Diploma Programme
Programme du diplôme
Programa del Diploma

Biology
Higher level
Paper 1

Wednesday 15 November 2017 (afternoon)

1 hour

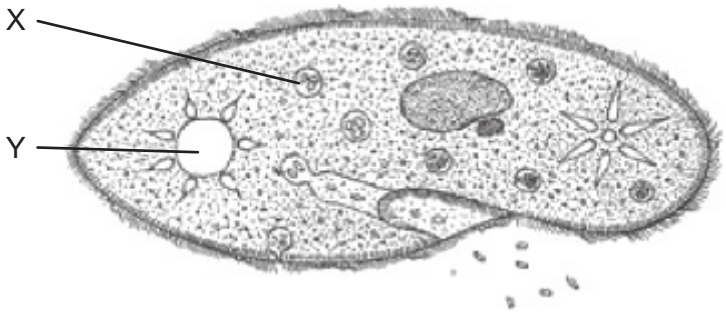
Instructions to candidates

- 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]**.

8817 – 6001

22 pages

The image of a Paramecium refers to question 1 and question 2.



[Source: Adapted from www.biology-resources.com. Copyright 2004–2017 D G Mackean & Ian Mackean. All rights reserved.]

1. Which function is accomplished by structures X and Y in the *Paramecium*?

	X	Y
A.	digestion	homeostasis
B.	feeding	metabolism
C.	food storage	movement
D.	DNA replication	respiration

2. The salt concentration inside the *Paramecium* is 1.8 %. The salt concentration in the surrounding medium suddenly drops to 0.2 %. What will be the likely response?

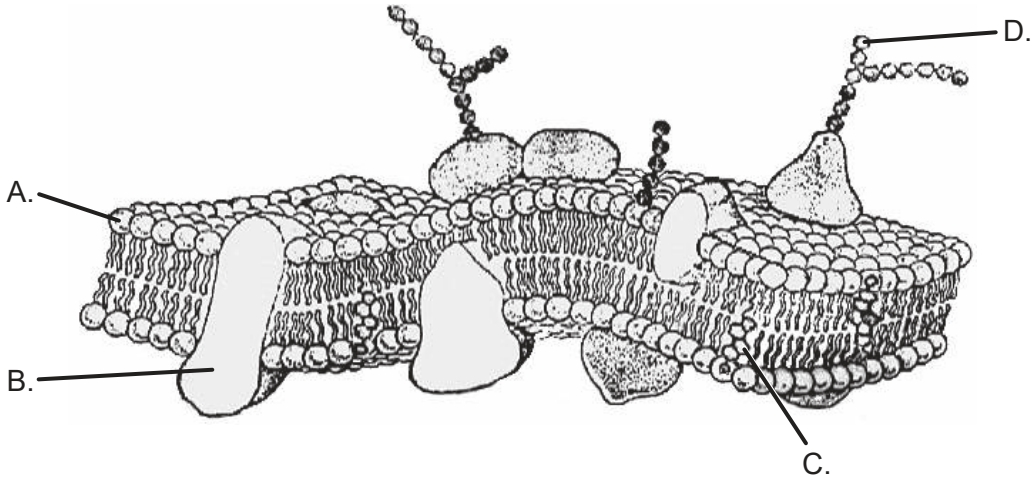
A. The cell will lose salt to the medium.

B. The contractile vacuole will expel more water.

C. The cell will swell and eventually burst.

D. The membrane will become more permeable to salt.

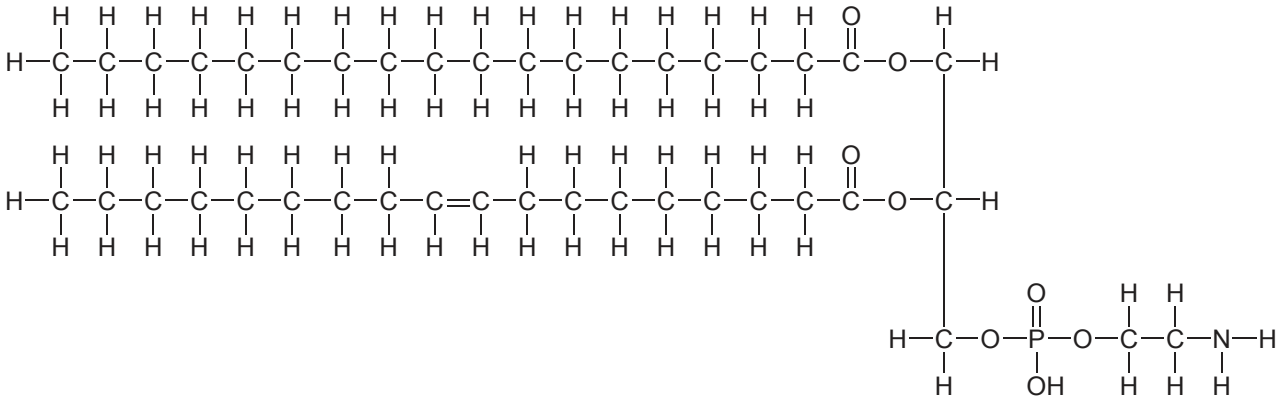
The diagram of a membrane refers to question 3 and question 4.



[Source: © International Baccalaureate Organization 2017]

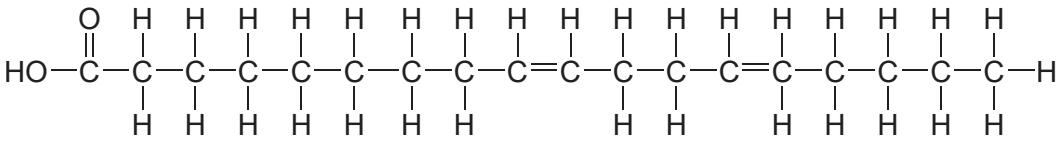
3. In the diagram, which structure is an intrinsic or integral protein?

4. In the diagram, which part of the membrane structure does the molecule below form?

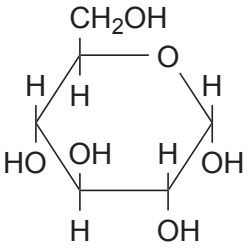


5. Which of the molecules contain peptide bonds or are sugar molecules?

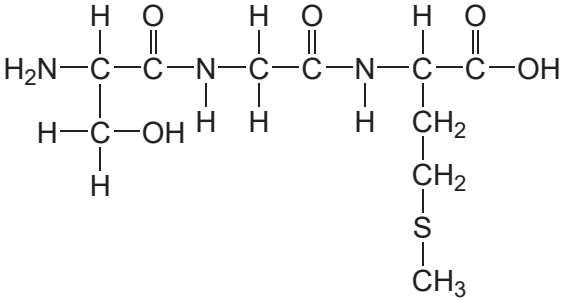
I.



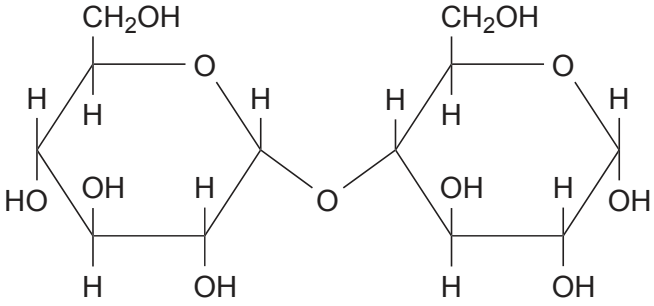
II.



III.

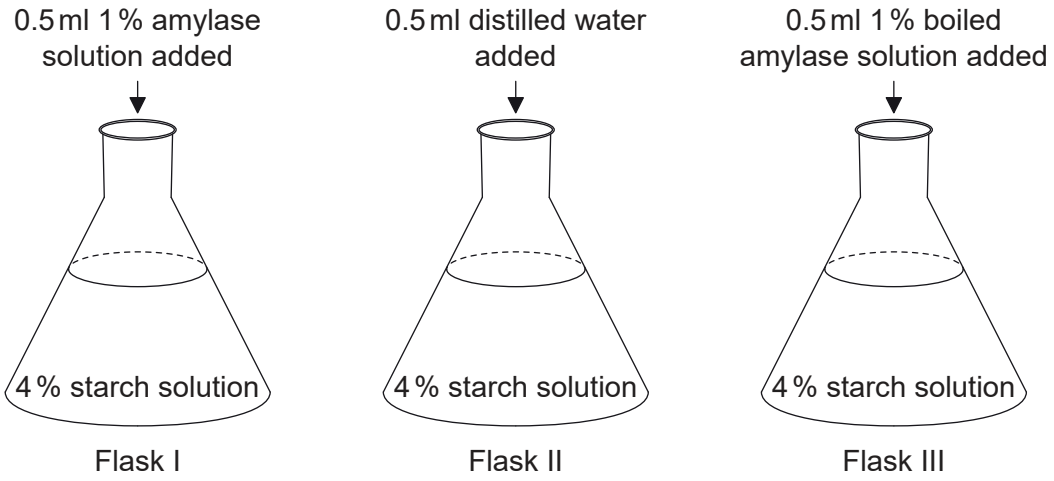


IV.



	Contain peptide bonds	Are sugar molecules
A.	I, III	II
B.	III	II, IV
C.	I, III, IV	II
D.	I	III, IV

6. Three flasks were prepared for an analysis of the activity of amylase. At time zero, each of the substances indicated in the diagrams was added.



Which flask(s) could provide support for the hypothesis that heat denatures enzymes?

A. Flasks I and II after 15 minutes

B. Flasks II and III after 15 minutes

C. Flasks I and III after 15 minutes

D. Flask III at time zero and again after 15 minutes

7. For which discovery about DNA do Watson and Crick receive credit?

A. DNA is the molecule that genes are made of.

B. The amount of adenine equals the amount of thymine in an organism.

C. Phosphate–pentose bonding along the nucleotide backbone is covalent.

D. The shape of DNA is a double helix.

8. Which sequence of bases and amino acids could be produced by transcription and translation of the DNA molecule shown?

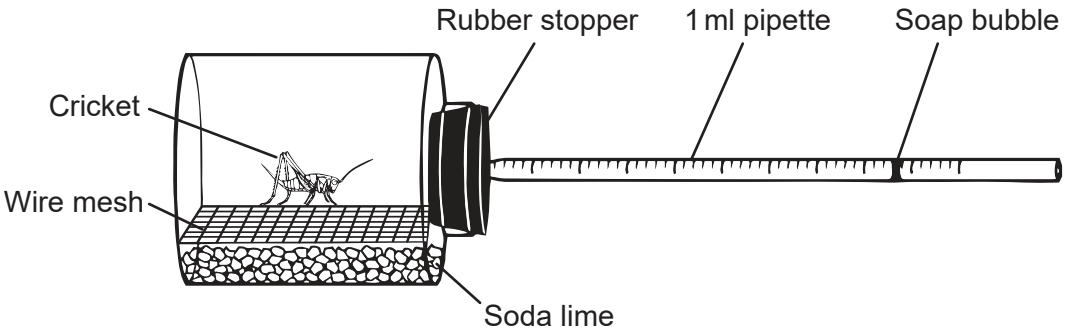
3′ A T G A A A T G C T T T C G C G G G 5′
5′ T A C T T T A C G A A A G C G C C C 3′

2nd base in codon

1st base in codon	U	C	A	G	3rd base in codon
U	Phe	Ser	Tyr	Cys	**U**
	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**

	Sequence of bases	Sequence of amino acids
A.	UAC-UUU-ACG-AAA-GCG-CCC	Leu-Lys-Cys-Phe-Arg-Gly
B.	GGG-CGC-UUU-CGU-AAA-CAU	Gly-Arg-Phe-Arg-Lys-His
C.	AUC-AAA-UGC-UUU-CGC-GGG	Met-Lys-Cys-Phe-Arg-Gly
D.	UAC-UUU-ACG-AAA-GCG-CCC	Tyr-Phe-Thr-Lys-Ala-Pro

9. A cricket was placed in a respirometer at constant temperature for ten minutes. The soap bubble moved along the pipette.



[Source: © International Baccalaureate Organization 2017]

What was measured by the movement of the soap bubble?

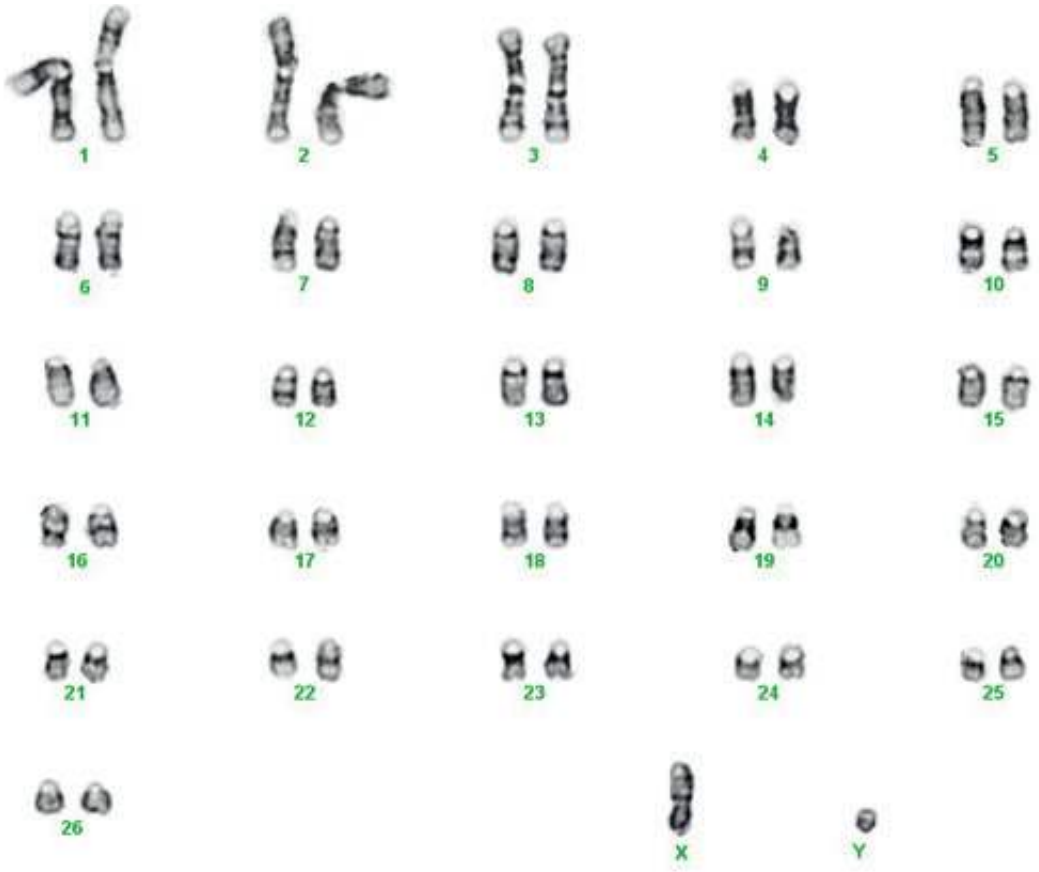
A. Production of carbon dioxide

B. Volume of excretory products

C. Oxygen consumption

D. Release of heat

10. The image shows a karyogram.



[Source: https://commons.wikimedia.org/wiki/File:Karyotype_of_sheep_(Ovis_aries).png, by M. Singh, X. Ma, E. Amoah and G. Kannan]

What information can be determined from this karyogram?

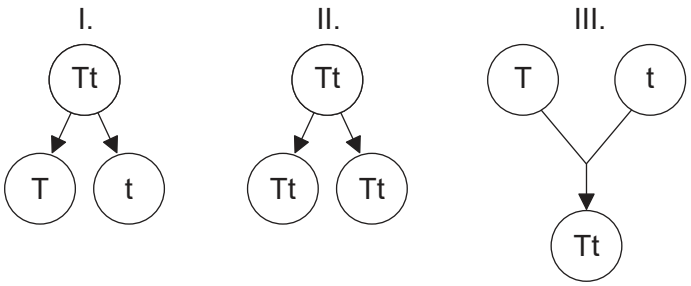
A. The sex is female.

B. The haploid number is 54.

C. Disjunction occurred during meiosis.

D. The species is not human.

11. Which diagram(s) represent(s) processes used in asexual reproduction?



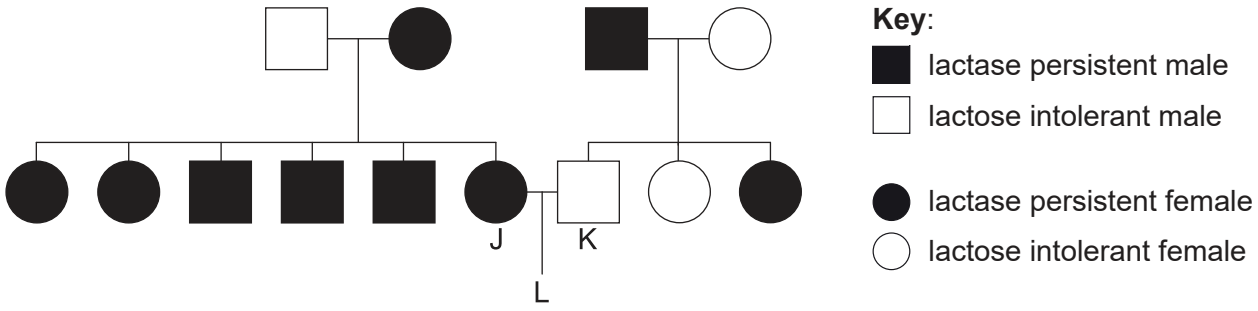
A. I only

B. I and II only

C. II only

D. I, II and III

12. A dominant autosomal allele for lactase persistence allows humans to digest milk as adults. People who lack this allele are lactose intolerant in adulthood.



If J and K have a child L, what is the probability that L will be lactase persistent?

A. 25 %

B. 50 %

C. 75 %

D. 100 %

13. *Hin*dIII is an endonuclease that recognizes the sequence A A G C T T, cutting between the two adenines.

5′ T T A A G C T T A A G A A G A A G C T T 3′
3′ A A T T C G A A T T C T T C T T C G A A 5′

Into how many DNA fragments would the strand shown be cut by *Hin*dIII?

A. 2

B. 3

C. 4

D. 5

14. In an area of forest measuring 100 m by 100 m, samples were taken to estimate the number of silver maple (*Acer saccharinum*) trees in the forest. The number of trees counted in each of five areas of 400 m^2 was recorded.

	3			
			5	
4		5		
			8	

Approximately how many silver maple trees are in the 10 000m^2 area of forest?

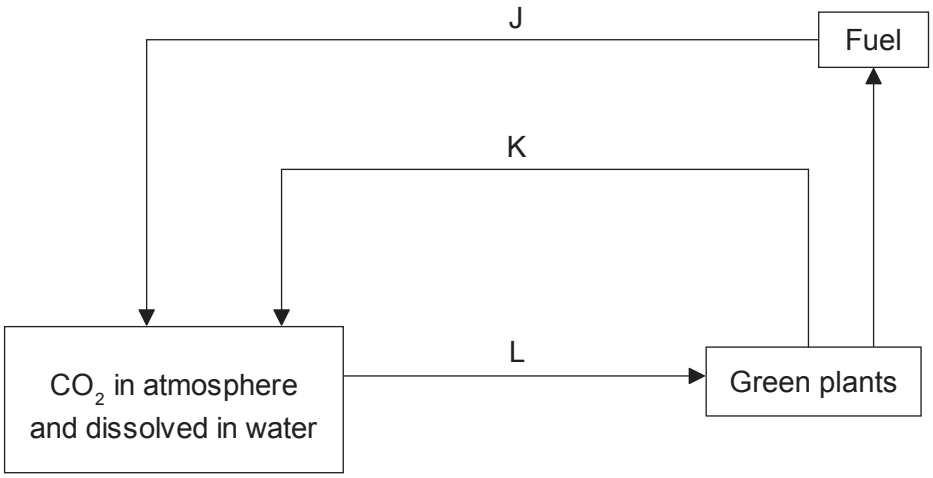
A. 5

B. 25

C. 125

D. 625

15. The diagram shows the carbon cycle.



[Source: © International Baccalaureate Organization 2017]

Which two processes correspond to the labelled arrows?

A. K is combustion and L is catabolism.

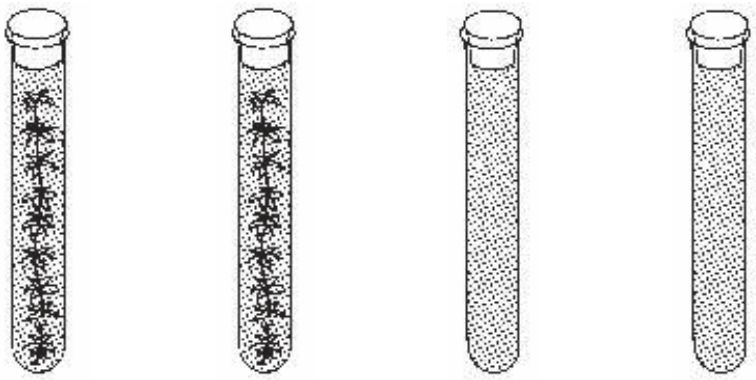
B. J is anabolism and K is respiration.

C. J is combustion and K is respiration.

D. J is anabolism and L is catabolism.

16. An experiment was set up so that each test tube contained water at a pH of 6.3 and a pH indicator. Test tubes 1 and 2 also contained a common pond autotroph. Carbon dioxide dissolves in water and forms carbonic acid. After three days the four test tubes were found to have these results.

Test tube 1	**Test tube 2**	**Test tube 3**	**Test tube 4**
kept in light pH = 7.0	kept in dark pH = 5.5	kept in light pH = 6.4	kept in dark pH = 6.2



What conclusion can be drawn from test tube 1 and test tube 2?

	Test tube 1	**Test tube 2**
A.	photosynthesis has used CO_2	respiration has produced CO_2
B.	photosynthesis has made the water more acidic	respiration has made the water less acidic
C.	photosynthesis occurred but not respiration	respiration occurred but not photosynthesis
D.	no conclusion can be drawn, since pH in the controls has changed	

17. The table shows the number of differences between humans and other selected organisms for the protein cytochrome c oxidase. This protein, consisting of 104 amino acids, is located in the mitochondria and functions as an enzyme during cell respiration.

Organism pairs	Number of amino acid differences
Human – chimpanzee	0
Human – fruit fly	29
Human – horse	12
Human – pigeon	12
Human – rattlesnake	14
Human – rhesus monkey	1
Human – screwworm fly	27
Human – snapping turtle	15
Human – tuna fish	21

If the data were used to draw a cladogram, which chordates would be furthest apart from humans?

A. Chimpanzee because it has zero differences

B. Fruit fly because it has the most differences

C. Tuna fish because it is the chordate with the most differences

D. Horse because it is in the same class

18. What causes variation within a population?

A. Fertilization and change in the environment

B. Fertilization and mutation

C. Mutation and evolution

D. Evolution and adaptive radiation

19. Which of the organisms A–D, identified by the key, represents a reptile?

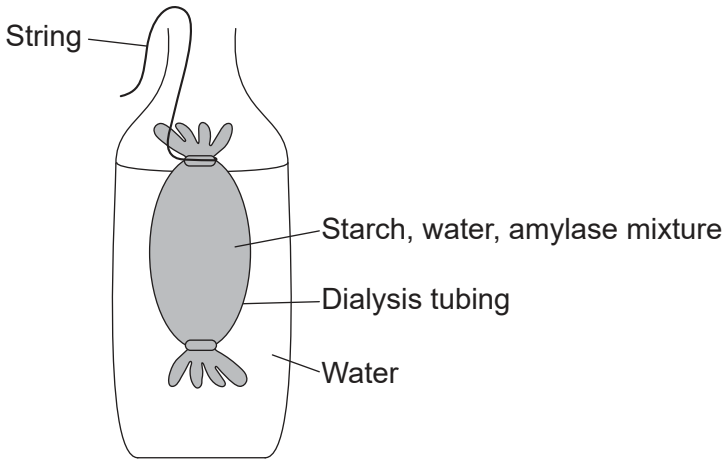
1. fins, gills, 2-chamber heart . . . . . fish
   no fins, more than 2 chambers in heart . . . . . go to 2

2. mucus on skin, gills and lungs . . . . . A.
   no gills, breathes with lungs . . . . . go to 3

3. dry scales, lays eggs on land or live birth . . . . . B.
   constant body temperature, 4 limbs . . . . . go to 4

4. lays eggs with hard shells . . . . . C.
   hair or fur, live birth . . . . . D.

20. Dialysis membrane was set up to model digestion and absorption in the small intestine.



What is a limitation of this model?

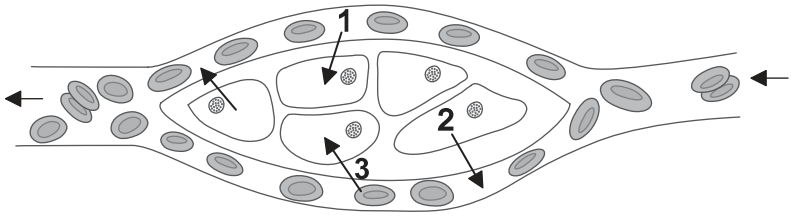
A. There can be no active transport.

B. Maltose will pass through the membrane.

C. Lipase should be present with protein.

D. The membrane is not permeable to starch.

21. The diagram shows red blood cells and undifferentiated tissue cells.



[Source: © International Baccalaureate Organization 2017]

Diffusion of oxygen from blood cells to tissue cells is represented by arrow 3 in the diagram. What molecules are shown diffusing by arrow 1 and arrow 2?

	Arrow 1	Arrow 2
A.	carbon dioxide	urea
B.	water	glucose
C.	glucose	carbon dioxide
D.	fatty acids	amino acids

22. What can protect the body from blood loss?

A. Antibodies

B. Fibrin

C. Histamines

D. Hemophilia

23. Which type of cell is specialized to facilitate gas exchange?

A. Type I pneumocytes

B. Type II pneumocytes

C. Internal intercostal muscle fibres

D. External intercostal muscle fibres

24. What happens when an action potential reaches motor end plates?

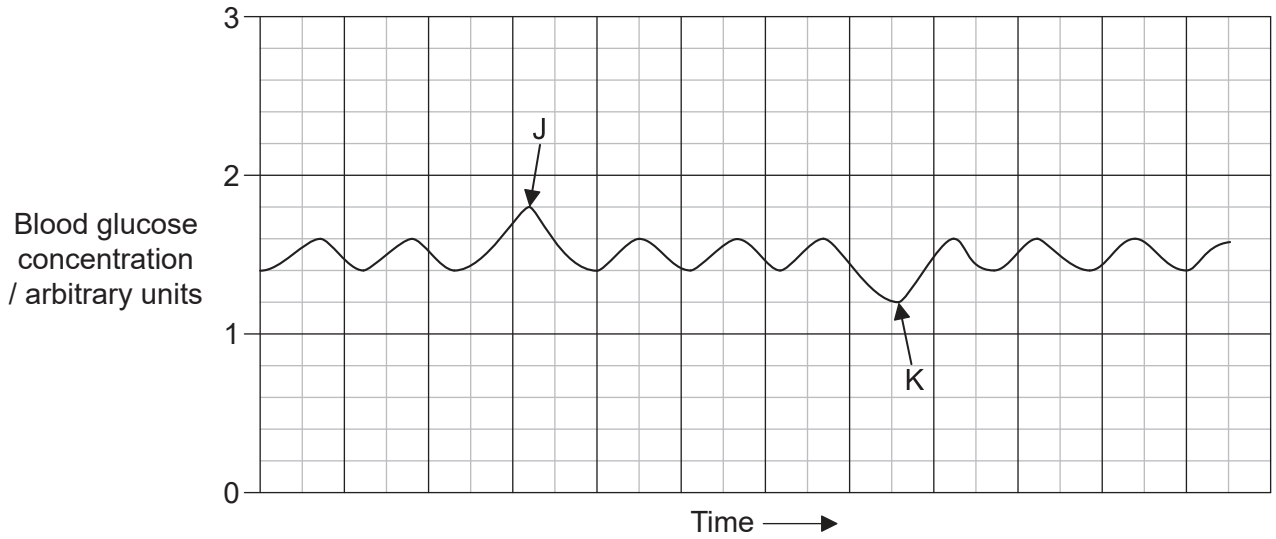
A. Calcium ions are absorbed by the muscle fibres.

B. The sarcomeres relax.

C. Neurotransmitter is released.

D. Action potential is passed to the neuron.

25. The graph shows changes in an individual's blood glucose concentration over time.



What hormones were secreted at J and K?

	J	K
A.	epinephrine	insulin
B.	insulin	glucagon
C.	glucagon	insulin
D.	thyroxin	epinephrine

26. Some regions of DNA do not code for the production of proteins. What are these regions of DNA used as?

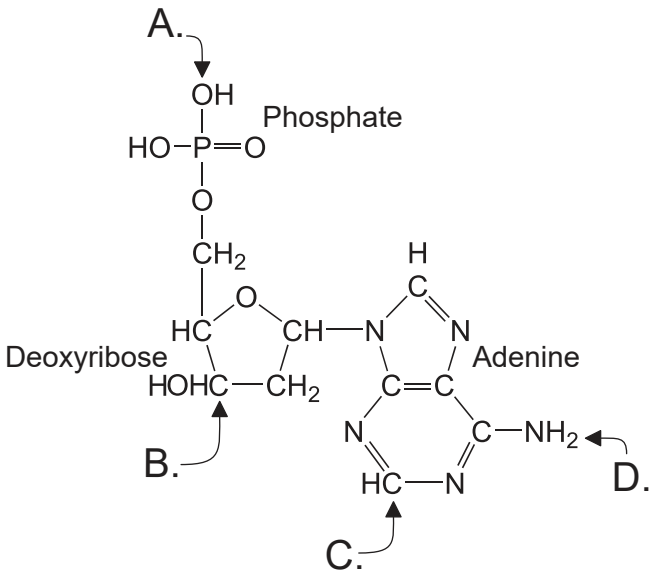
A. They have no known function and are recycled to provide nucleotides

B. Gene regulation and coding for production of enzymes used in translation

C. Telomeres and coding for production of tRNA

D. Introns and coding for production of structural proteins

27. Which letter (A–D) indicates where a new nucleotide would attach?



28. Which cell component synthesizes actin and myosin?

A. Free ribosomes

B. Rough endoplasmic reticulum

C. Smooth endoplasmic reticulum

D. Nuclear membrane

29. Which reaction does **not** cause a net release of energy?

A. ADP combines with inorganic phosphate to form ATP

B. ATP releases inorganic phosphate to form ADP

C. Loss of hydrogen from reduced NAD

D. Oxidation of reduced FAD

30. Which process occurs during the light-dependent reaction of photosynthesis?

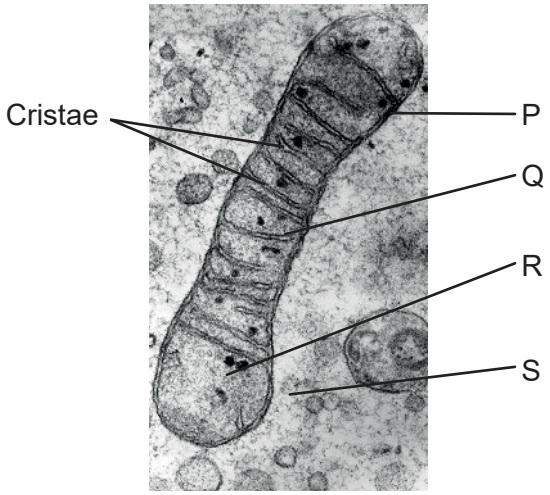
A. ATP, CO_2 and H_2O are produced.

B. CO_2 is used to produce carbohydrates.

C. ATP and O_2 are produced.

D. RuBP is phosphorylated.

31. The image shows a portion of a cell containing a mitochondrion.



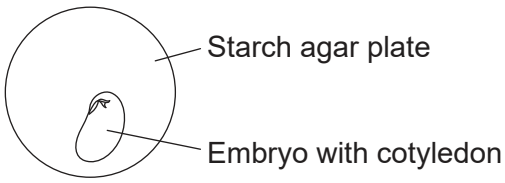
[Source: 'TEM of a mitochondrion' by Prof. R. Bellairs. Credit: Prof. R. Bellairs. CC BY 4.0.]

Where do glycolysis and electron transport occur?

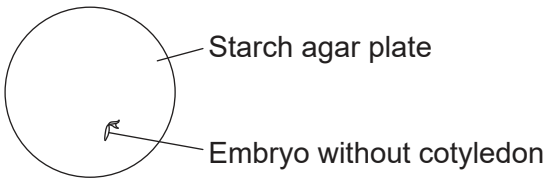
	Glycolysis	Electron transport
A.	P	R
B.	R	Q
C.	R	R
D.	S	Q

32. Agar is a growth medium without nutrients; starch agar is agar with starch added to it. Seed coats were removed from seeds and the seeds were used to set up the following conditions. Which plant embryo was **unable** to grow?

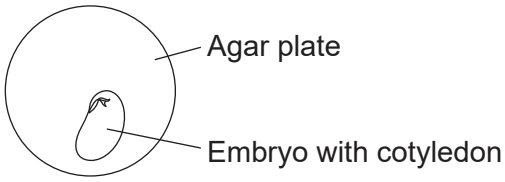
A.



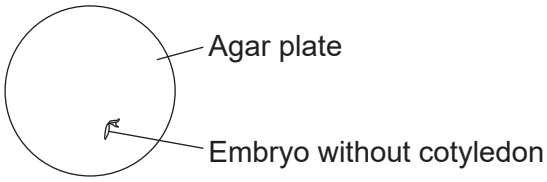
B.



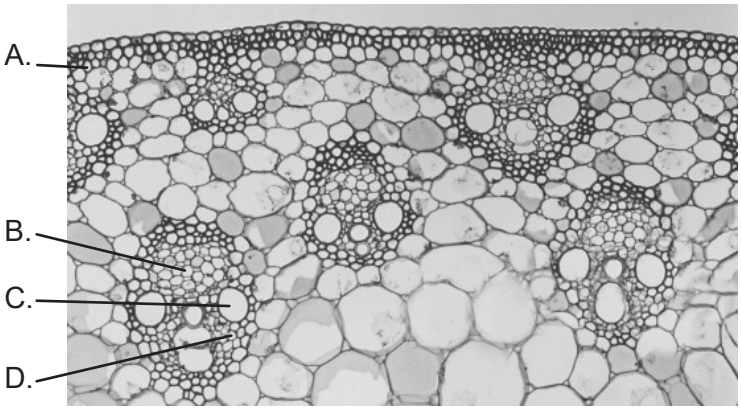
C.



D.



33. Which letter identifies phloem?



[Source: E R DEGGINGER/Getty Images]

34. Cobalt chloride paper is blue when dry but turns pink with water. Blue cobalt chloride paper was fastened to the upper and lower surfaces of a plant leaf. After 20 minutes, many small pink dots were observed on the paper on the lower surface, and a few pink dots were seen on the upper surface. What conclusions can be drawn?

I. There are more stomata on the lower surface than on the upper surface.
II. Stomata on the upper surface are blocked by the waxy cuticle.
III. More transpiration occurs through the lower surface than through the upper surface.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

35. How do the concepts of gradualism and punctuated equilibrium differ?

A. The timing of evolution

B. The mechanism causing evolution

C. The sequence of evolutionary events

D. The reality of evolution

36. In a plant, dark leaves are dominant to pale leaves and yellow seeds are dominant to white seeds.

A heterozygous dark-leaved plant with yellow seeds was crossed with a pale-leaved plant with white seeds. A large number of offspring were produced. They were either dark-leaved with yellow seeds or pale-leaved with white seeds in equal number.

What is the **most** likely cause of this pattern?

A. Crossing over has occurred.

B. The two genes are linked.

C. The traits are polygenic.

D. The genes are codominant.

37. What forms the basis of immunity after vaccination?

	Production of histamines	**Clonal selection**	**Production of memory cells**
A.	yes	no	no
B.	yes	no	yes
C.	no	yes	no
D.	no	yes	yes

38. Which processes require calcium?

I. Muscle contraction
II. Movement of an action potential along an axon
III. Production of the skeleton of hard corals

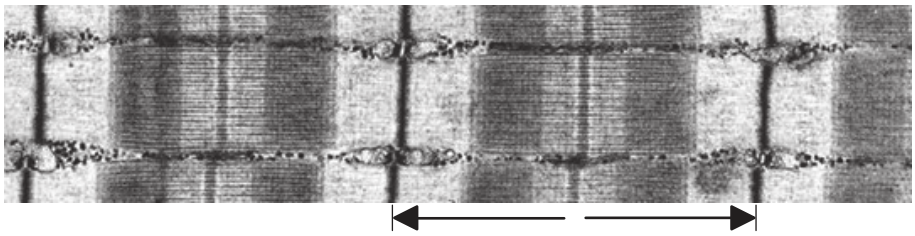
A. I and II only

B. I and III only

C. II and III only

D. I, II and III

39. What structure is indicated by the arrows?



[Source: Courtesy Roger Craig, University of Massachusetts]

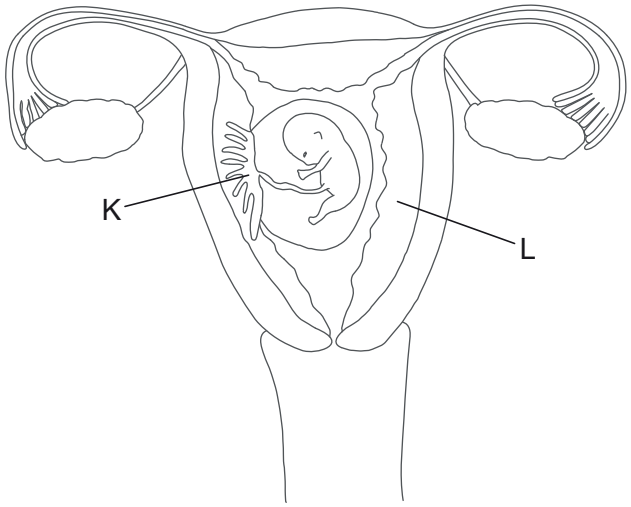
A. One muscle fibre

B. One sarcomere

C. One myofibril

D. One Z line

40. The diagram shows the female reproductive system.



[Source: © International Baccalaureate Organization 2017]

Which structures do K and L identify?

	K	L
A.	endometrium	uterine wall
B.	placenta	endometrium
C.	amnion	placenta
D.	fetus	uterine wall