

Biology
Higher level
Paper 1

Monday 1 May 2017 (afternoon)

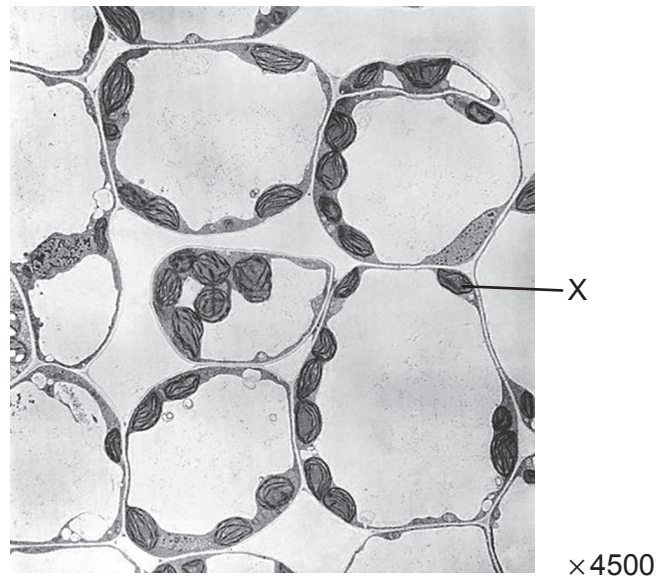
1 hour

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]**.

1. The giant alga *Acetabularia* has a feature that suggests it is an exception to the cell theory. What feature is this?
 - A. It lacks a nucleus.
 - B. It lacks a cell wall.
 - C. It has only one mitochondrion.
 - D. It lacks subdivision into separate cells.

2. The image shows an electron micrograph of mesophyll cells.

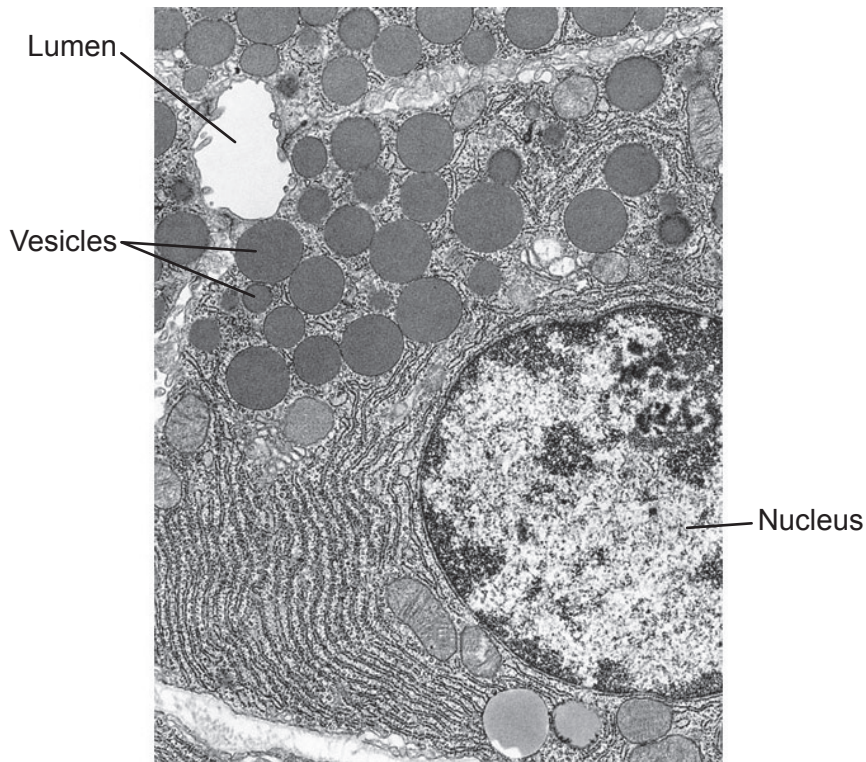


[Source: BIOPHOTO ASSOCIATES/SCIENCE PHOTO LIBRARY]

What is the name of the structure labelled X?

- A. Cytoplasm
- B. Mitochondrion
- C. Nucleus
- D. Chloroplast

3. The image shows an electron micrograph of pancreatic exocrine cells.



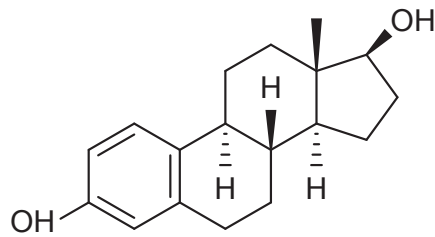
×390 000

[Source: Meschner AL, *Junqueira's Basic Histology: Text and Atlas*, 12th edition. Copyright McGrawHill Education.]

What is the role of the vesicles shown in the micrograph?

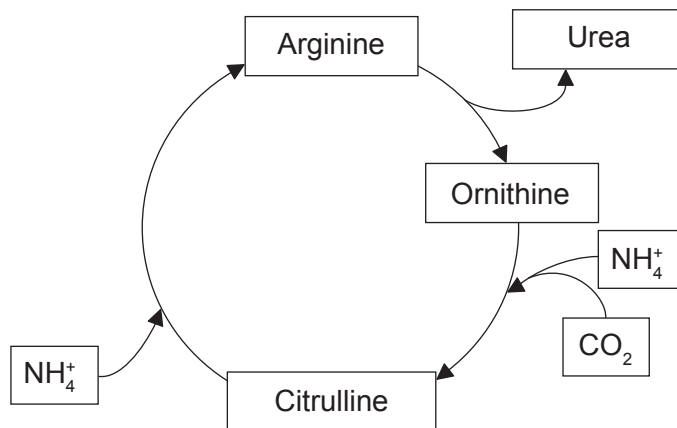
- A. To transport hormones between the rough endoplasmic reticulum and the Golgi apparatus
 - B. To store glycogen when blood glucose levels are high
 - C. To move enzymes out of the cell by exocytosis
 - D. To digest cellulose
4. What is evidence for the endosymbiotic theory?
- A. RNA can catalyse metabolic reactions.
 - B. Meteorites contain organic molecules.
 - C. Amino acids can be synthesized from inorganic compounds.
 - D. Mitochondria possess their own DNA.

5. What characteristic shows that this steroid molecule is a lipid?



- A. It is made of carbon rings.
- B. It has a very low proportion of oxygen to carbon.
- C. It contains OH groups as do fatty acids.
- D. It is made only of nitrogen, oxygen and hydrogen.

6. The diagram shows a cycle of reactions that occurs in human liver cells.

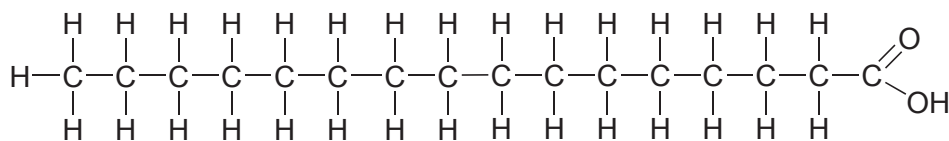


Which term describes the overall reactions of this cycle?

- A. Oxidation
- B. Catabolism
- C. Condensation
- D. Metabolism

7. Which can be explained by the solvent properties of water?
- A. Sodium chloride is transported as Na^+ and Cl^- in blood.
 - B. Movement of water occurs under tension in the xylem.
 - C. Water is the coolant in sweat.
 - D. Ice floats on liquid water.

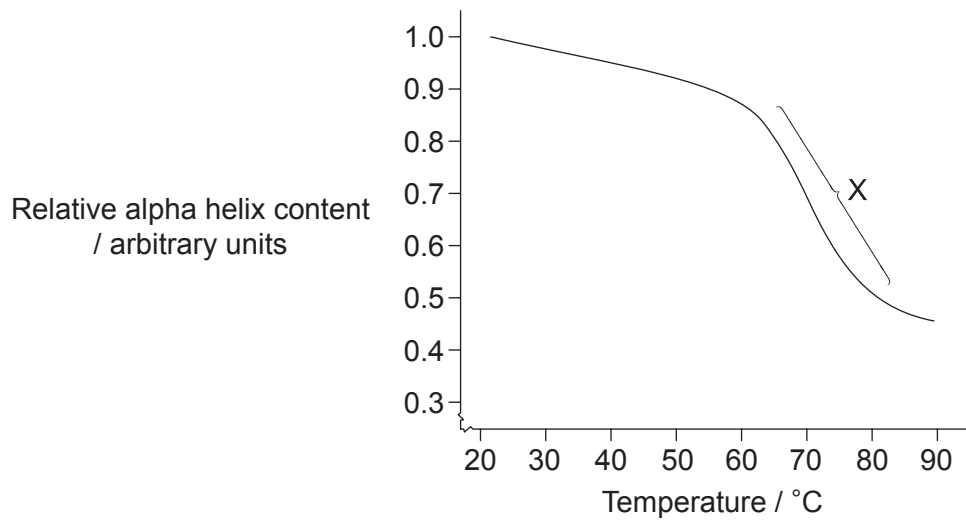
8. The diagram shows the structure of palmitic acid.



What type of fatty acid is palmitic acid?

- A. It is monounsaturated.
- B. It is polyunsaturated.
- C. It is saturated.
- D. It is a trans-fatty acid.

9. Scientists have heated a solution containing the protein albumin and measured its relative alpha helix content, shown on the graph.

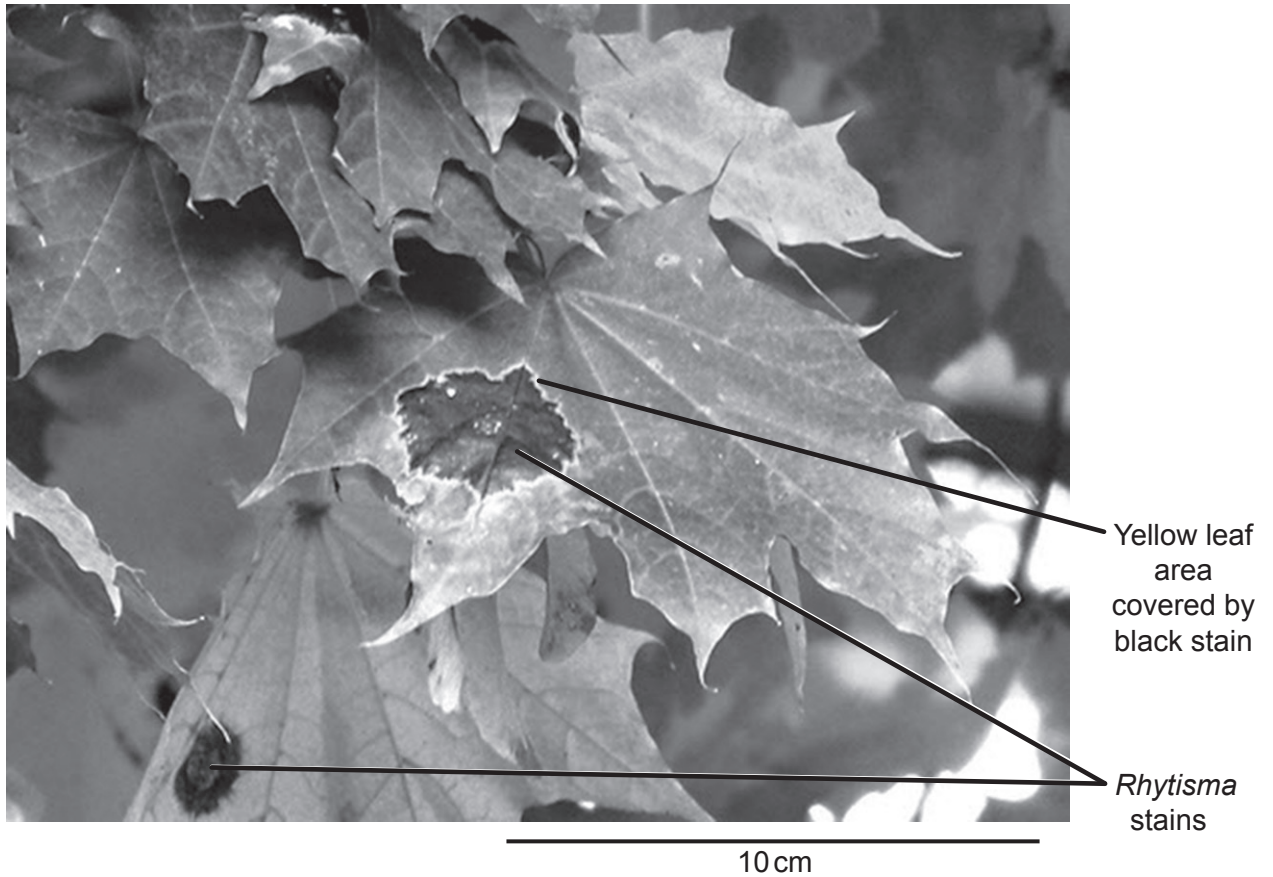


[Source: adapted from R Wetzel, *et al.*, (1980), *European Journal of Biochemistry*, **104** (2), Wiley, page 471]

What does the zone labelled X indicate?

- A. Rapid increase in beta pleated sheets
- B. Rapid formation of hydrogen bonds
- C. Rapid increase in denatured protein molecules
- D. Rapid decrease in peptide bonds

10. The fungus *Rhytisma* grows on the leaves of certain trees, causing a yellow leaf area in which chlorophyll is no longer present. A black, tar-like stain later spreads out.

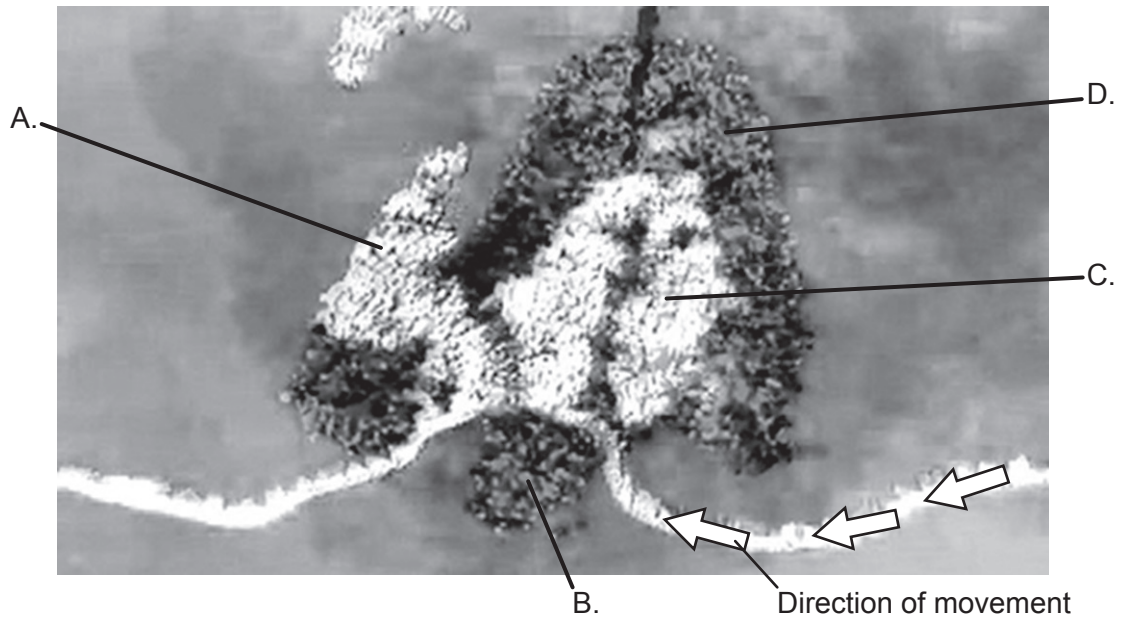


[Source: © International Baccalaureate Organization 2017]

What happens in the leaf when *Rhytisma* is present?

- I. An increase in the intake of carbon dioxide
 - II. A reduction in the production of oxygen
 - III. An increase in the loss of water
- A. I only
 - B. II only
 - C. II and III only
 - D. I, II and III

11. This image is taken from a visualization of a eukaryotic ribosome. The arrows show the direction of movement of mRNA. Which letter represents a tRNA exiting from the E site?



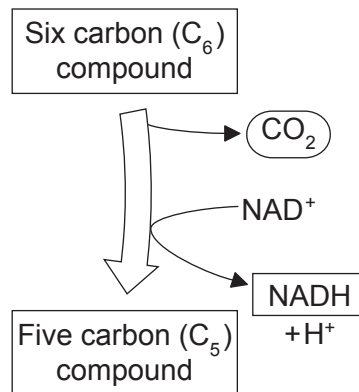
[Source: Adapted from Cold Spring Harbor Laboratory DNA Learning Center (www.dnalc.org)]

12. In which process(es) do nucleosomes play a role in eukaryotes?

- I. tRNA activation
 - II. Transcription regulation
 - III. DNA supercoiling
- A. I only
 - B. II only
 - C. II and III only
 - D. I, II and III

13. Which technological advance enabled Calvin to perform his lollipop experiment on the light-independent reactions of photosynthesis in 1949?
- A. Methods for tracing radioactive carbon incorporated in molecules produced by the alga *Chlorella*
 - B. Development of electron microscopes enabling the molecules produced by the alga *Scenedesmus* to be viewed
 - C. Methods for changing the wavelength of light shining on the alga *Scenedesmus* contained in the lollipop
 - D. Development of X-ray diffraction techniques enabling the molecules produced by the alga *Chlorella* to be identified

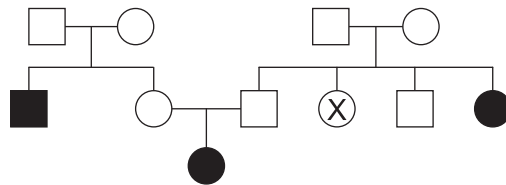
14. This reaction occurs in mitochondria.



What explains that this reaction enables energy to be converted into a usable form?

- A. The oxidized NAD⁺ will transfer the energy from the C₆ compound to ATP.
- B. The chemical energy stored in the C₆ compound is used to reduce NAD⁺ allowing ATP production.
- C. Energy stored in the CO₂ molecule will generate an electron gradient.
- D. The C₆ compound is reduced and the energy resulting from the removal of one carbon is used to oxidize NAD⁺.

15. What is used to reduce NADP in the light-dependent reactions of photosynthesis?
- A. Conversion of ATP into ADP + P_i
 - B. Electrons from Photosystem I
 - C. Protons from the thylakoid space
 - D. Oxygen released by photolysis of water
16. What distinguishes an allele from a gene?
- A. An allele is made of RNA.
 - B. An allele is shorter.
 - C. An allele is a variety of a gene.
 - D. An allele cannot be transferred during genetic modification.
17. Which is a characteristic of the haploid number of eukaryotic chromosomes?
- A. It doubles in mitosis.
 - B. It is fixed for each species.
 - C. It is an even number for all species.
 - D. It is positively correlated with an animal's mass.
18. The diagram shows a pedigree of cystic fibrosis, in which the black colour indicates the presence of cystic fibrosis.



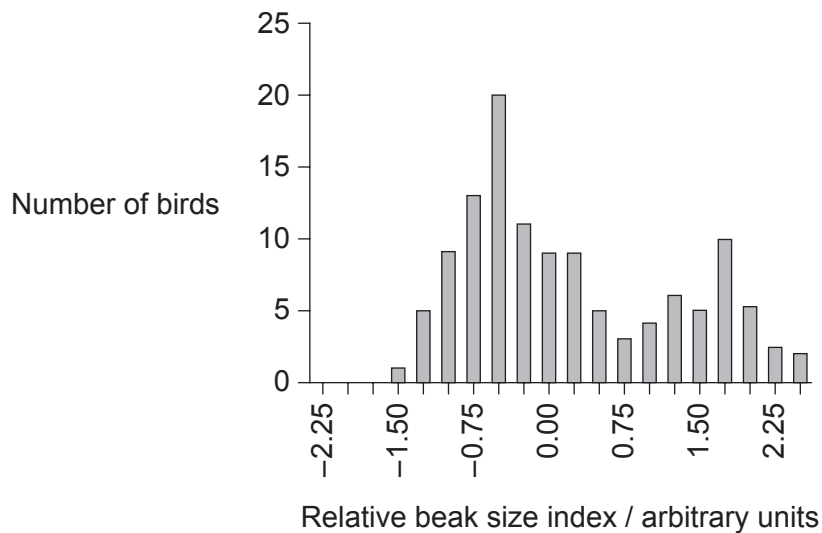
What is the probability that the individual labelled X is a carrier of cystic fibrosis?

- A. 1.00
- B. 0.50
- C. 0.25
- D. 0.00

19. The genetic determination of dogs' coats can be quite complex, with many different genes acting at the same time.
- The dominant allele **E** gives brown tones. The recessive allele **e** results in red tones.
 - The colour intensity is due to another gene. The dominant allele **B** gives a dark colour, whereas the recessive allele **b** results in a light colour.

What would be the genotype of a light brown dog produced from a cross between a dark brown dog and a light red dog?

- A. EEbb
 - B. EeBb
 - C. eeBb
 - D. Eebb
20. The graph shows variations in beak size for the bird *Geospiza fortis* on an island in the Galápagos archipelago.



[Source: adapted from A P Hendry et al. (2006) *Proceedings of the Royal Society B*, 273, page 1890, by permission of the Royal Society.]

What evidence from the graph indicates that disruptive selection is occurring?

- A. An intermediate beak size is less common.
- B. Median beak size is the most common.
- C. Smaller beaks are favoured.
- D. Larger beaks are favoured.

21. Which is a possible risk associated with a genetic modification of crops?
- A. Crop plants will become weaker with time.
 - B. It can increase mutations in the organisms that consume them.
 - C. Starch obtained from genetically modified plants will be more difficult to digest.
 - D. Resistance to herbicide genes can be transferred to weeds.

22. The image shows a transect through a stream and a field.

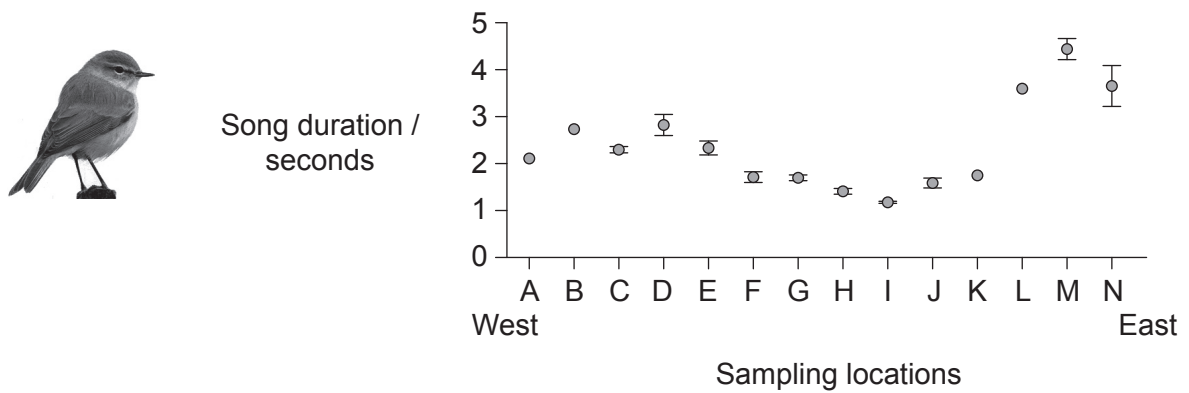


Which calculation would test for the association between two species of plants from quadrat data from section A and section B of the field?

- A. Correlation coefficient
 - B. Random numbers sampling
 - C. Standard deviation
 - D. Chi-squared
23. What favours the production of peat?
- I. Presence of organic matter
 - II. Anaerobic conditions
 - III. Acidic conditions
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III

24. By which mechanism do greenhouse gases contribute to global warming?
- A. Their higher concentration absorbs more long wave radiation coming from the Sun.
 - B. Short wave radiation emitted from the Earth's surface increases with their concentration.
 - C. They absorb higher amounts of long wave radiation emitted from the Earth's surface as their concentration increases.
 - D. They absorb higher amounts of short wave radiation caused by increased combustion of fossilized organic matter.

25. The graph shows the song duration of birds from the genus *Phylloscopus* sampled from west to east throughout Northern Europe and Northern Asia.

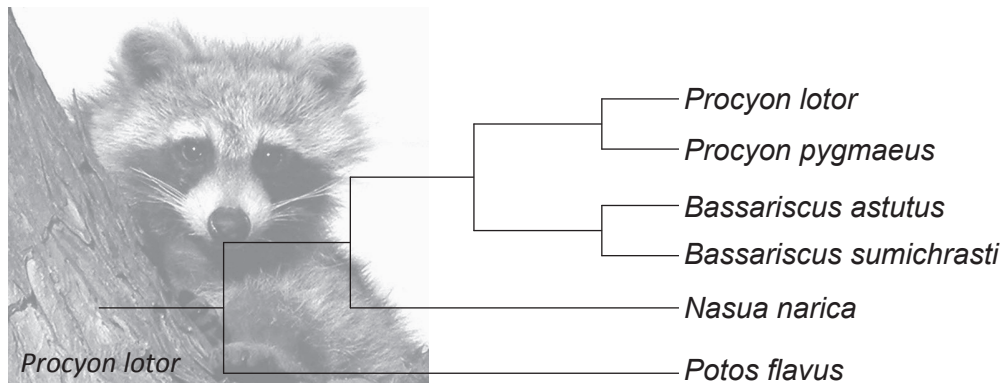


[Source: adapted from DE Irwin, (2000), *Evolution*, 54 (3), Wiley, page 1006]

What concept do these data illustrate?

- A. Gradual divergence
- B. Adaptive radiation
- C. Interbreeding populations
- D. Punctuated equilibrium

26. The diagram represents a cladogram of the family Procyonidae.

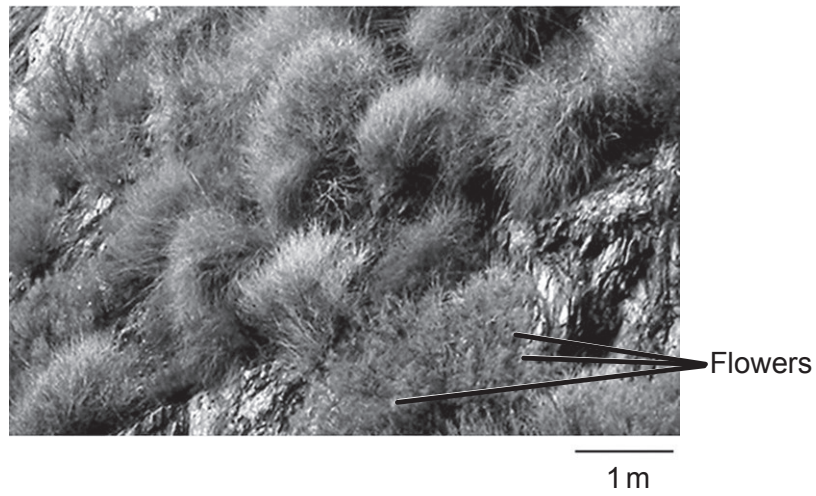


[Source: © International Baccalaureate Organization 2017]

What would justify classifying these organisms into four different genera?

- A. They live in different habitats.
 - B. They do not share any common ancestors.
 - C. There are enough differences between them.
 - D. The number of times that the species have split.
27. Which is a characteristic of both bryophyta and filicinophyta?
- A. Vascular tissue
 - B. Membranous leaves
 - C. Release of spores
 - D. Evergreen spines

28. The photograph shows vegetation in a rocky area.

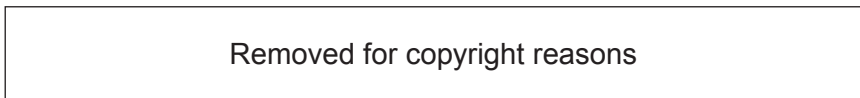


[Source: © International Baccalaureate Organization 2017]

Which characteristic of the plants indicates that the area in which they are growing is probably dry?

- A. Relatively small size
- B. Small flowers
- C. Narrow leaf surface
- D. Small root system

29. The image shows a light micrograph.



What is represented in the light micrograph?

- A. Small intestine with a thick layer of longitudinal muscles surrounded by a thin layer of circular muscles
- B. A primary xylem cell with a thick cellulose cell wall in the stem of a plant
- C. A phloem sieve tube in the root of a plant with a companion cell in the lower left corner
- D. A section of an artery with a thick circular muscular layer

30. Which process is matched with a valid example?

	Process	Example
A.	seed dispersal	a stamen explodes in the wind
B.	fertilization	a nucleus from the pollen grain fuses with a nucleus in the ovule
C.	fertilization	a bee carries pollen from flower to flower
D.	pollination	seeds are blown from a flower onto another one by the wind

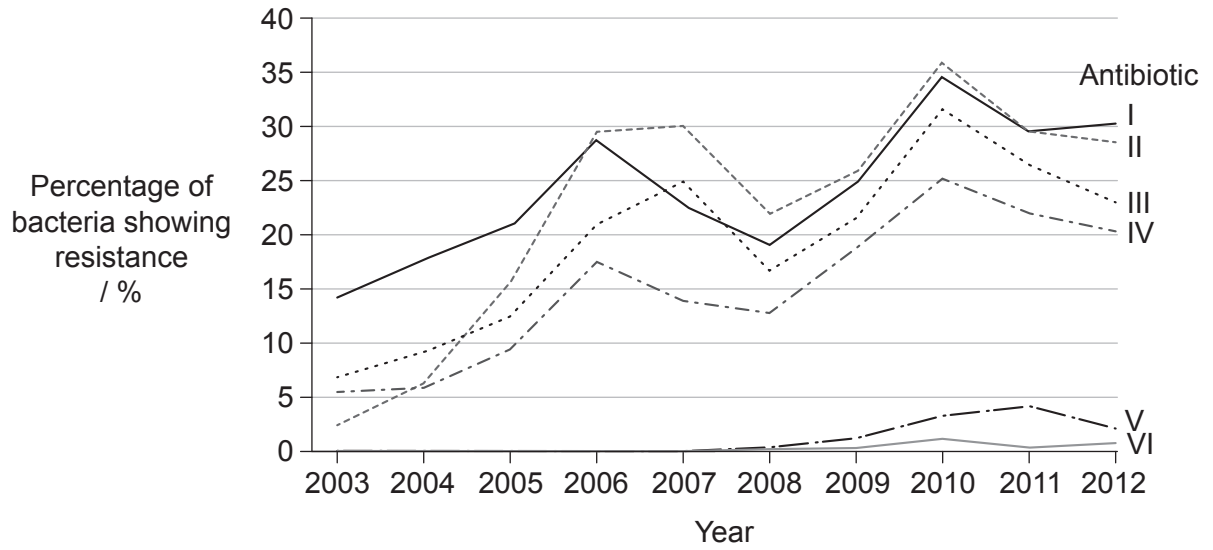
31. Where does the digestion of polypeptides start in humans?

- A. Mouth
- B. Esophagus
- C. Stomach
- D. Small intestine

32. Where is absorption of digested food carried out?

- I. Villi
 - II. Pancreas
 - III. Small intestine
- A. I only
 - B. I and II only
 - C. I and III only
 - D. I, II and III

33. The bacterium *Neisseria gonorrhoeae* causes infections related to the human reproductive system. The graph shows the percentage of samples in which this bacterium showed resistance to six antibiotics over a period of ten years.

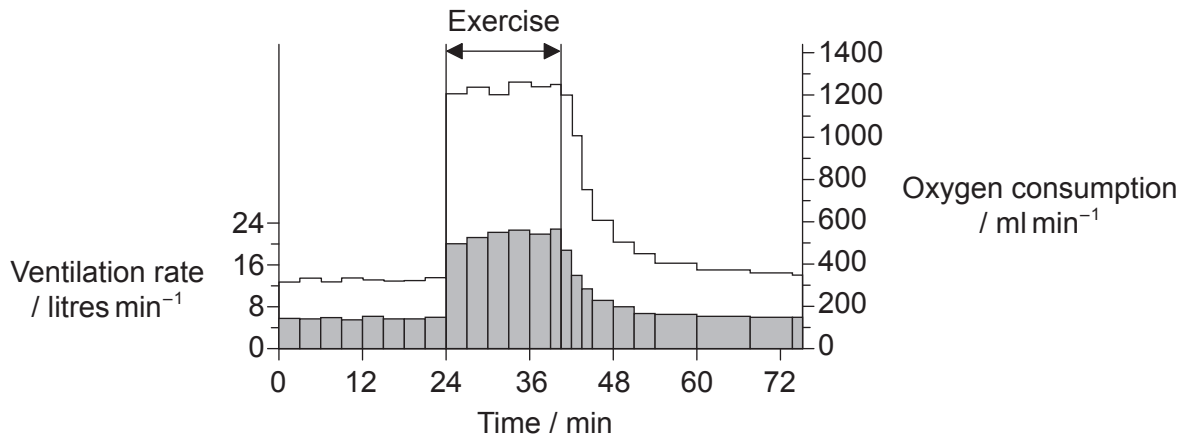


[Source: © All rights reserved. National Surveillance of Antimicrobial Susceptibilities of *Neisseria gonorrhoeae* Annual Summary 2012. Public Health Agency of Canada, 2012. Translated, adapted and reproduced with permission from the Minister of Health, 2017.]

What is a possible explanation for the total percentage resistance being larger than 100% in 2010?

- A. People do not take the antibiotics as prescribed.
- B. More people have been sampled in that year.
- C. There was an epidemic of *Neisseria gonorrhoeae* in that year.
- D. Some bacteria are resistant to more than one antibiotic.

34. The graph shows the ventilation rate and the oxygen consumption of a subject before, during and after a period of exercise.



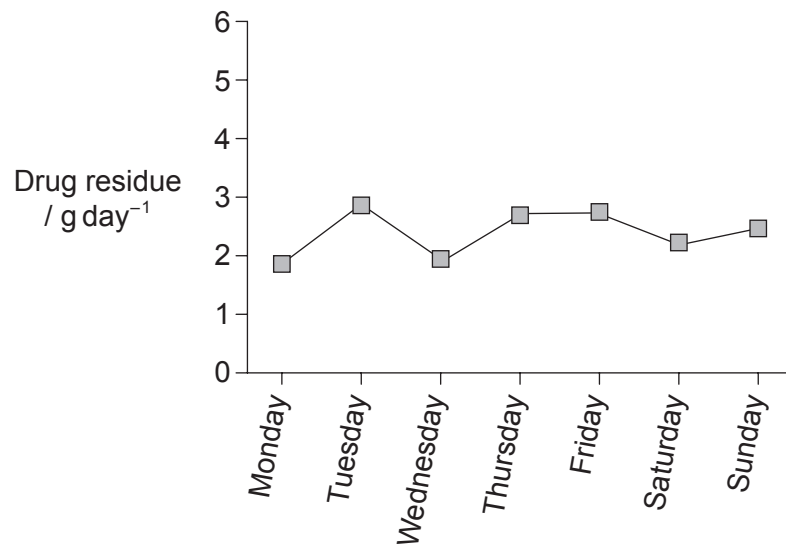
Key: ■ ventilation rate □ oxygen consumption

[Source: adapted from W E Huckabee (1958) *The Journal of Clinical Investigation*, 37 (2), page 256. Republished with permission of American Society for Clinical Investigation, permission conveyed through Copyright Clearance Center, Inc.]

Which could be a reason for the oxygen consumption to remain high for some time after the end of the period of exercise?

- A. Epinephrine keeps the ventilation rate high.
 - B. Part of the exercise was done using anaerobic respiration.
 - C. A low ventilation rate keeps the consumption high.
 - D. More ATP is necessary for cross bridge formation while muscles cool down.
35. What is essential for conduction of nerve impulses to be saltatory?
- A. Wrapping of myelin around the axon
 - B. Reaching the threshold potential in dendrites
 - C. Pumping potassium ions into the neuron
 - D. Releasing a neurotransmitter at the synapse

36. If schizophrenia is caused by an overabundance of the neurotransmitters dopamine and serotonin in the synapses of some areas of the brain, which drug action could work in treating the symptoms?
- A. Release of cholinesterase into the synaptic cleft
 - B. Increased re-uptake of dopamine and serotonin by presynaptic neurons
 - C. Increased permeability of the presynaptic neuron to sodium
 - D. Blockage of dopamine and serotonin receptors on presynaptic neurons
37. What is the role of calcium in muscle contraction?
- A. To release tropomyosin from myosin
 - B. To bind to troponin so myosin-binding sites on actin are exposed
 - C. To bind to tropomyosin so ATP can bind to actin
 - D. To release ATP from actin so myosin can bind to troponin
38. The graph shows the daily amount of the residue of a drug in the wastewater of a hospital.



What can be deduced from these data?

- A. The drug is not fully reabsorbed by the proximal convoluted tubules.
- B. The glomeruli are not permeable to the drug.
- C. The collecting ducts reabsorb all of the drug.
- D. The drug is catabolized by the liver.

39. What does the blastocyst secrete?

- A. HCG
- B. Estrogen
- C. ADH
- D. Progesterone

40. What helps to prevent polyspermy?

- A. The unequal division of oocytes
 - B. The placental barrier
 - C. The contraceptive pill
 - D. The cortical reaction
-