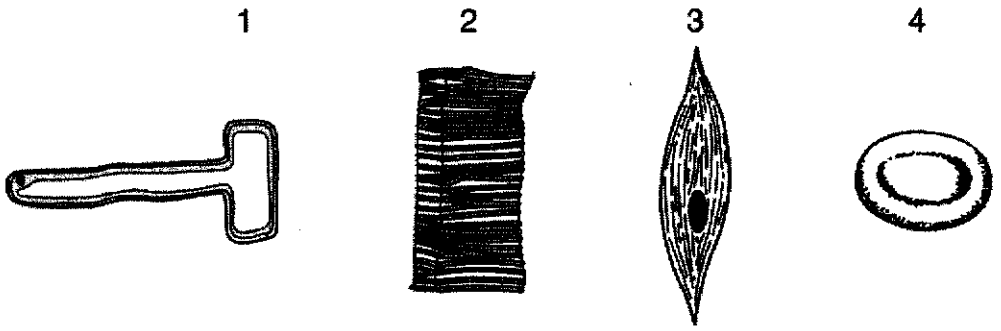
Multiple Choice Questions [40m]

Shade your answers in the OTAS answer sheet provided

1 The diagram shows four cells.



Which cells transport water?

A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 4

2 In the pancreas, there are groups of cells that make insulin.

What describes these cells?

A an organ in an organism
B an organ system in an organism
C cells within a cell wall
D tissue in an organ

3 An actively growing cell is supplied with radioactive amino acids.

Which cell component would first show an increase in radioactivity?

A Golgi body
B nucleus
C rough endoplasmic reticulum
D secretory vesicle

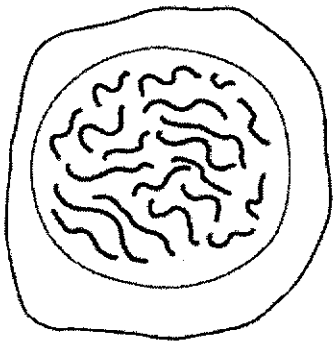
4 Mucus is a complex mixture that contains many chemically modified proteins. When mucus is secreted from a goblet cell in the trachea, these events take place.

1 addition of carbohydrate to protein
2 fusion of the vesicle with the plasma membrane
3 secretion of a chemically modified protein
4 separation of a vesicle from the Golgi apparatus

What is the sequence in which these events take place?

A 1 → 4 → 2 → 3
B 1 → 4 → 3 → 2
C 4 → 1 → 2 → 3
D 4 → 1 → 3 → 2

5 The diagram shows a cell of an organism formed by reduction division.



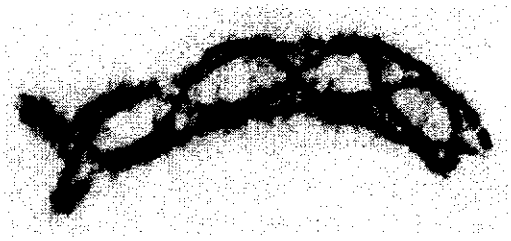
What is the haploid number for this organism?

A 10
B 20
C 40
D 46

6 What occurs in meiosis?

	homologous chromosomes pair	chromosome number remains the same
A	×	✓
B	✓	×
C	×	×
D	✓	✓

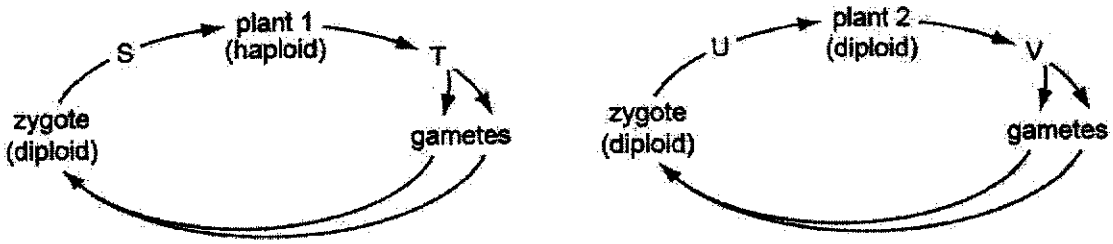
7 The diagram shows an event that occurs during synapsis of two homologous chromosomes.



Which statement does not describe the diagram?

A Crossing over occurs after chromatin threads condense and shorten.
B Crossing over occurs before sister chromatids separate.
C Crossing over occurs between two chromatids at the centromere.
D Crossing over occurs forming five chiasmata.

8 The diagram shows the life-cycles of two types of simple plant.



Where will reduction divisions occur in the life cycles?

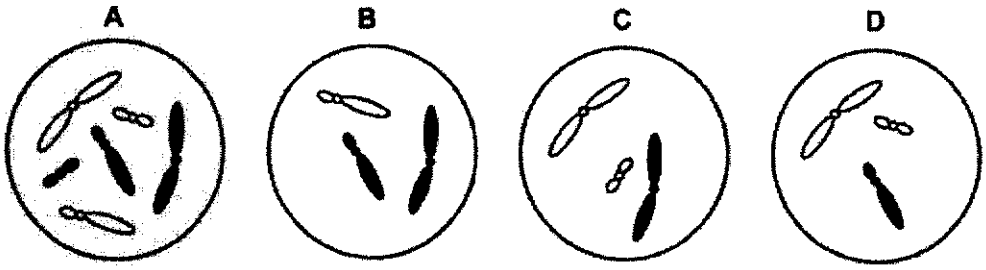
A at S and U
B at S and V
C at T and U
D at T and V

9 What are the conditions in a human cell just before the cell enters prophase?

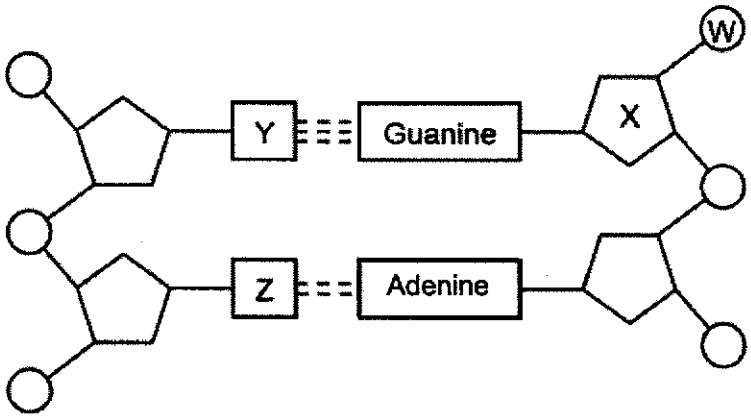
	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

10 The diagram below represents the nucleus of a body cell of an organism.

Which diagram represents a possible gamete nucleus produced by the organism?



11 The diagram shows part of a DNA molecule.



Which letters indicate cytosine, deoxyribose, phosphate and thymine, respectively?

	cytosine	deoxyribose	phosphate	thymine
A	W	X	Y	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Y	Z	X	W

12 Which statement describes a gene?

A a base with a sugar and a phosphate group
B a chain of alleles on a chromosome
C a number of DNA molecules
D a sequence of nucleotides

13 The table shows the percentages of bases on a single strand of DNA.

nucleotide	percentage
adenine	22.6
cytosine	20.4
guanine	47.1
thymine	11.3

What percentage thymine nucleotides will there be on the strand of DNA that is complementary to this strand?

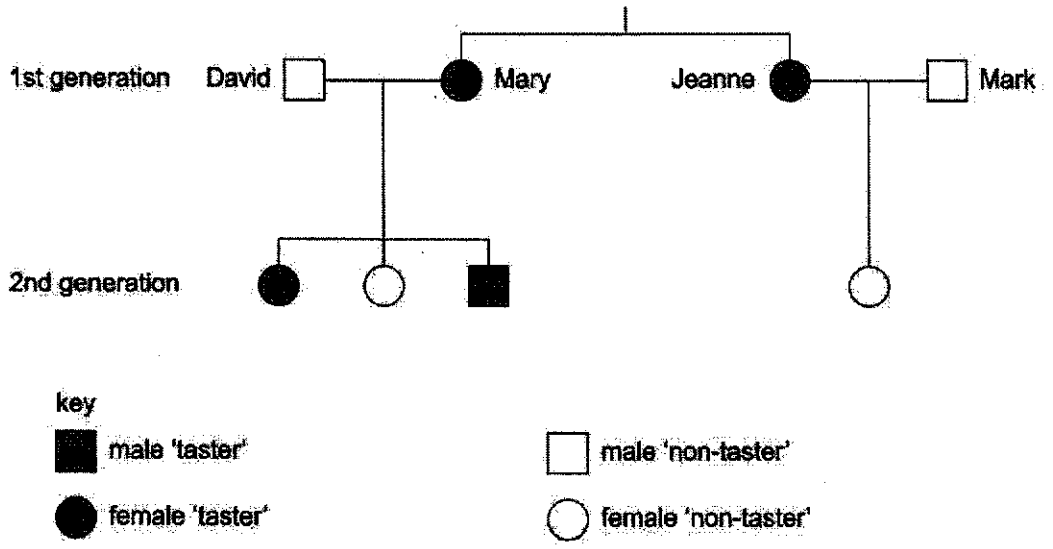
A 33.9
B 22.6
C 20.4
D 11.3

14 Which fertilisation would result in a female child with Down syndrome?

	chromosomes in ovum	fertilised by	chromosomes in sperm
A	22 + 1X		22 + 1X
B	22 + 1X		23 + 1X
C	23 + 1Y		22 + 1X
D	23 + 1Y		23 + 1X

15 The diagram shows a family tree and the inheritance of the ability to taste a certain substance.

The allele for the ability to taste this substance is dominant.



Which statement about the genotypes of the sisters Mary and Jeanne is correct?

A Mary is heterozygous and Jeanne is homozygous.
B Mary is homozygous and Jeanne is heterozygous.
C They are both heterozygous.
D They are both homozygous.

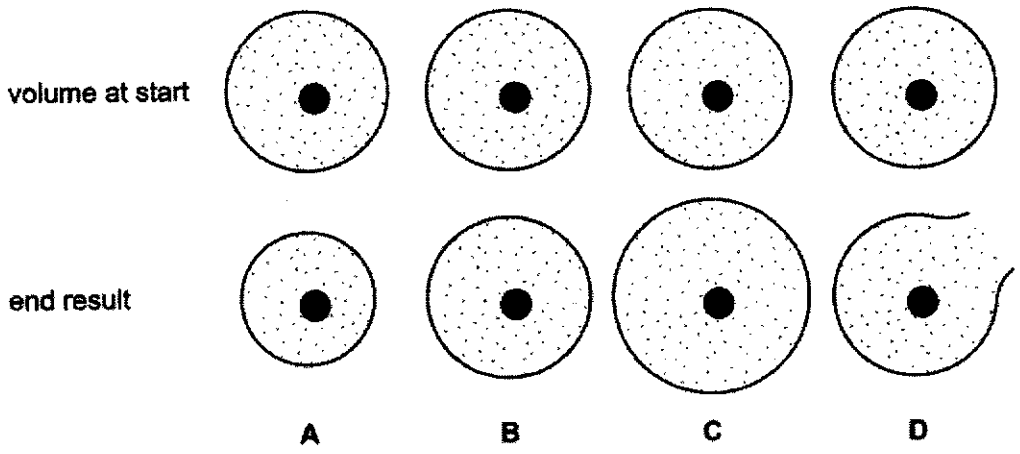
16 Which two statements about continuous variation are correct?

1 A group of adult males had heights ranging from 155 cm to 220 cm.
2 During puberty there is a dramatic growth spurt.
3 During old age, people tend to shrink in height.
4 Humans have stopped growing by the time they are 22 years old.
5 The heights of adult humans will partly depend on the quality of their diets when young.

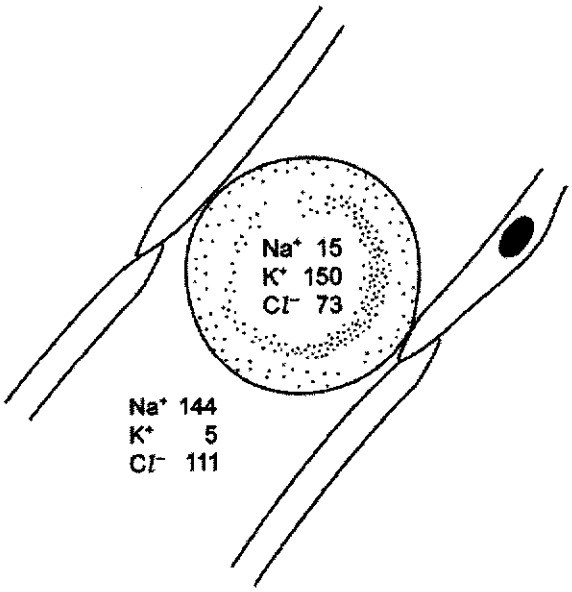
A 1 and 2
B 1 and 5
C 2 and 4
D 3 and 5

17 Identical animal cells were placed in solutions of differing water potentials. The diagram shows the volume of the cells at the start and the end result.

Which cell was placed in the solution with the lowest water potential?



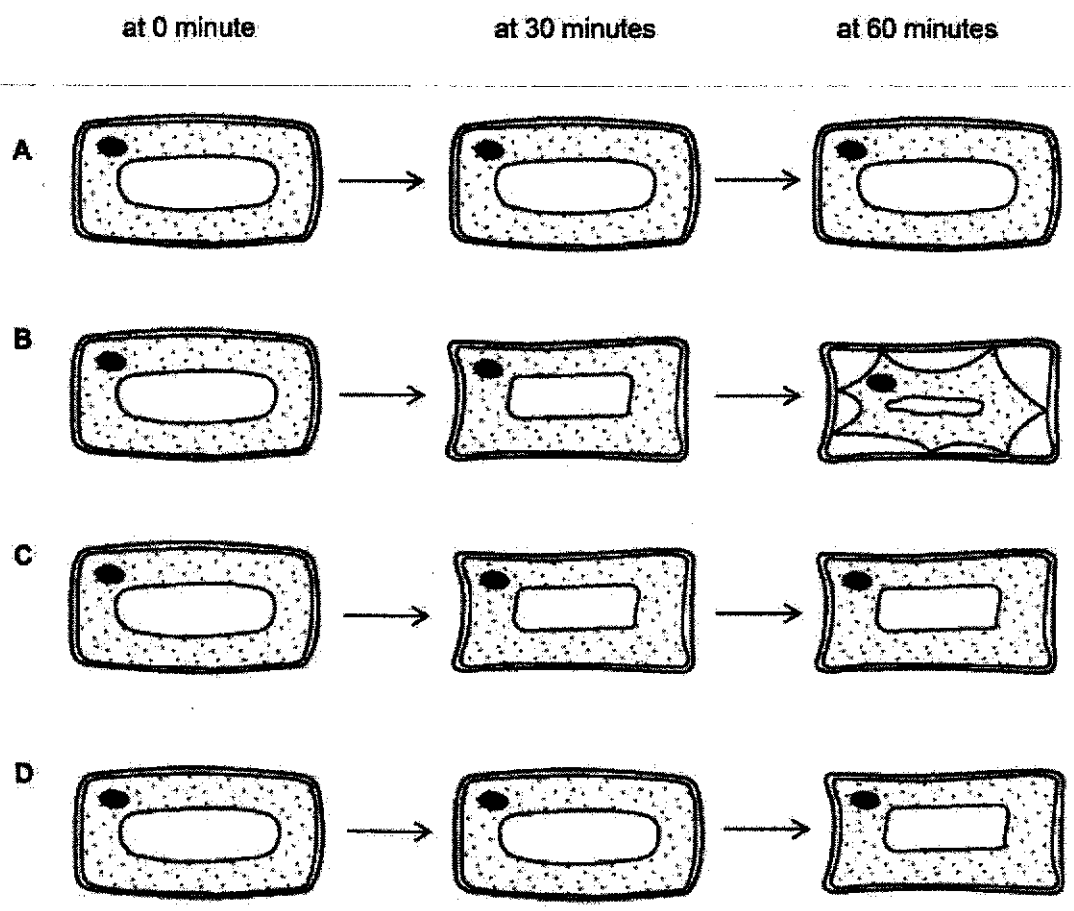
18 The diagram shows a red blood cell and the concentrations of ions, in mmol dm^{-3}, in the plasma and in the cell.



Which of the following is correct?

	active transport into cell	diffusion into cell
A	Cl^-	K^+
B	K^+	Na^+
C	Na^+	K^+
D	Na^+	Cl^-

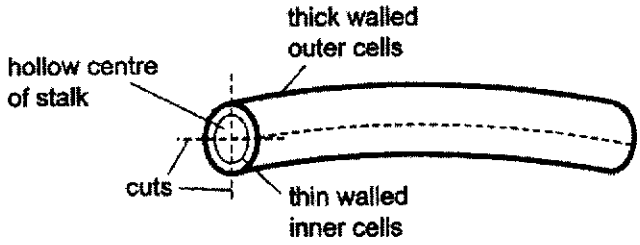
19 Which of the following shows the most likely changes in appearance of a plant cell in concentrated salt solution?



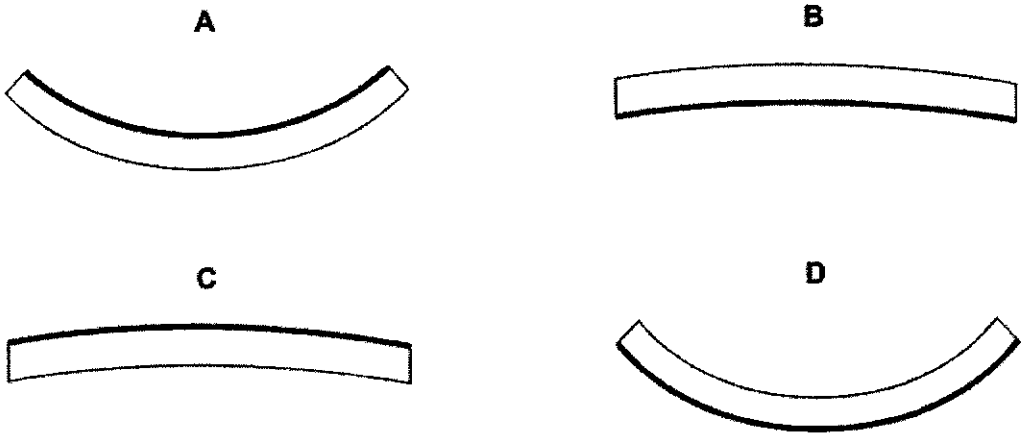
20 Which food test shows the presence of salivary amylase in saliva?

A Benedict's test
B biuret test
C ethanol emulsion test
D iodine test

21 The stalk of a dandelion flower is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in concentrated sucrose solution?



22 The diagram represents a large molecule found in egg white, synthesized by joining smaller molecules together.

Which line names the large molecule and its components?

	large molecule	amino acid	fatty acid	glucose	glycerol
A	glycogen	✓	×	✓	×
B	lipid	×	✓	×	✓
C	polypeptide	✓	×	×	×
D	starch	×	✓	✓	×

key
✓= component present
× = component absent

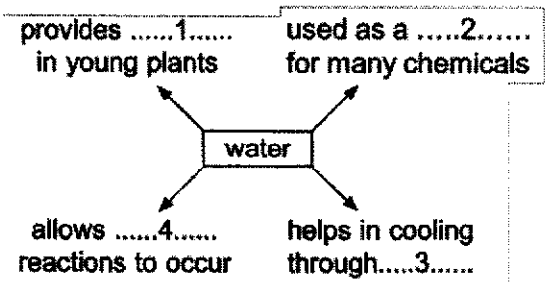
23 Four sugar solutions were tested with a standard Benedict's solution. The table shows the colour of the solutions after testing.

solution	colour
1	green
2	blue
3	brick-red
4	yellow

What is the best interpretation of the results?

	solution **1**	solution **2**	solution **3**	solution **4**
A	0.05% reducing sugar	0.5% non-reducing sugar	1.0% reducing sugar	0.1% reducing sugar
B	0.5% reducing sugar	0.05% reducing sugar	0.1% reducing sugar	1.0% reducing sugar
C	1.0% reducing sugar	1.0% non-reducing sugar	1.5% reducing sugar	0.5% reducing sugar
D	1.0% non-reducing sugar	0.5% reducing sugar	0.5% non-reducing sugar	0.1% non-reducing sugar

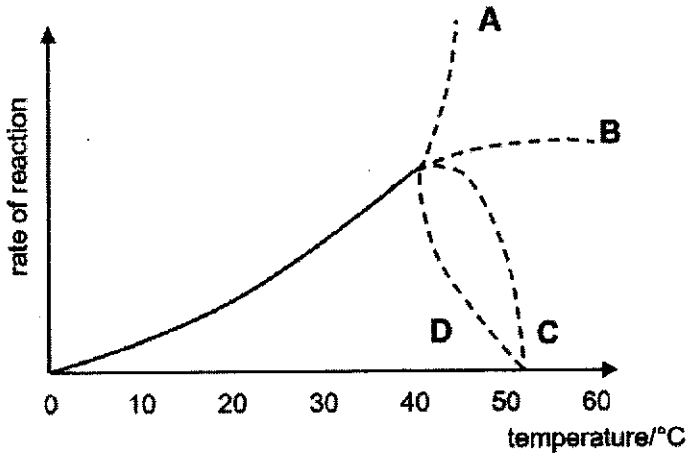
24 The diagram shows some uses of water.



Which words correctly complete blanks 1, 2, 3 and 4?

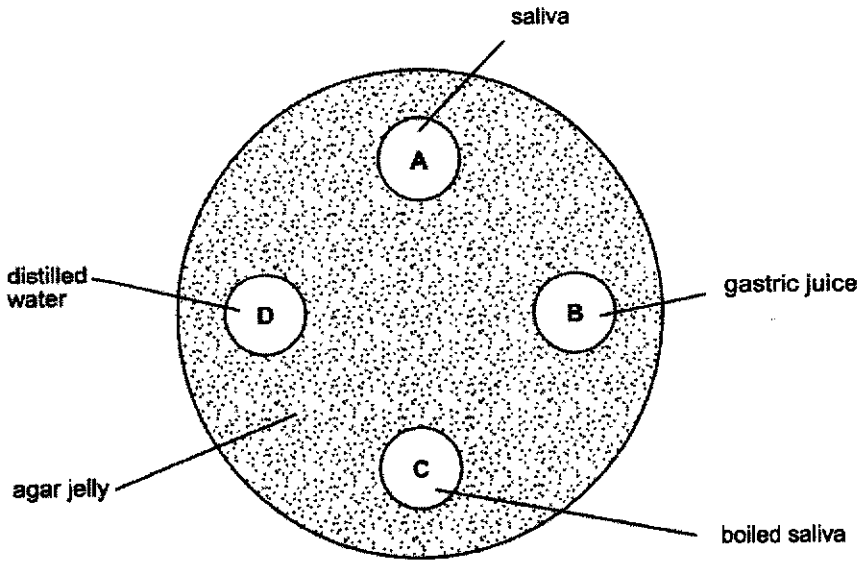
	1	2	3	4
A	chemical	evaporation	solvent	support
B	evaporation	support	chemical	solvent
C	support	solvent	evaporation	chemical
D	solvent	chemical	support	evaporation

25 The graph below shows the rate of reaction of an enzyme found in a bacterium that lives in hot springs with an average temperature of 60 °C. Which dotted line correctly continues the graph after 40 °C?

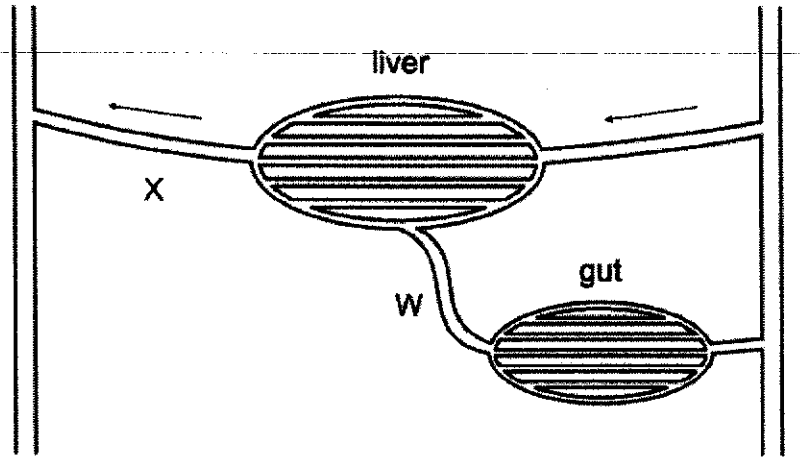


26 A dish is filled with agar jelly containing starch. Four holes are cut in the jelly and each hole is filled with the different substances shown.

Which hole will be surrounded by the largest area without starch after 30 minutes?



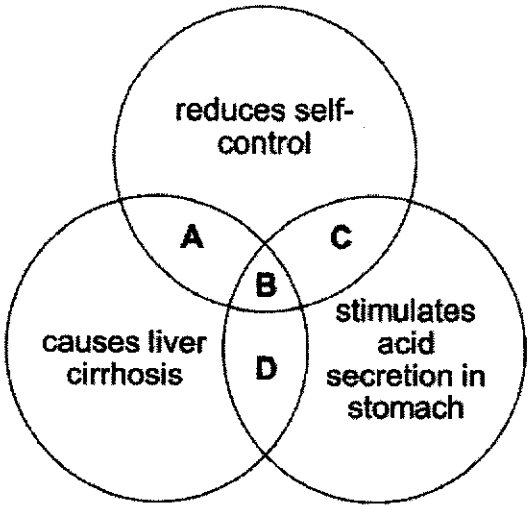
27 The diagram shows the liver and its blood supply. Two hours after a student ate a meal of protein, fat and carbohydrate, the contents of the blood in W and X were compared.



Which comparison is correct?

	W	X
A	less amino acids	more amino acids
B	less red blood cells	more red blood cells
C	more glucose	less glucose
D	more urea	less urea

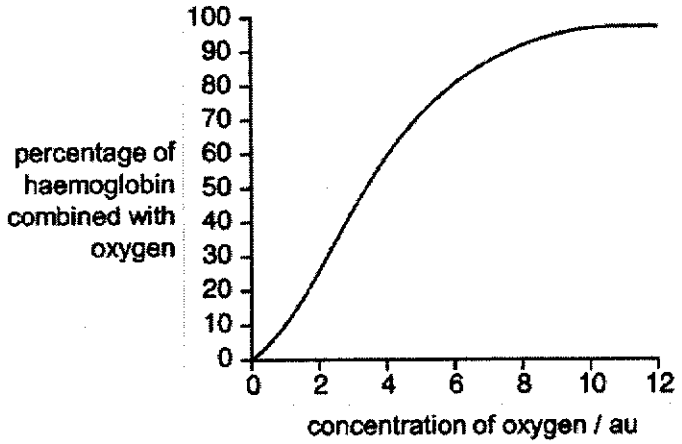
28 Which section of the diagram represents the effects of excessive alcohol consumption on the body?



29 Which statement about chemical digestion in the human alimentary canal is correct?

A Cellulase is secreted to break down cellulose in the duodenum.
B Digestion of carbohydrates is completed in the colon.
C Protein digestion is completed in the ileum.
D The stomach secretes enzymes to break down starch.

30 The graph shows how the percentage of haemoglobin combined with oxygen varies with oxygen concentration.



What percentage of haemoglobin would be combined with oxygen in the pulmonary arteries?

A 10 %
B 50 %
C 80 %
D 95 %

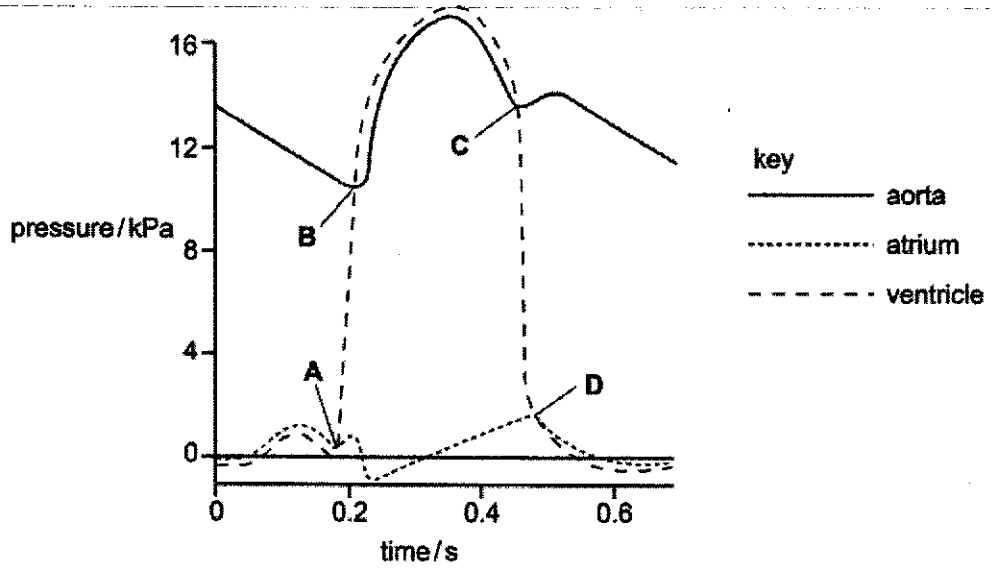
31 Normal venous pressure in the feet is 3.3 kPa. When a person stands very still venous blood pressure in the feet rises to 5.0 kPa.

What causes the high pressure?

A Muscles in the walls of the veins contract, reducing the diameter of the veins.
B Skeletal muscles in the legs are not squeezing blood upward in the veins.
C Systolic blood pressure increases.
D The semilunar valves in the veins of the leg cease to function.

32 The diagram gives information about blood pressure in various parts of the circulatory system during the cardiac cycle.

At which point does the semilunar valve of the aorta open?



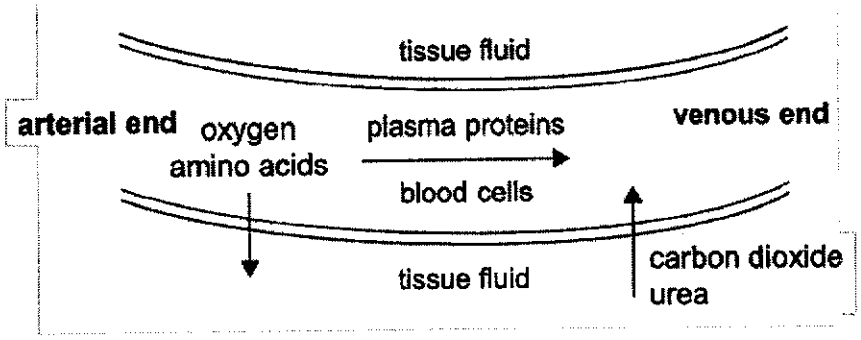
33 The table shows the blood groups of four people and the type of blood each received in a transfusion.

	blood group under ABO system	blood type received in transfusion
1	A	B
2	B	AB
3	AB	A
4	O	AB

Which blood transfusion(s) may lead to agglutination?

A 1 and 2 only
B 1, 2 and 4 only
C 2 and 4 only
D 3 only

34 The diagram shows substances passing between a capillary and tissues in a part of the body.

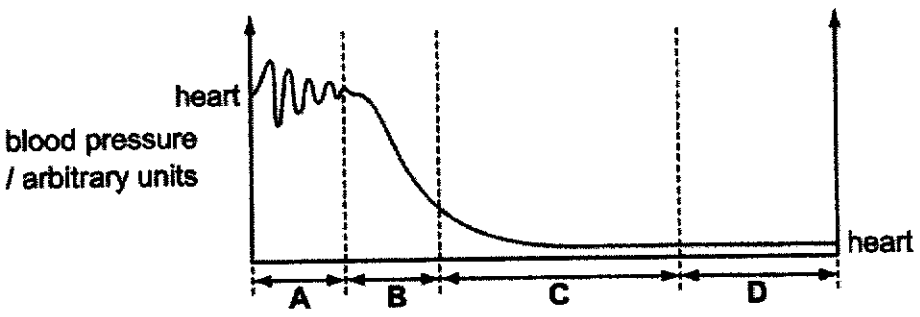


In which part of the body is this capillary found?

A between the alveoli
B in the kidney
C in the liver
D in the villi

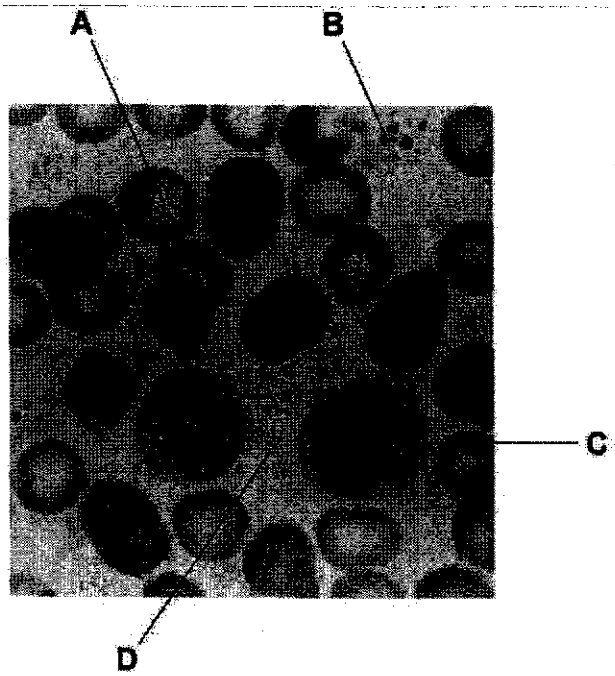
35 The graph shows changes in blood pressure as blood flows through the blood vessels of the human circulatory system.

Which blood vessel, **A, B, C** or **D**, has no elastic tissue in their walls?



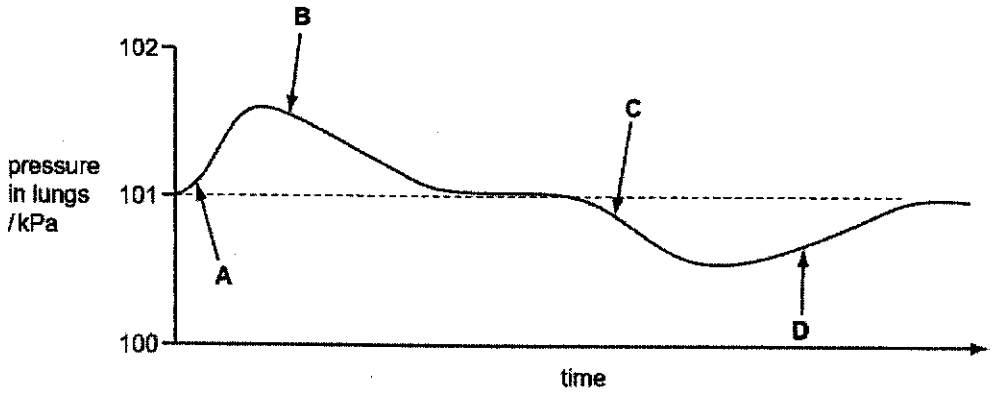
36 The photomicrograph shows human blood.

Which component will adrenaline be found in after a person is frightened by a large dog?

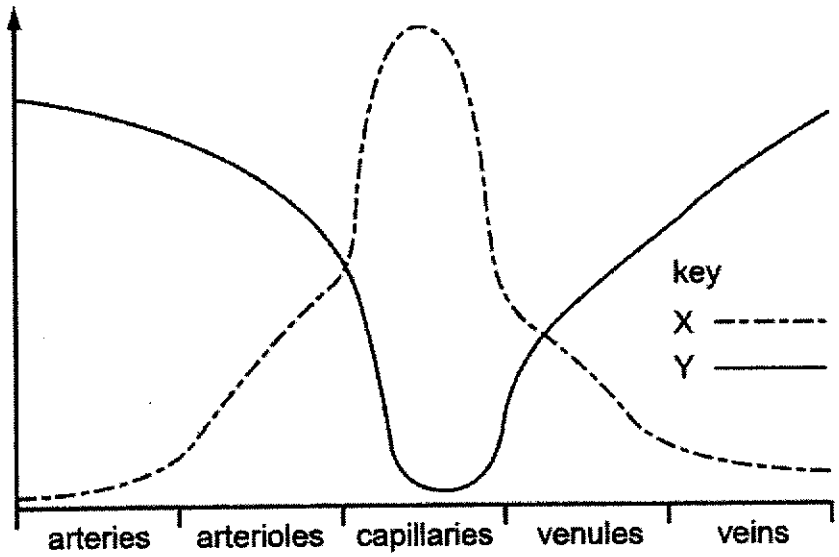


37 The diagram shows changes in air pressure inside the lungs during a complete cycle of breathing. Atmospheric pressure is 101 kPa.

Which position on the graph marks the point at which the ribs begin to move downwards?



38 The graph represents data on blood vessels and blood flow.



Which row correctly identifies the curves?

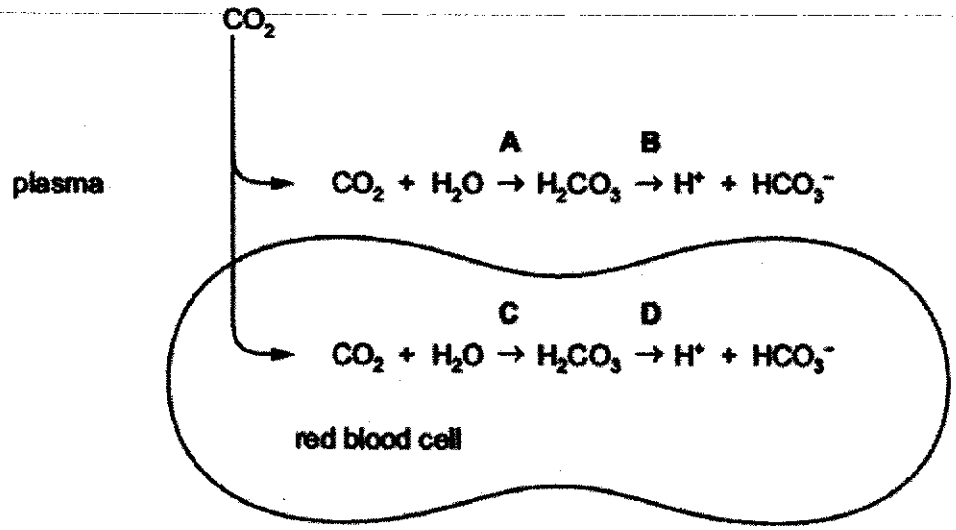
	X	Y
A	total cross-sectional area	pressure of blood
B	total cross-sectional area	velocity of blood flow
C	velocity of blood flow	pressure of blood
D	velocity of blood flow	total cross-sectional area

39 Which conditions result in the highest rate of diffusion of carbon dioxide from the blood capillaries into the alveolus?

	concentration of carbon dioxide in alveolus	concentration of carbon dioxide in capillary	rate of blood flow in capillary
A	high	high	fast
B	high	low	slow
C	low	high	slow
D	low	low	fast

40 The diagram shows some of the reactions of carbon dioxide when it enters the blood from cells in a metabolically active tissue.

Which reaction is catalysed by the enzyme carbonic anhydrase?



End of Paper 1

Section A: Structured Questions [50m]

Answer all questions in the spaces provided on the Question Paper.

1 Fig. 1 is a transmission electron micrograph of a plasma cell. Plasma cells are antibody-secreting cells that are formed from B-lymphocytes.

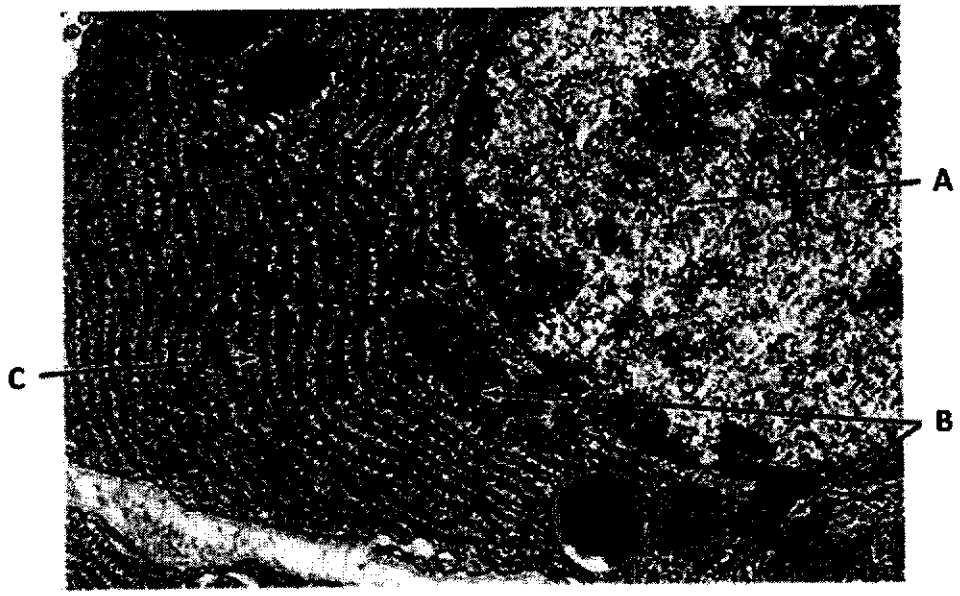


Fig. 1

(a) Name in full, structures **A**, **B** and **C**. [3]

A _____

B _____

C _____

(b) Outline how structures **A** and **C** contribute to the specific role of the plasma cell. [3]

_____

_____

_____

_____

[Total: 6]

2 Starch phosphorylase is an enzyme found in plant cells. In potato tuber cells, the enzyme takes part in the breakdown of starch when the tuber begins to grow.

$$\text{starch + phosphate ions} \xrightarrow{\text{starch phosphorylase}} \text{glucose 1-phosphate}$$

A student investigated the effect of pH on this reaction. The student prepared four test-tubes, **A** to **D**, as shown in Table 2.

The test-tubes were left for ten minutes in a water bath at 30 °C and then samples were tested for starch. The results are shown in Table 2.

Table 2

test-tube	contents					starch
	volume of starch solution / cm^3	volume of glucose 1-phosphate solution / cm^3	volume of phosphate ion solution/ cm^3	pH	enzyme	
A	2	–	0.5	6.5	unboiled	absent
B	2	–	0.5	2.0	unboiled	present
C	2	–	0.5	6.5	boiled	present
D	–	2	–	6.5	boiled	absent

(a) Describe how the test for starch is carried out on the solution. [2]

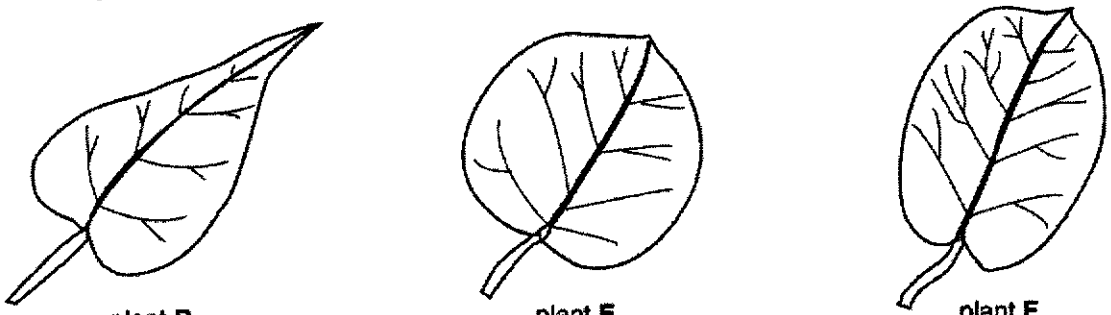
(b) Explain why the student boiled some of the extract in this investigation. [2]

(c) With reference to two test-tubes, explain the effect of pH on starch phosphorylase. [4]

(d) Explain the result for test-tube **D**. [1]

[Total: 9]

3 Fig. 3 shows leaves from three plants, **D**, **E** and **F**, of the same species.



plant **D** (spear-shaped)

plant **E** (round)

plant **F** (oval)

Fig. 3

(a) Plants **D** and **E** are both homozygous for leaf shape. Using your knowledge of co-dominance, explain the phenotype of plant **F** shown in Fig. 3. [3]

(b) In this species of plant, leaf shape is controlled by two alleles, S^1 and S^2. [3]

In the space below, construct a genetic diagram to show how a particular cross will **always** result in **all** offspring having a different phenotype from both parents.

(c) State the type of variation shown by leaf shape and explain your answer. [2]

type of variation _____

explanation _____

_____

[Total: 8]

4 Similar crops were grown on the same farm over a five-year period.

Fig. 4 shows the effect on the number of insects present on the crops when an insecticide is used in each of the five years.

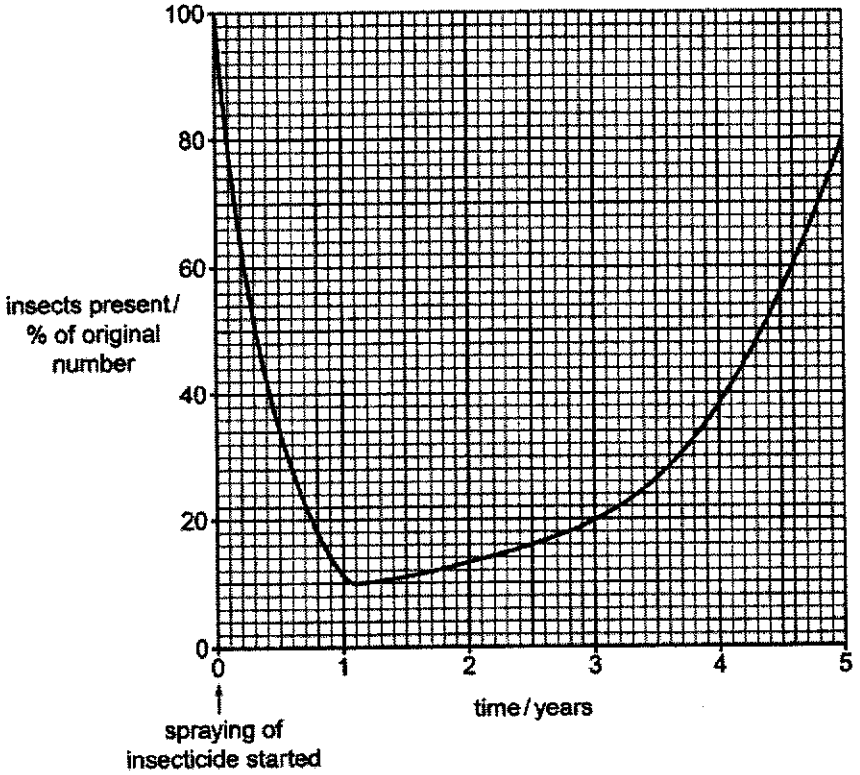


Fig. 4

(a) Describe the changes in the number of insects present over the period shown in Fig. 4. [3]

(b) **(i)** Define the term *mutation*. [1]

(ii) Explain the changes shown from the second year onwards. [4]

[Total: 8]

5 Human genes may be cloned by inserting lengths of DNA into bacteria. This may be carried out by inserting the DNA into a bacterial plasmid.

(a) Explain how lengths of DNA, cut by restriction enzymes, are inserted into plasmids. [3]

(b) State the method by which the recombinant plasmid is made to enter bacteria. [1]

(c) Fig. 5 shows the original plasmid, the recombinant plasmid containing the human gene, and the bacterium that takes up the plasmid.

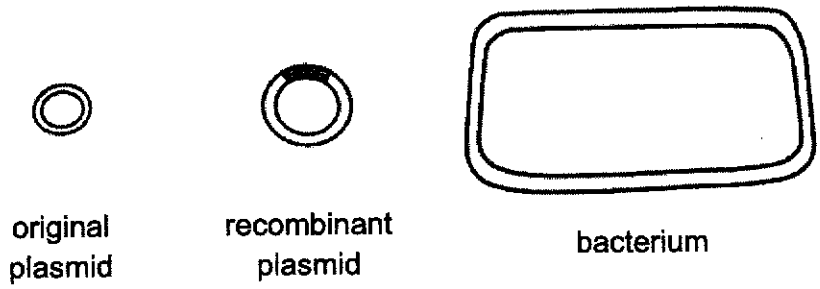


Fig. 5

During the process of genetic engineering, not all plasmids will take up the human DNA, and not all bacterial cells will take up plasmids.

Draw the three types of bacterial cells present at the end of the process. [3]

[Total: 7]

6 Fig. 6 shows the mean heart rates of two groups of people, **J** and **K**, over a five-year period.

From the start, and throughout the period, group **K** were treated with a drug to treat high blood pressure.

Group **J** did not take any form of medication.

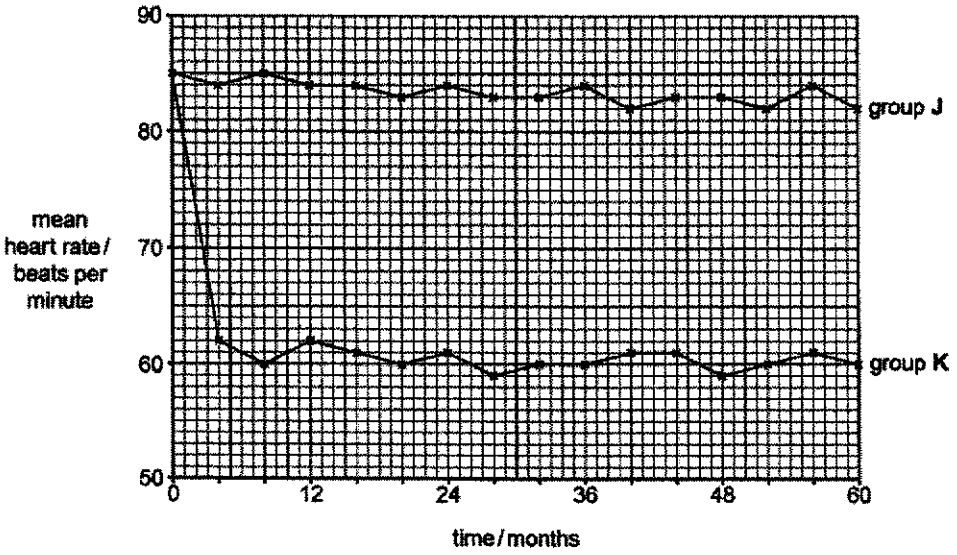


Fig. 6

(a) Using information from Fig. 6, describe the effect of taking the drug on the mean heart rate. [3]

(b) During the study, people in group **K** were given the drug through an injection into the bloodstream.

Explain how the drug was transported to the heart muscle. [3]

_____

_____

_____

_____

_____

[Total: 6]

7 Table 7.1 shows some of the recommended dietary allowances for a child under the age of six months.

Table 7.2 shows part of the composition of bottle milk that may be fed to a child under the age of six months.

Table 7.1

component	recommended dietary allowance
energy	2770 kJ
protein	13 g
vitamin C	30 mg
iron	6 mg

Table 7.2

component	amount per 100 cm^3 of bottle milk
energy	277 kJ
fat	3.6 g
carbohydrate	7.3 g
protein	1.3 g
vitamin C	3.0 mg
iron	0.6 mg

(a) Calculate the volume of bottle milk that a child under the age of six months should be fed each day to obtain the recommended dietary allowance of each component listed in Table 7.1.

You may use the space below to work out your answer.

answer _____ [2]

(b) Outline how the carbohydrates in milk are used in energy release. [2]

(c) State and explain the health risks to a child who is fed less bottle milk each day than the volume you have calculated in **(a)**. [2]

[Total: 6]

Section B: Free Response Questions [30m]

Answer **three** questions.

Question **10** is in the form of an **Either/Or** question.

Only one part should be answered.

Write your answers on the space provided.

8 A student investigated what happens to red blood cells when placed into sodium chloride solutions of different concentrations.

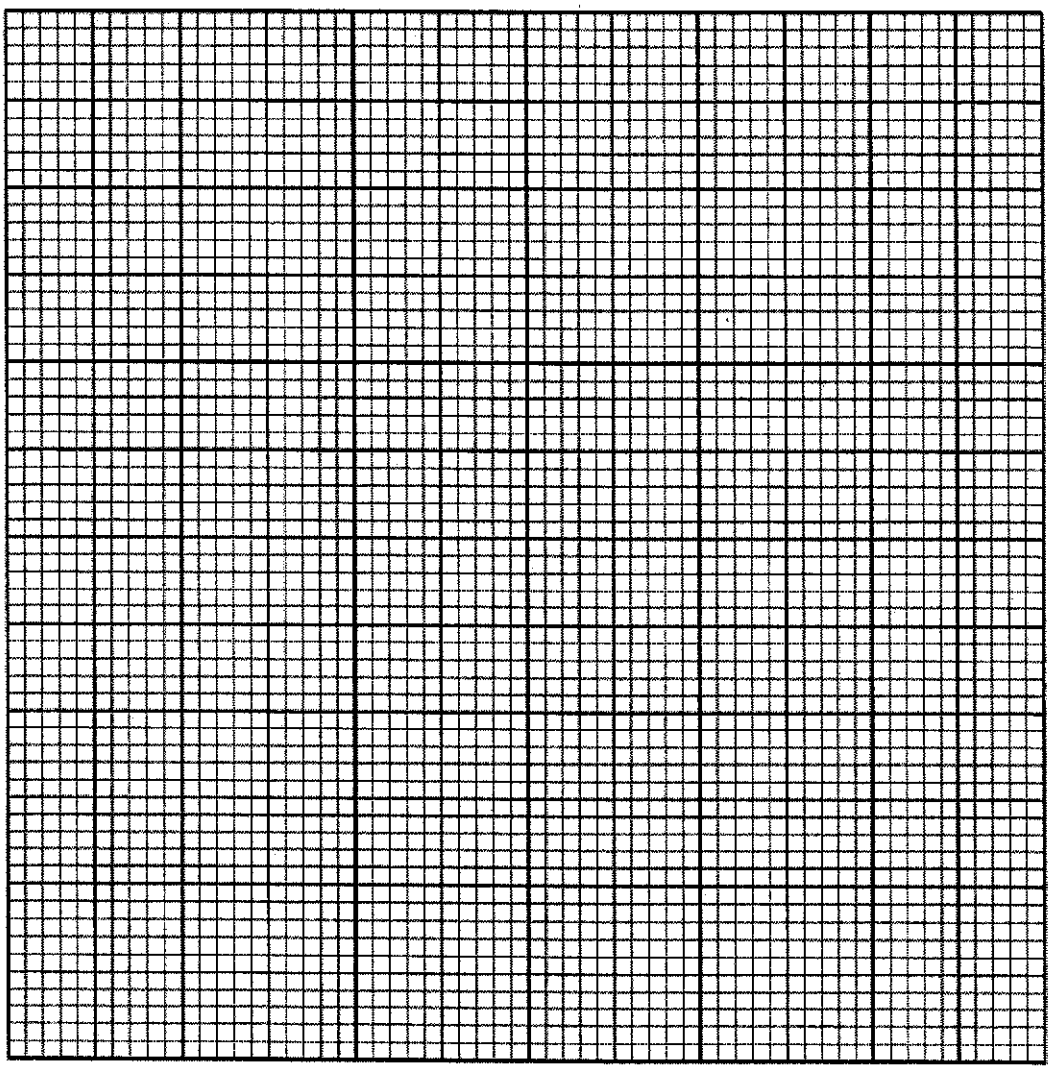
A small drop of blood was added to 10 cm^3 of each sodium chloride solution. Samples were taken from each mixture and observed under the microscope. The percentage of red blood cells remaining in each sample was calculated.

Table 8 shows the results.

Table 8

concentration of NaC*l* / %	percentage of cells remaining
0.0	0
0.2	0
0.4	3
0.6	35
0.8	96
1.0	100

(a) Plot the percentage of cells remaining against the concentration of NaC*l*. [4]



(b) Using the information from your graph,

(i) describe the results of the experiment; [3]

(ii) state the concentration of NaCl that is equivalent to that of blood plasma and explain your answer. [3]

_____

_____

_____

_____

[Total: 10]

9 Scientists have invented a radio transmitter, which fits into a small tablet. When this tablet is swallowed with some food, the pH along the alimentary canal is shown on a computer.

Fig. 9 shows the changes in pH as the tablet travels along the alimentary canal.

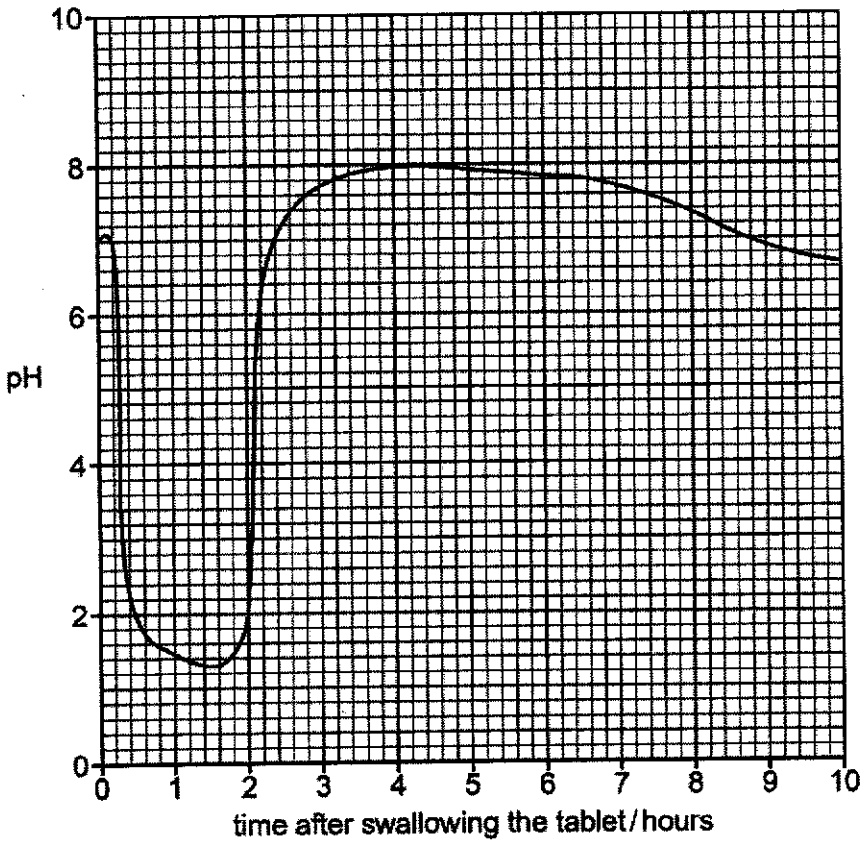


Fig. 9

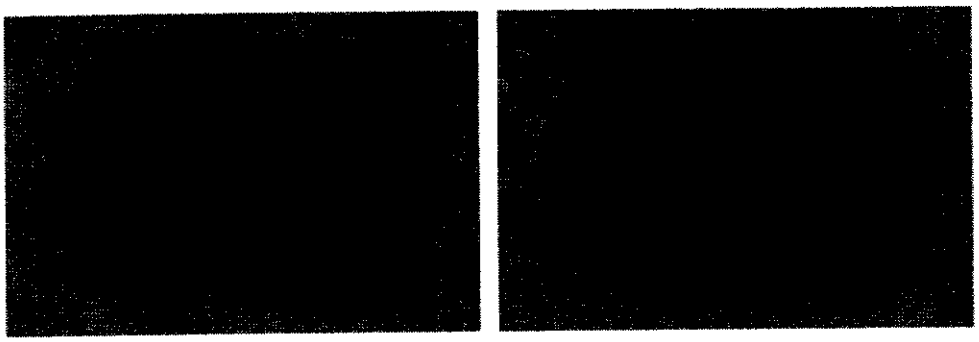
(a) With reference to different parts of the alimentary canal, describe and explain the shape of the graph in Fig. 9. [6]

(b) Describe how food is moved along the alimentary canal. [4]

[Total: 10]

Either

10 Fig. 10.1 shows two stages of mitosis in a cell from a root tip of *Allium cepa*.



D E

Fig. 10.1

(a) (i) Name each of the stages shown in Fig. 10.1. [2]

D _____ **E** _____

(ii) Describe what happens to the chromosomes during mitosis between the stage shown in **D** and the stage shown in **E**. [4]

(b) Describe the similarities and differences between the stages **D** and **E** in Fig. 10.1 and the equivalent stages in meiosis I. [4]

[Total: 10]

Or

10 Fig. 10.2 shows the epithelium lining the bronchioles in two individuals, **A** and **B**.

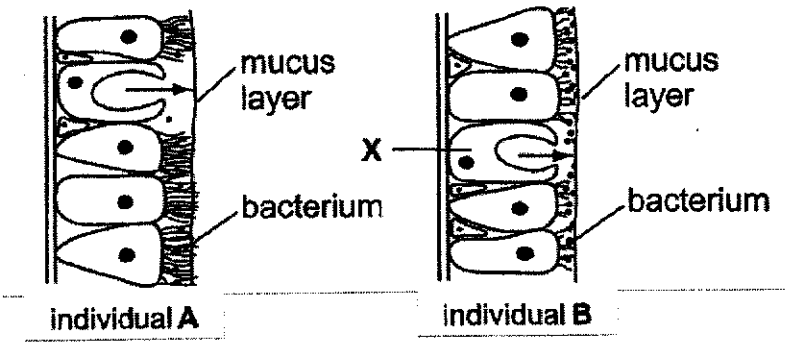


Fig. 10.2

(a) Describe the part played by cell **X**. [3]

(b) Describe and explain the differences between the epithelia in the two individuals **A** and **B** shown in Fig. 10.2. [4]

(c) Suggest what individual **B** will experience as a result of the differences described in **(b)**. [3]

[Total: 10]

End of Paper 2

PEIRCE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2019
SECONDARY 3 EXPRESS

BIOLOGY
Paper 1 (Theory)

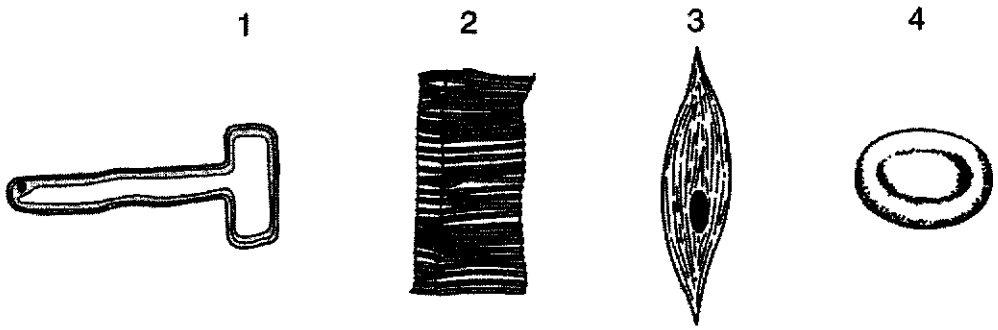
6093/01
2019

1	2	3	4	5	6	7	8	9	10
A	D	C	A	B	B	C	B	D	D
11	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
B	D	B	B	C	B	A	B	B	B
21	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
D	C	A	C	B	A	C	B	C	A
31	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
B	B	B	C	C	D	A	B	C	C

Multiple Choice Questions [40m]

Shade your answers in the OTAS answer sheet provided

1 The diagram shows four cells.



Which cells transport water?

A 1 and 2
B 1 and 3
C 2 and 4
D 3 and 4

2 In the pancreas, there are groups of cells that make insulin.

What describes these cells?

A an organ in an organism
B an organ system in an organism
C cells within a cell wall
D tissue in an organ

3 An actively growing cell is supplied with radioactive amino acids.

Which cell component would first show an increase in radioactivity?

A Golgi body
B nucleus
C rough endoplasmic reticulum
D secretory vesicle

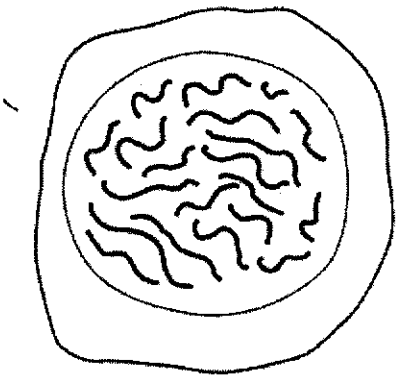
4 Mucus is a complex mixture that contains many chemically modified proteins. When mucus is secreted from a goblet cell in the trachea, these events take place.

1 addition of carbohydrate to protein
2 fusion of the vesicle with the plasma membrane
3 secretion of a chemically modified protein
4 separation of a vesicle from the Golgi apparatus

What is the sequence in which these events take place?

A 1 → 4 → 2 → 3
B 1 → 4 → 3 → 2
C 4 → 1 → 2 → 3
D 4 → 1 → 3 → 2

5 The diagram shows a cell of an organism formed by reduction division.



What is the haploid number for this organism?

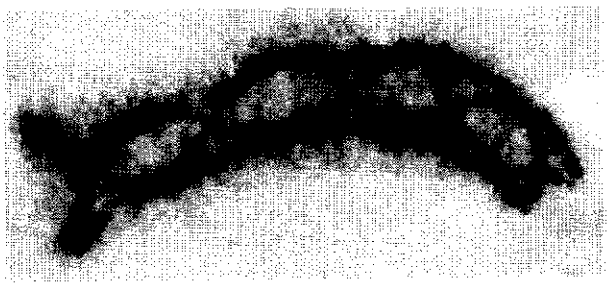
A 10
B 20
C 40
D 46

6 What occurs in meiosis?

	homologous chromosomes pair	chromosome number remains the same
A	×	✓
B	✓	✓
C	×	×

D	✓	✓

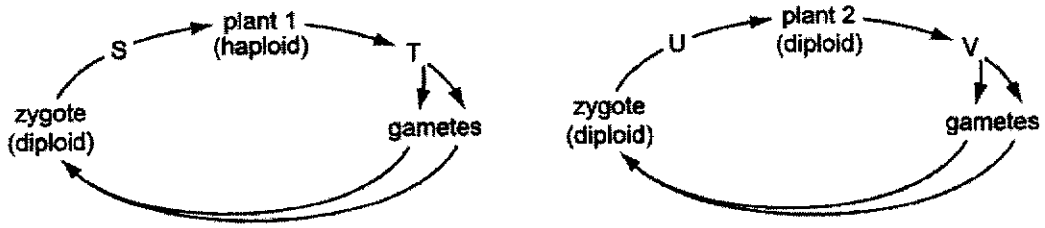
7 The diagram shows an event that occurs during synapsis of two homologous chromosomes.



Which statement does not describe the diagram?

A Crossing over occurs after chromatin threads condense and shorten.
B Crossing over occurs between two chromatids at the centromere.
C Crossing over occurs forming five chiasmata.
D Crossing over produces new combinations of alleles along its chromosomes.

8 The diagram shows the life-cycles of two types of simple plant.



Where will reduction divisions occur in the life cycles?

A at S and U
B at S and V
C at T and U
D at T and V

9 What are the conditions in a human cell just before the cell enters prophase?

	number of chromatids	number of molecules of DNA in nucleus	spindle present	nuclear envelope present

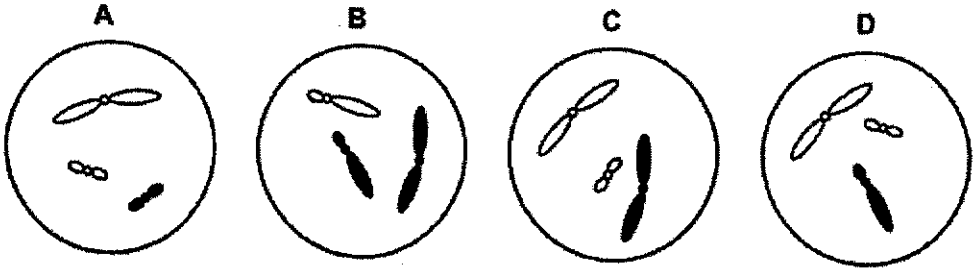
A	46	46	yes	no
B	92	46	no	yes
C	46	92	yes	yes
D	92	92	no	yes

9700_s06_qp_1

The majority of candidates realised that just before prophase, each chromosome consists of two chromatids so that there would be 92 chromatids present. However, weaker candidates did not know that this was because the DNA had replicated using new nucleotides (radioactive nucleotides, in the case of **Question 20)** and each chromatid is one DNA molecule.

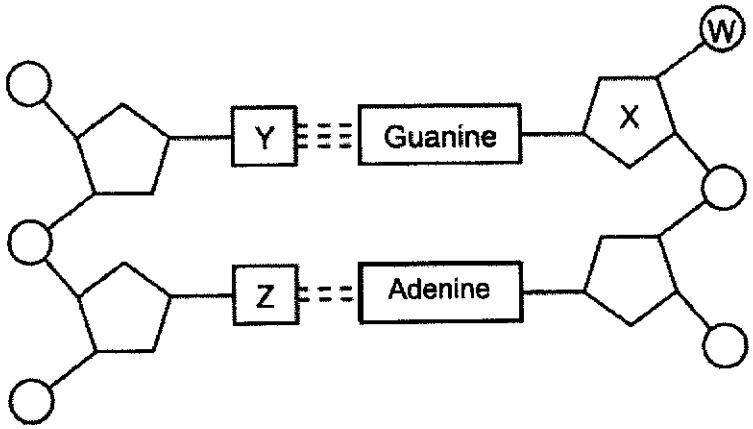
10 The diagram below represents the nucleus of a body cell of an organism.

Which diagram represents a possible gamete nucleus produced by the organism?



ANS D

11 The diagram shows part of a DNA molecule.



Which letters indicate cytosine, deoxyribose, phosphate and thymine?

	cytosine	deoxyribose	phosphate	thymine
A	W	X	Y	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Y	Z	X	W

12 Which statement describes a gene?

A a base with a sugar and a phosphate group
B a chain of alleles on a chromosome
C a number of DNA molecules
D a sequence of nucleotides

13 The table shows the percentages of bases on a single strand of DNA.

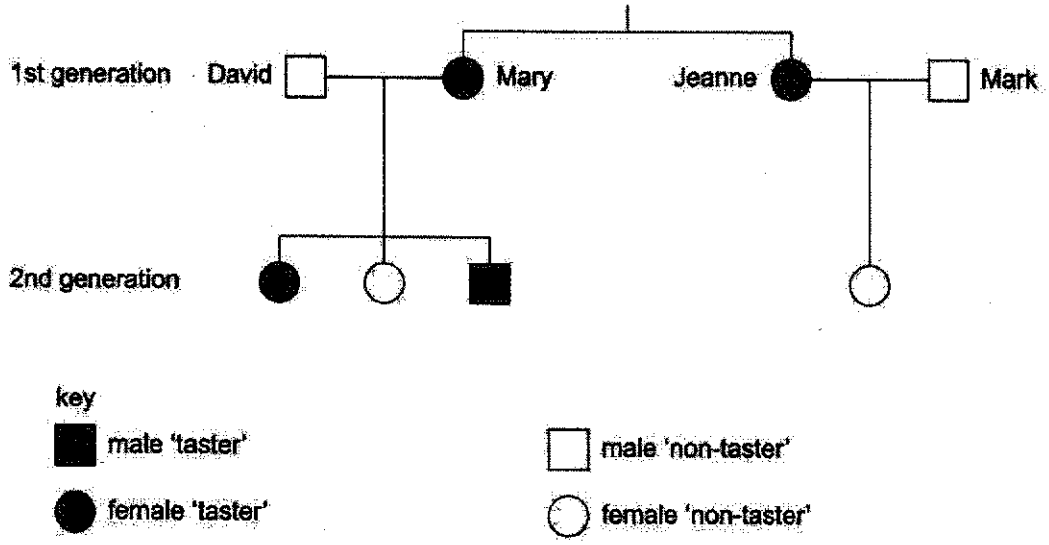
nucleotide	percentage
adenine	22.6
cytosine	20.4
guanine	47.1
thymine	11.3

What percentage thymine nucleotides will there be on the strand of DNA that is complementary to this strand?

A 33.9
B 22.6
C 20.4
D 11.3

14 The diagram shows a family tree and the inheritance of the ability to taste a certain substance.

The allele for the ability to taste this substance is dominant.



Which statement about the genotypes of the sisters Mary and Jeanne is correct?

A Mary is heterozygous and Jeanne is homozygous.
B Mary is homozygous and Jeanne is heterozygous.
C They are both heterozygous.
D They are both homozygous.

15 Which fertilisation would result in a female child with Down syndrome?

	chromosomes in ovum	fertilised by	chromosomes in sperm
A	22 + 1X		22 + 1X
B	22 + 1X		23 + 1X

C	23 + 1Y	22 + 1X
D	23 + 1Y	23 + 1X

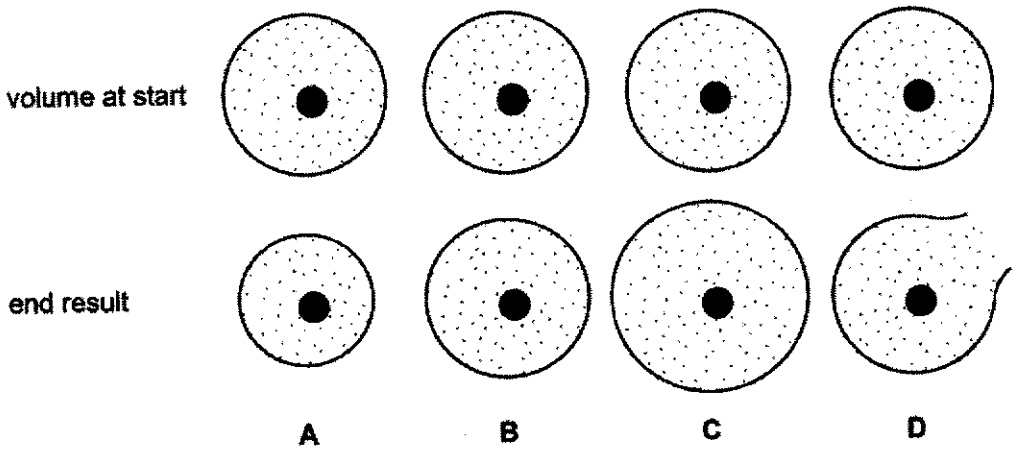
16 Which two statements about continuous variation are correct?

1 A group of adult males had heights ranging from 155 cm to 220 cm.
2 During puberty there is a dramatic growth spurt.
3 During old age, people tend to shrink in height.
4 Humans have stopped growing by the time they are 22 years old.
5 The heights of adult humans will partly depend on the quality of their diets when young.

A 1 and 2
B 1 and 5
C 2 and 4
D 3 and 5

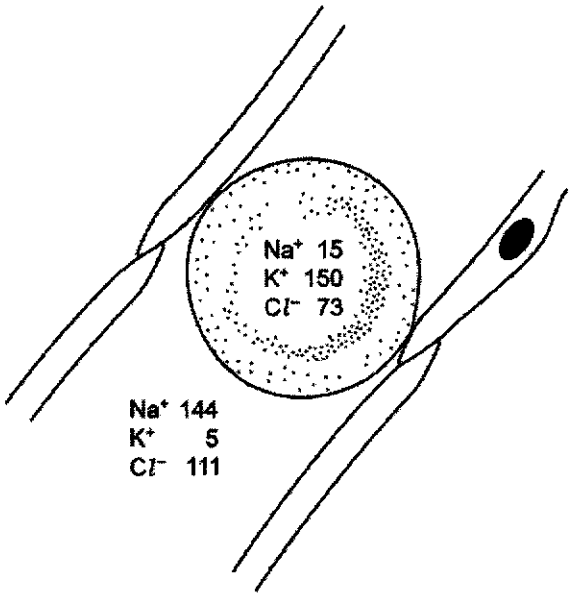
17 Identical animal cells were placed in solutions of differing water potentials. The diagram shows the volume of the cells at the start and the end result.

Which cell was placed in the solution with the lowest water potential?



ANS A

18 The diagram shows a red blood cell and the concentrations of ions, in mmol dm^{-3}, in the plasma and in the cell.

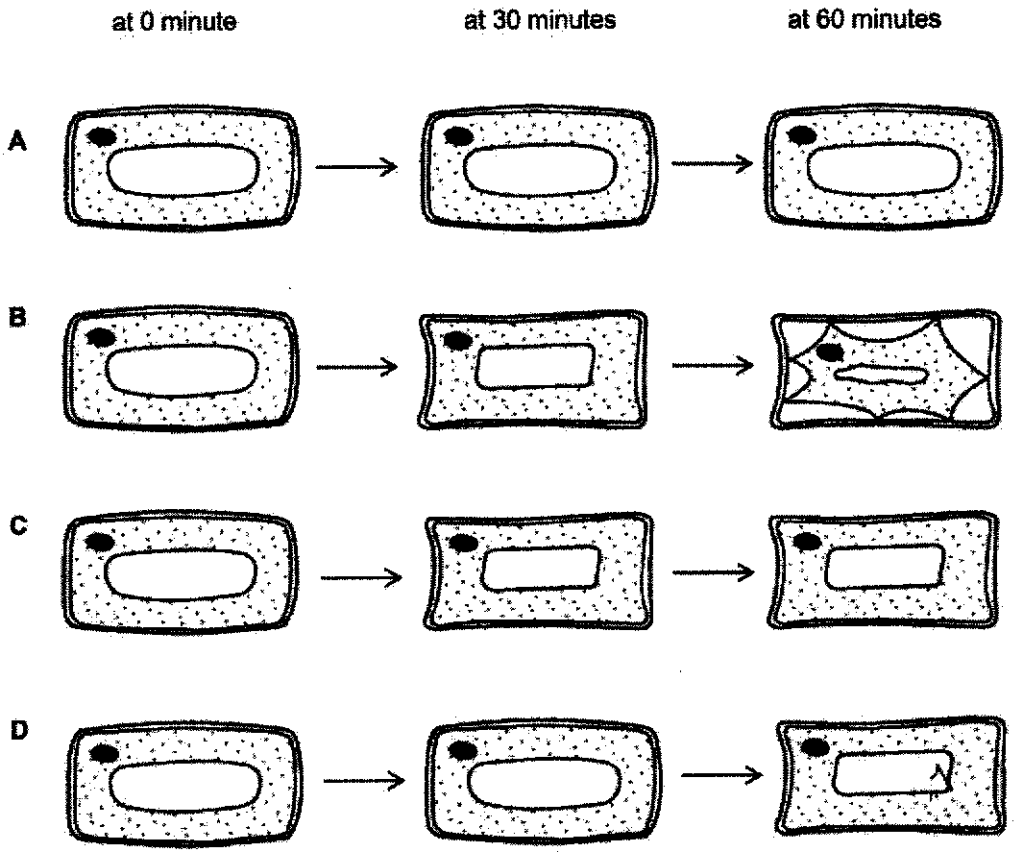


Which of the following is correct?

	active transport into cell	diffusion out of cell
A	Cl^-	K^+
B	K^+	Na^+
C	Na^+	K^+
D	Na^+	Cl^-

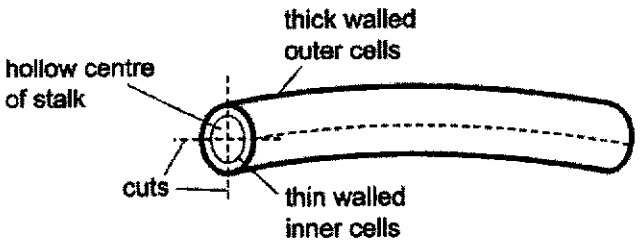
The high discrimination shows that the more able candidates understand the concept of active transport, as movement from a low concentration to a high concentration.

19 Which of the following shows the most likely changes in appearance of a plant cell in concentrated salt solution?

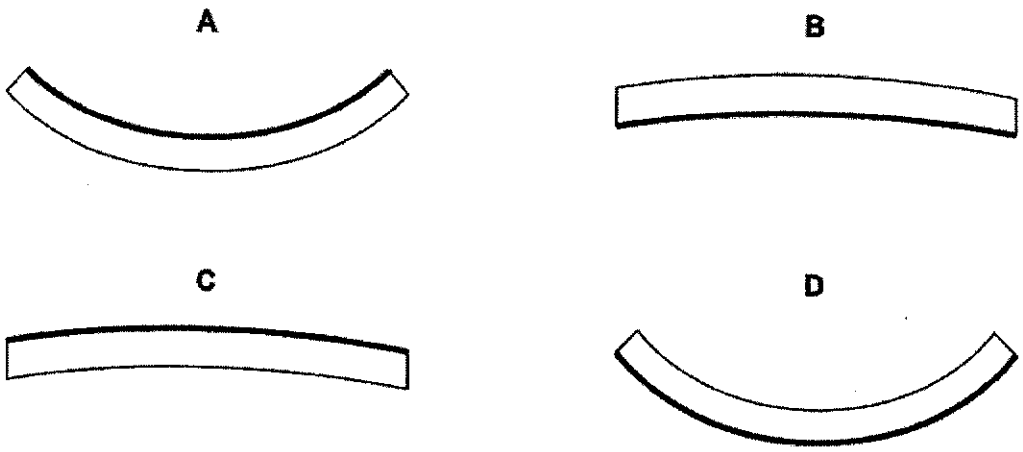


ANS B

20 The stalk of a dandelion flower is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in concentrated sucrose solution?



ANS C

21 Which food test shows the presence of salivary amylase in saliva?

A Benedict's test
B biuret test
C ethanol emulsion test
D iodine test

22 Four sugar solutions were tested with a standard Benedict's solution. The table shows the colour of the solutions after testing.

solution	colour
1	green
2	blue
3	brick-red
4	yellow

What is the best interpretation of the results?

	solution 1	solution 2	solution 3	solution 4
A	0.05% reducing sugar	0.5% non-reducing sugar	1.0% reducing sugar	0.1% reducing sugar
B	0.5% reducing sugar	0.05% reducing sugar	0.1% reducing sugar	1.0% reducing sugar
C	1.0% reducing sugar	1.0% non-reducing sugar	1.5% reducing sugar	0.5% reducing sugar

D	1.0% non-reducing sugar	0.5% reducing sugar	0.5% non-reducing sugar	0.1% non-reducing sugar

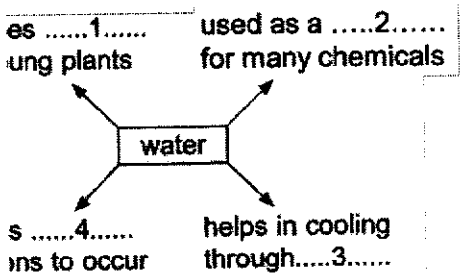
23 The diagram represents a large molecule found in egg white, synthesized by joining smaller molecules together.

Which line names the large molecule and its components?

	molecule	amino acid	fatty acid	glucose	glycerol
A	glycogen	✓	×	✓	×
B	lipid	×	✓	×	✓
C	polypeptide	✓	×	✓	×
D	starch	×	✓	✓	×

key
✓= component present
× = component absent

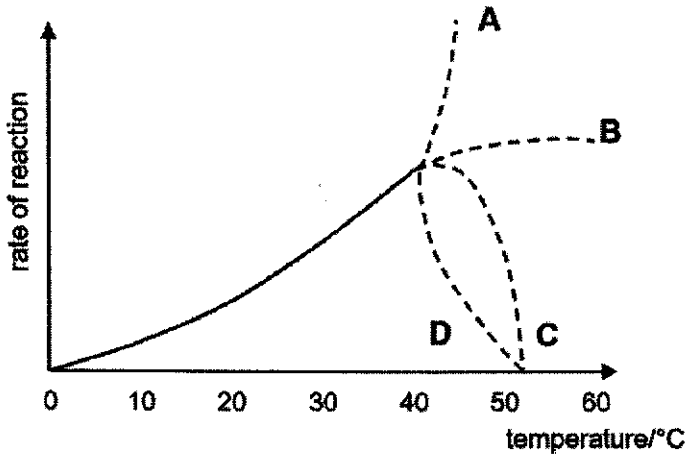
24 The diagram shows some uses of water.



Which words correctly complete gaps 1, 2, 3 and 4?

	1	2	3	4
A	chemical	evaporation	solvent	support
B	evaporation	support	chemical	solvent
C	support	solvent	evaporation	chemical
D	solvent	chemical	support	evaporation

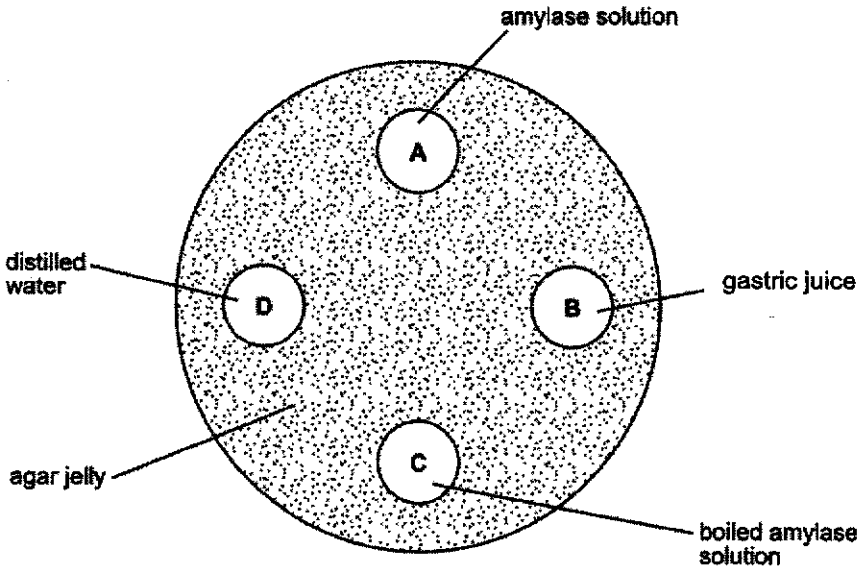
25 The graph below shows the rate of reaction of an enzyme found in a bacterium that lives in hot springs with an average temperature of 60 °C. Which dotted line correctly continues the graph after 40 °C



ANS B

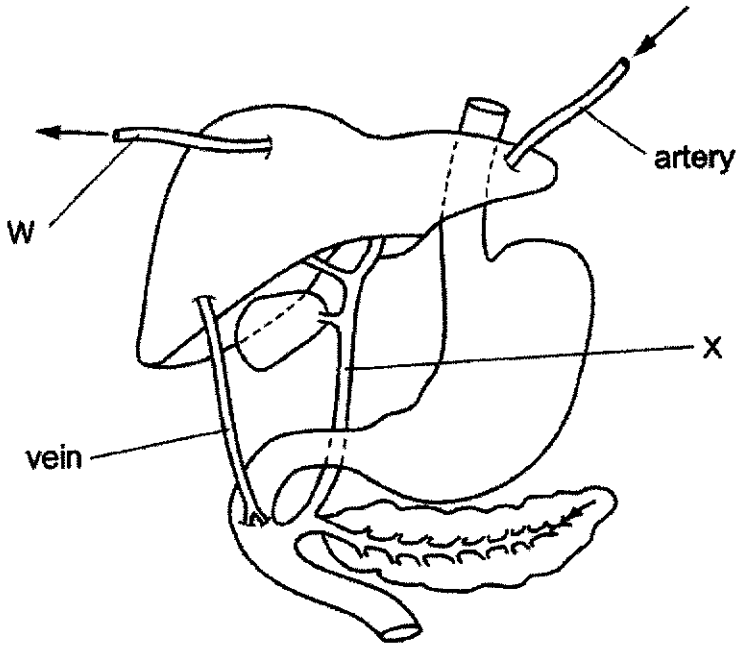
26 A dish is filled with agar jelly containing starch. Four holes are cut in the jelly and each hole is filled with the different substances shown.

Which hole will be surrounded by the largest area without starch after 30 minutes?



ANS A

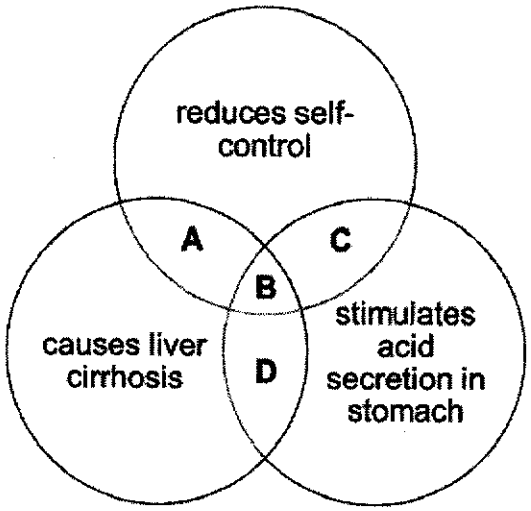
27 The diagram shows the liver and its blood supply. Two hours after a student ate a meal of protein, fat and carbohydrate, the contents of the blood in W and X were compared.



Which comparison is correct?

	W	X
A	less amino acids	more amino acids
B	less red blood cells	more red blood cells
C	more glucose	less glucose
D	more urea	less urea

28 Which section of the diagram represents the effects of excessive alcohol consumption on the body?



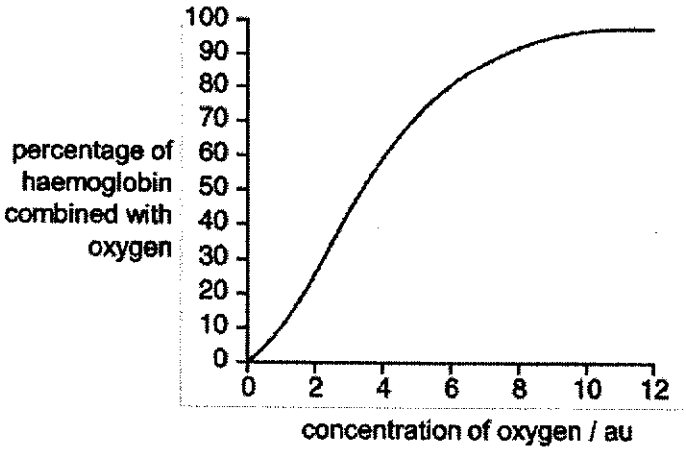
ANS B

Stimulates acid secretion in the stomach – BM, 2nd ed., p107

29 Which statement about chemical digestion in the human alimentary canal is correct?

A Cellulase is secreted to break down cellulose in the duodenum.
B Digestion of carbohydrates is completed in the colon.
C Protein digestion is completed in the ileum.
D The stomach secretes enzymes to break down starch.

30 The graph shows how the percentage of haemoglobin combined with oxygen varies with oxygen concentration.



Which range of oxygen concentration would be found in the pulmonary arteries?

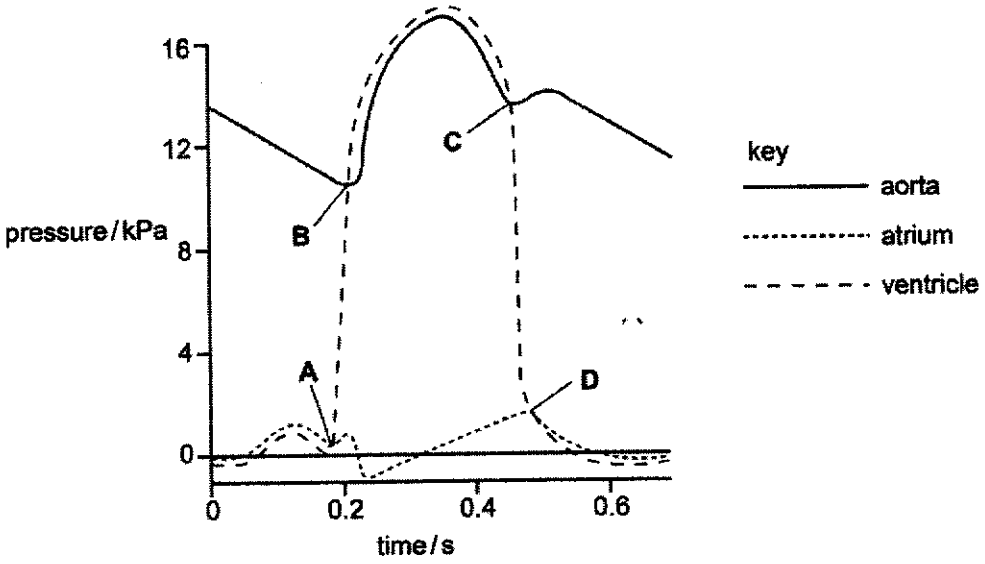
A between 0 and 2 au
B between 2 and 6 au
C between 6 and 8 au
D between 8 and 12 au

Most candidates knew that pulmonary arteries carry deoxygenated blood. However, there is a common misconception that this blood is devoid of oxygen.

See also rsc / transport of oxygen in the blood

31 The diagram gives information about blood pressure in various parts of the circulatory system during the cardiac cycle.

At which point does the semilunar valve of the aorta open?



ANS B

32 Normal venous pressure in the feet is 3.3 kPa. When a person stands very still venous blood pressure in the feet rises to 5.0 kPa.

What causes the high pressure?

A Muscles in the walls of the veins contract, reducing the diameter of the veins.
B Skeletal muscles in the legs are not squeezing blood upward in the veins.
C Systolic blood pressure increases.
D The semilunar valves in the veins of the leg cease to function.

Less able candidates did not appreciate the fact that skeletal muscles in the legs are responsible for blood movement.

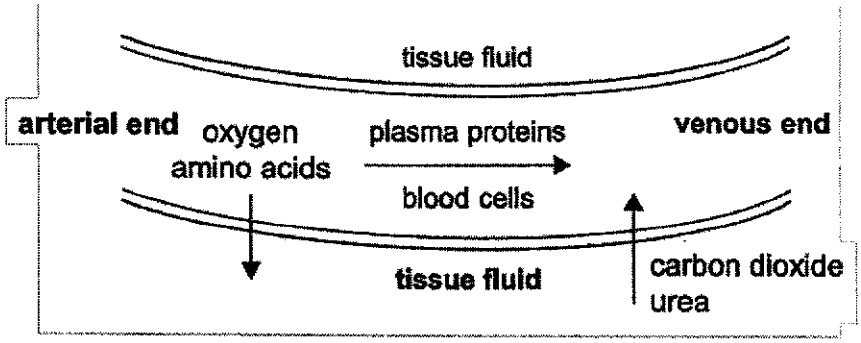
33 The table shows the blood groups of four people and the type of blood each received in a transfusion.

	blood group under ABO system	blood type received in transfusion
1	A	B
2	B	AB
3	AB	A
4	O	AB

Which blood transfusion(s) may lead to agglutination?

A 1 and 2 only
B 1, 2 and 4 only
C 2 and 4 only
D 3 only

34 The diagram shows substances passing between a capillary and tissues in a part of the body.



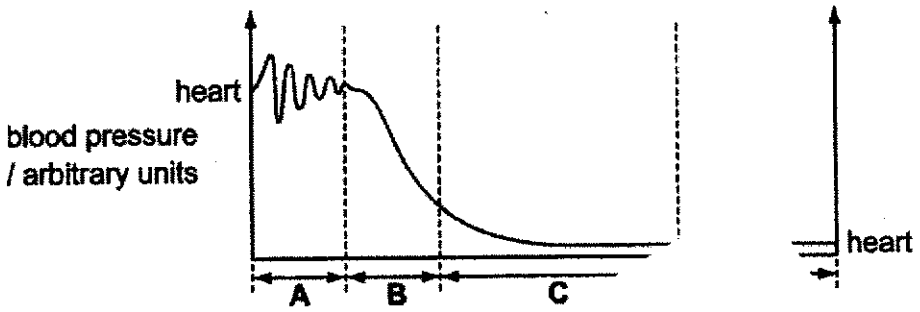
In which part of the body is this capillary found?

A between the alveoli
B in the kidney
C in the liver
D in the villi

Urea is made in the liver so it is already in the blood arriving at the kidneys. Kidney cells will be using O2 and amino acids and releasing CO2.

35 The graph shows changes in blood pressure as blood flows through the blood vessels fo the human circulatory system.

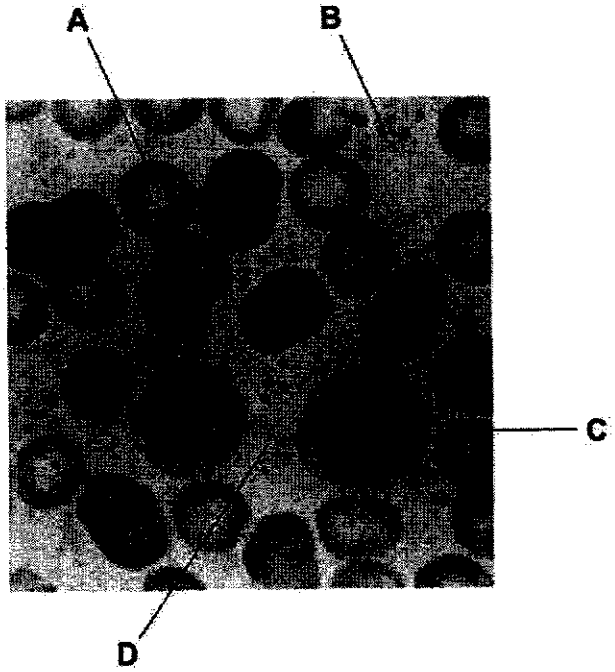
Which blood vessel, **A, B, C** or **D**, has no elastic tissue in their walls?



Own: D is the vein - closest to the heart; B are the arterioles (since blood pressure is still quite high)
ANS C

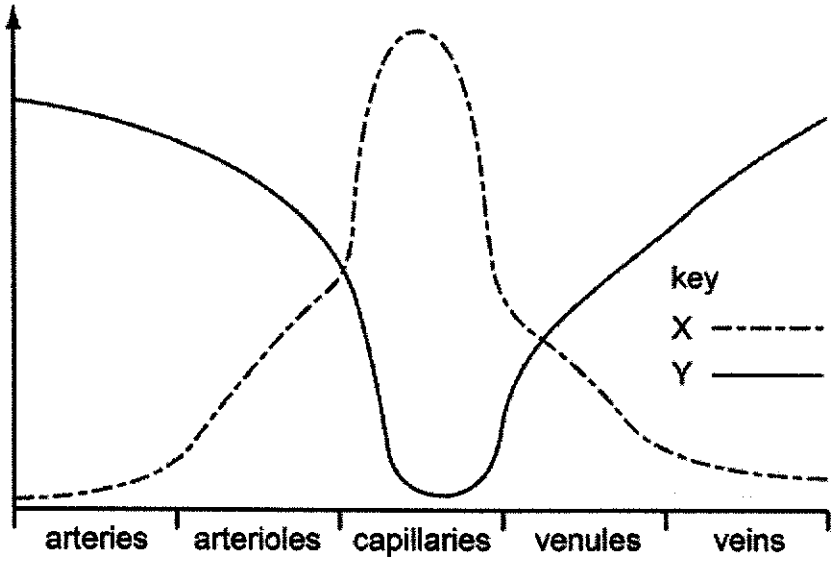
36 The photomicrograph shows human blood.

Which component will adrenaline be found in after a person is frightened by a large dog?



ANS: D

37 The graph represents data on blood vessels and blood flow.

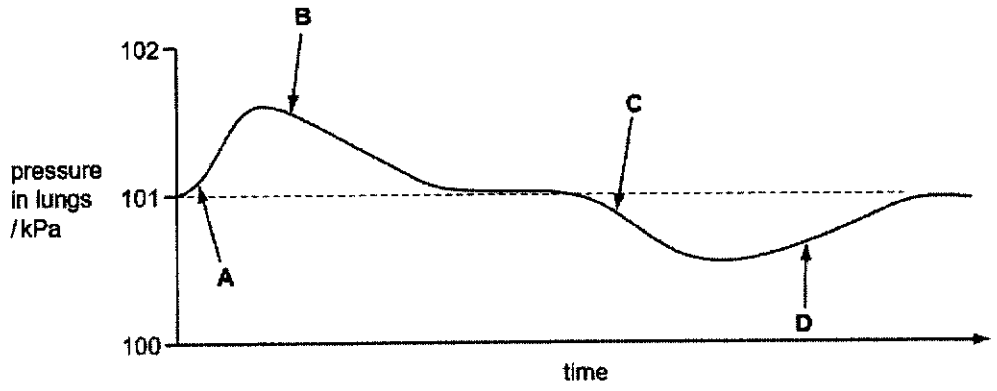


Which row correctly identifies the curves?

	X	Y
A	total cross-sectional area	pressure of blood
B	total cross-sectional area	velocity of blood flow
C	velocity of blood flow	pressure of blood
D	velocity of blood flow	total cross-sectional area

38 The diagram shows changes in air pressure inside the lungs during a complete cycle of breathing. Atmospheric pressure is 101 kPa.

Which position on the graph marks the point at which the ribs begin to move downwards?



ANS A

Which position on the graph marks the point at which the ribs are beginning to be **raised**?

ANS C

This question proved difficult, but largely as a result of confusion over what the graph was showing. Without the graph, most candidates would probably state that **raising** the ribs **increases the volume** in the chest cavity **lowering the pressure** in the lungs. When faced with interpreting the graph, many allowed themselves to suggest that raising the ribs *increases* the pressure in the lungs. Significantly, the more able candidates avoided this confusion.

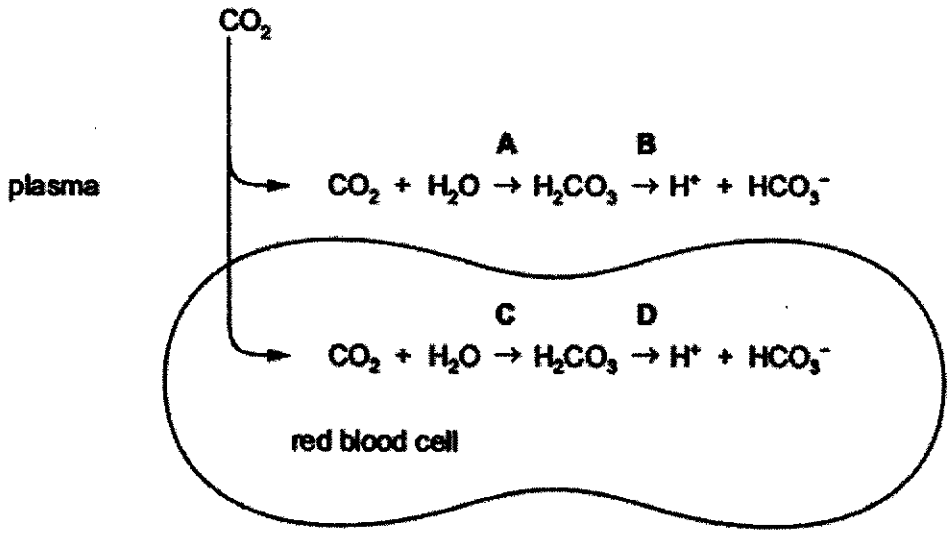
0610_s11_er

39 Which conditions result in the highest rate of diffusion of carbon dioxide from the blood capillaries into the alveolus?

	concentration of carbon dioxide in alveolus	concentration of carbon dioxide in capillary	rate of blood flow in capillary
A	high	high	fast
B	high	low	slow
C	low	high	slow
D	low	low	fast

40 The diagram shows some of the reactions of carbon dioxide when it enters the blood from cells in a metabolically active tissue.

Which reaction is catalysed by the enzyme carbonic anhydrase?



ANS C

End of Paper 1

PEIRCE SECONDARY SCHOOL
END-OF-YEAR EXAMINATION 2019
SECONDARY 3 EXPRESS

BIOLOGY **6093/02**
Paper 2 (Theory) **2019**

Section A: Structured Questions [50m]
Answer all questions in the spaces provided on the Question Paper.

1 a A nucleus ; [3]
A chromatin
R chromosome
B mitochondrion ;
A mitochondria
C rough endoplasmic reticulum ;
ignore RER

b (nucleus contains) gene(s) / genetic information / genetic material / DNA, (coding) for, antibody / protein / polypeptide ; [3]
transcription (occurring) / mRNA synthesis ; AW (ref. antibodies)
allow ecf for nucleolus
(followed by) synthesis / modification / processing / transport, of, antibody / protein / polypeptide (on RER) ;
A translation
allow ecf for Golgi or SER or ER

[Total: 6]

2 a few drops of iodine, 2 cm^3 of sample solution ; [2]
if blue-black, starch present, brown, absent ;

b control ; [2]
to show, enzyme involved/enzyme catalysed reaction/not spontaneous/AW ;

c **(A)** starch, broken down/converted to glucose (1-) phosphate/AW ; [4]
ora for B
(A) at pH 6.5/nearly neutral/AW, enzyme is active /AW ; e.g. ref to optimum at or near 6.5
(B) at pH 2.0/acidic qualified, enzyme is inactive /AW ; e.g. well away from optimum

d **(D)** glucose phosphate gives, no reaction with iodine/negative result ; **A** no starch/no substrate added gives, no reaction with iodine/negative result [1]

[Total: 9]

3 a (phenotype of plant F) heterozygous ; [3]
(bears) alleles for spear-shaped and for round leaf ;
both alleles expressed (in plant F) ;

Source: figure from 5090_w03_qp_2

b [3]

parent phenotype	spear-shaped	round
parent genotype ;	S^1S^1	S^2S^2
gametes ;	(S1)	(S2)
F1 genotype ;	all S^1S^2	
F1 phenotype	(all) oval	

c discontinuous ;
clear-cut shapes ;

[Total: 8]

4 a Sharp decrease ; [3]
100 – 10%, first year ;
Gradual increase ;
10 – 80%, second year onwards ;
[max 3]

bi sudden random change ; [1]
in structure of a gene or in the chromosome number ;

bii (mutation leads to) [4]
variation among insects, resistance to insecticide (R immunity);
survival / no longer has an effect / natural selection;
(survivors) breed / pass on allele for resistance;
more / greater proportion of resistant individuals each year;

[Total: 8]

5 a plasmid DNA cut with same restriction enzyme ; [3]
DNA and plasmid mixed together / AW ; **R** inserted
ref complementary base pairing ;
ligase forms bonds between sugar and phosphate ;
[max 3]

b temporary heat / electric shock ; [1]

c bacterium with neither plasmid ; [3]
bacterium with original plasmid only ;
bacterium with recombinant plasmid only ;
A bacterium with both plasmids ;
Source: figure from 426538-june-2016-question-paper-21

[Total: 7]

6 a rate + drops / reduces / AW + rapidly / AW / quoted figures (85 to 62 + bpm) ; [3]
during first 4 months ;
remains (more or less) constant ; **A** stays low
(constant at) 59 / 60 / 61 / 62 + bpm ;

b drug dissolves in blood plasma ; [4]
carried in veins to the heart ;
after going through pulmonary circulation ;
leaves the heart through aorta ;
through coronary arteries ; to the heart muscles
[max 4]

[Total: 6]

7 a 1000 / 1 ; [2]
cm^3 / dm^3 ;
A 1 litre / 1 dm^3 for 2 marks
A ml in place of cm^3, unit must match figure for second mark

b broken down / digested into, glucose ; [2]
(aerobic / anaerobic) respiration ;

c *state* [2]
reference to low / lack of energy (intake into body) ;
reference to lack of fat or carbohydrate (for energy) ;

explain
reference to specified problem ;
A muscle contraction / protein synthesis / cell division / active transport / growth / passage of nerve impulses / maintenance of a constant body temperature / mend or repair tissues

award two marks for any one of the following:
kwashiorkor / named symptom + lack of protein ;
scurvy / named symptom + lack of vitamin C ;
anaemia or described + lack of iron ;

[Total: 6]

Section B: Free Response Questions [30m]

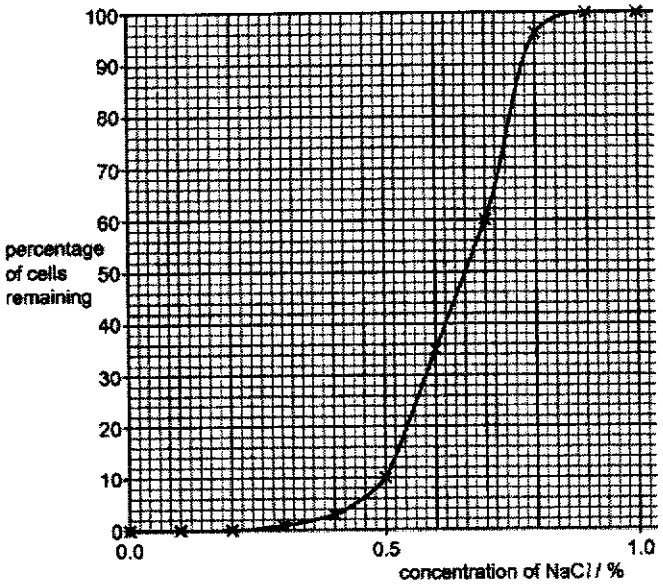
Answer **three** questions.

Question **10** is in the form of an **Either/Or** question.

Only one part should be answered.

Write your answers on the lined papers provided.

8 a



[4]

b i *accept ora*
penalise once if refs. in context of rates e.g. faster
no cells remaining, correct concentration value given (accept up to 0.26%) ;
100% / AW, cells remaining, ref. from 0.86%–0.9% / AW ;
steep increase in percentage cells remaining between 0.5–0.8% ; **A** to 0.7% *if next marking point included*
steepest increase between 0.7–0.8% ;
comparative data quote to support ref. to increase ;
[max 3]

[3]

ii any value between 0.86%–0.9% ;
at lower concentrations, some cells burst ; ora
cell membrane cannot withstand pressure ;

[3]

[Total: 10]

9 a

description [max 3]	explanation [max 3]
pH 7 + 0 – 12 minutes ;	mouth and esophagus ; saliva, neutral ;
pH 2 + 12 minutes – 2 hours ;	stomach ; HCl ;
pH 8 + 2 hours onwards ;	duodenum ; **A** small and large intestines ; alkaline ;

[6]

[max 6]

b circular and longitudinal muscles; [4]
peristalsis;
antagonistic action / one muscle contracts while other relaxes / AW;
rhythmic wave-like contractions move the food along (the alimentary canal) / AW;
[max 4]

[Total: 10]

Either

10 a i Prophase Anaphase [2]

ii *ignore references to prophase* [4]

at D/during metaphase
chromosomes arrange, on metaphase plate/at equator/on equatorial plate; **R** middle of cell
chromosomes with two (sister) chromatids/AW;
chromosomes attached to spindle at centromeres; [max 2]

at E/during anaphase
centromere(s), break/divide/duplicate; **R** replicate/split
chromosomes/chromatids, move/separate to opposite poles; **R** ends
ref microtubules/spindle (fibres), with centromeres leading;
[max 2]

b differences [max 3] [4]

stage	comparison	mitosis	meiosis I
D	pairing of homologous chromosomes	✗	✓
D	crossing over	✗	✓
E	separation	sister chromatids separate	homologous chromosomes separate

similarities [max 1]
for D
chromatin threads condense/coil/shorten ;
asters form around centrioles ;
centrioles move to opposite poles of the cell ;
nuclear envelope and nucleolus disappear ;
spindle fibres form ;
for E
spindle fibres shorten ;

[Total: 10]

Or

10 a produce mucus; [3]
to trap dust;
and bacteria / pathogens (**R** germs);
cilia;
to move mucus + up AW;
moisten air / warm air;

b B is a smoker ; [4]
cilia paralysed / destroyed / killed AW;
airways blocked with mucus / mucus builds up / excess mucus produced (**A** mucus not removed);
pathogens not removed / enter lungs / bacteria proliferate;
[max 4]

c narrower airways / breathing difficulty / breathlessness; [3]
(smoker's) cough;
tendency to infection / disease or named caused by pathogen;
lung / tracheal cancer / emphysema;
ref. to the effect of decreased oxygen uptake;
[max 3]

[Total: 10]

End of Paper 2