

Name:		Index Number:		Class:	
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**Preliminary Examination 3
Secondary 4**

BIOLOGY

5158/01

Paper 1 Multiple Choice

Friday 16 September 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, index number and class on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE ON THE MARGINS.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answer **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done in this booklet.

The use of an approved scientific calculator is expected, where appropriate.

For examiner's use only:

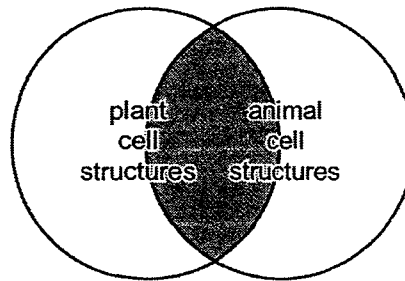
Paper 1	/ 40
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The number of marks is given in brackets [] at the end of each question or part question.

This paper consists of **15** printed pages.

[Turn over

- 1 The shaded area of the diagram represents structures found in both plant and animal cells.



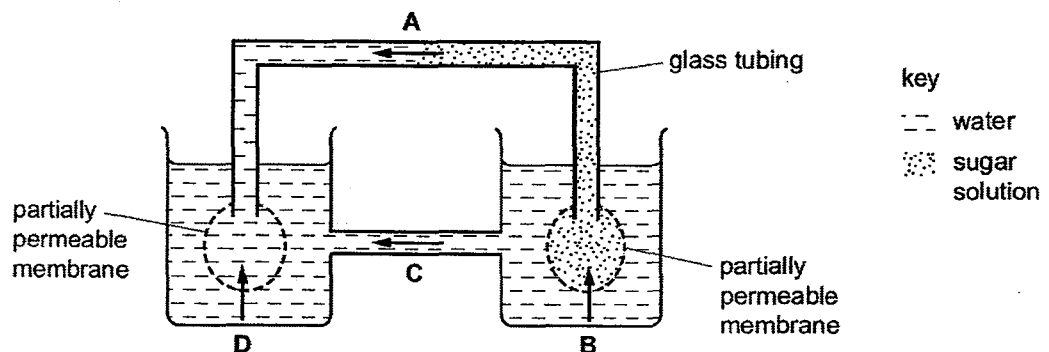
Which cell structure is from the shaded area?

- A cell membrane
 B cell wall
 C chloroplast
 D large vacuole
- 2 What is the correct order of increasing size of the following structures, from smallest to largest?
- A chromosome → liver → white blood cell
 B chromosome → white blood cell → liver
 C liver → chromosome → white blood cell
 D white blood cell → liver → chromosome
- 3 Which row describes a root hair cell?

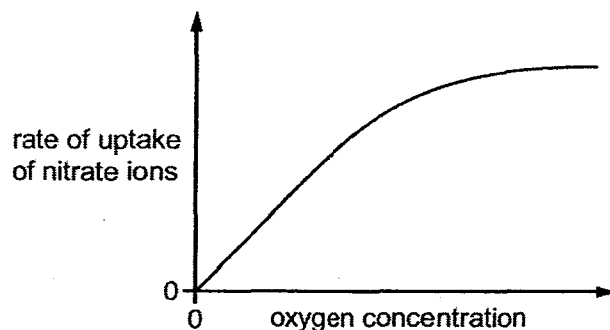
	allows water to pass into the plant	increases the surface area of the root	loses water by transpiration
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

- 4 The diagram shows an experiment on osmosis.

Which arrow shows the direction of the net movement of water at the start of the experiment?



- 5 The graph shows the effect of oxygen concentration on the uptake of nitrate ions from the soil into a root hair cell.

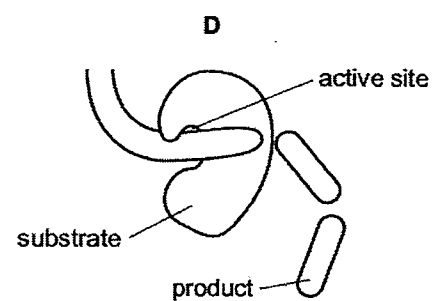
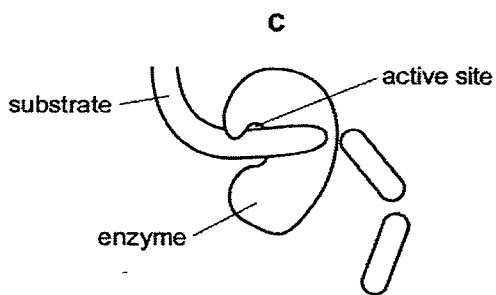
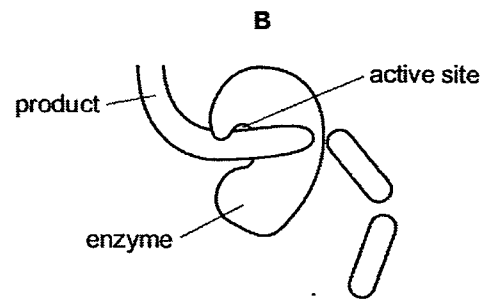
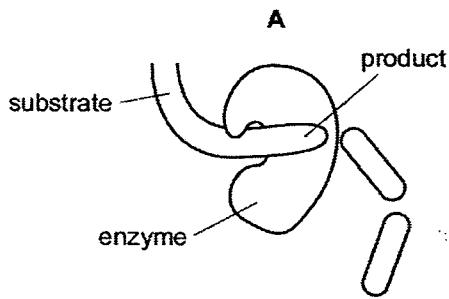


What can be concluded from this information?

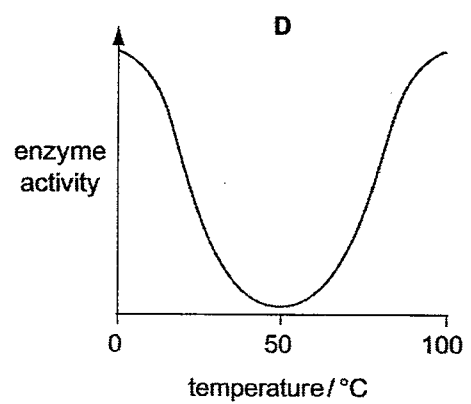
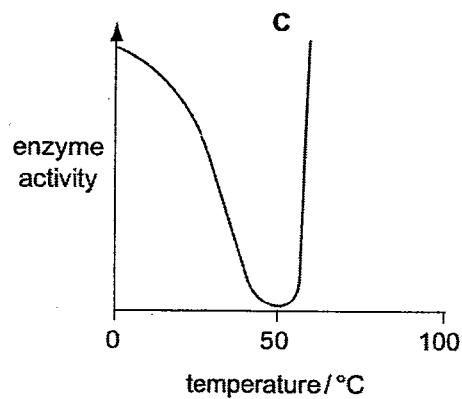
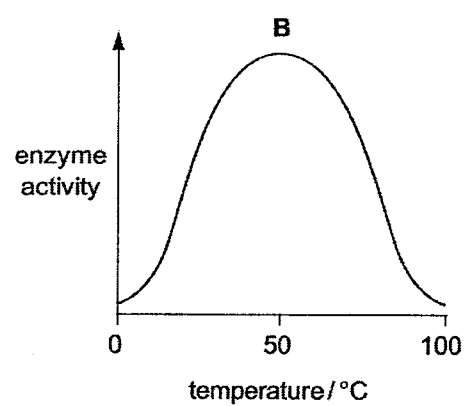
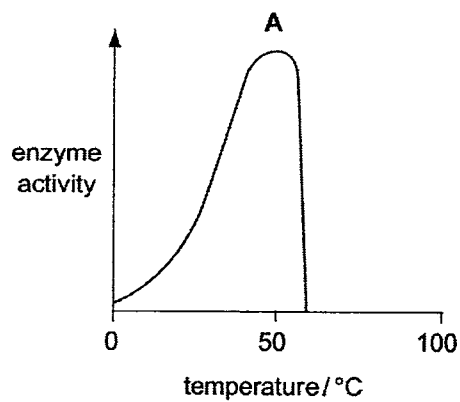
- A Nitrate ions enter the root hair cell by active transport.
 - B Nitrate ions enter the root hair cell by osmosis.
 - C Nitrate ions leave the root hair cell by diffusion.
 - D Nitrate ions leave the root hair cell in low oxygen concentrations.
- 6 Which biological molecules always contain the element nitrogen?
- A amino acids, cellulose, DNA
 - B amino acids, DNA, lipids
 - C enzymes, plasma proteins, DNA
 - D membrane proteins, starch, lipids
- 7 Amylase solution is tested with Benedict's solution, biuret solution and iodine solution. Which colours are obtained?

	Benedict's solution	biuret solution	iodine solution
A	blue	blue	blue-black
B	blue	blue	brown
C	blue	purple	brown
D	red	purple	blue-black

- 8 The diagrams show a protease enzyme catalysing the breaking of part of a protein molecule into smaller pieces. Which diagram has three **correct** labels?



- 9 Which graph shows the effect of temperature on the activity of an enzyme?



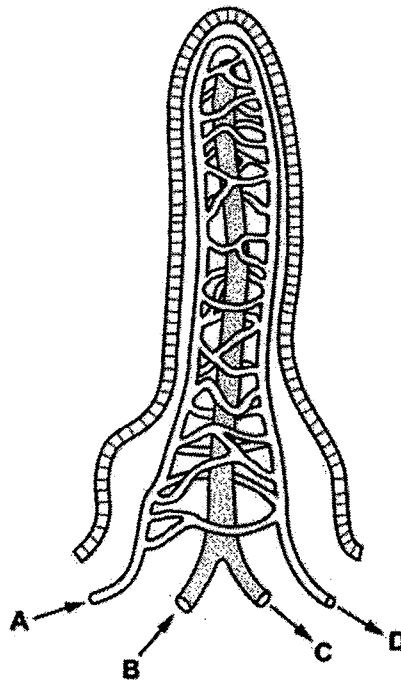
- 10 The diagram shows a fat globule (P) in one part of the alimentary canal and the same globule (Q) as it appears in another part of the alimentary canal.



In which parts of the alimentary canal are P and Q found?

	P	Q
A	duodenum	stomach
B	ileum	oesophagus
C	oesophagus	ileum
D	rectum	ileum

- 11 The diagram shows a villus. The arrows show the direction of flow within vessels associated with the villus. Which vessel carries blood to the liver?



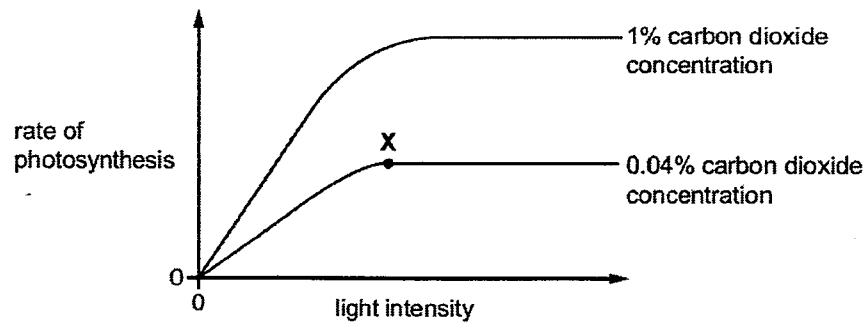
- 12 Which row shows what happens in photosynthesis?

	energy conversion	immediate product of photosynthesis	storage product of photosynthesis
A	chemical energy to light energy	glucose	starch
B	chemical energy to light energy	starch	glucose
C	light energy to chemical energy	glucose	starch
D	light energy to chemical energy	starch	glucose

- 13 For the stomata of a leaf to open, the guard cells accumulate more potassium ions than the surrounding cells. Which row describes what happens?

	movement of potassium ions	movement of water in relation to guard cells	final state of the guard cells
A	active transport	in	turgid
B	active transport	out	flaccid
C	diffusion	in	plasmolysed
D	diffusion	out	no change

- 14 The graph shows how the rate of photosynthesis of a plant varies with light intensity at two different carbon dioxide concentrations. The temperature is kept constant at 20°C.



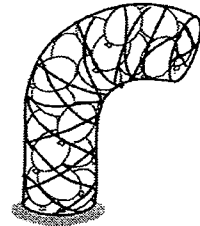
Which factor is limiting the rate of photosynthesis at point X?

- A** availability of chlorophyll
- B** availability of water
- C** concentration of carbon dioxide
- D** intensity of light

- 15 The diagrams show a cylindrical net packed with rubber balloons full of air. The structure is used by a teacher to explain wilting.



all the balloons fully inflated



the same number of balloons with some of the air let out

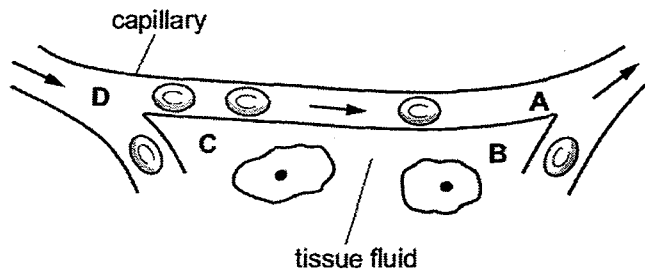
What is represented by the parts of the structure shown?

	air	balloons	net	rubber
A	cells	cell sap	cell walls	epidermis
B	cell sap	cells	epidermis	cell walls
C	cell walls	epidermis	cell sap	cells
D	epidermis	cell walls	cells	cell sap

- 16 Which feature is a leaf adaptation for living in the desert?

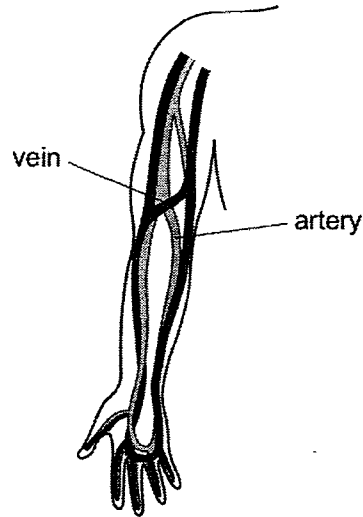
- A large size
- B many stomata
- C rolled along its length
- D thin waxy cuticle

- 17 The diagram shows the movement of blood through a tissue.



At which labelled point is the pressure highest?

- 18 The diagram shows arteries and veins in the human forearm.

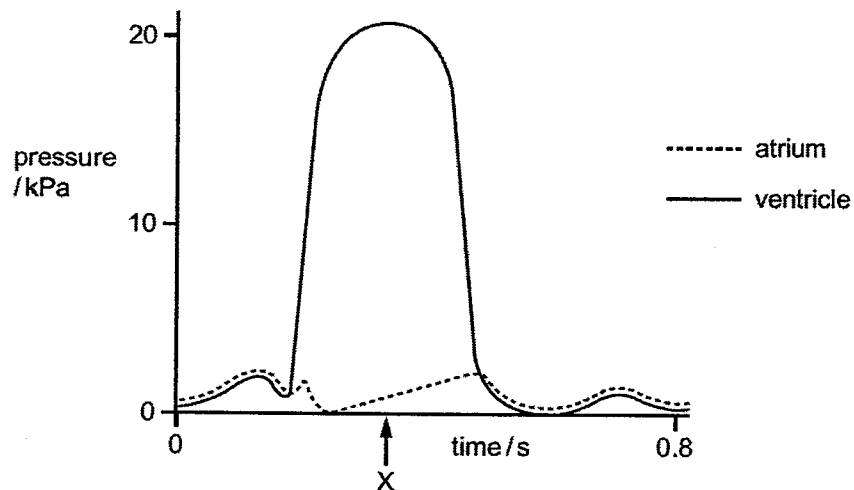


Which statements apply to a vein in the human forearm?

	carries oxygenated blood	has valves	blood is returning to the heart
A	✓	✓	x
B	✓	x	x
C	x	✓	✓
D	x	x	✓

key
 ✓ = yes
 x = no

- 19 The graph shows pressure changes in the left atrium and in the left ventricle during one heartbeat.



What is the state of the valves in the heart at time X?

	left atrio-ventricular valve (bicuspid)	semi-lunar valve (in aorta)
A	closed	closed
B	closed	open
C	open	closed
D	open	open

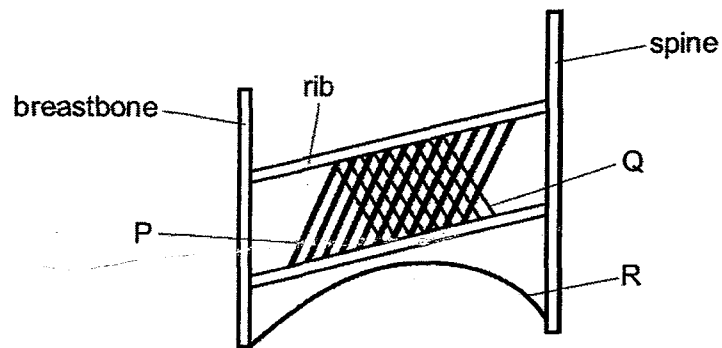
20 Some factors associated with coronary heart disease are listed.

- 1 high blood pressure
- 2 high intake of fruit and vegetables
- 3 high intake of saturated fats
- 4 low blood cholesterol
- 5 low intake of processed foods

Which factors decrease the risk of coronary heart disease?

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

21 The diagram represents some of the muscles involved with breathing.



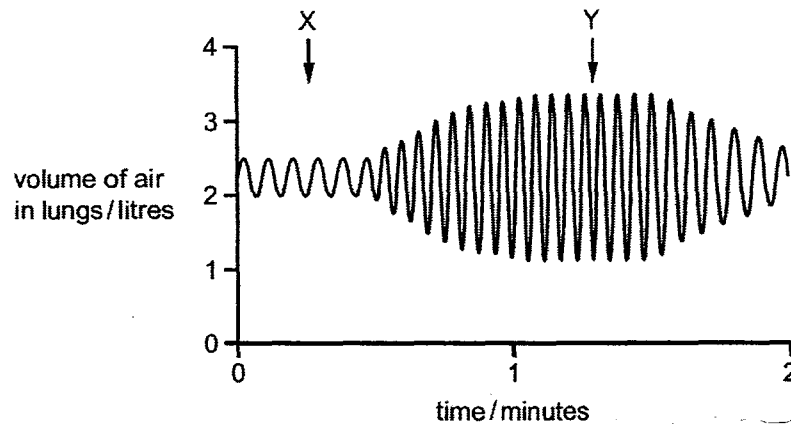
Which muscles are contracting during breathing in?

- A P and Q B Q and R C P and R D P, Q and R

22 What helps oxygen to be absorbed rapidly into the blood in the lungs?

- A Air breathed in has less oxygen than air breathed out.
- B Alveoli have thick walls and a large surface area.
- C Alveoli have thin walls and a large surface area.
- D The concentration of oxygen in the blood is higher than in the alveoli.

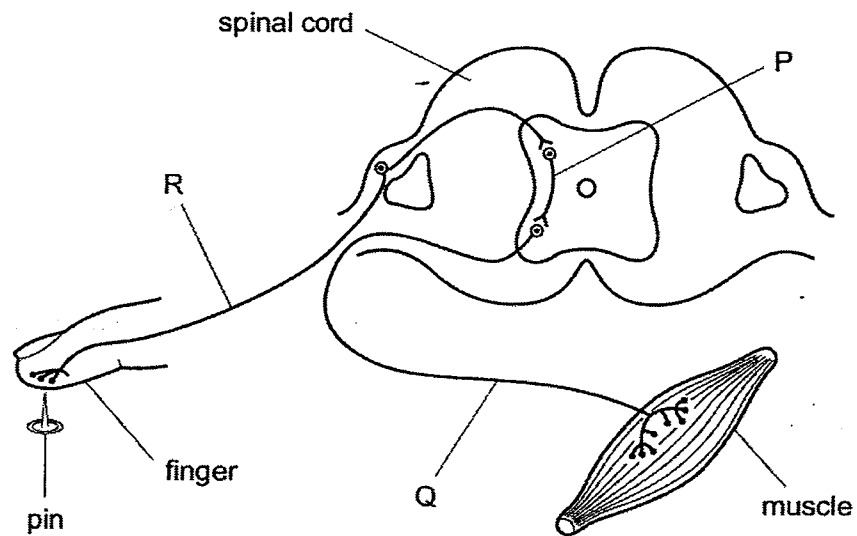
- 23 The diagram shows changes in the volume of a person's lungs over a period of two minutes.



What could cause the change in the pattern of the graph between points X and Y?

- A changing from running to walking
 - B changing from walking to running
 - C increased frequency of contractions of the internal intercostal muscles
 - D increased strength of contractions of the internal intercostal muscles
- 24 During a sunny day, which substance is excreted from a leaf?
- A carbon dioxide
 - B nitrogen
 - C oxygen
 - D sucrose
- 25 Which process is **not** a result of negative feedback?
- A A decrease in the surrounding temperature leads to a decrease in respiration rate.
 - B A decrease in the surrounding temperature leads to a decrease in sweating.
 - C A decrease in the surrounding temperature leads to a decrease in blood flow through the skin surface.
 - D A decrease in the surrounding temperature leads to shivering.

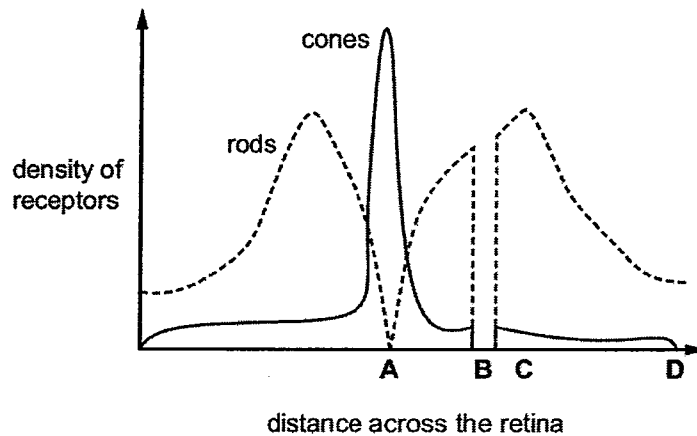
26 The diagram represents a simple reflex arc.



What is the sequence of nerve cells through which an impulse passes during a reflex action?

	first	—————>		last
A	P	Q	R	
B	Q	R	P	
C	Q	P	R	
D	R	P	Q	

27 The diagram shows the density of rods and cones across a horizontal section of the retina.

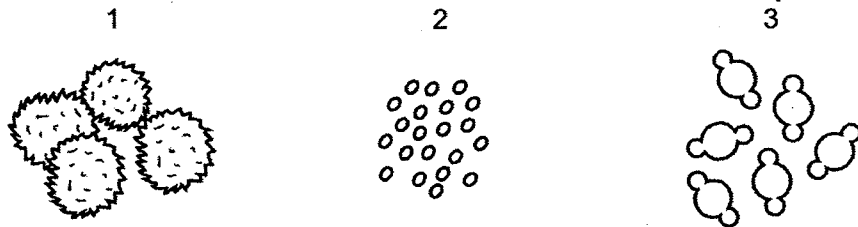


What is the position of the optic nerve?

28 What is **not** an effect of the hormone adrenaline?

- A decreased production of sweat
- B dilated pupils
- C increased blood glucose
- D increased pulse rate

29 The diagrams show pollen grains from three different species of plant as they appear under the microscope. The diagrams are all to the same scale.



Which pollen grains are involved in insect-pollination?

- A 1 and 2
- B 1 only
- C 2 and 3
- D 3 only

30 Where does the placenta allow the exchange of materials to take place between mother and fetus?

- A oviduct wall
- B umbilical cord
- C uterus wall
- D vagina wall

31 When a cell divides, these events occur.

- 1 The DNA inside the cell is duplicated exactly.
- 2 Daughter cells are produced with the same chromosome number as the parent cell.

Which type of division has occurred?

- A meiosis producing genetically different cells
- B meiosis producing genetically identical cells
- C mitosis producing genetically different cells
- D mitosis producing genetically identical cells

- 32 Two black female mice were mated with the same black male. One female had nine offspring, all of which were black. The other female had six black and two white offspring.

Which cross represents the parents of the all black family?

	female	male
A	bb	Bb
B	Bb	Bb
C	Bb	BB
D	BB	Bb

key
 B = allele for black
 b = allele for white

- 33 The whole of an island's population of short-haired bumblebees is descended from just two parents. These were introduced from the mainland.

Which statement about the island's short-haired bumblebee population, compared with that of the mainland, is **correct**?

- A The population is less in danger of collapsing from disease.
 B The population is more able to adapt to environmental changes.
 C The population shows more genetic variety.
 D The population will adapt to environmental changes more slowly.
- 34 Which statement is evidence that genes are copied and passed on to the next generation?
- A Asexual reproduction produces genetically identical offspring.
 B Different alleles of a gene can produce variation in phenotype.
 C Each species of a plant or animal has a fixed number of chromosomes.
 D Sexual reproduction produces genetically different offspring.

- 35 Which statements describe an allele?

	an alternative form of a gene	copied during cell division	part of a DNA molecule
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

key
 ✓ = yes
 x = no

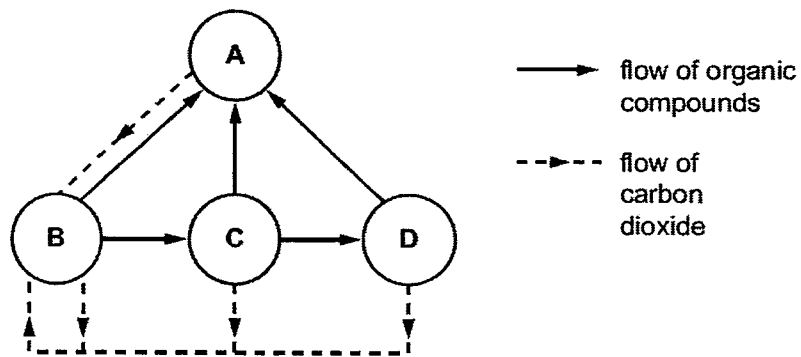
- 36 The diagram shows the order of bases along part of one strand of DNA.

A—C—T—T—A—G—A—T

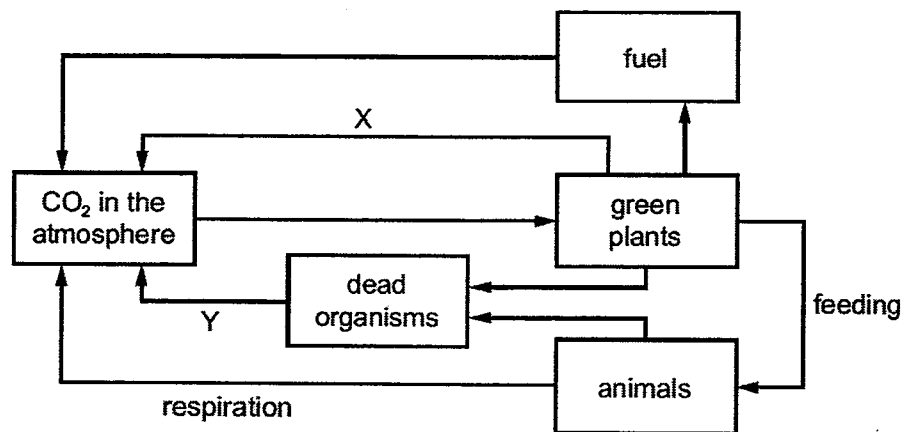
What is the order of bases on the corresponding part of the other strand?

- A** A—C—T—T—A—G—A—T
B C—A—G—G—C—T—C—G
C T—A—G—A—T—T—C—A
D T—G—A—A—T—C—T—A

- 37 The diagram shows the flow of substances within an ecosystem. The circles represent trophic levels. Which circle represents herbivores?



- 38 The diagram shows part of the carbon cycle.



What are the processes X and Y?

	X	Y
A	photosynthesis	decomposition
B	photosynthesis	excretion
C	respiration	photosynthesis
D	respiration	respiration

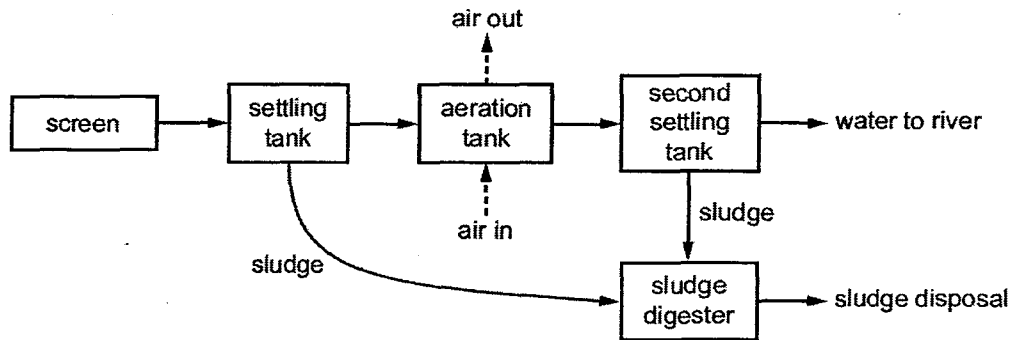
- 39 A farmer is growing wheat in a field. The farmer uses insecticides to kill insect pests and chemicals to kill weeds in the field.

Which statements about this field are **correct**?

- 1 Both the wheat and the weeds are producers.
- 2 Insects feed at the first trophic level.
- 3 Weeds may use light, water and mineral ions that the wheat plants need.

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

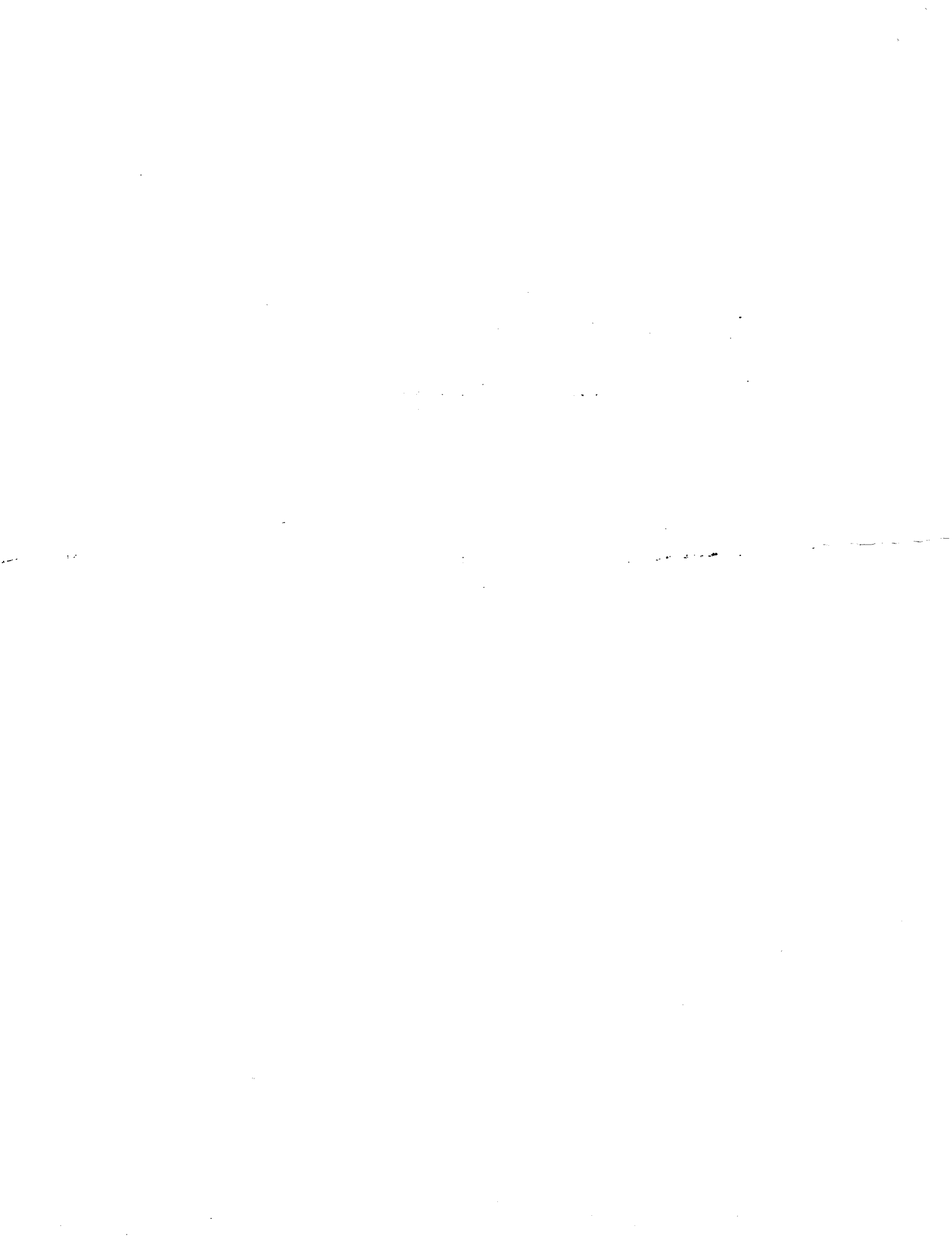
- 40 The diagram shows how sewage is treated.



Why is air bubbled through the aeration tank?

- A** to encourage microorganisms to reproduce quickly
- B** to float the sludge
- C** to settle the sludge
- D** to stop microorganisms from reproducing too quickly

- The End -



Name:		Index Number:		Class:	
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**Preliminary Examination 3
Secondary 4**

A1

BIOLOGY

Paper 2

5158/02

Friday 16 September 2016

1 hour 45 minutes

Additional Materials: -

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE ON THE MARGINS.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

The number of marks is given in brackets [] at the end of each question or part question.

For examiner's use only:

Section A	/ 50
Section B	/ 30

This paper consists of **20** printed pages.

[Turn over

Section A

Answer **all** questions.

Write your answer in the spaces provided.

- 1 Figure 1.1 shows the alimentary canals of two mammals, an insect-eating bat, which is a carnivore, and a rabbit, which is a herbivore.

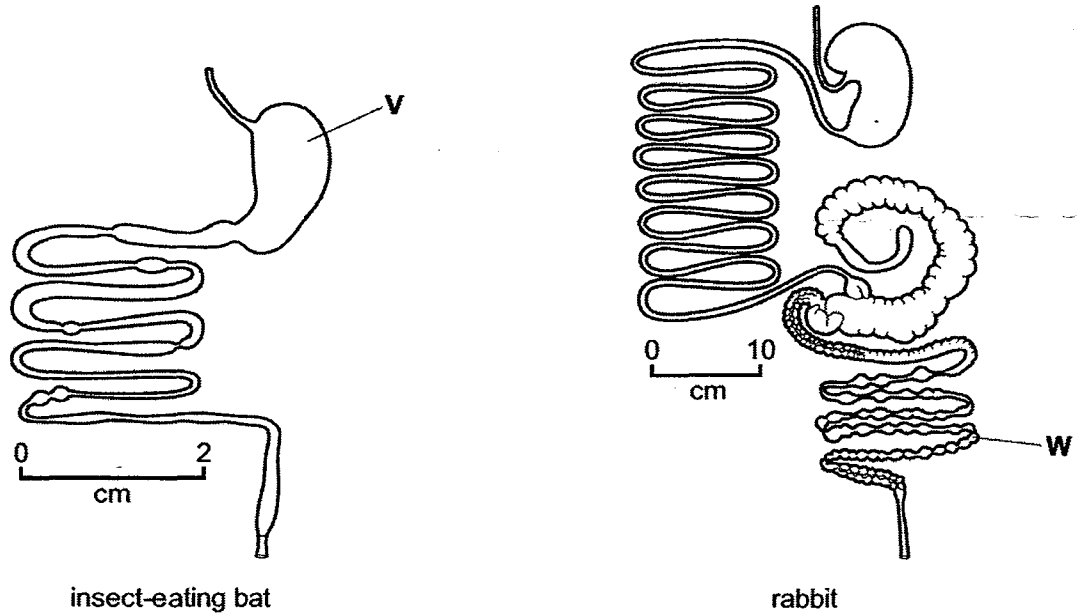


Figure 1.1

- (a) Name the organs labelled **V** and **W**. [2]

V _____

W _____

- (b) Explain the role of mechanical digestion. [3]

Scientists investigated digestion in different species of mammal. The mammals that they studied ranged in size from an elephant shrew, *Elephantulus edwardii*, with a mass of 50 g to an ox, *Bos taurus*, with a mass of 220 kg.

The scientists added indigestible particles to the animals' food and timed how long the particles stayed in the digestive system. The results for 24 different mammal species are shown in Figure 1.2.

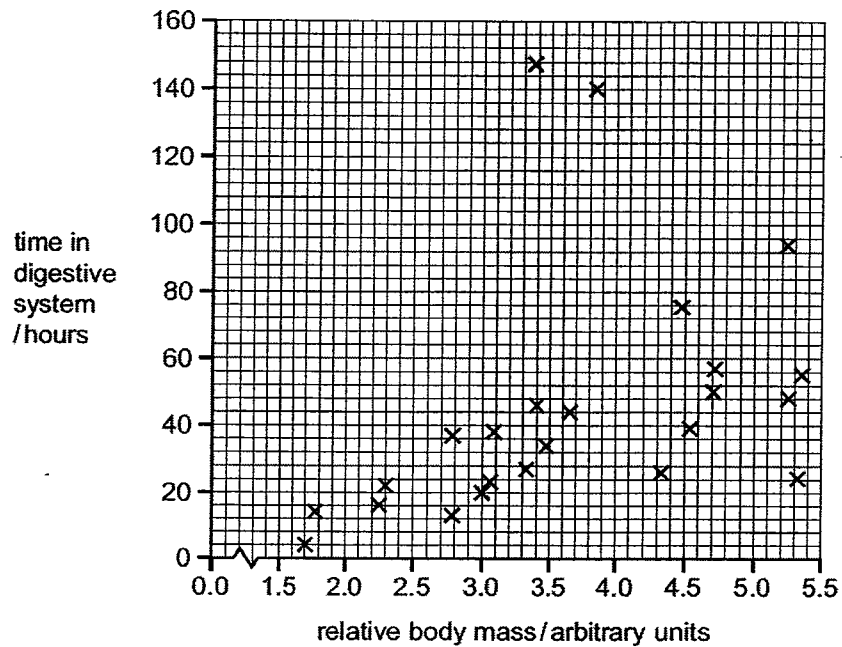


Figure 1.2

The scientists concluded that food stays longer in the digestive systems of larger mammals compared with smaller mammals.

- (c) Discuss the evidence from Figure 1.2, for and against the statement that food stays longer in the digestive systems of larger mammals. [4]

[Total: 9 marks]

- 2 (a) Figure 2.1 shows the human heart and the main blood vessels. The functions of the parts of the heart and some of the blood vessels are given in Table 2.1.

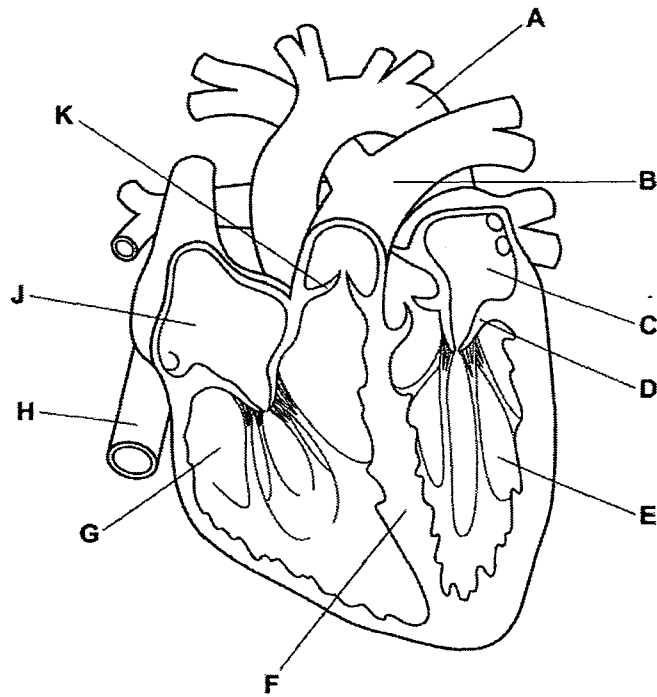


Figure 2.1

Complete Table 2.1.

[4]

Table 2.1

function	letter on Figure 2.1	name
structure that separates oxygenated and deoxygenated blood		
structure that prevents backflow of blood from ventricle to atrium		
blood vessel that carries deoxygenated blood		
chamber of the heart that contains deoxygenated blood		

- (b) A group of students used a heart monitor to record the pulse rate of an athlete during a 5000-metre race. The recordings started just before the race began and ended just after it had finished, as shown in Figure 2.2.

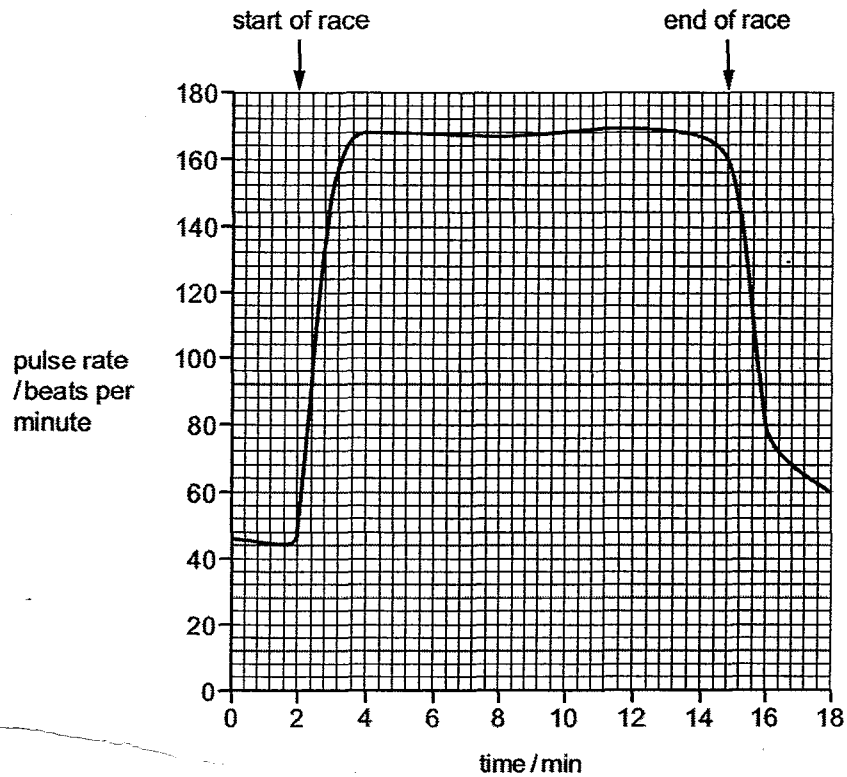


Figure 2.2

- (i) Use data from Figure 2.2 to describe the effect of exercise on the pulse rate of the athlete. [3]

- (ii) Explain the change in pulse rate between 2 minutes and 3 minutes after the recordings started. [4]

[Total: 11 marks]

- 3 Catalase is an enzyme that breaks down hydrogen peroxide inside cells. Red blood cells contain catalase.

Some dogs have an inherited condition in which catalase is not produced. This condition is known as acatalasia and it is caused by a mutation in the gene for catalase.

- (a) Define the terms gene and gene mutation. [2]

gene _____

gene mutation _____

- (b) A geneticist was asked to investigate the inheritance of acatalasia in dogs. The normal allele is represented by **B** and the mutant allele is represented by **b**.

The geneticist made the diagram in Figure 3.1 to show the inheritance of acatalasia in a family of dogs. The shaded symbols indicate the dogs with acatalasia.

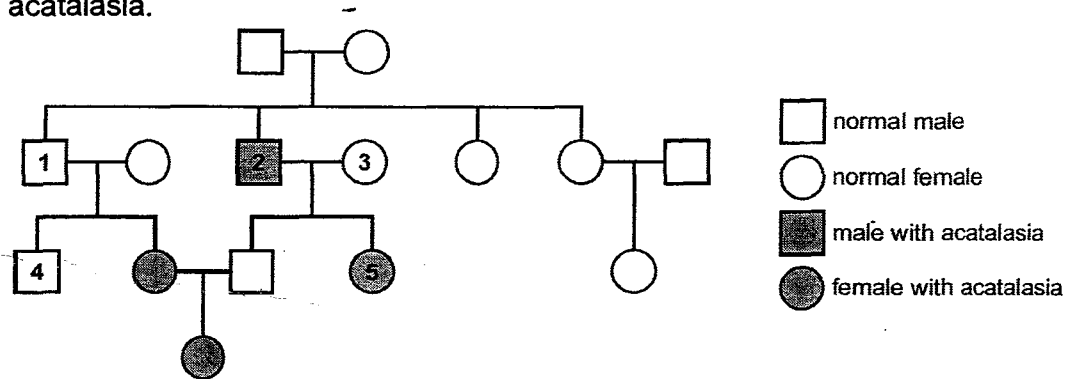


Figure 3.1

- (i) State the genotypes of the dogs identified as 1, 2 and 3 in Figure 3.1. [3]

1 _____ 2 _____ 3 _____

- (ii) The geneticist crossed dog 4 with dog 5. Approximately half of the offspring had acatalasia and half the offspring did not have acatalasia. Construct a genetic diagram to show how this is possible. [4]

- (iii) State the name given to the type of cross that you have completed in (b)(ii). [1]

[Total: 10 marks]

Name:		Index Number:		Class:	
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**Preliminary Examination 3
Secondary 4**

A2

BIOLOGY

Paper 2

5158/02

Friday 16 September 2016

1 hour 45 minutes

Additional Materials: -

READ THESE INSTRUCTIONS FIRST

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Write in dark blue or black pen.

You may use a pencil for any diagrams, graphs or rough working.

Do not use staples, paper clips, glue or correction fluid.

DO NOT WRITE ON THE MARGINS.

Section A

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Section B

Answer **all** questions.

Write your answers in the spaces provided on the Question Paper.

Electronic calculators may be used.

You are advised to spend no longer than one hour on Section A and no longer than 45 minutes on Section B.

The number of marks is given in brackets [] at the end of each question or part question.

For examiner's use only:

Section A	/ 50
Section B	/ 30

This paper consists of 20 printed pages.

[Turn over

4 Excretion is the process of removing waste products of metabolism from the body.

(a) Name the two main products of metabolism that need to be excreted from the human body. [2]

1 _____

2 _____

(b) The kidney is one of the main excretory organs of the body. Its role is to filter the blood. Some substances leave the blood and are removed from the body in the urine. The concentration of protein in the blood entering the kidneys in the renal arteries is 83 g dm^{-3} .

State the concentration of protein that you would expect in the urine of a healthy person and explain your answer. [2]

concentration _____ g dm^{-3}

explanation _____

(c) Dialysis can be used to treat people whose kidneys do not function properly. Figure 4.1 shows dialysis treatment.

Key

→ movement of blood

⇒ movement of dialysis fluid

→ movement of substances in and out of blood

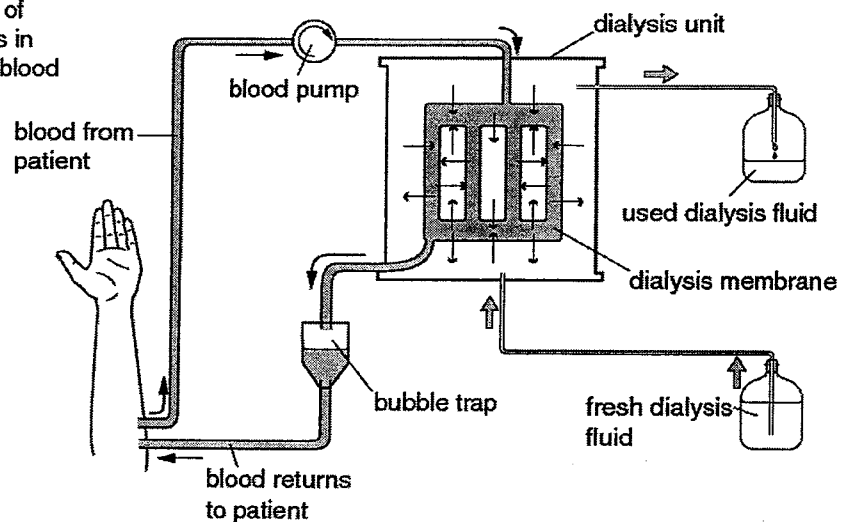


Figure 4.1

Use Figure 4.1 to describe the process of dialysis and explain changes that occur in a person's blood.

[5]

(d) Some people with kidney failure are given a kidney transplant.

State **one** advantage and **one** disadvantage of having a kidney transplant instead of dialysis treatment.

[2]

advantage _____

disadvantage _____

[Total: 11 marks]

Name:		Index Number:		Class:	
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**Preliminary Examination 3
Secondary 4**

B

BIOLOGY

Paper 2

5158/02

Friday 16 September 2016

1 hour 45 minutes

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Section A

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Section B

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Section A	/ 50
Section B	/ 30

This paper consists of **20** printed pages.

[Turn over

Section B

Answer **three** questions.

Question **8** is in the form of an **Either/Or** question. Only one part should be answered.

- 6** In an investigation into the effects of alcohol on the nervous system, people were asked to carry out a test on their reaction time.

The person being tested looked at a coloured block on a computer screen. As soon as the colour changed they pressed a button. The time taken to press the button was recorded by the computer. This was their reaction time.

Twenty people were tested before and after consuming a drink containing the same concentration of alcohol.

Table 6.1 shows the results of this investigation.

Table 6.1

test person	reaction time before consuming alcohol / milliseconds	reaction time after consuming alcohol / milliseconds
1	272	322
2	310	350
3	225	270
4	243	290
5	240	308
6	264	315
7	201	238
8	262	300
9	225	252
10	235	278
11	225	253
12	247	271
13	226	266
14	194	220
15	206	239
16	309	340
17	223	261
18	243	286
19	270	316
20	180	225
mean	240	

5 Figure 5.1 shows the stages in the process of genetic engineering to produce the hormone insulin.

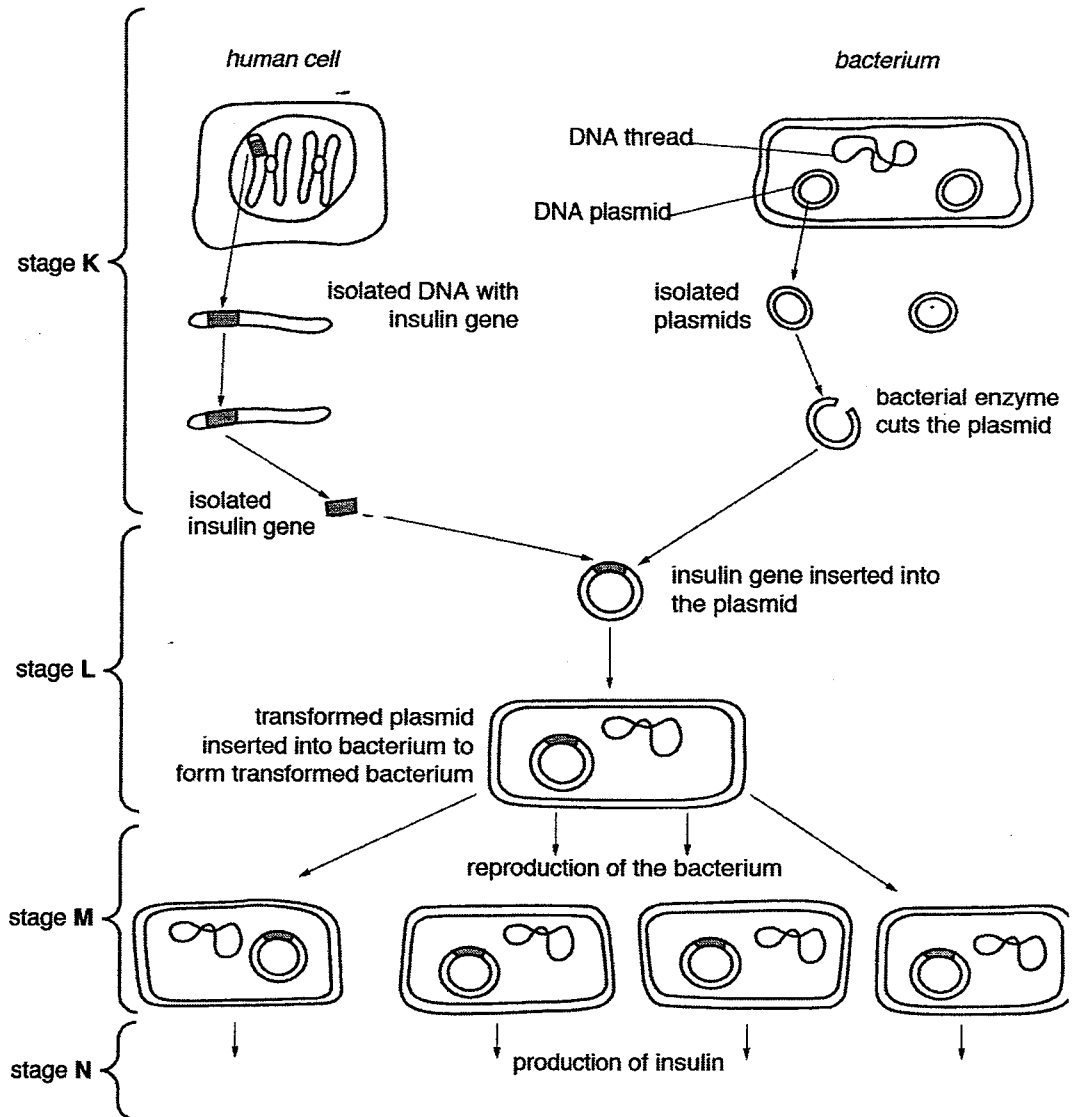


Figure 5.1

(a) Describe how the location and organisation of genetic material in the human cell shown in stage K of Figure 5.1 is different from that in the bacterial cell shown. [3]

- (b) Use your knowledge of cells to name two structures that the transformed plasmid must pass through to form a transformed bacterium in stage **L** of Figure 5.1. [2]

_____ and _____

- (c) State the type of reproduction that takes place in stage **M** of Figure 5.1. [3]
Use your knowledge of the process of cell division to explain why it is important that this type of reproduction occurs.

type of reproduction _____

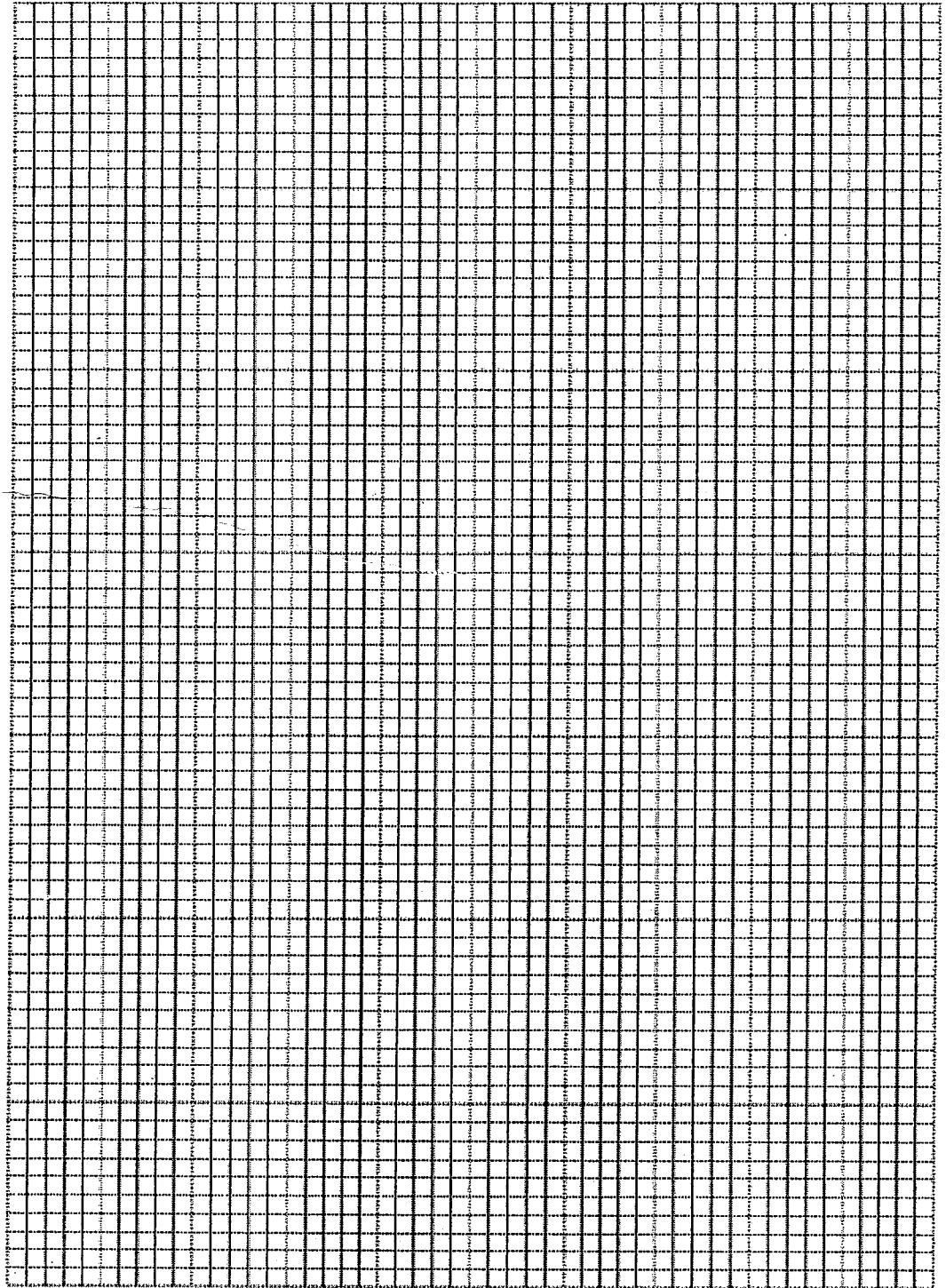
explanation _____

- (d) Name the condition in humans that is treated using insulin produced by the bacteria in stage **N** of Figure 5.1. [1]

[Total: 9 marks]

- End of Section **A2** -

- (a) Calculate the mean for the reaction time after consuming alcohol. [1]
Write your answer in Table 6.1.
- (b) Plot a bar chart to show the mean reaction time of the people tested before [4]
and after consuming alcohol.



(c) The range of reaction times recorded before consuming alcohol is 180-310 milliseconds. Use Table 6.1 to identify the range of reaction times recorded after consuming alcohol. [1]

(d) Describe effects on the body of long-term, excessive consumption of alcohol. [3]

(e) Suggest one social implication of alcohol misuse. [1]

[Total: 10 marks]

7 Figure 7.1 shows an area of forest where some of the trees have been cut down.

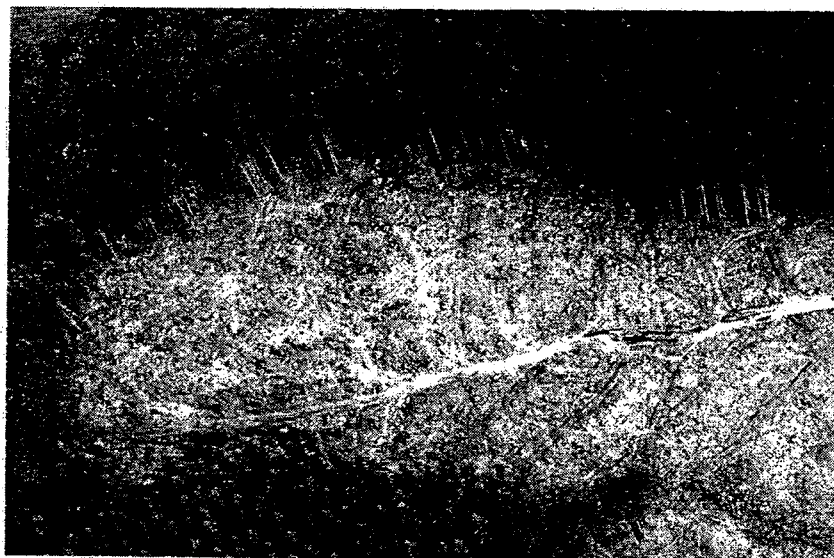


Figure 7.1

- (a) Explain the reasons why forests may be cut down as shown in Figure 7.1. [2]

- (b) The loss of forests from parts of the world is assessed by satellite imagery. Table 7.1 shows data on the forests in Indonesia and Malaysia, two countries in South-East Asia which have large areas of forest.

Table 7.1

country	type of forest	area / thousands of hectares			
		1990	2000	2005	2010
Indonesia	natural forest	118 545	95 737	94 158	90 883
Malaysia	natural forest	20 420	19 932	19 317	18 649

- Calculate the percentage loss of natural forest in Indonesia between 1990 and 2010 (Show your working and express your answer to the nearest whole number). [2]

- (c) Many hectares of natural forest have been cleared in countries such as Malaysia and Indonesia for oil palm plantations. Both countries have also replanted forests to grow timber and other forest products. [2]

Suggest why replanted forests and plantations are less useful for conservation than natural forest.

(d) Discuss the effects of deforestation on areas of land.

[4]

[Total: 10 marks]

8 Either

(a) Many flowering plants can reproduce sexually and asexually.
Define the term asexual reproduction.

[3]

- (b)** Describe advantages and disadvantages of asexual reproduction for flowering plants with reference to a named commercially important application. [7]

[Total: 10 marks]

8 Or

- (a)** Describe what happens at ovulation. [2]

- (b) If an embryo implants in the uterus, the embryo secretes a hormone known as hCG that stimulates the reproductive organs of the woman to continue to secrete progesterone. Describe what happens after fertilisation until the time that the embryo secretes hCG. [7]

- (c) Fertility drugs are taken to increase the chance that a woman may become pregnant. Suggest how these drugs improve the chances of becoming pregnant. [1]

[Total: 10 marks]

- End of Section B -

2016 SECONDARY 4 BIOLOGY PRELIMINARY EXAMINATION 3

Mark Scheme

5158/01 (40 marks)

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

5158/02

Section A (50 marks)

- 1 (a) V – stomach [1]
W – large intestine / colon / rectum [1] I: intestine unqualified
- 1 (b) mp 1 breaks up food into small(er) pieces [1] R: molecules
mp 2 without chemical change [1] A: without enzymes
mp 3 by teeth / muscles [1] A: mastication / chewing / churning
mp 4 to mix (with digestive juice) [1]
mp 5 increases surface area [1]
mp 6 for enzyme action [1]
mp 7 speeds up chemical digestion [1]
mp 8 easier to swallow [1]
[max 3]
- 1 (c) *for*
mp 1 positive correlation / as (relative) body mass increases + time in digestive system increases [1]
mp 2 any two or more figures from the graph (units must be quoted at least once) [1]
- against*
mp 3 two/one/few/some + are outliers/anomalies (e.g. either outlier quoted) [1]
mp 4 any figure(s) from the graph [1]
mp 5 (description of) some mammals do not fit the + pattern/trend [1]
mp 6 any example from the graph [1]

- mp 7 only information about 26 species of mammal / small sample size [1]
 mp 8 idea about unknown validity [1]
 mp 3-8 [max 3]

mp 1-2 + mp 3-8 [max 4]

2 (a)

function	letter on Figure 1.1	name	
structure that separates oxygenated and deoxygenated blood	F	septum	[1]
structure that prevents backflow of blood from ventricle to atrium	D	bicuspid/mitral/atrioventricular + valve A: "AV valve" R: right atrioventricular valve	[1]
blood vessel that carries deoxygenated blood	B H	pulmonary artery vena cava	[1]
chamber of the heart that contains deoxygenated blood	J G	right atrium right ventricle	[1]

- 2 (b) (i)
- mp 1 pulse rate increases and remains constant [1]
 mp 2 immediate/sudden/steep/rapid/AW + increase in pulse rate [1] R: exponential
 mp 3 increases from 44–48 bpm to 164–170 bpm / increases by 120–126 bpm / by 3.5 to 4 times or approx 4 [1]
 mp 4 maximum / 164–170 bpm + at 4 min(utes) / 2 min(utes) after race starts [1]
 R: no units used
 [max 3]

- 2 (b) (ii)
- mp 1 adrenaline stimulates increase in + heart/pulse rate [1]
 mp 2 increase in blood + carbon dioxide (concentration) / acidity + detected [1]
 A: decrease in pH
 mp 3 nerves stimulate heart to beat faster [1]
 mp 4 ref to muscle contraction / AW [1]
 mp 5 muscles require more energy / muscles are doing more work [1]
 mp 6 (rate of aerobic) respiration increases [1]
 R: 'produce' energy
 mp 7 increase demand for + oxygen / glucose [1]
 mp 8 ref to removal of + carbon dioxide / lactic acid / heat [1]
 mp 9 more + blood / carbon dioxide + to lungs (per unit time) [1]
 mp 10 more + blood / oxygen / glucose + to muscles [1]
 mp 11 AVP (e.g. ref to ATP / vasodilation in muscles) [1]
 [max 4]

- 3 (a)
- gene – a length of DNA that codes for a protein [1]
 R: chromosome / molecule of / genome
 gene mutation – a change in base sequence of DNA [1]

- 3 (b) (i)
- 1 – Bb [1]
 2 – bb [1]
 3 – Bb [1]

- 3 (b) (ii) phenotype of parents: unaffected (by acatalasia) x affected (by acatalasia) [1]

A: normal/carrier (in place of "unaffected")
 R: father/mother/male/female/sick
 genotype of parents: Bb x bb [1]
 gametes: B, b, b, b [1]
 R: lines are not drawn / not correctly aligned
 genotype of offspring: Bb, Bb, bb, bb [1]
 phenotype of offspring: unaffected, unaffected, affected, affected [1]
 R: "F1/F2 generation"
 [max 4]

3 (b) (iii) test (cross) [1]

4 (a) carbon dioxide [1]
urea [1]

4 (b) 0 / 0.0 (g dm⁻³) [1]
proteins too big, to pass through the capillary wall (in glomerulus) / to be filtered (from the blood) / out of the glomerulus [1]

4 (c) mp 1 blood flows into the (dialysis) machine / blood is returned to the patient [1]
mp 2 blood passes over a dialysis membrane / countercurrent flow described [1]
mp 3 the dialysis membrane separates the person's blood and the dialysis fluid [1]
mp 4 dialysis fluid contains + glucose / salts / no urea [1]
mp 5 movement (across membrane) by diffusion / down a concentration gradient [1]
mp 6 urea leaves the blood / enters the dialysis fluid [1]
mp 7 dialysis fluid is refreshed [1]
mp 8 excess/some salt + leaves the blood / enters the dialysis fluid [1]
mp 9 excess/some water + leaves the blood / enters the dialysis fluid [1]
mp 10 glucose/salts in dialysis fluid same concentration as (should be) in blood [1]
mp 11 no net loss of glucose [1]
[max 5]

4 (d) advantage
no need to visit hospital [1]
no need for dialysis / time not taken up with dialysis [1]
no need for a restricted diet [1]
no long term discomfort / pain [1]
improved quality of life / lead a normal life [1]
[max 1]

disadvantage
rejection of kidney [1]
difficult to find suitable donor [1]
risk associated with operation [1]
need to take immunosuppressant drugs [1]
[max 1]

5 (a) DNA
in nucleus (human) / within nuclear membrane [1]
in cytoplasm (bacteria) [1]

presence of plasmid(s) (bacteria) [1]
correct reference to chromosomes / AW (human) [1]
genes / chromosomes paired (human) [1]
[max 3]

5 (b) (cell) wall [1]
(cell) membrane [1]

5 (c) type:
asexual / binary fission / mitosis [1]

explanation:
genetically + identical (cells produced) OR clones [1]
all capable of producing insulin / same product [1]
A: to produce insulin in large quantities / to produce a large number of bacteria / produce bacteria quickly

5 (d) diabetes [1]

Section B (30 marks)

6 (a) 280 [1]

6 (b) A axes labelled
y-axis: (mean) reaction time / ms
x-axis: before drinking alcohol and after drinking alcohol / before and after / or key given
x-axis labels approximately under each bar
S columns at least half the grid on y-axis + even scale [1]
P both plots accurate $\pm \frac{1}{2}$ small square [1]
C columns not touching + of same width [1]

6 (c) 220–350 + milliseconds [1]

6 (d) cirrhosis (of liver) / (chronic) liver disease [1]
cancer of the liver / stomach / mouth (oral) / throat [1]
pancreatitis / kidney failure / liver failure [1]
stomach ulcers [1]
brain damage [1]
heart disease / heart failure / heart attack / stroke / high blood pressure [1]
reduced fertility [1]
depression / AW [1]
addiction / dependence [1]
[max 3]

6 (e) violent crime / domestic violence [1]
road accidents / drink driving [1]
(petty) crime / vandalism [1]
family breakdown / divorce / relationship breakdown [1]

impaired performance at work / unemployment / difficulty getting a job [1]
[max 1]

- 7 (a) timber/paper + manufacture / AW [1] A: wood unqualified
firewood [1] A: fuel

clearance for
agriculture [1]
urbanisation / roads / housing / factories / industry / leisure developments [1]
extraction of minerals / for other natural resources [1]
[max 2]

- 7 (b) $118\,545 - 90\,883 = 27\,662$
 $27\,662 / 118\,545 \times 100$ [1]
 $23 + \%$ [1]

- 7 (c) planted forest + has one (dominant) species [1]
loss of biodiversity [1]
qualification of biodiversity loss (e.g. habitats / example / extinction of a species) [1]
I: homes / organisms die
(plantation) susceptible to pest / disease [1]
nutrients removed / soils become infertile [1] A: use of chemicals
ref to alien / foreign / invasive / non-indigenous species [1]
AVP (e.g. vegetation is removed / lower canopy / all immature) [1]
[max 2]

- 7 (d) mp 1 roots die so do not bind the soil [1]
mp 2 loss of soil / soil erosion [1]
mp 3 silting of rivers [1]
mp 4 reduced (soil) fertility [1]
A: loss of + minerals/ions/nutrients
mp 5 no trees to absorb the water [1]
mp 6 increased risk of flooding [1]
mp 7 increased rate of evaporation / land is exposed to drying [1]
A: drought / decreased rainfall
mp 8 desertification / decreased soil water [1]
mp 9 loss of + habitat / places where organisms live / described [1]
I: home
mp 10 disruption to food chain / described [1]
mp 11 endangered / extinction, of species or loss of biodiversity [1]
I: organisms die
mp 12 AVP – named example of affected ‘land’ organism in context / removed
trees cause nutrient cycling disruption / lack of decomposition [1]
[max 4]

- 8 E (a) production of genetically identical offspring [1]
from one parent [1]
no gametes
ref to (only) mitosis [1]
[max 2]

8 E (b) name of correct organism / crop / technique (e.g. cutting, micro-propagation, tubers, bulbs, layering, runners) [1]

advantage

mp 1 fast [1]

mp 2 always an exact / similar copy [1]

mp 3 known characteristics / more certain outcome / AW [1]

mp 4 only one parent/individual needed [1]

mp 5 can be conducted in controlled conditions [1]

mp 6 not reliant on pollination (agent) [1]

mp 7 colonise new areas quickly / if the parent is well adapted to the environment the offspring will be also / [1]

mp 8 higher yield / AW [1]

[max 5]

disadvantage

mp 9 little/no + variation [1]

mp 10 disease / change in environmental conditions + likely to kill all organisms / AW [1]

mp 11 limited ability to adapt to environmental changes / AW [1]

mp 12 no dispersal + so competition (with parent / others) likely [1]

[max 3]

I: advantage/advantage not qualified

[max 8]

8 O (a) release of an, egg / ovum / oocyte [1]

either

from + follicle/ovary

or

into + oviduct / fallopian tube [1]

8 O (b) mp 1 zygote / fertilised egg + divides [1]

mp 2 mitosis / cell division [1]

I: embryo forming after implantation

mp 3 forms + an embryo [1]

A: blastocyst / blastula

mp 4 (hollow) ball / collection / group / AW + of cells [1]

mp 5 goes/moves + down oviduct / down fallopian tube / towards uterus [1]

mp 6 by ciliary action / peristalsis / muscle contraction [1]

mp 7 implants / AW + into lining of the uterus / uterine lining / endometrium [1]

A: "embeds"

R: "uterus"

mp 8 growth / development + of placenta [1] R: zygote implants

mp 9 follicle becomes + yellow body / corpus luteum / remains of follicle / AW [1]

mp 10 corpus luteum / ovary / AW + secretes/releases/produces progesterone [1]

mp 11 progesterone maintains + endometrium / uterine lining / lining of uterus [1]

R: "wall"

mp 12 progesterone + prevents menstruation [1]

mp 13 inhibition of FSH (secretion / release) [1]

mp 14 prevents + production of more eggs / production of follicles [1]

[max 7]

8 O (c) (named) drug (e.g. FSH / clomiphene / clomid) + injected/taken [1]

stimulates + production/development/maturation/release + follicles/eggs/ova/oocytes [1]

more eggs are released [1]

A: inhibits action of oestrogen

A: makes sure that FSH concentration is high enough

A: LH stimulates + ovulation / release of eggs

[max 1]

