IB · DP · Biology

40 mins 40 questions

Practice Paper 1

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Total Marks **/40**

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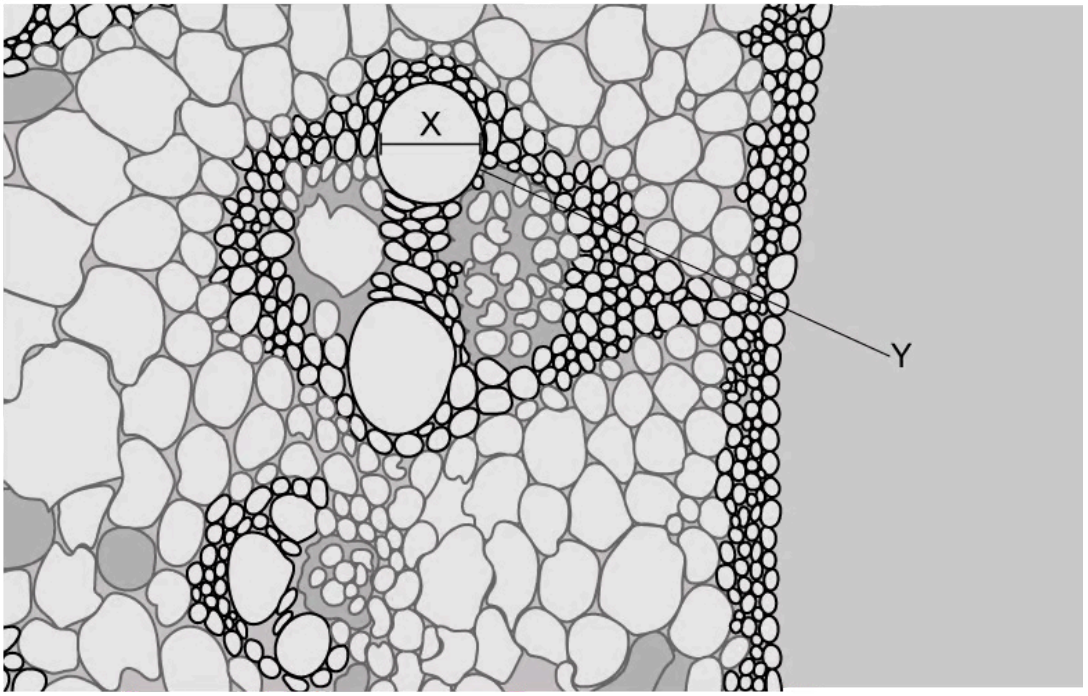
1 The electron micrograph below shows a root vascular system. The magnification of the image is × 200. A student uses a ruler to measure distance X and finds it to be 10 mm.



What is the diameter of the cell labelled Y?

A. 100 µm

B. 50 µm

C. 10 µm

D. 5 µm

(1 mark)

2 The electron micrograph below shows a section of part of a palisade mesophyll cell.

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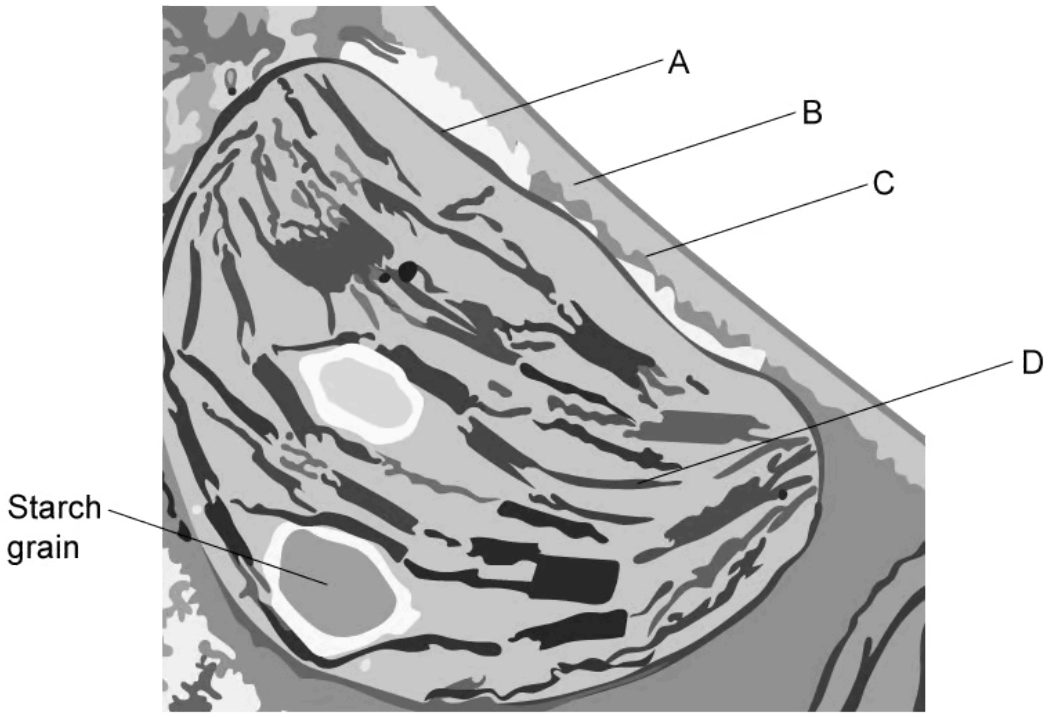

Which structure controls the exchange of substances into and out of the cell?

(1 mark)

3 Select the table row that correctly completes the following sentence:

Cholesterol is a component of animal cell membranes. Most of a cholesterol molecule is ...I... . This means that cholesterol ...II...

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	I	II
A	...hydrophobic, so it is attracted to the hydrocarbon tails at the centre of the membrane.	...reduces the fluidity of the membrane and reduces its permeability to particles such as sodium ions and hydrogen ions.
B	...hydrophilic, so it is attracted to the hydrocarbon tails at the centre of the membrane.	...increases the fluidity of the membrane and reduces its permeability to particles such as sodium ions and hydrogen ions.
C	...hydrophobic, so it is attracted to the hydrocarbon tails at the centre of the membrane.	...reduces the fluidity of the membrane and increases its permeability to particles such as sodium ions and hydrogen ions
D	...hydrophilic, so it is attracted to the phosphate heads on the periphery of the membrane.	...increases the fluidity of the membrane and increases its permeability to particles such as sodium ions and hydrogen ions.

(1 mark)

4 Which of the following is evidence for the endosymbiotic theory?

A. 70S ribosomes can be found in prokaryotic cells.

B. Mitochondria contain their own DNA.

C. Meteorites have been found that contain organic molecules.

D. In certain cases, gene transfer from prokaryotic cells to eukaryotic cells via plasmids has been found to occur.

(1 mark)

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5 A study was conducted to investigate the effect of saturated fat intake on the risk of developing coronary heart disease (CHD) in women.

- The study involved 20 women, aged between 35 and 50, divided into two groups (**A** and **B**) of 10.
- Group **A** was given a diet rich in saturated fats, while group **B** followed a diet low in saturated fats.
- The levels of low-density lipoprotein (LDL) in their blood was monitored over a six month period. High LDL levels has been linked to an increase in the risk of developing CHD.

At the end of the study the levels of LDL in group **A** was much higher than that of group **B**. The scientists concluded that saturated fats increases the risk of developing CHD.

Which evaluation of their conclusion would be most valid?

A. The conclusion of the scientist may not be valid as they would have to repeat the investigation over a longer period of time, using animal test subjects

B. The conclusion of the scientists may not be valid as they should have monitored a larger number of women between the ages of 20 and 35

C. The conclusion of the scientists may not be valid as they should have taken into consideration the medical history of the women

D. The conclusion of the scientists may not be valid as they should have repeated their investigation with women over the age of 75

(1 mark)

6 Which **one** of the following phenomena is **not** a consequence of end-product inhibition in biochemical pathways?

A. Regulation of the pathway.

B. Prevention of a build-up of biochemical intermediate compounds.

C. Shutdown of the pathway once product levels reach zero.

D. Allosteric changes to an enzyme involved in the pathway.

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(1 mark)

7 Which of the following observations is **not** explained by water's high latent heat of vaporisation and specific heat capacity?

A. Ice is less dense than liquid water, so it floats on water.

B. Water exists in all three physical states (solid, liquid and gas) on Earth.

C. A small volume of water can dissipate a lot of heat from an organism.

D. A lot of heat energy is required to raise the temperature of water.

(1 mark)

8 Which of the following is **not** a feature of lipids that contain trans-fatty acids?

A. They tend to form liquids at room temperature.

B. They increase the risk of coronary heart disease.

C. They are often labelled as 'partially hydrogenated vegetable oils' on food packaging.

D. They create more stable emulsions in food manufacture.

(1 mark)

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9 Rituximab is an example of a therapeutic protein that is used to treat certain types of cancers and autoimmune diseases. It is very sensitive to temperature and pH changes and is typically injected into the bloodstream of patients.

Which of the following statements would explain why therapeutic proteins, such as rituximab, cannot be taken orally?

I. The molecule would vibrate so fast once in the stomach that the intermolecular bonds would break

II. The conformation of the protein will change once in the stomach and it may become non-functional

III. The protein may become insoluble once in the stomach and form a precipitate due to the breakage of ionic bonds

IV. Conditions in the stomach will cause the hydrophobic R-groups of the protein to be exposed to the outside of the molecule

A. I and IV

B. I, II and III

C. II and III

D. II, III and IV

(1 mark)

10 A student drew a diagrammatic representation of a transverse section of a plant stem based on what they saw using a light microscope.

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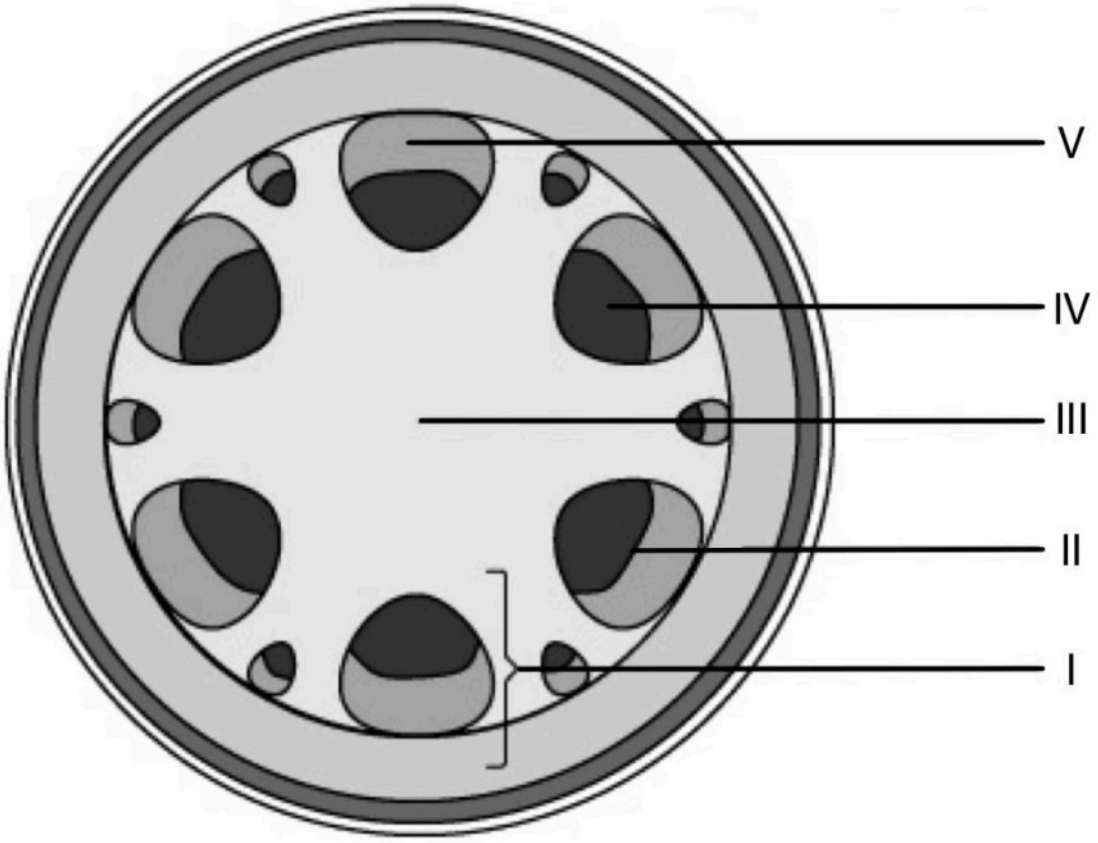

Identify the correct labels required for the drawing above.

	I	II	III	IV	V
A	Vascular bundle	Pith	Phloem	Cambium	Xylem
B	Phloem	Xylem	Vascular bundle	Cambium	Pith
C	Vascular bundle	Xylem	Pith	Cambium	Phloem
D	Vascular bundle	Cambium	Pith	Xylem	Phloem

(1 mark)

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11 In prokaryotes, the processes of transcription and translation are said to be coupled, which means they can proceed simultaneously.

Which is the **key** cellular feature of prokaryotes that allows this to happen?

A. Circular chromosomal DNA

B. Free ribosomes

C. The lack of a nucleus

D. The presence of introns in prokaryotic DNA

(1 mark)

12 The muscle protein titin is an important component of cardiac muscle tissue. Several forms of titin exist, even though it is coded for by the same gene. During the development of the foetal heart, titin exists in the form of long, springy protein strands, while in the adult heart titin is much shorter.

Which of the following provides the most plausible explanation for the occurrence of the different forms of titin?

A. Different post-transcriptional changes are made to the pre-mRNA of the titin gene, resulting in different mature mRNA molecules that can be translated into different polypeptides

B. Different exons of the gene coding for titin are spliced to form different mature mRNA molecules that can be translated into different polypeptides.

C. Different introns of the gene coding for titin are joined together to form different mature mRNA molecules that can be translated into different polypeptides.

D. Different poly-A tails are added to the 3' end of pre-mRNA molecules, resulting in different mature mRNA molecules that can be translated into different polypeptides.

(1 mark)

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13 Which of the following statements is **not** correct with regards to chemiosmosis in photosynthesis?

I. Protons move down their concentration gradient through ATP synthase located in the chloroplast membrane
II. The photolysis of water provides protons needed for chemiosmosis to occur
III. ADP is phosphorylated to ATP due to the energy released by the movement of electrons down the electron transport chain
IV. A high concentration of protons build up outside the intermembrane space, creating a concentration gradient

A. I. and IV. only

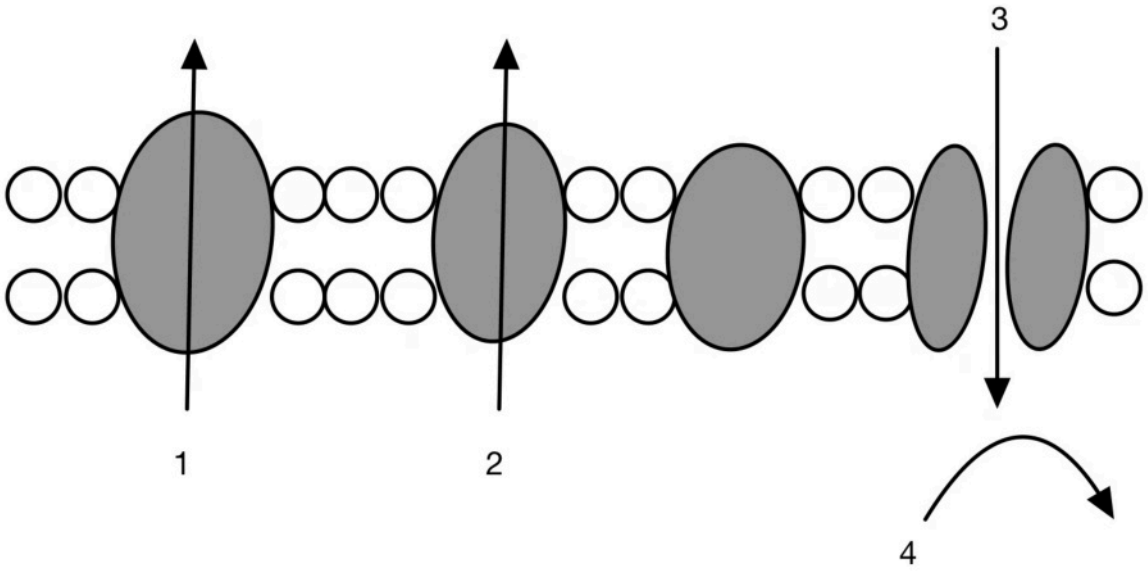
B. II. and III. only

C. I., III. and IV.

D. II., III. and IV.

(1 mark)

14 The diagram below represents a simplified version of the electron transport chain and chemiosmosis.



Which row correctly describes the events labelled 1-4 above?

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	1	2	3	4
A	Protons move across the cristae into the intermembrane space	Protons move across the cristae into the intermembrane space	Protons are pumped through ATP synthase	ADP is phosphorylated
B	Protons move across the cristae into the matrix	Protons move across the cristae into the matrix	Protons are pumped through ATP synthase	ATP is phosphorylated
C	Protons move across the cristae into the intermembrane space	Protons move across the cristae into the intermembrane space	Protons diffuse through ATP synthase	ADP is phosphorylated
D	Protons move across the cristae into the intermembrane space	Protons move across the cristae into the intermembrane space	Protons diffuse through ATP synthase	ATP is phosphorylated

(1 mark)

15 Which process is **not** part of the light-independent reaction of photosynthesis?

A. Glycerate-3-phosphate is converted to triose phosphate

B. Rubisco is regenerated from triose phosphate

C. ATP is dephosphorylated to ADP

D. Carboxylation of RuBP

(1 mark)

16 In a newt, normal tail length is dominant to short tail length and green scales are dominant to white scales.
A heterozygous normal tailed newt with green scales was crossed with a short tailed newt with white scales. A large number of offspring were produced. They were either normal tailed with green scales or short tailed with white scales in equal number.
What is the most likely cause of this pattern?

A. The genes are codominant

B. Crossing over has occurred

C. The two genes are linked

D. The traits are polygenic

(1 mark)

17 Which discovery was first made by Bateson and Punnett in the early 20th century?

A. Sex linkage in *Drosophila melanogaster*

B. New, as-yet-unseen alleles in sweet pea plant crosses

C. Chromosomes assorting independently

D. Non-typical ratios of offspring phenotype, at odds with Mendel's predicted ratios

(1 mark)

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18 A game farm in South Africa has a population of about 5 000 large antelope called Kudu. Kudu bulls have large, spiralled horns which draw the attention of trophy hunters that frequently visit the game farm.

The antelope are all kept in a large, fenced-off area consisting of open grassland habitat.

Could this be considered an example of a stable gene pool?

A. No, since there will be a selective pressure to increase the allele frequency for antelope with large horns

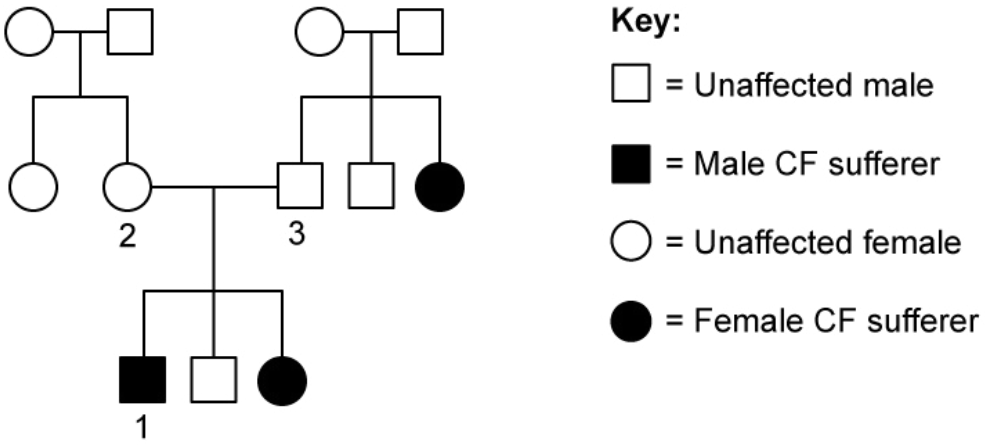
B. No, since there will be a selective pressure for antelope with smaller horns

C. Yes, it is a large population of antelope with an equal chance to mate with each other

D. Yes, it is a large population located in a habitat that enables random matings between antelope of different phenotypes

(1 mark)

19 The pedigree diagram shows the inheritance of cystic fibrosis across 3 generations.



Identify the genotype of the individuals labelled 1, 2 and 3 in the pedigree diagram.

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	1	2	3
A	Heterozygous	Homozygous dominant	Heterozygous
B	Homozygous recessive	Homozygous dominant	Heterozygous
C	Homozygous recessive	Heterozygous	Heterozygous
D	Heterozygous	Homozygous recessive	Homozygous dominant

(1 mark)

20 Scientists use theories to explain observed phenomena. Which of the following combinations of observed phenomenon and explanation shows how scientists developed the theory that explains antibiotic resistance in bacteria?

	Observed phenomenon	**Explanation**
A.	Resistance to an antibiotic appears soon after an antibiotic is first used	Bacteria respond to a new antibiotic by developing resistance
B.	Resistance to an antibiotic appears soon after an antibiotic is first used	Bacteria with alleles that provide resistance to the antibiotic survive treatment and pass on their alleles
C.	Bacteria with alleles that provide resistance to the antibiotic survive treatment and pass on their alleles	The frequency of resistant alleles increases in a bacterial population
D.	Antibiotic resistance in bacteria is on the increase in hospitals	Patients in hospitals are more susceptible to infection than the general population.

(1 mark)

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21 In 1989 a company called AquaBounty Technologies genetically engineered (GE) Atlantic salmon to contain a growth hormone-regulating gene which had been extracted from another species of salmon (the Pacific Chinook salmon).

The modification resulted in an increased rate of growth without impacting any other health qualities. Fully grown GE salmon were the same size as the unmodified salmon, however, it took less time for them to reach full size.

Identify which of the following options would not be considered a risk for GE salmon.

A. There may be changes to the biodiversity of the natural environment

B. Presence of the new gene may influence the expression of other genes in the genome

C. There may be a lot of negative publicity surrounding the integration of GE salmon into the human food chain

D. GE fish may outcompete natural fish stocks

(1 mark)

22 A chi-squared test was carried out to test for association between species A and species B. The results of the chi-squared test are given below.

Results of chi-squared test:

Chi-squared value	5.89
Degrees of freedom	1

Critical values table:

Degrees of freedom	**Probability level**			
	0.1	**0.05**	**0.01**	**0.001**
1	2.71	3.84	6.64	10.83
2	4.60	5.99	9.21	13.82

What can be concluded from the chi-squared test for association carried out to test for association between species A and species B?

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A. There is no significant association between species A and species B

B. Species A competes with species B for resources

C. There is a statistically significant association between species A and species B at the 5% probability level

D. There is a statistically significant association between species A and species B at the 1% probability level

(1 mark)

23 Which of the following chemical equations correctly represents one method for how carbon is made available for absorption by aquatic autotrophs?

A. $H_2CO_3 \rightarrow H^+ + HCO_3^-$

B. $CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$

C. $CO_2 + H_2O \rightarrow H_2CO_3$

D. $CH_3COOH \rightarrow CH_4 + CO_2$

(1 mark)

24 The graph below shows the differences between the radiation reaching the earth from the sun and the radiation re-emitted by the earth.

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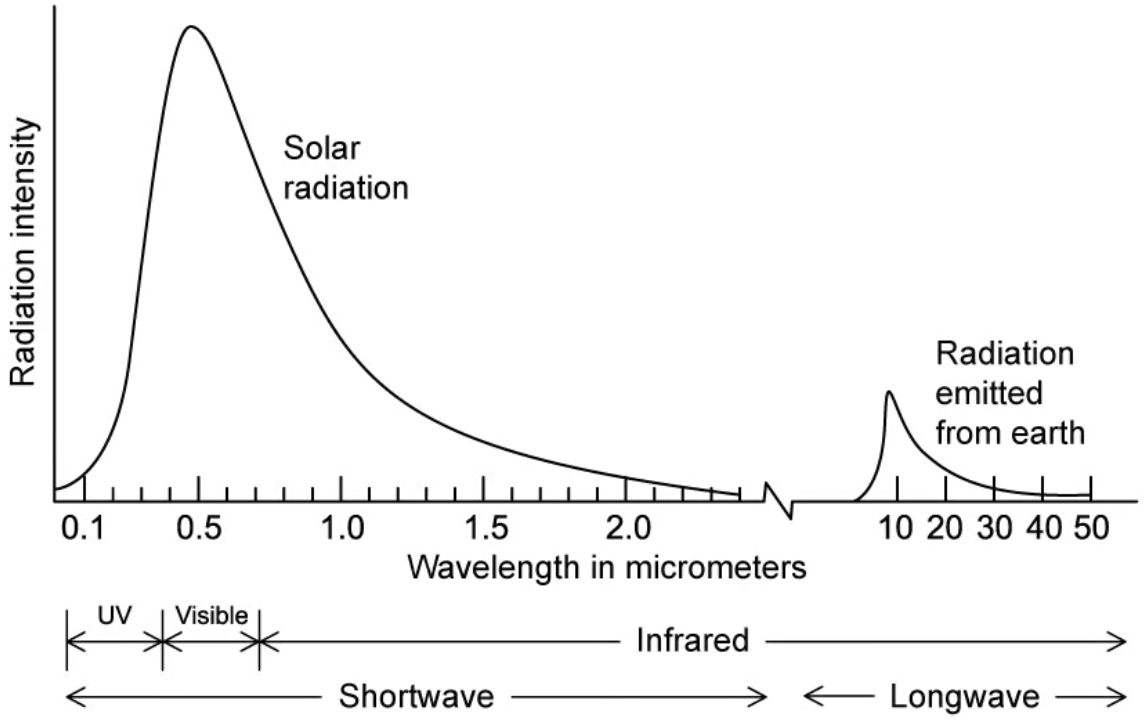

How does this radiation cause the greenhouse effect?

A. Greenhouse gases absorb mainly low intensity radiation.

B. Greenhouse gases absorb mainly shortwave radiation.

C. Greenhouse gases absorb mainly UV radiation.

D. Greenhouse gases absorb mainly longwave radiation.

(1 mark)

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25 Which of the following applies to the process of evolution by natural selection?

I. Changes in the phenotype of organisms in a population
II. Selection pressures favouring certain alleles within a population
III. Individuals with a certain genetic makeup will not pass on their genes
IV. Changes in the allele frequencies within a population over time

A. II only

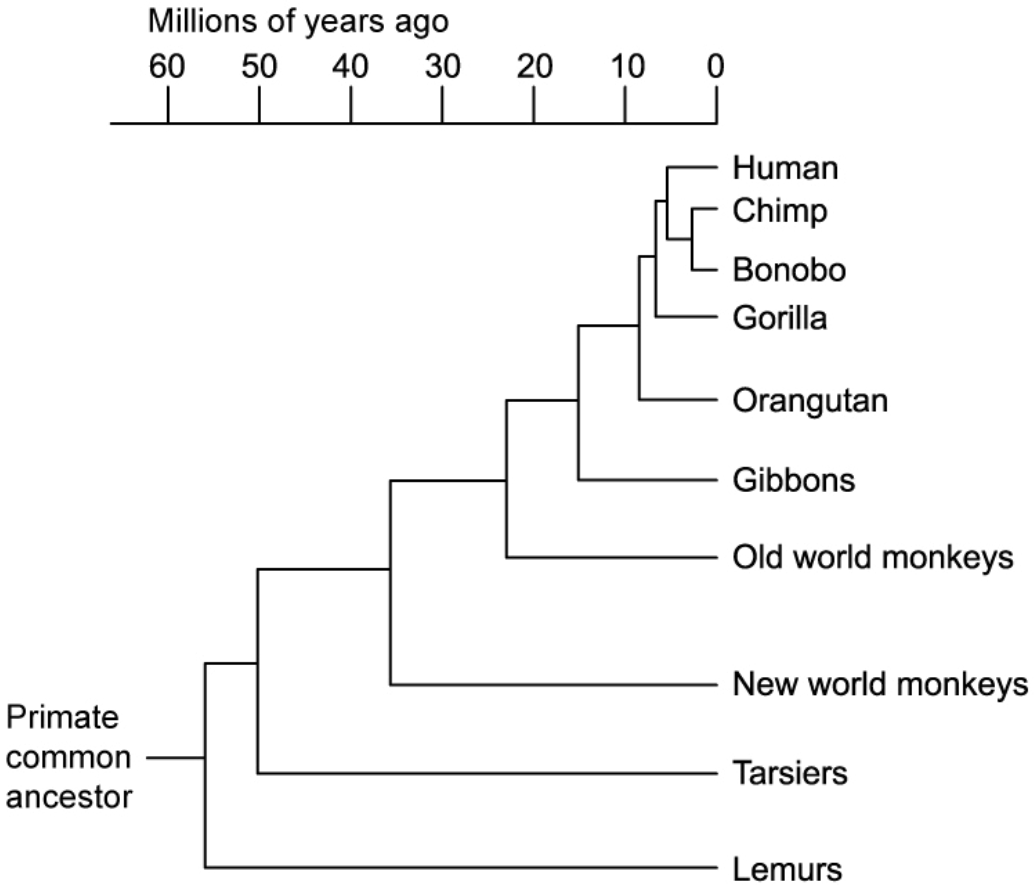
B. I, II and III

C. II and IV only

D. I, II, III and IV

(1 mark)

26 Which of the following **cannot** be concluded from the cladogram below?



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A. Chimps and bonobos are more closely related to each other than to any other species of primate.

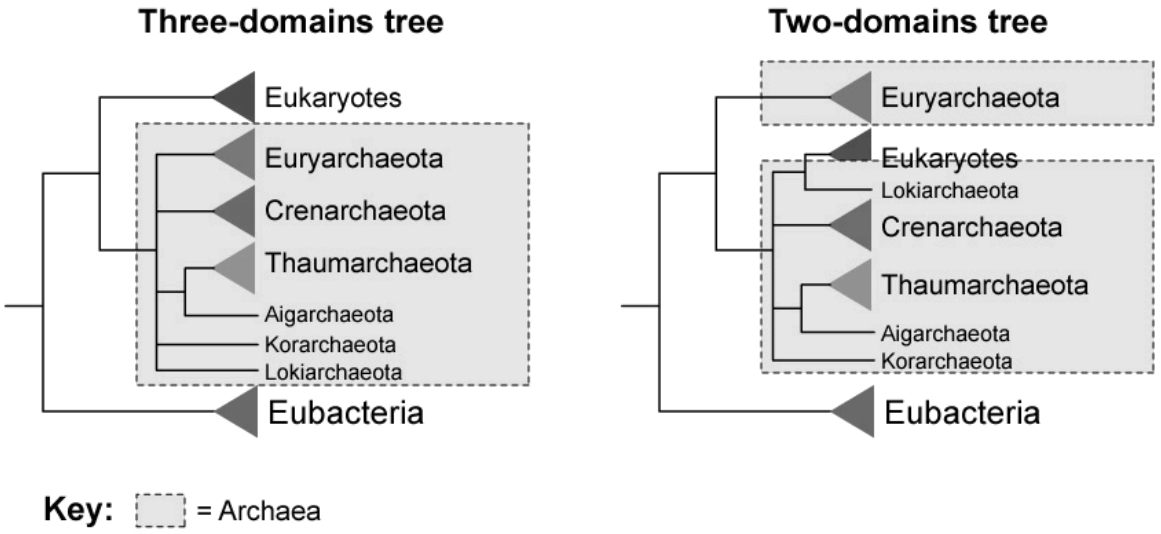
B. Chimps, bonobos, humans, and gorillas form a clade.

C. Lemurs diverged from the rest of the primates around 56 million years ago.

D. Chimps, bonobos, humans, and orangutans form a clade.

(1 mark)

27 RNA analysis led to the development of the three domains system of classifying organisms. More recent methods of building evolutionary trees has led to the proposal of the two domains system. The image compares the three domains tree and the two domains tree.



Which of the following pairs of statements correctly compares the three domains and two domains trees?

	Three domains	Two domains
A.	The eubacteria form a clade	The eubacteria form a clade
B.	The eukaryotes share a common ancestor with the archaea	The common ancestor of all the eukaryotes is within the archaea
C.	The archaea form a clade	The archaea form a clade
D.	The eukaryotes are more closely related to the euryarchaeota than to any other group	The eukaryotes are more closely related to the lokiarchaeota than to any other group

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(1 mark)

28 Which of the following statements about inorganic nutrients are true?

I. Carbon and hydrogen are key components of inorganic ions necessary for cell growth and development
II. Inorganic ions enter the ecosystem through plant roots using energy from ATP
III. Drought leading to dry soils results in a reduced availability of inorganic ions
IV. Sustainability of an ecosystems relies on inorganic ions being locked up within the biomass of an organism

A. I, II and IV

B. II and III

C. II, III and IV

D. II only

(1 mark)

29 Which of the following describes a function of ATP in muscle contraction?

A. To actively transport calcium ions into myofibrils from the sarcoplasmic reticulum

B. To move tropomyosin and expose myosin binding sites

C. To allow crossbridge formation

D. To cause cocking of the myosin head

(1 mark)

30 The graph below shows plant flowering at different day lengths in a species of plant.

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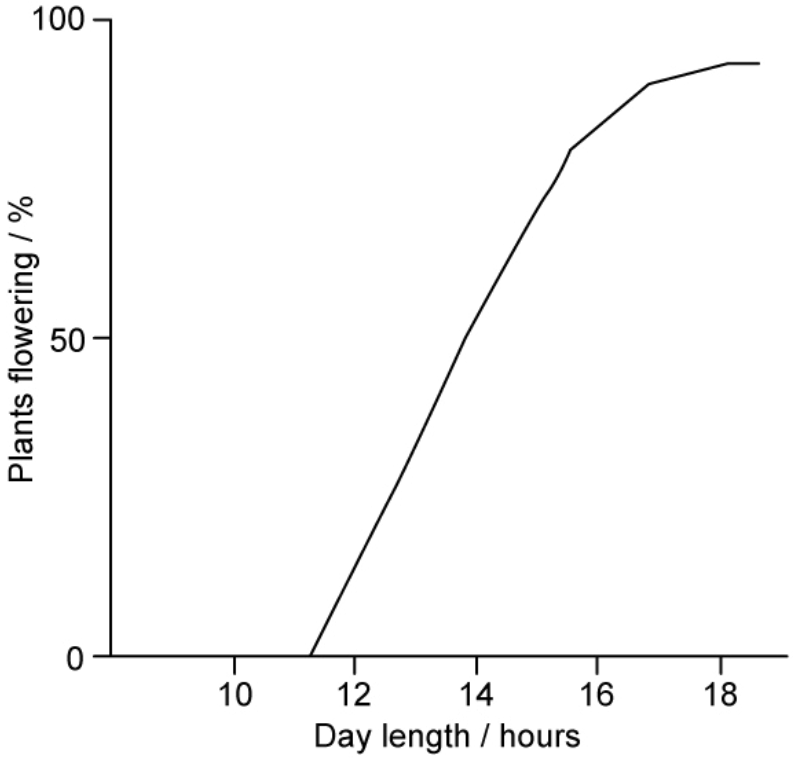

Which of the following provides the most accurate explanation of the data?

A. This is a short day plant and high levels of P_{FR} that are generated when days are long activate flowering.

B. This is a long day plant and high levels of P_R that are generated when days are long activate flowering.

C. This is a long day plant and high levels of P_{FR} that are generated when days are long activate flowering.

D. This is a long day plant and low levels of P_{FR} that are generated when days are short activate flowering.

(1 mark)

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31 Which of the following does **not** form part of the fertilisation process in humans?

A. The cortical granules release glycoproteins to harden the zona pellucida.

B. The cell surface membranes of the oocyte and sperm cell fuse together.

C. The sperm cell binds to proteins on the surface of the oocyte.

D. Digestive enzymes released from the acrosome break down the zona pellucida.

(1 mark)

32 Which combination of secretions are produced by the pancreas?

A. Bile, amylase and maltase.

B. Pepsin, amylase and lipase.

C. Amylase, lipase and phospholipase.

D. Lactase, sucrase and exopeptidases.

(1 mark)

33 Avian bird flu is caused by the H5N1 virus. Scientists are concerned that this could affect humans and cause a pandemic.

Which of these measures would help prevent the spread of disease in humans?

A. Reducing the number of flights between different countries.

B. Killing all birds.

C. Taking a course of antibiotics.

D. Increasing the number of winter flu vaccines administered.

(1 mark)

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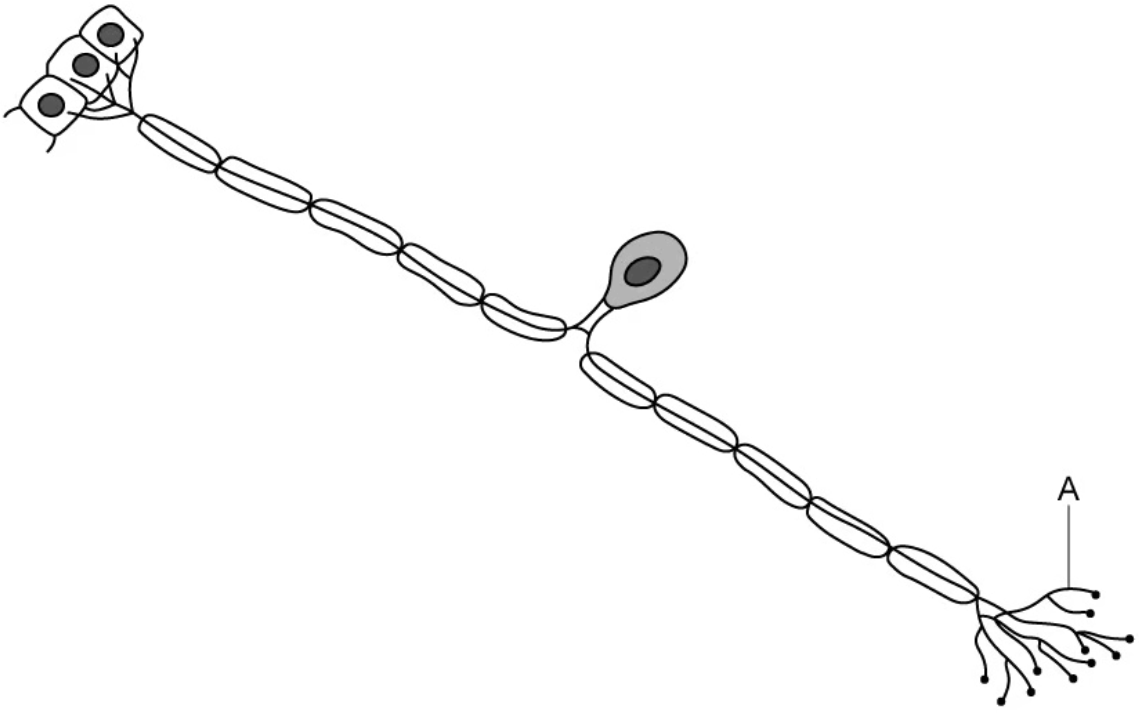
34 During a gas exchange investigation, measurements were recorded from four animals that were observed as they breathed normally over a period of 5 minutes. Note that the efficiency of gas exchange was the same in all four animals and that tidal volume refers to the volume of air that moves into the lungs with each normal breath.

Which animal had the highest oxygen intake during five minutes of normal breathing?

Animal	Tidal volume / dm^3	Breathing rate / breaths per minute
A.	0.2	10
B.	0.6	20
C.	0.5	18
D.	0.33	24

(1 mark)

35 The diagram below shows a sensory neurone connected to its associated receptor cells.



Which best describes the function of the structure labelled **A**?

A. Contains most cellular structures

B. Acts as an electrical insulator

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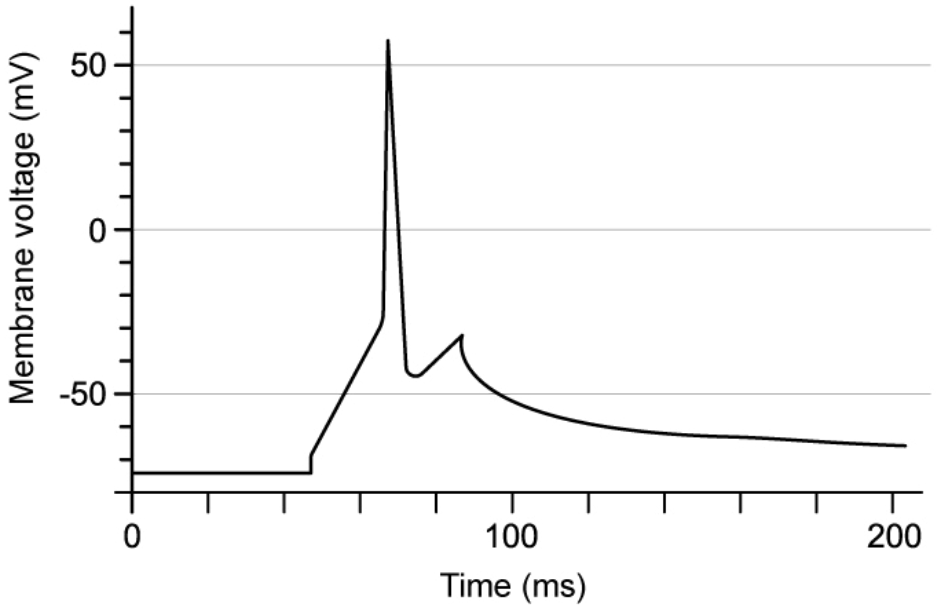
C. Transmit impulses to the spinal cord

D. Transmit and recieve impulses to other neurones

(1 mark)

36 The oscilloscope trace shown below was taken using a digital oscilloscope. It shows an action potential in a hippocampal pyramidal neurone of a potoroo (a small marsupial species) that occurred when the neurone was stimulated with a current pulse.



How many action potentials could be stimulated in this neurone every second?

A. 6

B. 60

C. 12

D. 7

(1 mark)

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37 Which of the following is **not** a range of movement demonstrated by a synovial joint such as an elbow or knee joint?

A. Abduction

B. Flexion

C. Extension

D. Inversion

(1 mark)

38 Water leaves the descending limb of the loop of Henlé by osmosis.

Which is the correct reason for this?

A. Ions are pumped out of the ascending limb of the loop of Henlé, raising the osmolarity of the surrounding medulla.

B. Ions are pumped out of the descending limb of the loop of Henlé, raising the osmolarity of the surrounding medulla.

C. Ions are pumped out of the ascending limb of the loop of Henlé, lowering the osmolarity of the surrounding medulla.

D. Water is reabsorbed into the vasa recta from the surrounding medulla.

(1 mark)

39 The diagram below shows the events occurring inside an ovary during oogenesis.

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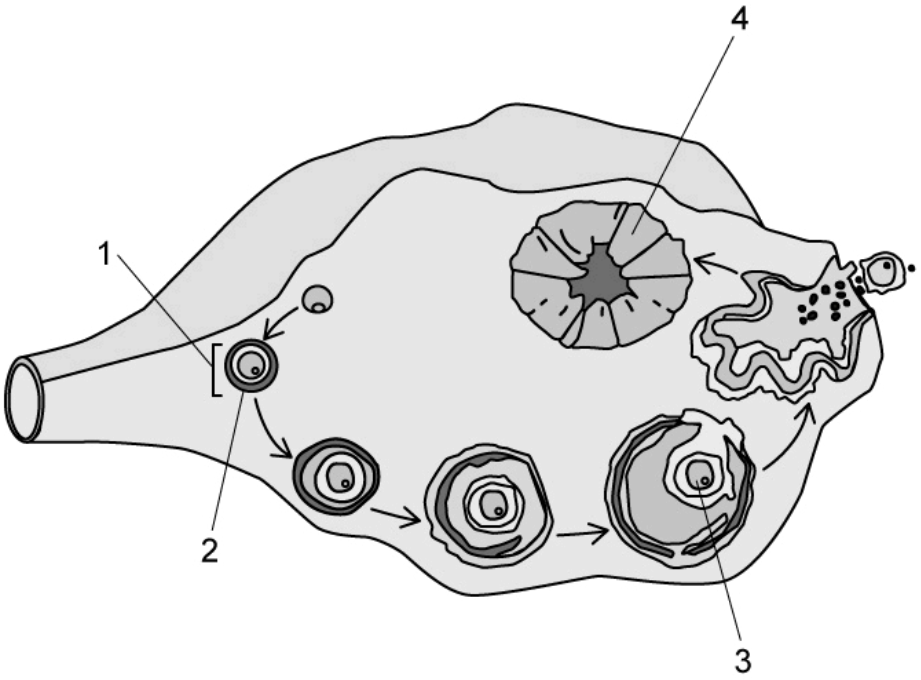

Which row correctly identifies the structures labelled **1**-**4**?

	1	2	3	4
A.	Oogonium	Layer of follicle cells	Primary follicle	Corpus luteum
B.	Primary follicle	Layer of follicle cells	Secondary oocyte	Corpus luteum
C.	Primary follicle	Zona pellucida	Secondary oocyte	Ovum
D.	Germinal epithelium cell	Zona pellucida	Ovum	Secondary oocyte

(1 mark)

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40 Which of the following statements relating to the placenta are correct?

I. The surface area of the placenta increases as the foetus grows.

II. Maternal and fetal blood mixes in the intervillous spaces.

III. The placental barrier is selectively permeable.

A. I and II only.

B. I and III only.

C. II and III only.

D. III only.

(1 mark)

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