening of Na^+ channels → repolarization → opening of K^+ channels → depolarization

D. Repolarization → opening of Na^+ channels → depolarization → opening of K^+ channels

26. What is a difference between the leading and lagging strands in DNA replication?

A. Fewer Okazaki fragments are produced on the leading strand.

B. Exons are only produced on the lagging strand.

C. More RNA primers are assembled on the lagging strand.

D. DNA nucleotides are linked 5' to 3' on the leading strand and 3' to 5' on the lagging strand.

27. Which regions of DNA do not code for proteins but have other important functions?

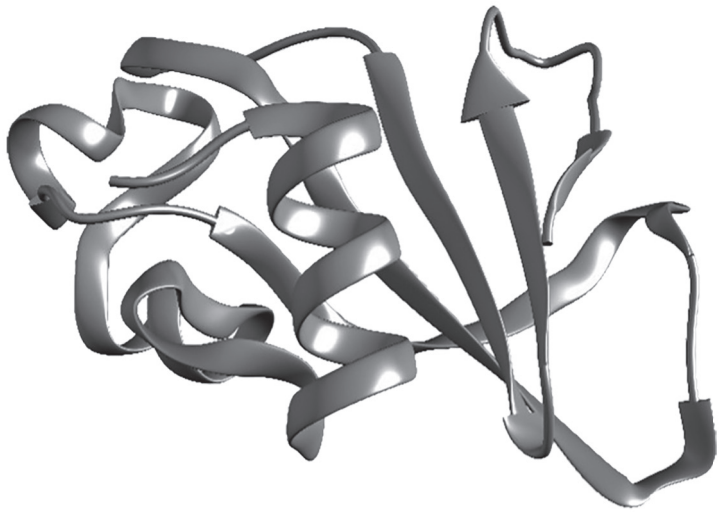
A. Promoters, telomeres, DNA coding for tRNA

B. Promoters, nucleosomes, introns

C. Introns, nucleosomes, tandem repeats

D. Exons, tandem repeats, DNA coding for tRNA

28. The nuclease enzyme shown in the diagram is from the bacterium *Bacillus amyloliquefaciens*. It consists of 110 amino acids.



Which levels of protein structure does this nuclease enzyme have?

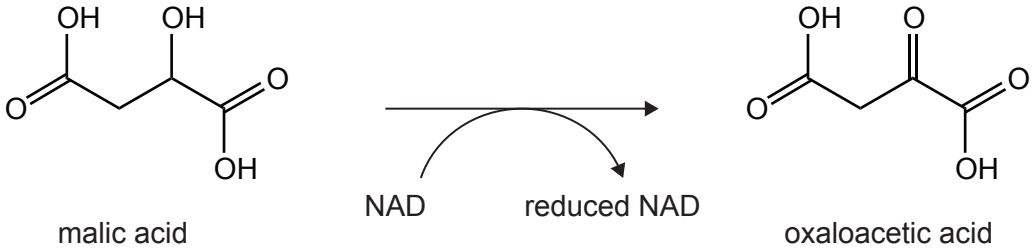
A. Primary, secondary and tertiary only

B. Primary, secondary and quaternary only

C. Primary, tertiary and quaternary only

D. Primary, secondary, tertiary and quaternary

29. The diagram shows a reaction that occurs during aerobic cell respiration.



Which type of chemical change happens to malic acid?

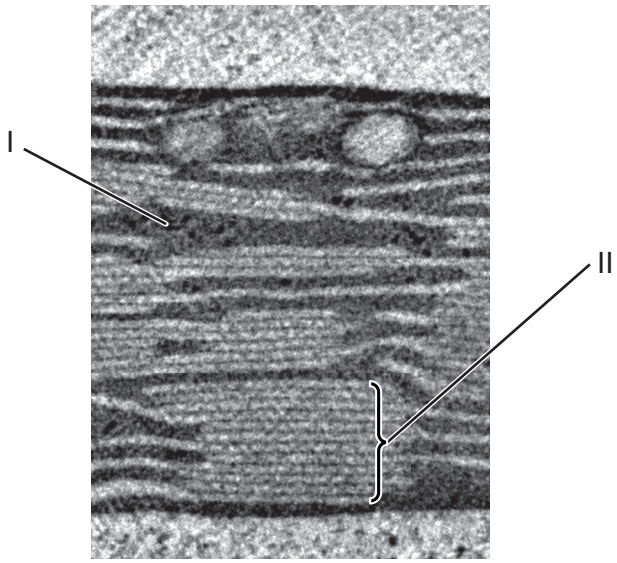
A. Carboxylation

B. Decarboxylation

C. Oxidation

D. Reduction

30. The image shows part of a chloroplast and was produced by electron tomography.



What is the name of I and which reactions of photosynthesis occur in II?

	Name of I	Reactions in II
A.	Matrix	Light-independent reactions
B.	Stroma	Light-independent reactions
C.	Matrix	Light-dependent reactions
D.	Stroma	Light-dependent reactions

31. Cellulose is the main component of leaf cell walls. What are properties of cellulose?

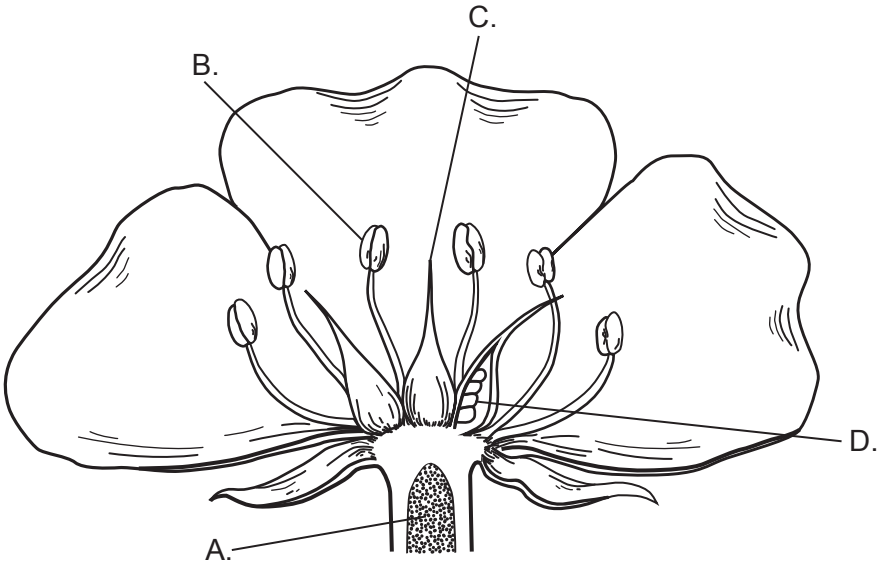
A. Cellulose is insoluble in water, but water adheres to it.

B. Cellulose is insoluble in water, and water does not adhere to it.

C. Cellulose is soluble in water, but water does not adhere to it.

D. Cellulose is soluble in water, and water adheres to it.

32. The diagram shows a half-view of a *Filipendula* flower. Where does fertilization occur in the flower?



33. When do sister chromatids separate during meiosis?

A. Anaphase I

B. Metaphase I

C. Anaphase II

D. Metaphase II

34. Heterozygous spotted short-haired rabbits were crossed with homozygous unspotted long-haired rabbits. The expected ratio of phenotypes in the offspring was 1:1:1:1. The table shows the observed numbers of offspring.

spotted short	spotted long	unspotted short	unspotted long
157	26	23	144

The calculated value of chi-squared is 184.7. At the 0.05 level of significance, the critical value is 7.815. What conclusion is drawn?

A. The genes for coat colour and length assort independently.

B. The calculated value for chi-squared is not in the critical region.

C. The null hypothesis is accepted.

D. There is significant evidence that the ratio is not 1:1:1:1.

35. What is a possible cause of abrupt speciation?

A. Polygenic inheritance

B. Polymorphism

C. Polyploidy

D. Polyspermy

36. What is contained in vaccines?

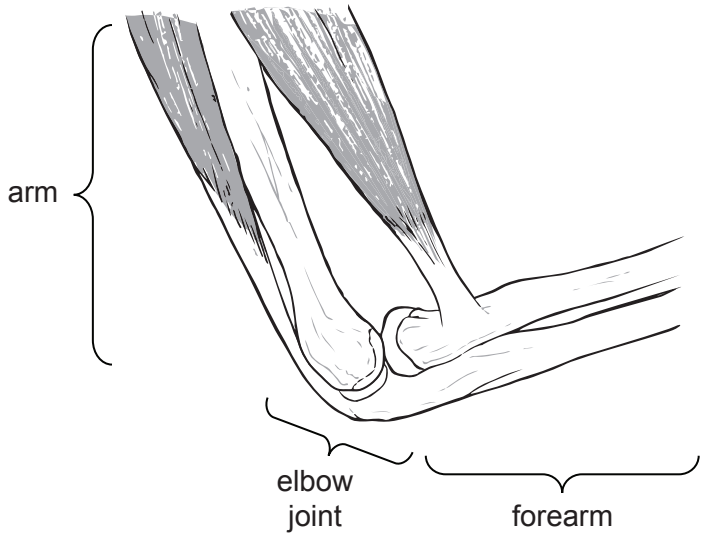
A. Antigens or RNA coding for antigens

B. Specific or non-specific immunoglobulins

C. Plasma cells or memory cells

D. Antibodies

37. The diagram shows the structure of the human elbow joint and associated bones and muscles.



From the position shown in the diagram, how does the downward movement of the forearm take place?

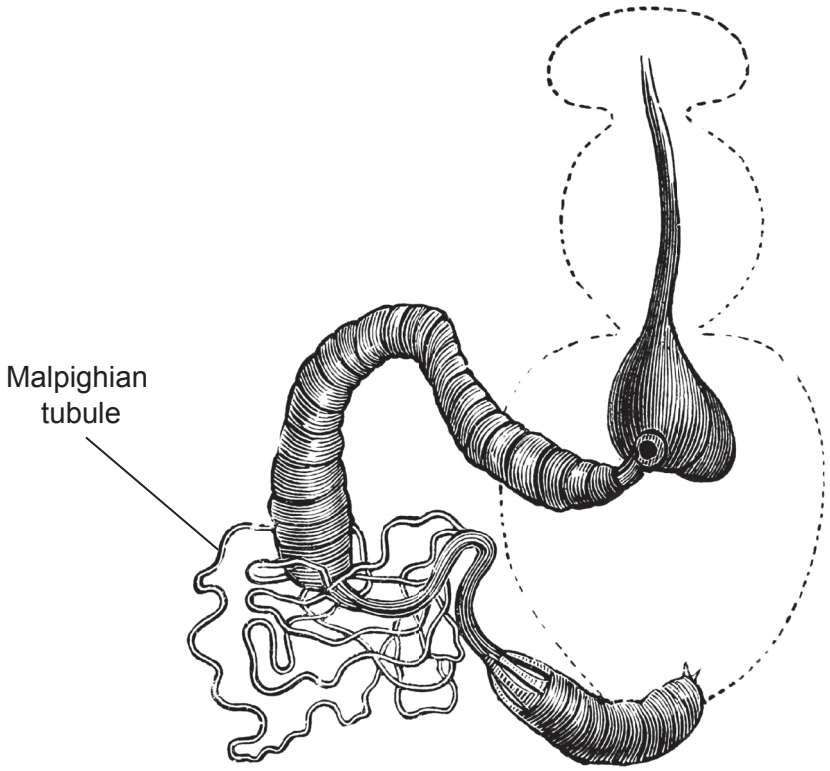
A. The biceps contracts to pull down the radius.

B. The triceps contracts to pull down the ulna.

C. Arm muscles relax to lower the forearm.

D. Arm muscles do opposite actions to lower the humerus.

38. The drawing shows the gut of a honeybee with the Malpighian tubule system labelled.



What are the functions of the Malpighian tubule system?

I. Digestion
II. Excretion
III. Osmoregulation

A. I and II only

B. II and III only

C. I and III only

D. I, II and III

39. What is a difference between spermatogenesis and oogenesis in humans?

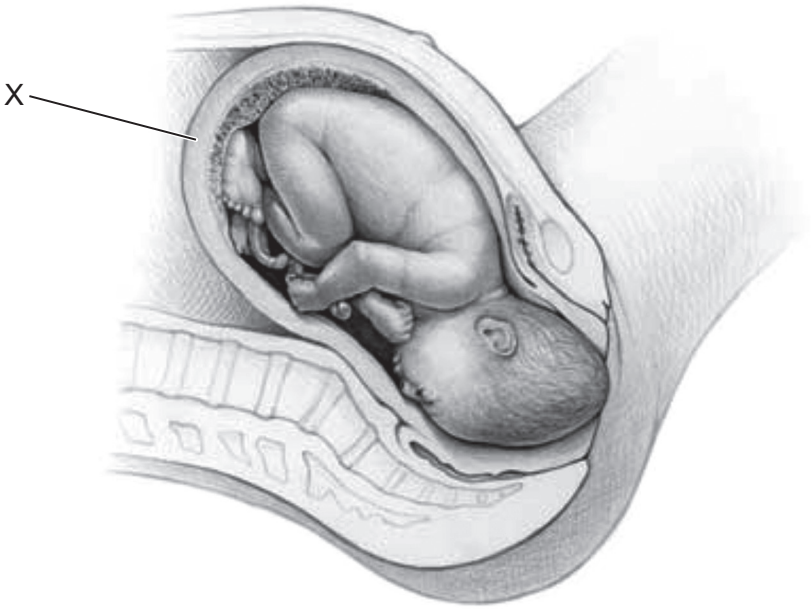
A. Spermatogenesis takes longer than oogenesis.

B. Spermatogenesis requires two divisions of meiosis, but oogenesis requires only one.

C. Spermatogenesis is stimulated by a steroid hormone, but oogenesis is not.

D. Spermatogenesis takes place at a lower temperature than oogenesis.

40. The diagram shows the position of the fetus at childbirth.



Which hormone stimulates contractions of muscle cells in the region labelled X?

A. Estrogen

B. Oxytocin

C. Progesterone

D. Thyroxin

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References:

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