Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Higher level
Paper 1

Wednesday 20 November 2019 (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]**.

8819 – 6001

1. Stargardt's disease, a genetic disorder that causes vision loss, is being treated using retinal cells derived from human embryonic stem cells. Why are embryonic stem cells used?

A. They are already specialized for this function.

B. They are able to differentiate into the required cell type.

C. They retain stem cell properties after specialization.

D. There are no ethical issues concerning their use.

2. By which process do potassium ions move through potassium channels in axons?

A. Active transport

B. Exocytosis

C. Facilitated diffusion

D. Simple diffusion

3. Which statement provides evidence for endosymbiosis?

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.

4. Students examined micrographs and counted cells in the different stages 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?

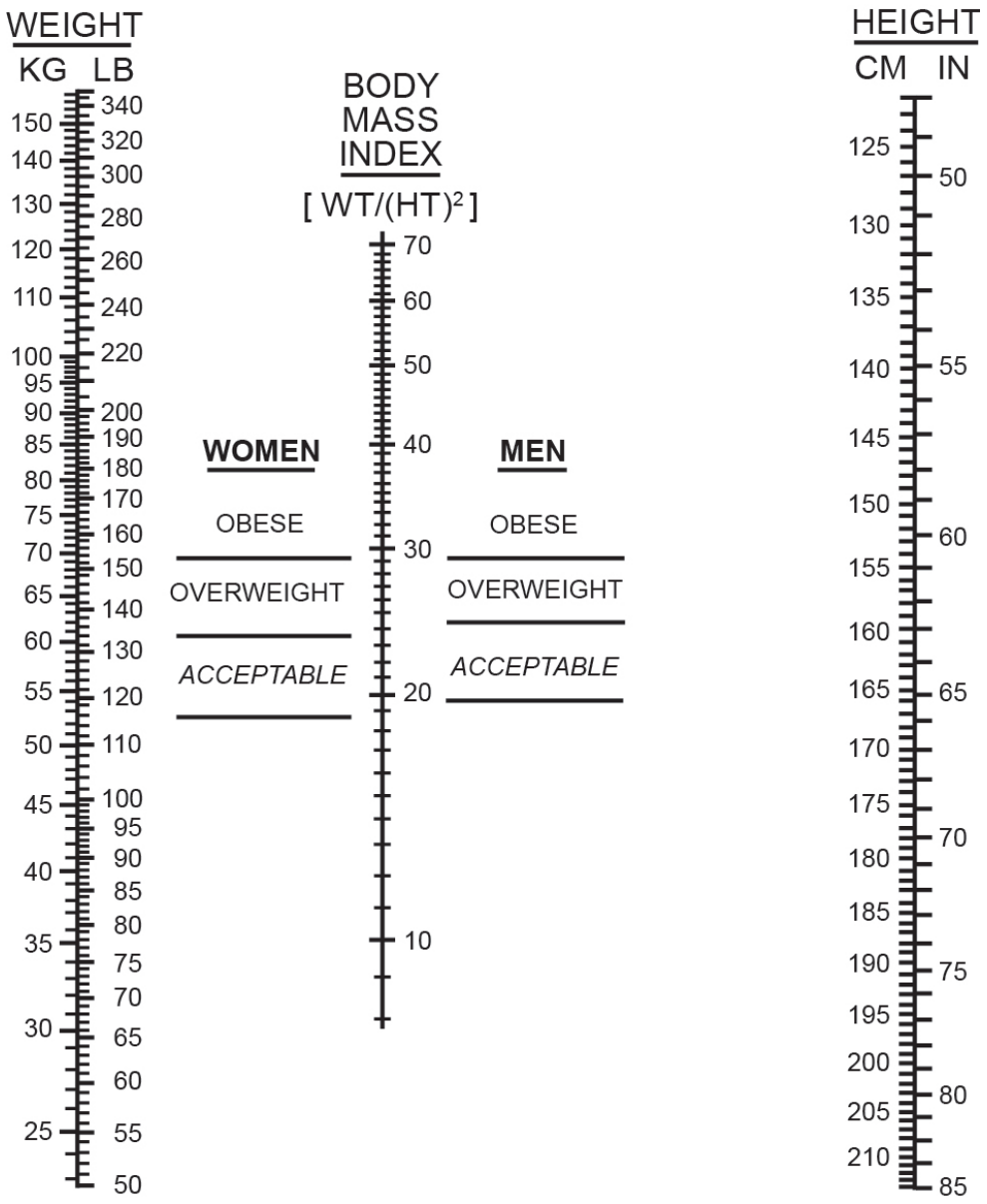
A. 0.2

B. 0.4

C. 0.6

D. 0.7

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



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

A. 72

B. 67

C. 64

D. 61

6. What is a proteome?

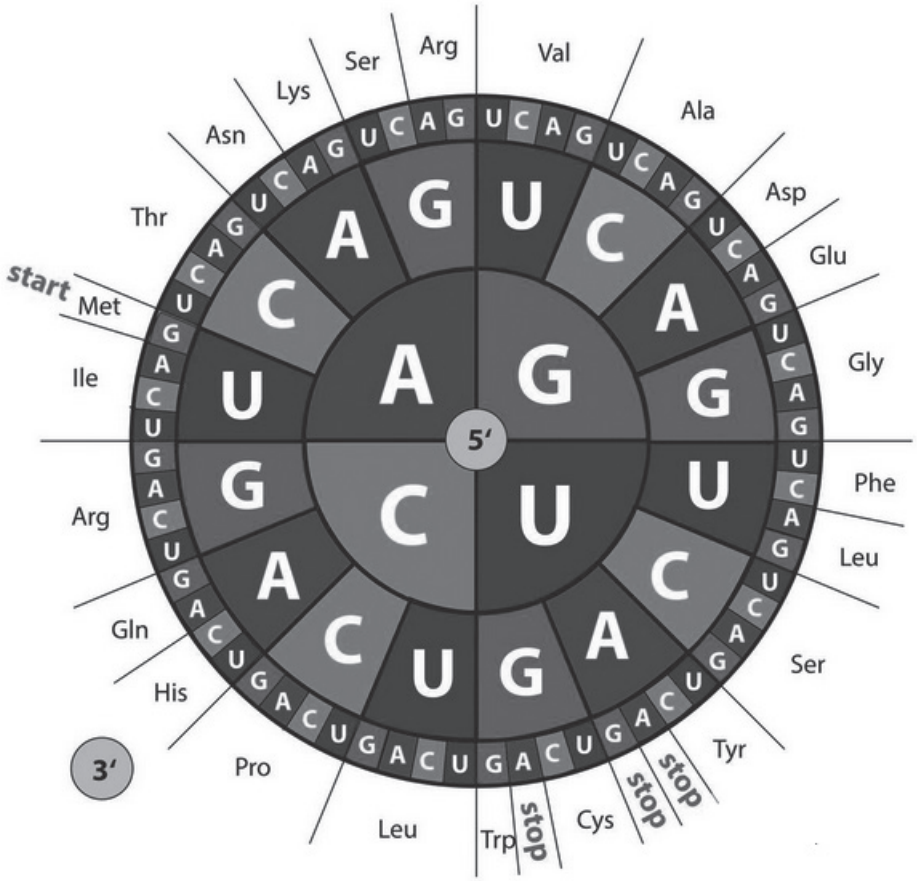
A. The genes that code for all the proteins in the ribosome

B. The group of proteins that generate a proton gradient in mitochondria

C. The entire genome of a prokaryote

D. The entire set of proteins expressed by an organism at a certain time

7. The diagram shows mRNA codons.



[Source: elementix / Alamy Stock Photo]

The mRNA sequence UGGAACGUA codes for what amino acid sequence?

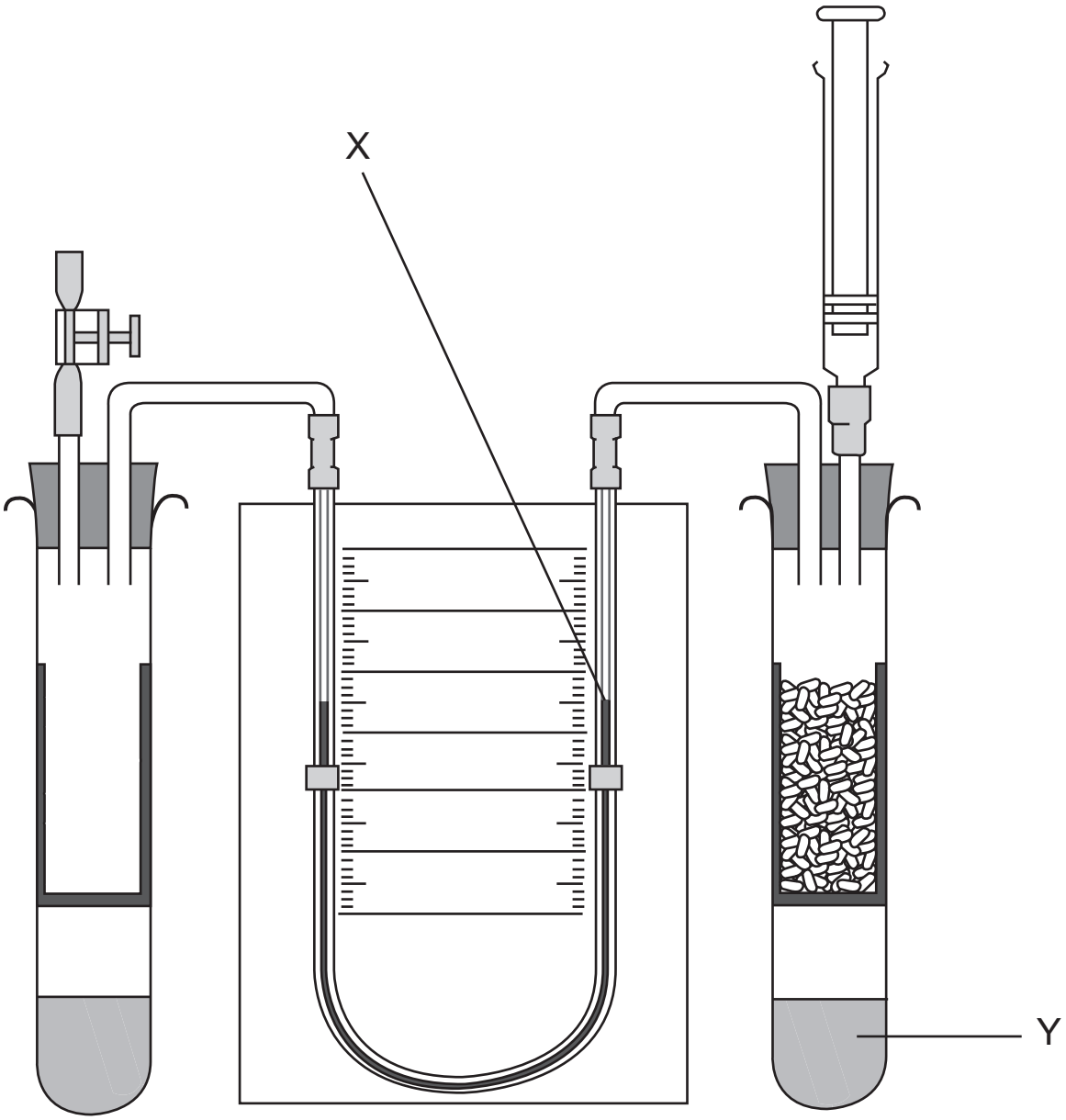
A. Glycine-Glutamine-Methionine

B. Methionine-Glutamine-Glycine

C. Threonine-Valine-Histidine

D. Tryptophan-Asparagine-Valine

8. The diagram shows a respirometer used to measure respiration rate in germinating seeds.



[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

9. Some photosynthesis experiments require water that is free of carbon dioxide. What is the best way to produce this?

A. Boiling and cooling water

B. Adding hydrogencarbonate solution to water

C. Adding alkali to water

D. Immobilizing carbon dioxide on alginate beads

10. Which statements are characteristics of alleles?

I. Alleles differ significantly in number of base pairs.
II. Alleles are specific forms of a gene.
III. New alleles are formed by mutation.

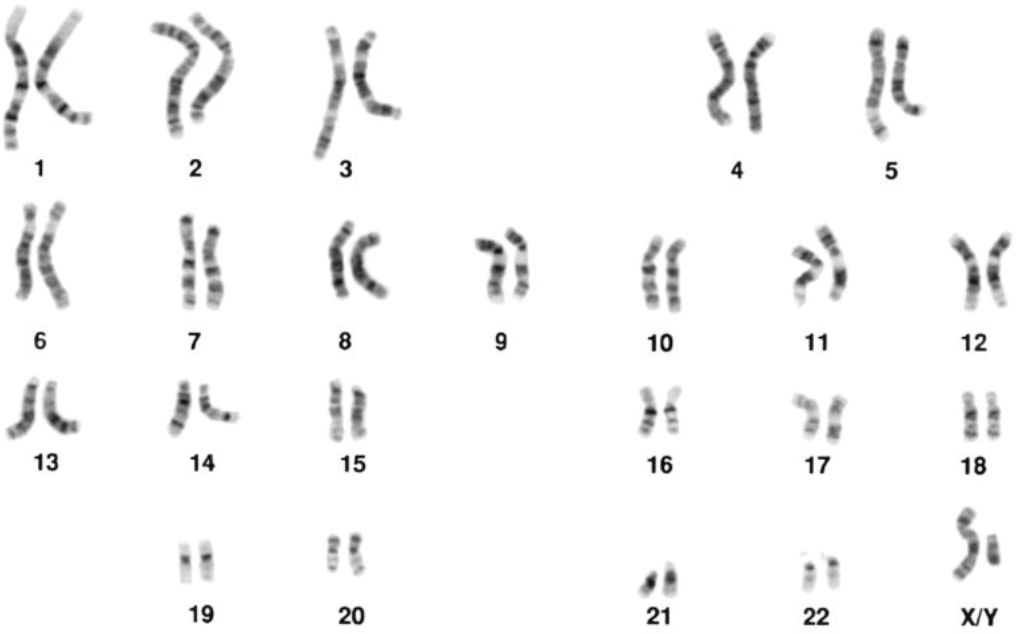
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

11. A pregnant woman had fetal cells removed by chorionic villus sampling and tested. The following karyogram was produced.



[Source: Mediscan / Alamy Stock Photo]

What does this show?

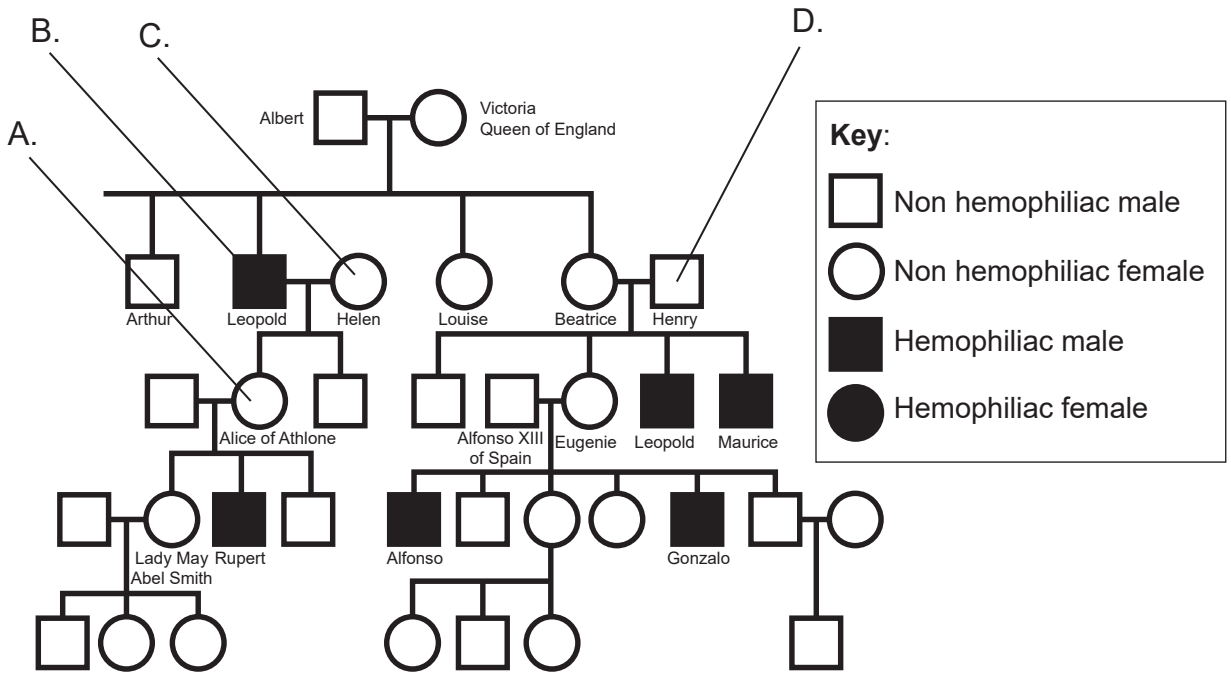
A. The child is female with Down syndrome.

B. The child is female without Down syndrome.

C. The child is male with Down syndrome.

D. The child is male without Down syndrome.

12. The pedigree chart shows the inheritance of hemophilia in some of the descendants of Queen Victoria. Which letter points to a family member certain to be heterozygous?



[Source: © International Baccalaureate Organization 2019]

13. 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?

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

14. Hummingbirds eat flower nectar and small insects. To which nutritional group do they belong?

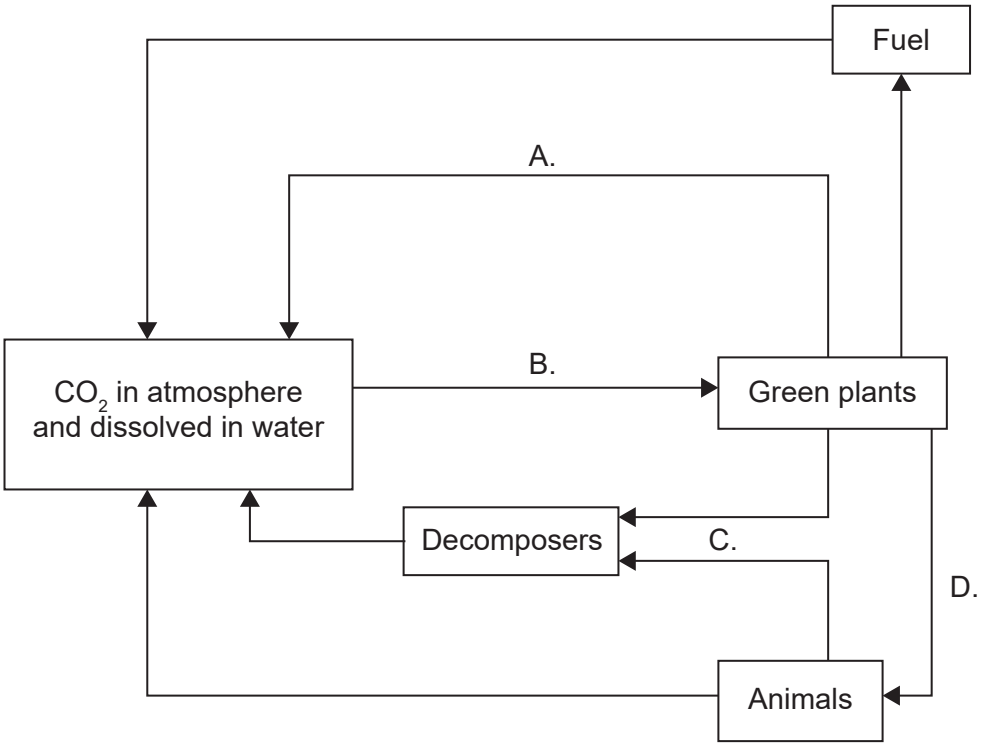
A. Autotrophs

B. Consumers

C. Detritivores

D. Saprotrophs

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



[Source: © International Baccalaureate Organization 2019]

16. What material is formed when organic matter is not fully decomposed in acidic waterlogged soils?

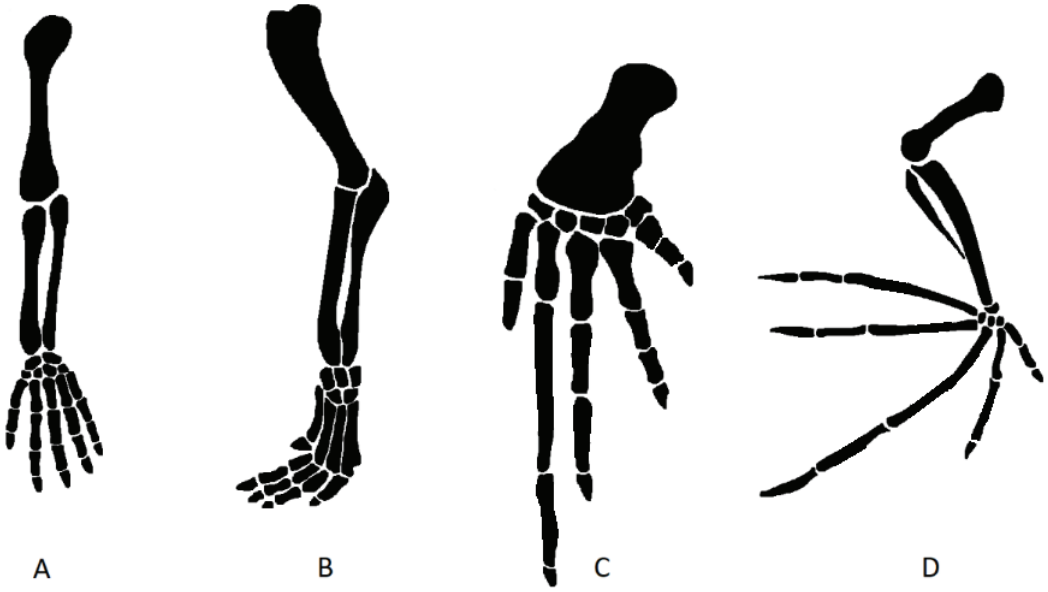
A. Coal

B. Hydrogen

C. Oil

D. Peat

17. Which pentadactyl limb is adapted for flight?



[Source: adapted from Volkov Vladislav Petrovich, 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]

18. An organism has the following characteristics:
- single opening for ingestion and egestion
- radial symmetry
- tentacles with stinging cells.

In what phylum would it most likely be classified?

A. Annelida

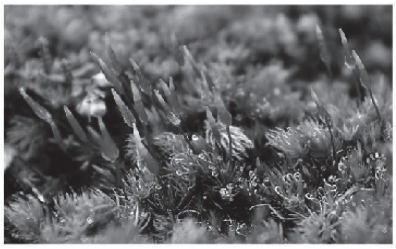
B. Cnidaria

C. Platyhelminthes

D. Porifera

19. Which organism is a member of the filicinophyta? (*Note that these are not drawn to scale*)

A



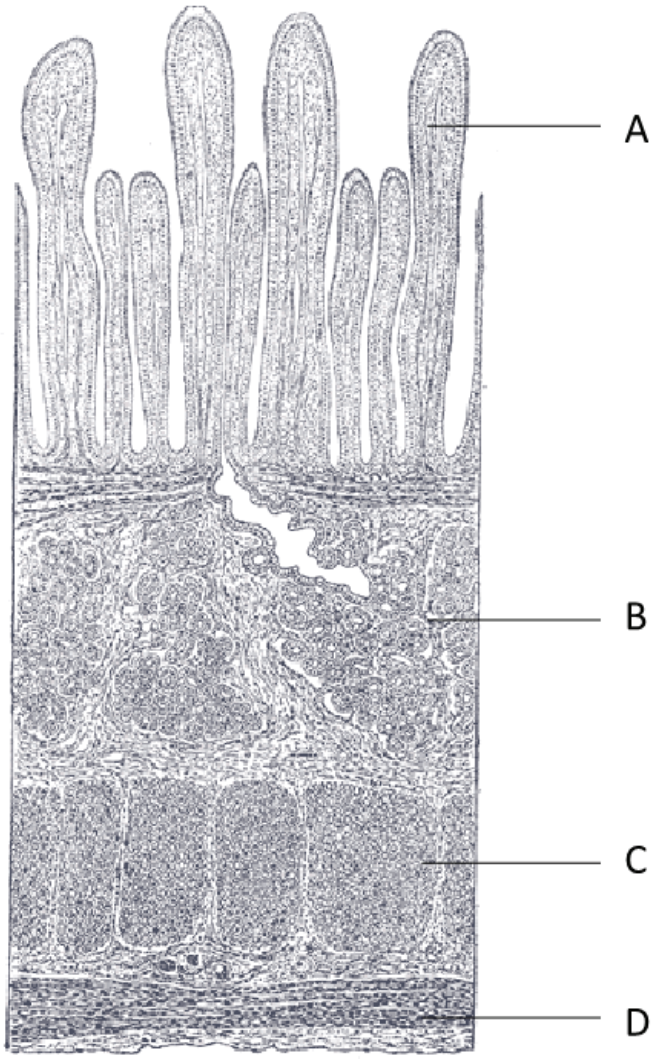
B

C

D

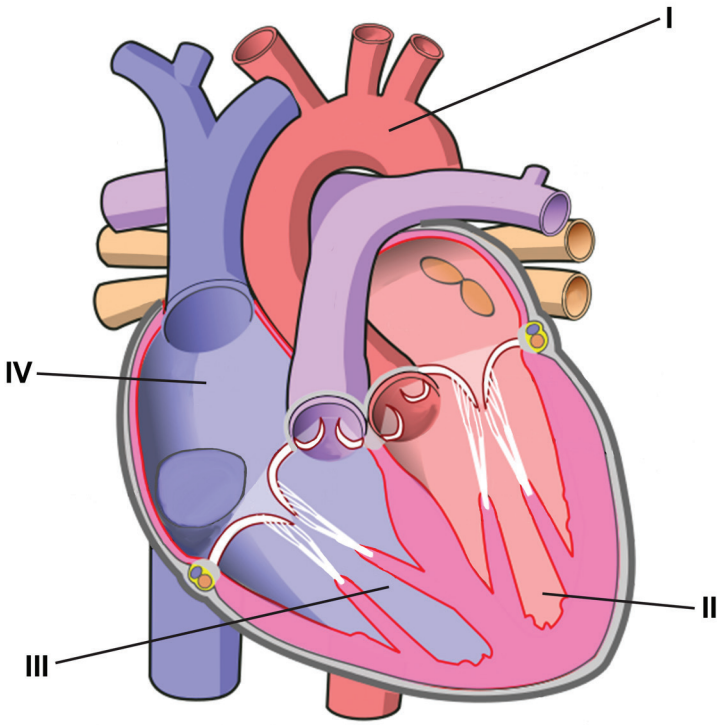
[Source: A: Sanjay ach/https://creativecommons.org/licenses/by-sa/3.0/deed.en
B: Vaelta/https://creativecommons.org/licenses/by-sa/3.0/deed.en
C: Andrey Zharkikh/https://creativecommons.org/licenses/by/2.0/deed.en
D: courtesy of Caroline Needham]

20. The micrograph is of a longitudinal section through the small intestine. Which letter represents the circular muscle layer?



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

21. The diagram shows a human heart.



[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]

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

22. How does HIV affect the immune system adversely?

A. Progressive reduction in number of active lymphocytes

B. Continuous overproduction of antibodies

C. Rapid production of clone of plasma cells

D. Immediate development of AIDS

23. Which factors could cause emphysema?

I. Air pollution
II. Genetic predisposition
III. Tobacco smoke

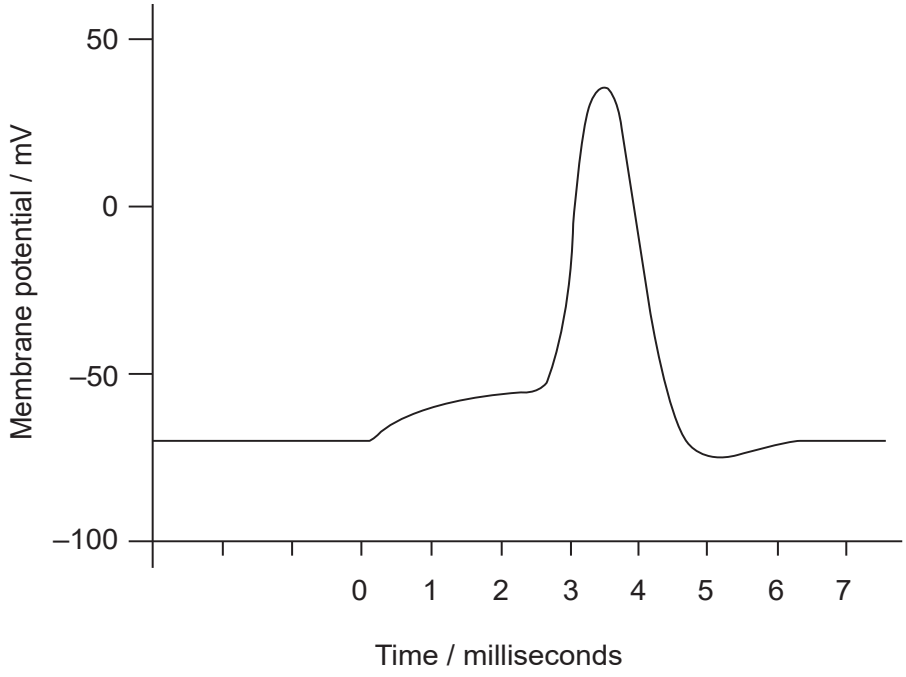
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

24. The graph shows an action potential.



What is the change in membrane potential from resting potential to complete depolarization?

A. –70 mV

B. 15 mV

C. 40 mV

D. 110 mV

25. What is the role of the hormone leptin?

A. To regulate the metabolic rate

B. To inhibit appetite

C. To control circadian rhythms

D. To increase blood sugar concentration

26. What is a function of DNA polymerase I?

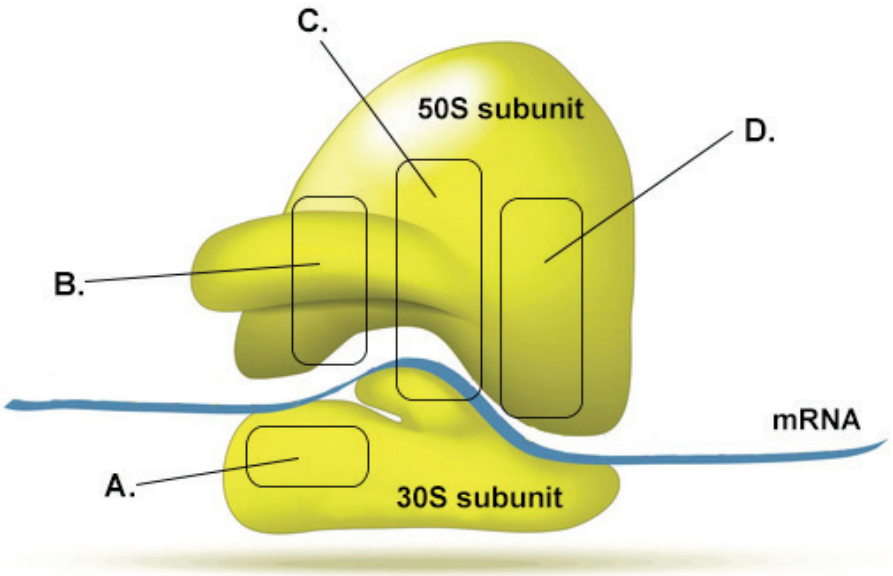
A. Adds nucleotides in a 5’ to 3’ direction to elongate the chain

B. Uncoils the DNA double helix and splits it into two template strands

C. Removes RNA primer and replaces it with DNA

D. Produces sugar-phosphate bonds to link Okazaki fragments

27. In the diagram of a ribosome, which letter indicates the P site?



[Source: iStock.com/ttsz]

28. How do R group interactions contribute to protein structure?

I. Determining the sequence of amino acids in the primary structure
II. Stabilizing beta pleated sheets in the secondary structure
III. Stabilizing further foldings of a polypeptide into a tertiary structure

A. I only

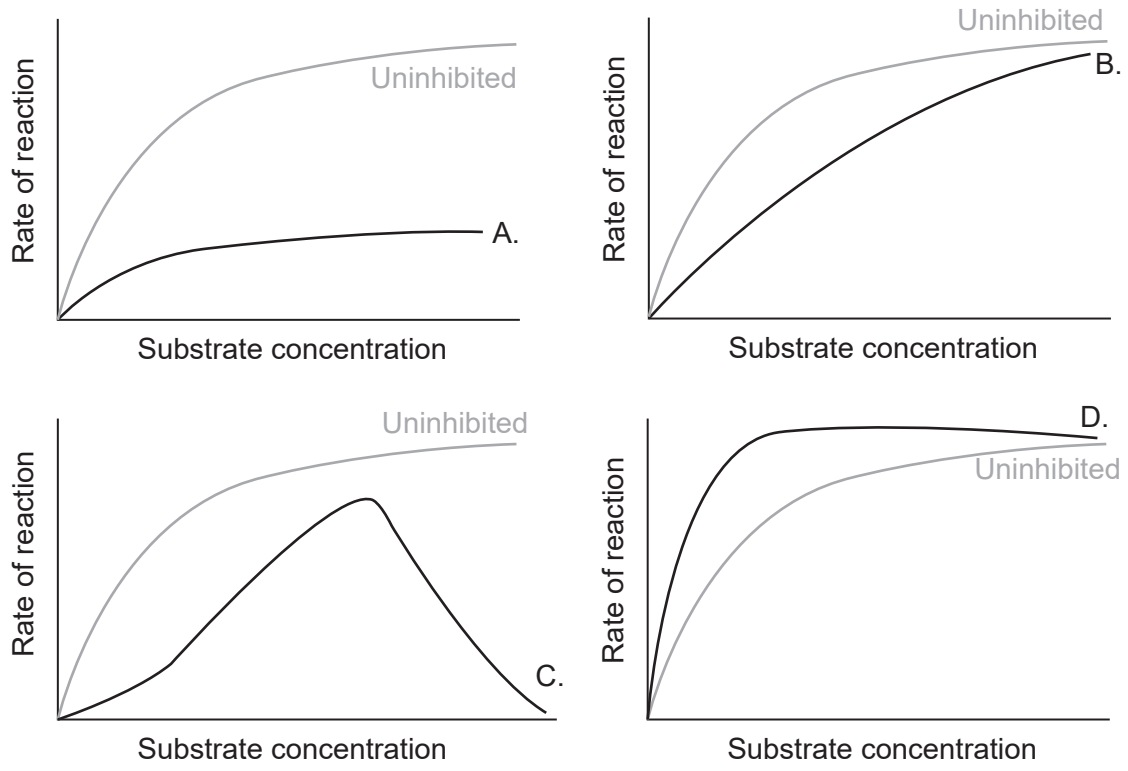
B. II and III only

C. III only

D. I, II and III

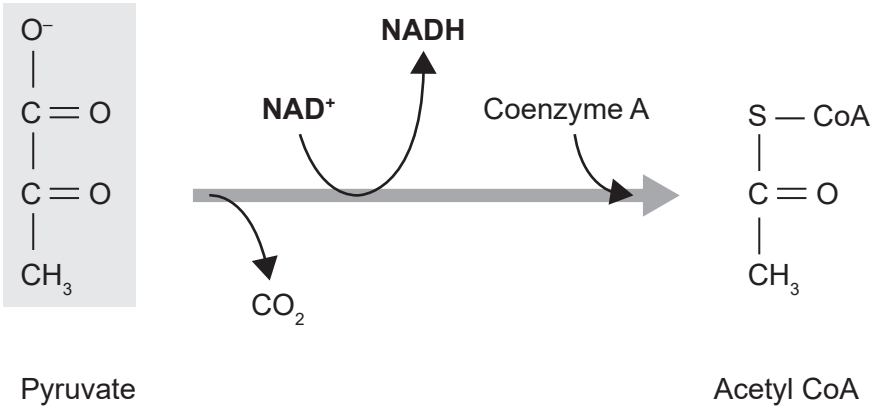
29. The grey line in each of the graphs below represents the rate of reaction catalysed by an uninhibited enzyme as substrate concentration is increased.

Which graph shows expected results if a competitive inhibitor was added to the reaction?



[Source: © International Baccalaureate Organization 2019]

30. The diagram shows the link reaction between glycolysis and the Krebs cycle.



[Source: © International Baccalaureate Organization 2019]

Which type of reaction is occurring?

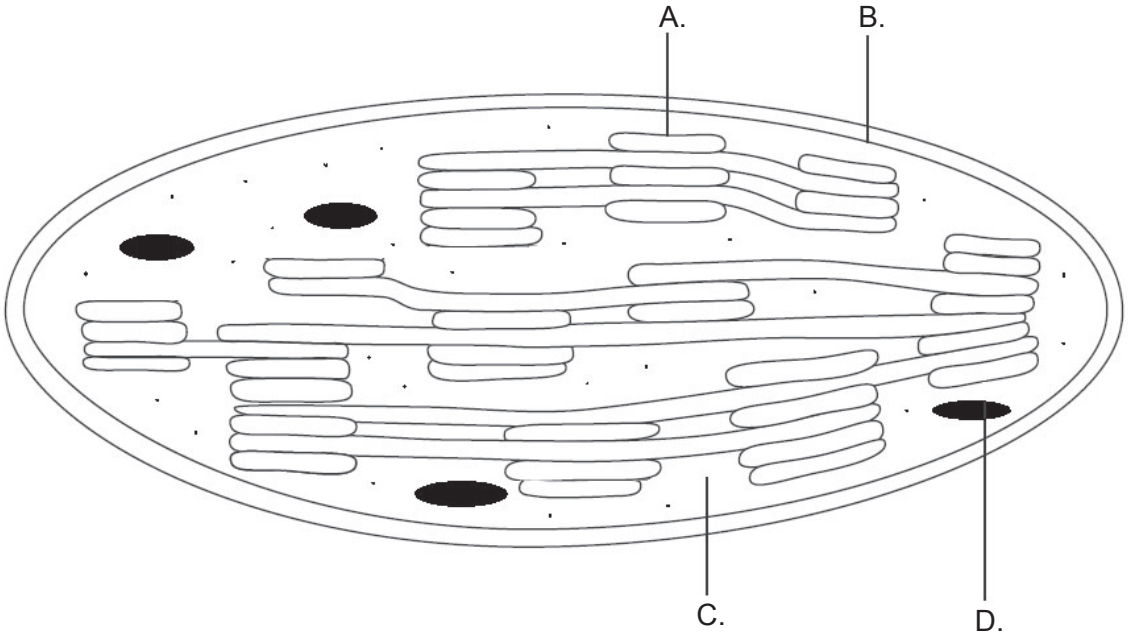
A. Pyruvate is carboxylated.

B. CO_2 is oxidized.

C. NAD^+ is reduced.

D. Pyruvate is phosphorylated.

31. Which structure in the chloroplast diagram is adapted to carry out chemiosmosis?



[Source: © International Baccalaureate Organization 2019]

32. Which process is most responsible for movement of water from roots to leaves of a plant on a hot sunny day?

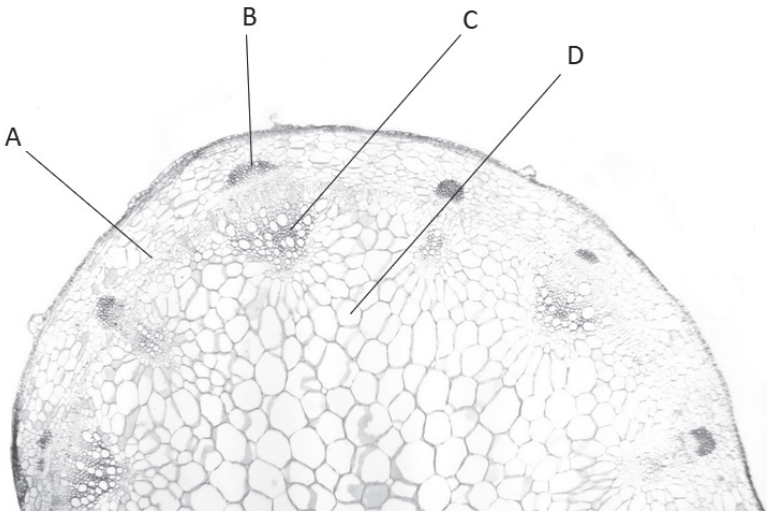
A. Active translocation of mineral ions in roots

B. Active transport of organic compounds into sieve tubes

C. Raised hydrostatic pressure gradients

D. Evaporation of water from mesophyll cell walls

33. In the micrograph of a plant stem, which letter indicates the xylem?



[Source: adapted from Kelvinsong/https://creativecommons.org/licenses/by/3.0/deed.en]

34. A pollen tube grows down the style to an egg inside the ovary of a flower. What is the next process that occurs?

A. Dispersal

B. Fertilization

C. Germination

D. Pollination

35. Which event happens in meiosis II but not in meiosis I?

A. Spindle microtubules attach to centromeres.

B. Crossing over occurs.

C. Sister chromatids move to opposite poles.

D. Chromosomes become shorter and thicker by coiling.

36. A hunter tends to kill the bigger individuals of a population for their meat or for large ornamental trophies. Therefore, the population tends to have more individuals who are smaller. What is this an example of?

A. Directional selection

B. Disruptive selection

C. Natural selection

D. Stabilizing selection

37. What is a role of activated B cells?

A. Secrete antibiotics in response to specific antigens

B. Activate T cells in the immune response

C. Release histamine in response to allergens

D. Multiply to form clones of plasma cells

38. What is a similarity between human and insect muscles?

A. They are attached to an exoskeleton.

B. They work as antagonistic pairs.

C. The flexor muscles straighten the joint.

D. They move bones.

39. Damselflies are flying insects. They lay eggs that hatch into larval forms that are aquatic. Adults excrete uric acid while the larval forms excrete ammonia. What is a possible explanation of this?

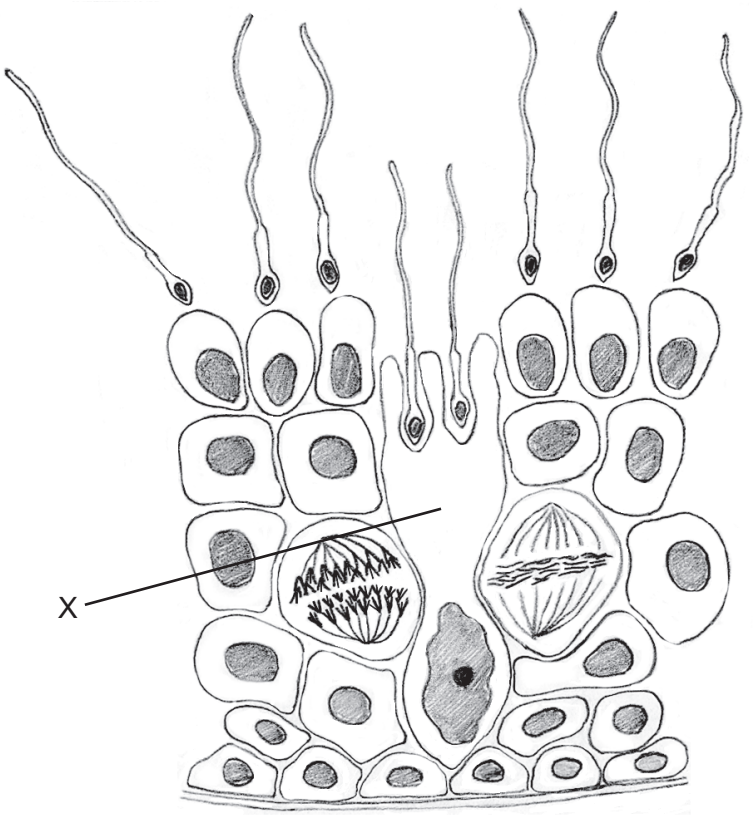
A. Uric acid can be excreted in a more concentrated form than ammonia.

B. Ammonia is less toxic than uric acid.

C. Uric acid requires more water for excretion than ammonia.

D. Only adult forms can produce uric acid.

40. The diagram shows a section through the seminiferous tubules. What is the cell labelled X?



[Source: © International Baccalaureate Organization 2019]

A. Spermatid that will differentiate into sperm

B. Primary spermatocyte that will undergo meiosis to form secondary spermatocytes

C. Sertoli cell that provides nutrients

D. Stem cell that will divide by mitosis to form spermatogonia