

Name: _____ ()

Class: _____

PRELIMINARY EXAMINATIONS 2016
Secondary Four Express

BIOLOGY (WITH SPA)

Paper 1 Multiple Choice

5158/01

Duration: 1 hour

Classes: 405 and 406

Additional Materials: Optical Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

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

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

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

Read the instructions on the Optical 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 question.

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

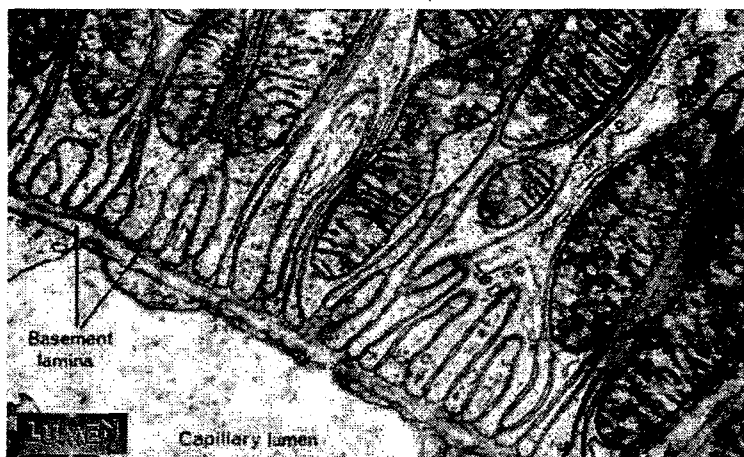
1 The diagram shows the electron micrograph of a plant cell.



Which row correctly identifies the organelles?

	I	II	III	IV	V
A	chloroplast	cell surface membrane	nucleus	Golgi apparatus	central vacuole
B	chloroplast	cellulose cell wall	nucleolus	chloroplast	ribosome
C	mitochondrion	cell surface membrane	nucleus	chloroplast	central vacuole
D	mitochondrion	cellulose cell wall	nucleolus	Golgi apparatus	ribosome

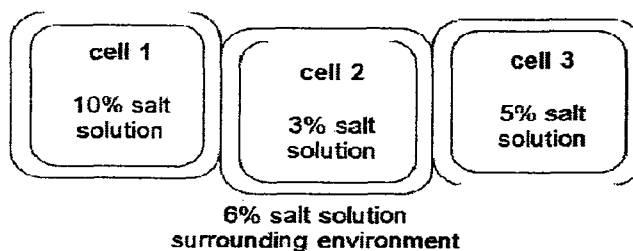
2 The diagram shows a model of an animal cell.



Which statement is true about the function of the cell?

- A absorption of substances by active transport and diffusion
- B absorption of substances by diffusion only
- C packaging of substances into vesicles for transport to other parts of the cell
- D synthesis of lipids

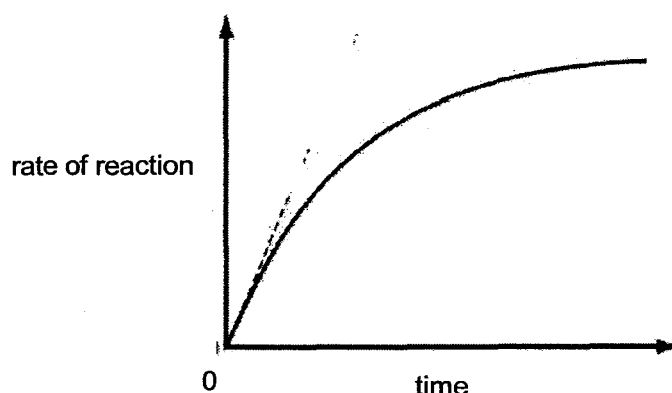
- 3 The diagram shows the relative water potential in some plant cells and in their surrounding solution.



Which statement best describes the movement of water?

- A All three cells are turgid, so water will not move into the cells.
 B Water from cell 1, cell 3 and the surrounding environment moves into cell 2.
 C Water moves from cell 2 to cell 1, cell 3 and the surrounding environment.
 D Water moves from cell 3 to the surrounding environment and from the surrounding environment to cell 1.
- 4 Which statement describes the effect of high temperature on an enzyme-catalysed reaction?
- A More products are formed per unit time.
 B There are more effective collisions between substrate molecules and active sites of enzymes.
 C The shape of active sites of enzymes would become distorted and do not allow substrate molecules to bind to them.
 D The shape of substrate molecules would become distorted and cannot bind to the active sites of enzymes.
- 5 A fixed volume of the enzyme catalase was added to a fixed volume of hydrogen peroxide solution.

The diagram shows how the rate of the reaction changed over the course of the reaction.



Why did the rate of reaction become constant over time?

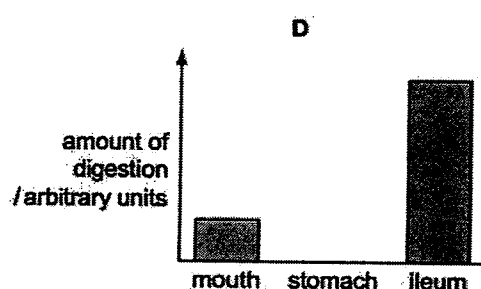
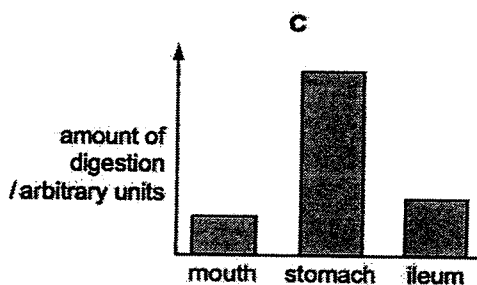
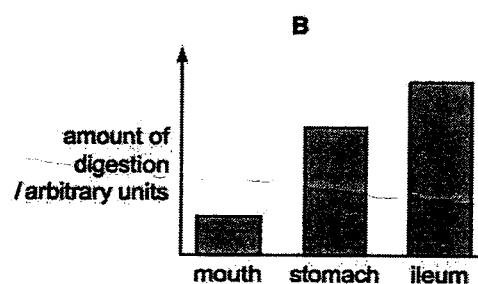
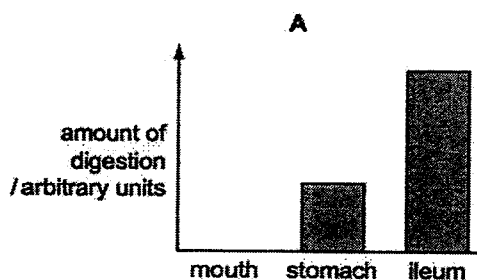
- A The active site of enzymes becomes saturated.
 B The enzymes were denatured.

- C The products were all formed.
 D The substrate molecules were used up.
- 6 The amount of reducing sugar present in any mixture can be determined by Benedict's test. Three samples, X containing 10 % glucose; Y containing 5 % sucrose; and Z containing 1 % glucose are tested.

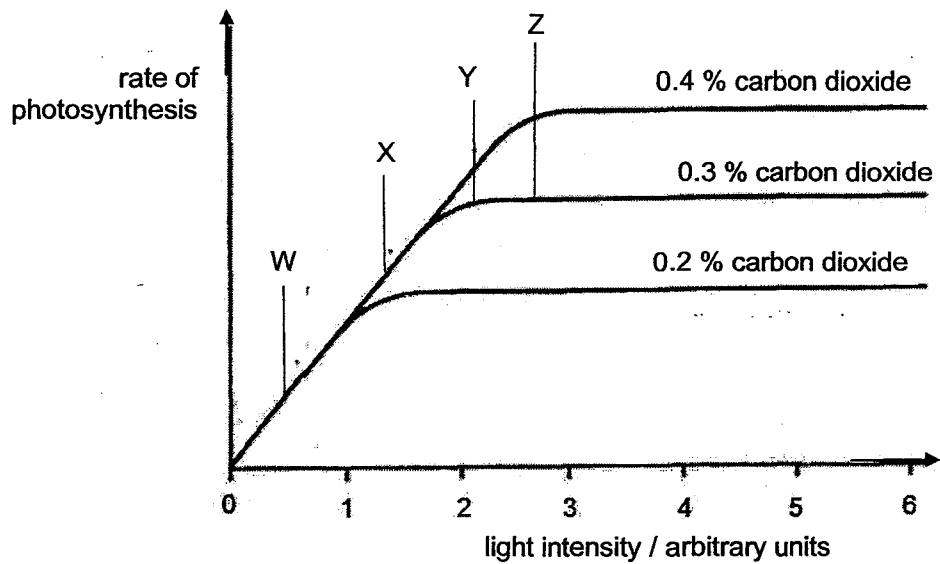
Which option shows the expected results for the three samples?

	X	Y	Z
A	blue precipitate	green precipitate	brick-red precipitate
B	green precipitate	blue solution	blue solution
C	brick-red precipitate	blue solution	green precipitate
D	brick-red precipitate	brick-red precipitate	green precipitate

- 7 If the pancreatic duct of a person becomes blocked, which symptom would be observed?
- A decrease in the release of bile
 B decrease in the release of insulin
 C decrease in the rate of digestion of fats
 D increase in blood glucose concentration
- 8 Which bar chart represents the amount of starch digested in the mouth, stomach and ileum of a human?



For questions 9 and 10, refer to the graph below which shows the effect of light intensity on the rate of photosynthesis at three concentrations of carbon dioxide.



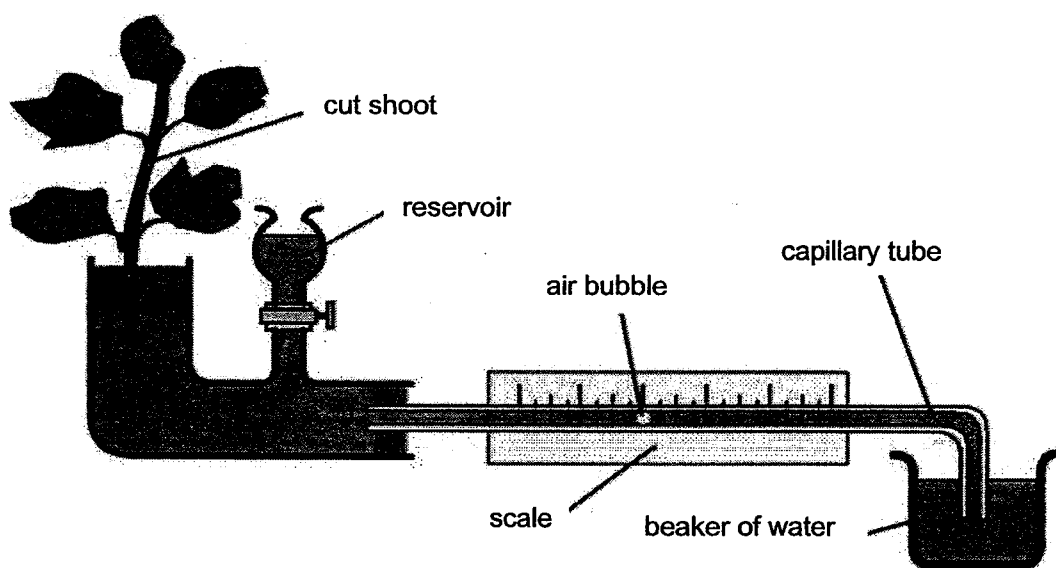
- 9 At which point is light intensity the limiting factor for the three experiments?
- A 0 – 1 arbitrary unit
 B 1 – 2 arbitrary units
 C 2 – 3 arbitrary units
 D 3 – 4 arbitrary units
- 10 At which point on the graph does carbon dioxide concentration start to become the limiting factor for the graph at 0.3 % carbon dioxide?
- A W
 B X
 C Y
 D Z

11 A plant is exposed to different temperatures.

Which set of conditions would cause the plant to lose the most water?

	light intensity / lux	temperature / °C	relative humidity / %
A	150	15.0	70.0
B	250	35.0	60.0
C	400	15.0	50.0
D	800	35.0	30.0

12 The diagram shows a potometer.



At the start of the experiment, the position of the air bubble is at a cm.

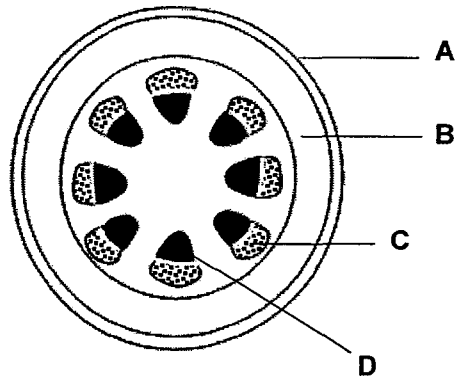
After one hour, the position of the air bubble is at b cm.

Which option correctly represents the rate of transpiration?

- A $\frac{a+b}{2}$ cm / h
 B $\frac{a-b}{2}$ cm / h
 C $a - b$ cm / h
 D b cm / h

13 The photomicrograph shows a section of a young stem.

Which labelled cells do not respire?

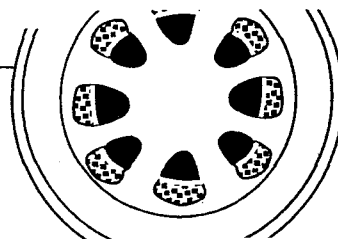
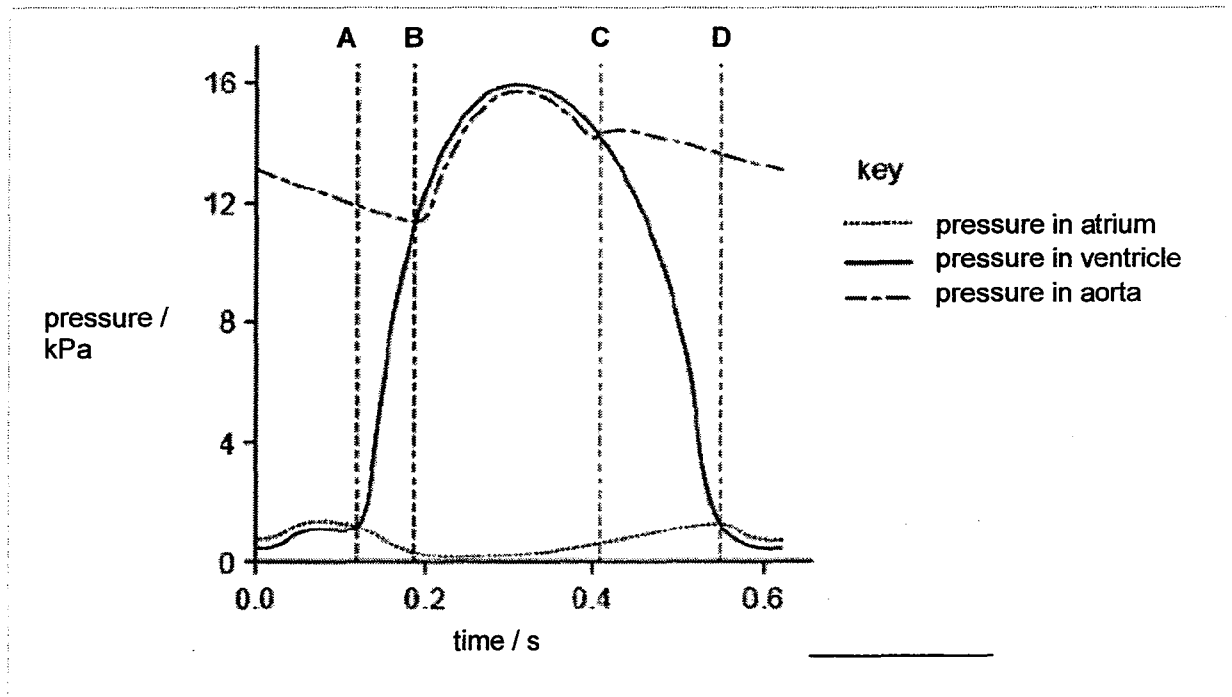


14 Which option shows the location, reactant(s) and product(s) of the reaction catalysed by carbonic anhydrase at the lungs?

	location	reactant(s)	product(s)
A	blood plasma	H_2CO_3	$H_2O + CO_2$
B	blood plasma	$H_2O + CO_2$	H_2CO_3
C	red blood cell	H_2CO_3	$H_2O + CO_2$
D	red blood cell	$H_2O + CO_2$	H_2CO_3

15 The graph shows pressure changes in the left side of the heart during a single heart beat.

At which point does the bicuspid valve close?

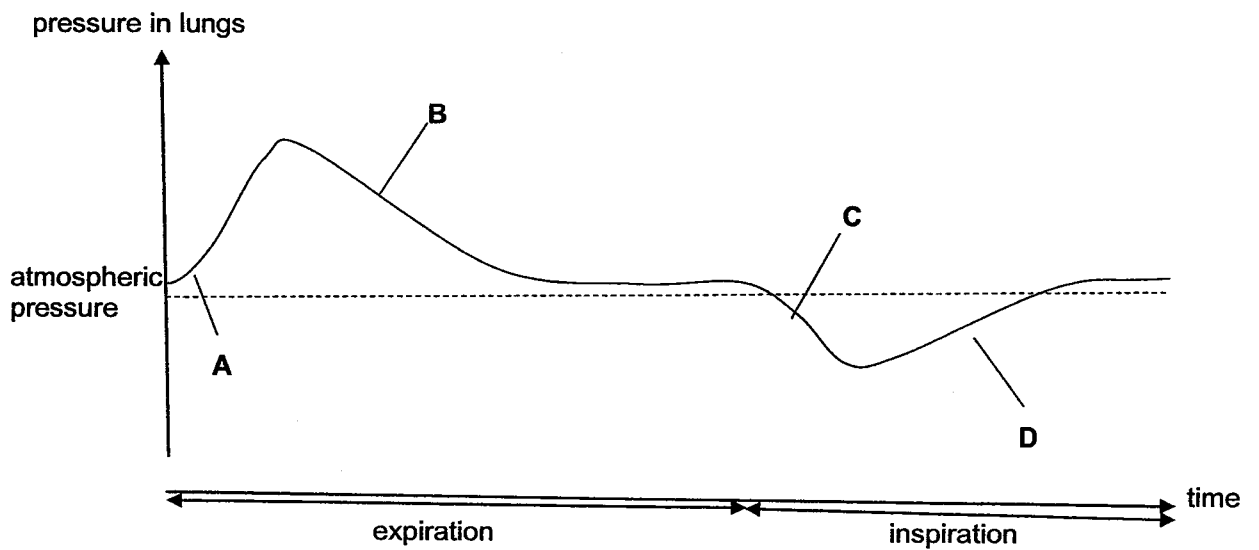


- 16 Which option shows the result of breathing in the same air that was expired?

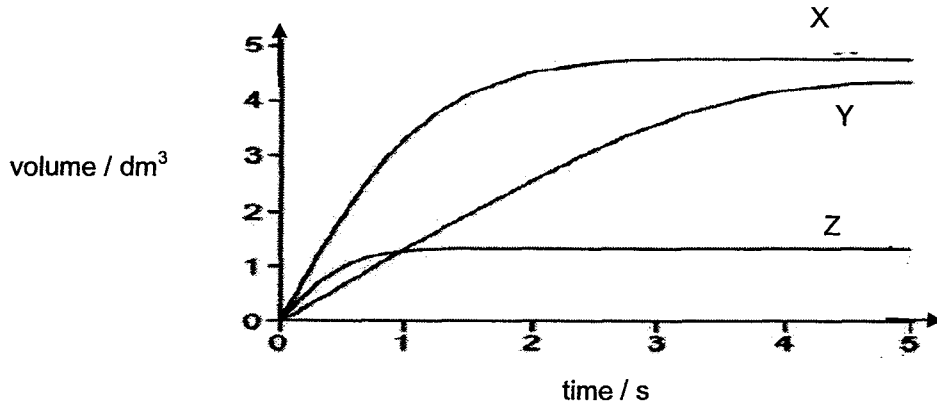
	blood pH	breathing rate
A	decreases	decreases
B	decreases	increases
C	increases	increases
D	increases	decreases

- 17 The diagram illustrates changes in air pressure taking place inside the lungs during a complete cycle of breathing.

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



- 18 The graph shows the volume of air breathed out quickly and with force following a deep breath, for three persons X, Y and Z.



Of the three persons, one is suffering from chronic bronchitis, another is suffering from emphysema and the third person has normal lung function.

Which option correctly matches X, Y and Z to their respective lung condition?

	chronic bronchitis	emphysema	normal lung function
A	X	Y	Z
B	X	Z	Y
C	Y	Z	X
D	Z	Y	X

- 19 Urease is an enzyme which breaks down urea.



This process results in the release of ammonia gas which turns red litmus paper blue. An experiment was set up to investigate the chemical composition of three liquids. The contents of each test-tube is given below. There was a moist red litmus paper at the mouth of each test-tube.

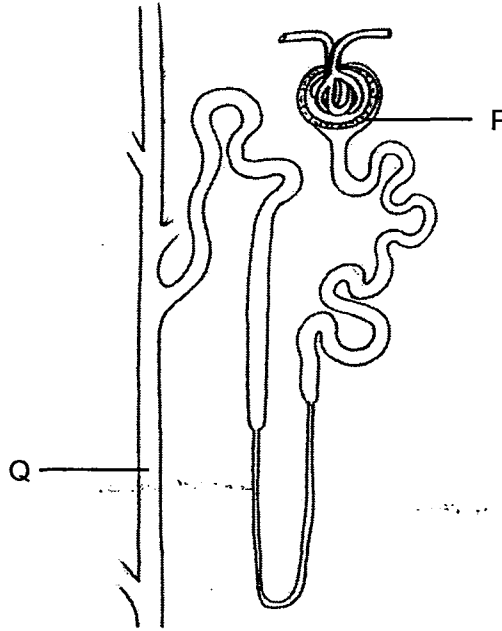
- test-tube 1 – urease and a solution equivalent to the composition of plasma from renal artery
- test-tube 2 – urease and a solution equivalent to the composition of plasma from renal vein
- test-tube 3 – urease and a solution equivalent to the composition of urine

In which test-tube(s) would the red litmus paper turn blue?

- A 2 only
 - B 3 only
 - C 1 and 2 only
 - D 1 and 3 only
- 20 Which part of the nephron traverses through the cortex, medulla and pelvis?
- A Bowman's capsule
 - B collecting duct
 - C distal convoluted tubule

D proximal convoluted tubule

21 The diagram shows the simplified structure of a kidney nephron.



The table shows the quantities of three substances 1, 2 and 3 as they pass through parts P and Q of the nephron of a healthy individual.

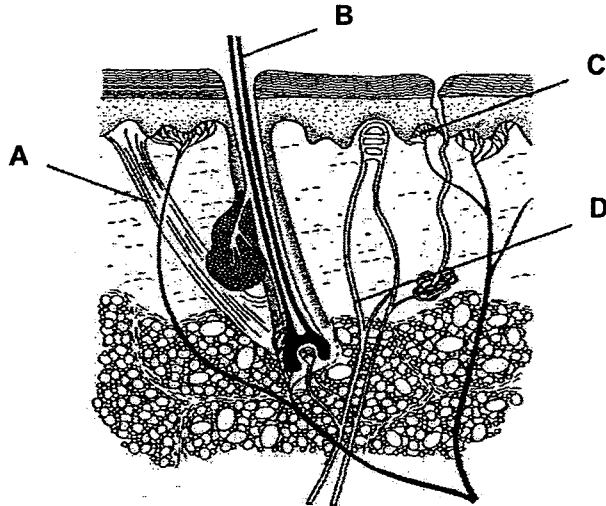
substance	amount passing through P / g	amount passing through Q / g
1	0.50	0.15
2	60	60
3	2.0	0.0

Based on the data given in the table, what are the identities of substances 1, 2 and 3?

	substance 1	substance 2	substance 3
A	glucose	urea	water
B	sodium ion	water	glucose
C	water	sodium ion	urea
D	water	urea	glucose

22 A person walks into a very cold room. Shortly afterwards he starts to shiver.

Which structure is involved in detecting the change in room temperature?



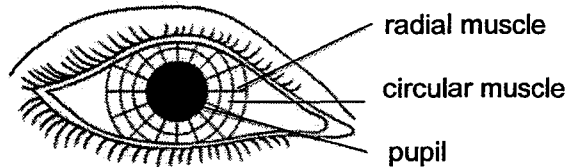
23 Negative feedback involves four events:

- 1 A receptor detects a change in the internal environment.
- 2 Effectors bring about corrective responses.
- 3 Nerve or hormone information are sent to effectors.
- 4 Variation from the norm is counteracted.

Which option shows the order of the sequence of events?

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

24 The diagram shows the front view of an eye of a student in a dark room.

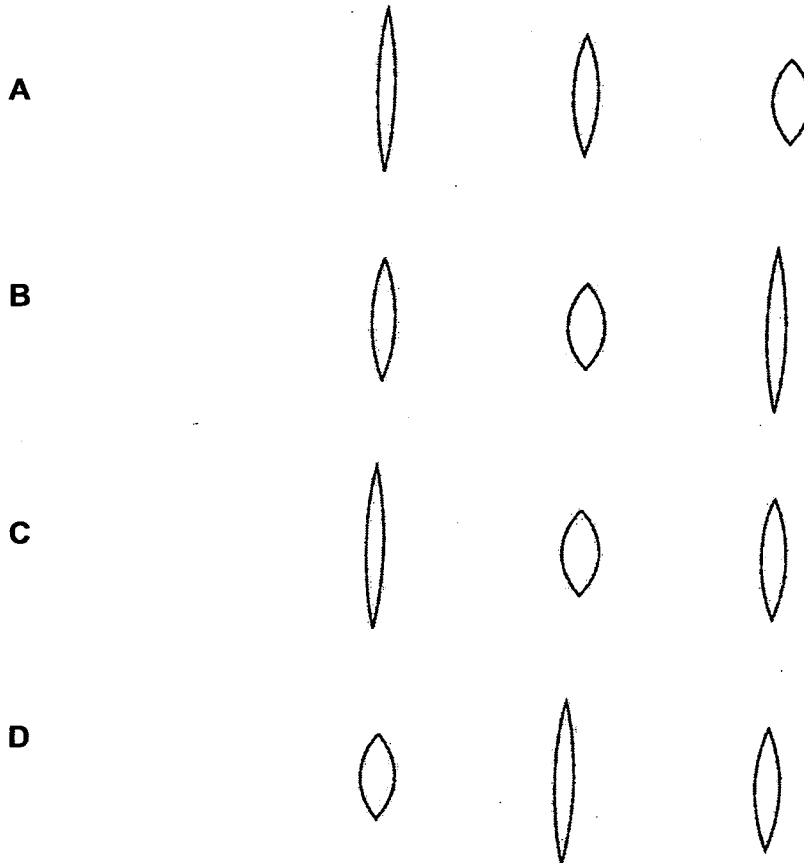


Which option shows the changes in the eye when the light is switched on?

	size of pupil	radial muscles	circular muscles
A	increases	relax	contract
B	decreases	relax	contract
C	increases	contract	relax
D	decreases	contract	relax

- 25 A railway traveler sees his train approaching from the distance, looks at his watch and checks it with the station clock.

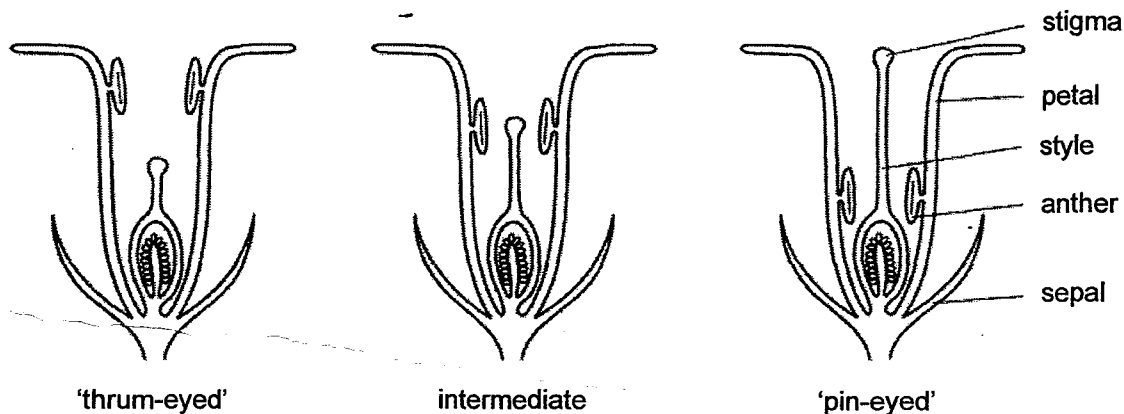
Which option shows the sequence of changes taking place in the shape of the lens of his eye?



- 26 Which option shows the effect of adrenaline?

	heart rate	rate and depth of breathing	glucose concentration in the blood
A	decreases	no change	increases
B	increases	no change	no change
C	increases	increases	increases
D	no change	decreases	decreases

- 27 The diagram shows the different flower shapes of the primrose plant. 'Thrum-eyed' flowers have a short style, 'pin-eyed' flowers have much longer styles, whereas intermediate flowers have a medium-length style.

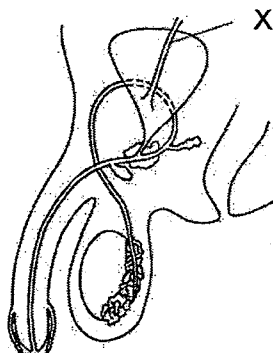


Which of the following statements are correct?

- 1 Cross-pollination will be favoured between 'pin-eyed' and 'thrum-eyed' primroses.
- 2 Primroses with 'pin-eyed' flowers are likely to show more genetic variation than primroses with intermediate flowers.
- 3 Primroses with intermediate flowers are likely to be more able to adapt to changing environmental conditions than 'pin-eyed' and 'thrum-eyed' primroses.
- 4 Self-pollination is more likely to occur in primroses with intermediate flowers.

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

- 28 The diagram shows the male reproductive system.



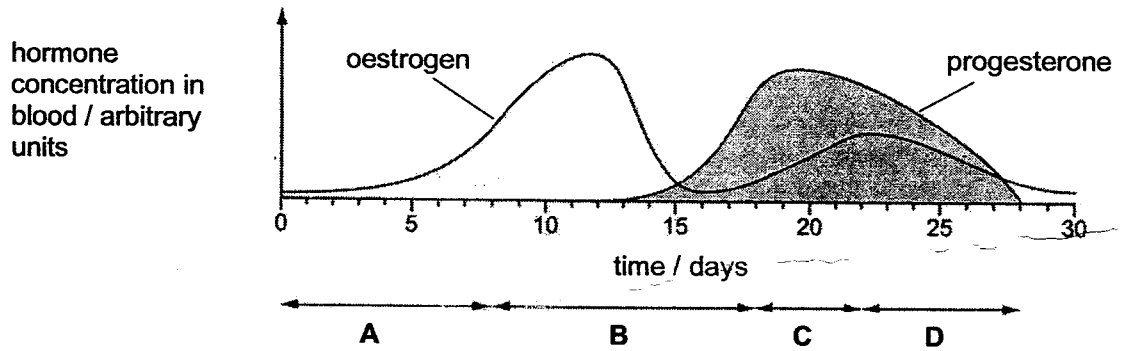
Which option correctly identifies X?

- A rectum
 B sperm duct
 C ureter

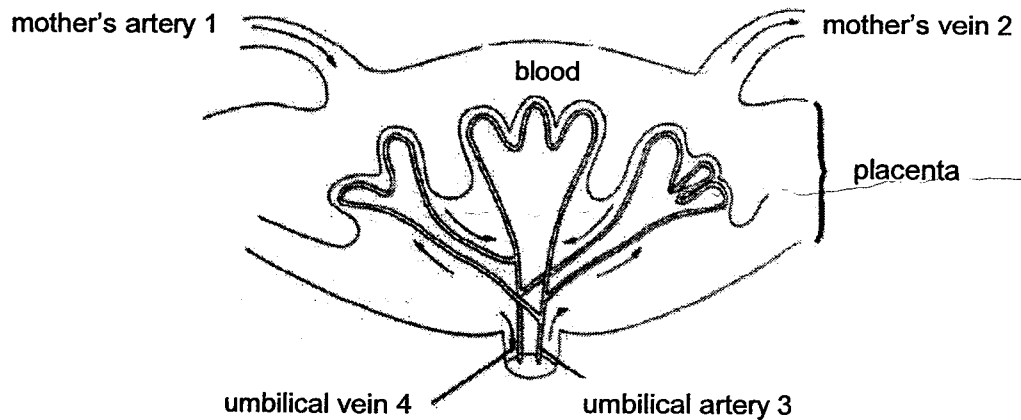
D urethra

29 The graph shows the concentration of two reproductive hormones in the blood of an adult female.

During which period is she most likely to become pregnant if she has sexual intercourse?



30 The diagram shows part of a placenta.

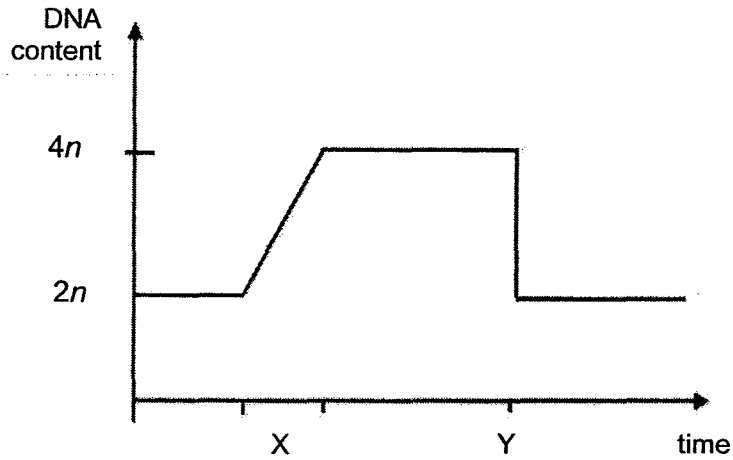


In which numbered parts does the blood contain the most oxygen?

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

- 31 The graph shows the changes in the amount of DNA present in the nuclei of the cells during cell division.

A diploid cell has $2n$ nuclear DNA content.

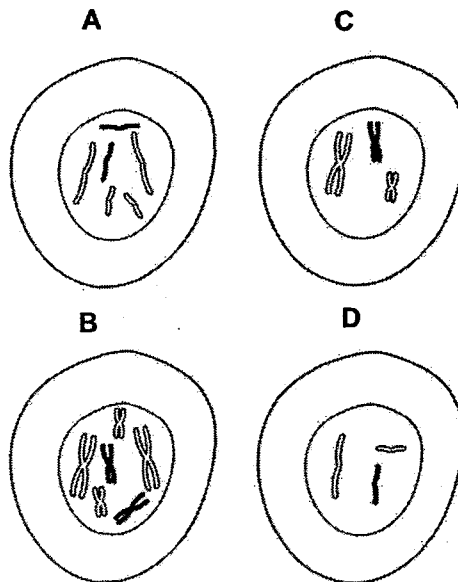


Which option shows the events taking place at X and Y?

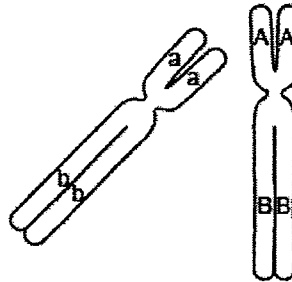
	X	Y
A	interphase	meiosis
B	interphase	mitosis
C	uncoiling of DNA	meiosis
D	uncoiling of DNA	mitosis

- 32 A cell containing three pairs of chromosomes divides by meiosis.

Which diagram shows one of the daughter cells after telophase II?



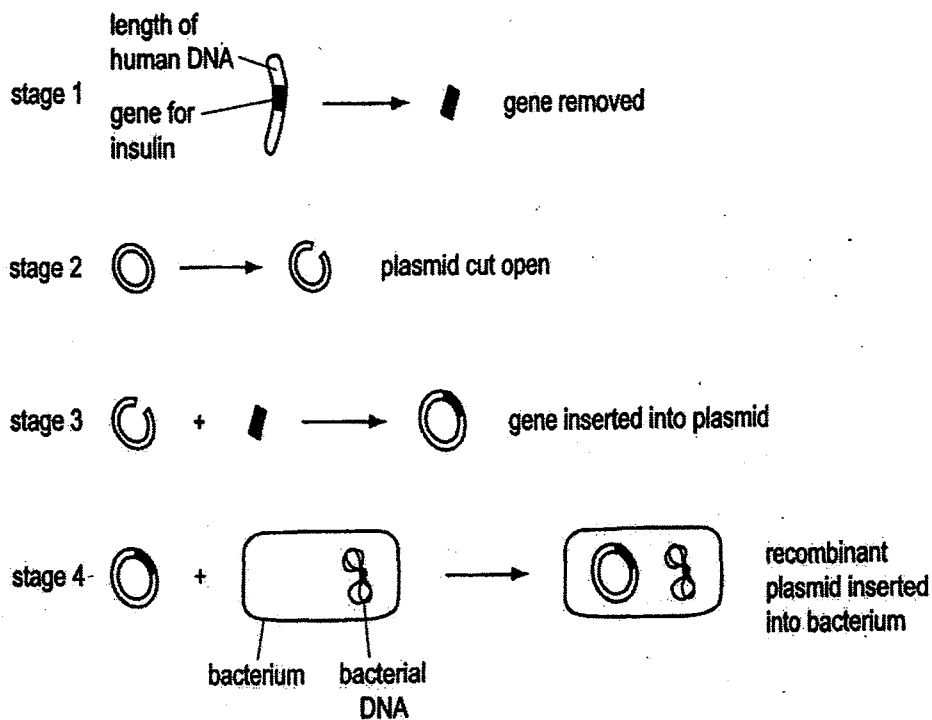
- 33 The diagram shows two homologous chromosomes in early prophase I of meiosis in an animal cell. Two genes, with alleles A/a and B/b, whose loci occur on the homologous chromosomes are also shown.



Which option is a possible representation of these chromosomes at anaphase I and prophase II?

	anaphase I	prophase II
A		
B		
C		
D		

- 34 A human insulin gene can be cut out of human DNA and inserted into the plasmid of a bacterium. The diagram shows four stages of this process.



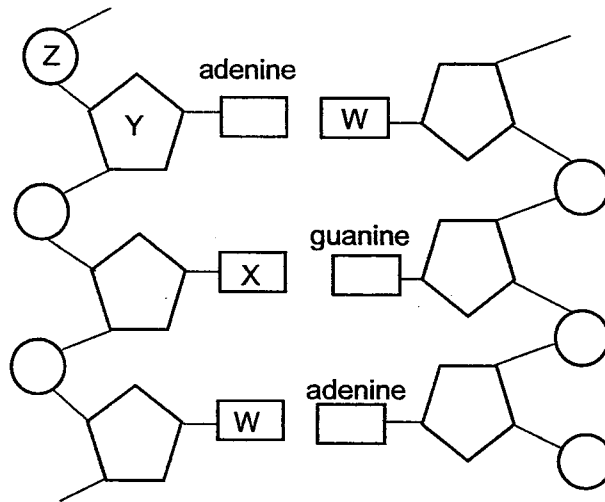
Which row correctly identifies if enzyme ligase and restriction enzyme is/are used at each stage?

	stage	enzyme ligase	restriction enzyme
A	1	✓	x
B	2	x	x
C	3	✓	x
D	4	✓	x

key

✓ enzyme used
x enzyme not used

35 The diagram shows a short section of DNA.



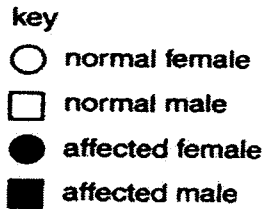
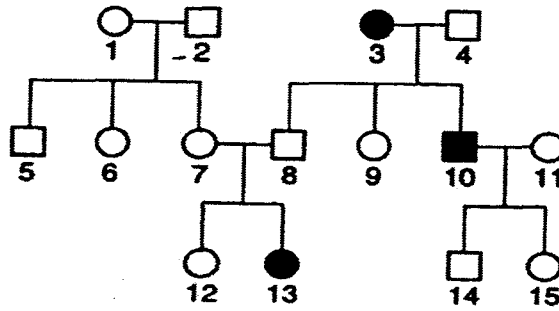
Which row correctly identifies the parts labelled W, X, Y and Z?

	W	X	Y	Z
A	cytosine	adenine	phosphate	sugar
B	phosphate	sugar	cytosine	adenine
C	sugar	phosphate	adenine	cytosine
D	thymine	cytosine	sugar	phosphate

36 In the ABO blood grouping system, which genotype is homozygous dominant?

- A $I^A I^O$
- B $I^A I^B$
- C $I^B I^B$
- D $I^O I^O$

37 The family tree shows the inheritance of a condition caused by the recessive allele, h.



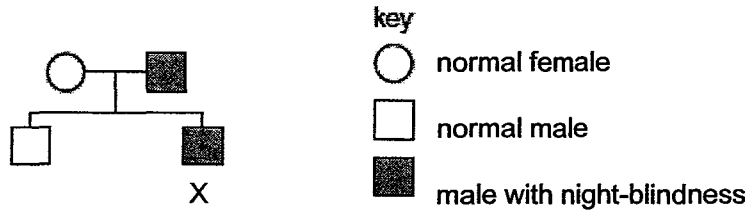
Individual 14 marries a carrier.

Which option shows the probability of their first child to have the genotype Hh?

- A 0.25
- B 0.50
- C 0.75
- D 1.00

38 Night-blindness is an inherited condition caused by a dominant allele.

The chart shows how this condition was passed on in one family.



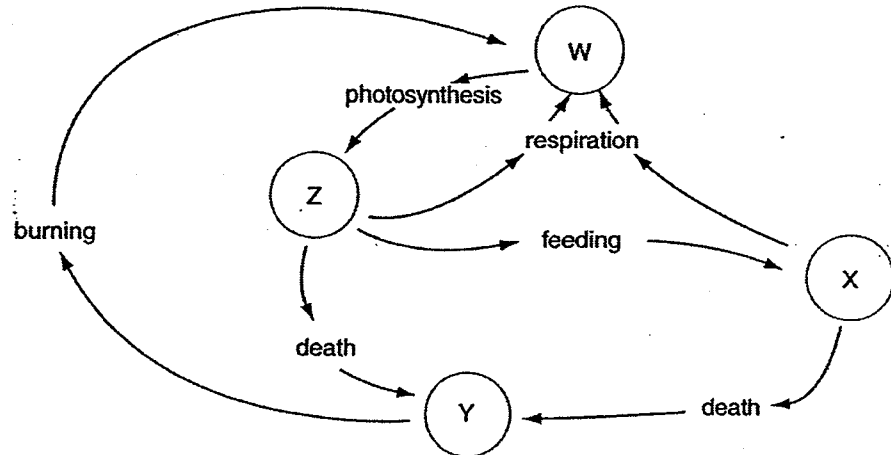
Person X marries someone with normal sight.

What is the chance that their first child will have night-blindness?

- A 0 %
- B 25 %

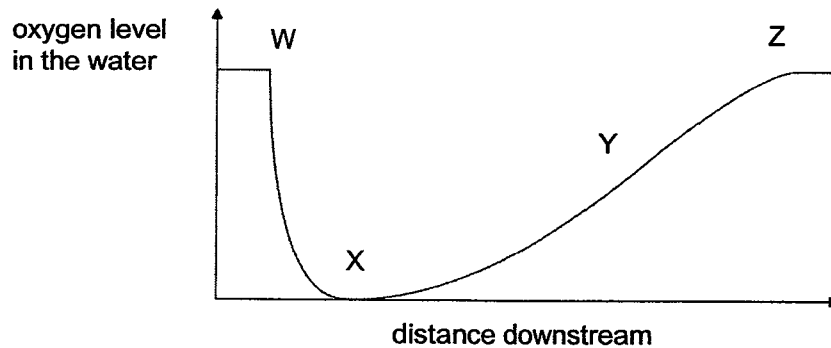
- C 50 %
D 75 %

39 The diagram shows some stages in the carbon cycle. W, X, Y and Z are carbon compounds.



What is Y?

- A carbon compounds found in dead animals only
B carbon compounds found in dead animals and dead plants
C carbon dioxide in the air
D coal and oil
- 40 The graph shows the oxygen level in a slow-moving fresh water stream that has been contaminated by sewage.



Which statement explains the rapid drop in oxygen level between W and X?

- A fishes take in all of the oxygen
B microorganisms carry out aerobic respiration and multiply rapidly
C plants produce carbon dioxide which replaces the oxygen
D water plants photosynthesise too quickly

BLANK PAGE

Name: _____ ()

Class: _____

PRELIMINARY EXAMINATIONS 2016
Secondary Four Express

BIOLOGY (WITH SPA)

Paper 2

5158/02

Duration: 1 hour 45 minutes

Classes: 405 and 406

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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

Write in dark blue or black pen on both sides of the paper.

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

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

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.

At the end of the examination fasten all your work securely together.

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

FOR EXAMINER'S USE	
Paper 1	/ 40
Paper 2	
Section A	/ 50
Section B	/ 30
TOTAL	/ 120

This question paper consists of 19 printed pages.

[Turn over



Section A

Answer **all** the questions.

Write your answers in the spaces provided.

- 1 Aspartame is an artificial sweetener found in low-calorie soft drinks.

Fig. 1.1 shows the chemical structure of aspartame.

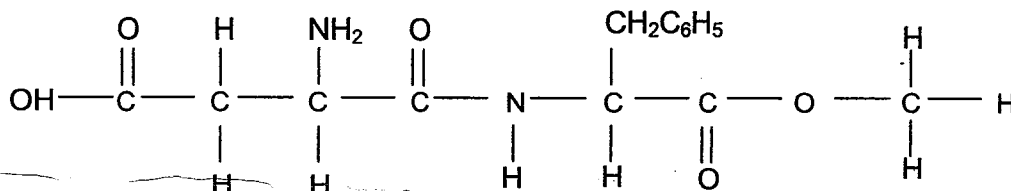


Fig. 1.1

- (a) (i) Name the type of biological molecule shown in Fig. 1.1.

..... [1]

- (ii) Explain how you derived your answer to (a)(i).

..... [1]

- (iii) In the space below, draw the products formed when aspartame is completely digested in the human body.

[1]

- (b) Explain why a can of soft drink containing aspartame have lower calories than those containing sucrose.

.....

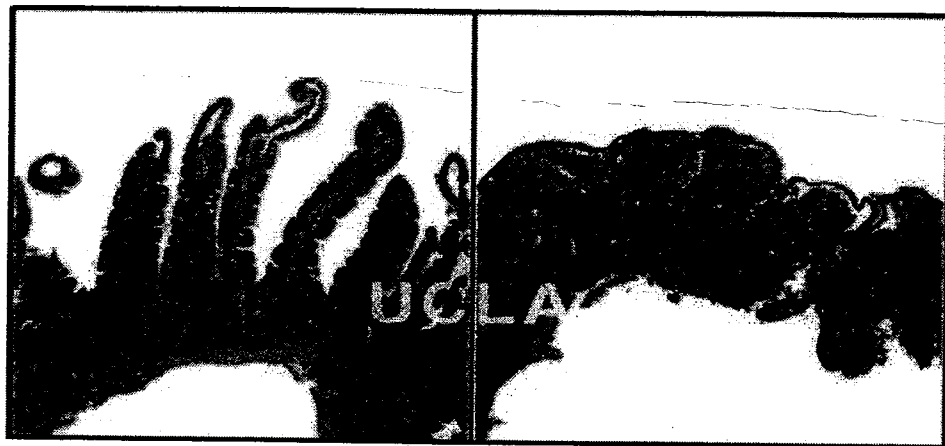
..... [1]

1 (c) Describe an experiment to compare the energy level of aspartame and sucrose.

.....
.....
.....
.....
.....
..... [3]

[Total: 7]

2 Celiac disease is an autoimmune disease that results in damage to the lining of the ileum when food containing gluten is consumed. Fig. 2.1 shows the surface view of the ileum of two patients X and Y.



X

Y

Fig. 2.1

(a) (i) State which patient, X or Y, is a healthy patient.

..... [1]

(ii) Explain your answer to (a)(i).

.....
..... [1]

2 (b) Describe and explain the effect of celiac disease on nutrient absorption.

.....

 [2]

(c) Suggest how consumption of gluten by a celiac patient can cause the inner surface area of the ileum to be destroyed.

.....

 [2]

[Total: 6]

3 (a) Table 3.1 shows the response of three unknown blood types and serum containing antibodies a and b respectively.

Table 3.1

blood type	antibody a serum	antibody b serum
X	x	x
Y	✓	x
Z	x	✓

key:
 ✓ agglutination occurs
 x agglutination does not occur

(i) State the identity of blood type X, Y and Z.

X

Y

Z

[3]

3 (a) (ii) Explain your answer.

.....

[2]

(b) Fig. 3.2 shows the surface view of a mammalian heart.

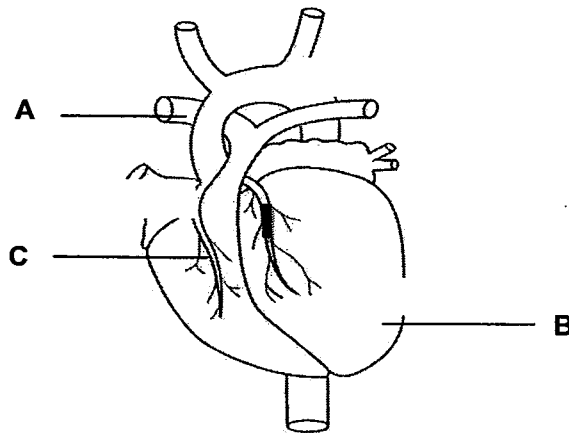


Fig. 3.2

(i) Identify structures A and B.

A

B

[1]

(ii) Describe the function of blood vessel labelled C.

.....

[2]

(iii) In Fig. 3.2, one of the blood vessels of C is clogged with fats and a piece of artery from the patient's chest is grafted to redirect the blood flow. This clogged area is shaded in black.

The procedure is known as coronary bypass graft surgery.

Indicate on Fig. 3.2 the possible position at which coronary bypass graft surgery can be done.

[1]

[Total: 9]

- 4 Fig. 4.1 shows the organs involved in the knee jerk reflex. A hammer is used to tap the stretch receptor gently at X.

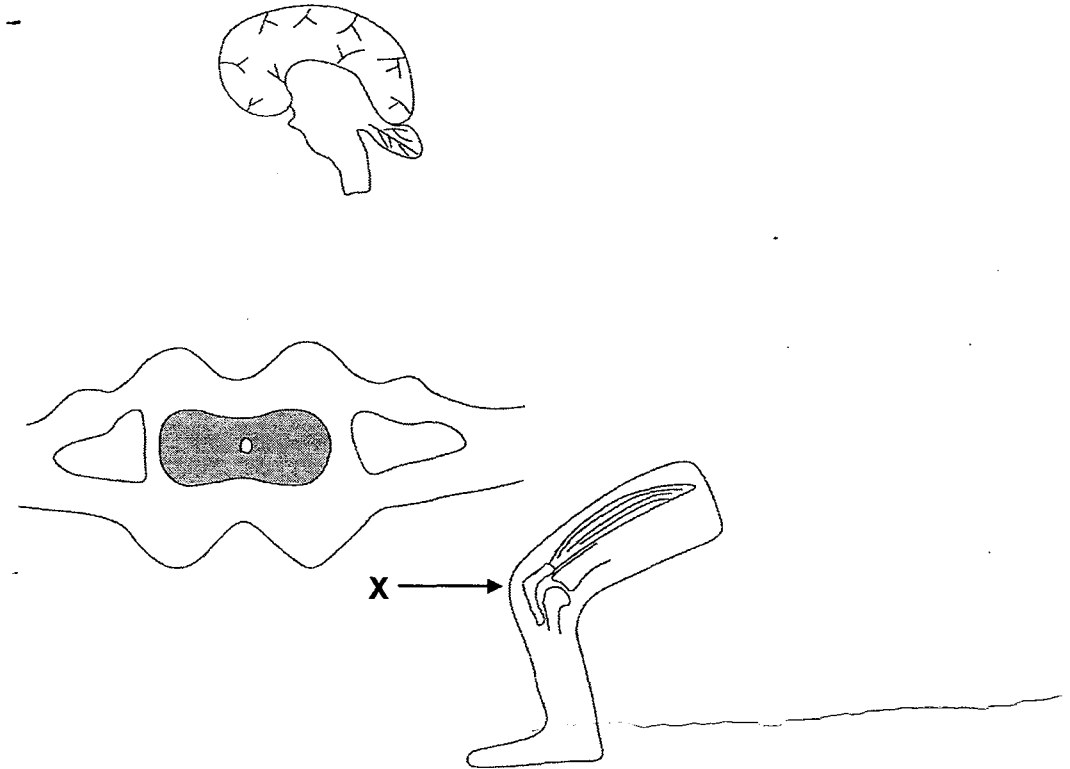


Fig. 4.1

- (a) On Fig. 4.1, draw and label the
- (i) stretch receptor, [1]
 - (ii) neurones involved in the knee jerk reflex action and indicate the direction of the nerve impulse transmission, [2]
 - (iii) neurones involved in creating sensation and indicate the direction of the nerve impulse transmission. [1]
- (b) Suggest if the knee jerk reflex action or sensation of the knee jerk response occurs first. Explain your answer.

.....

.....

.....

..... [2]

[Total: 6]

5 Fig. 5.1 shows the cross-section of human sweat glands.

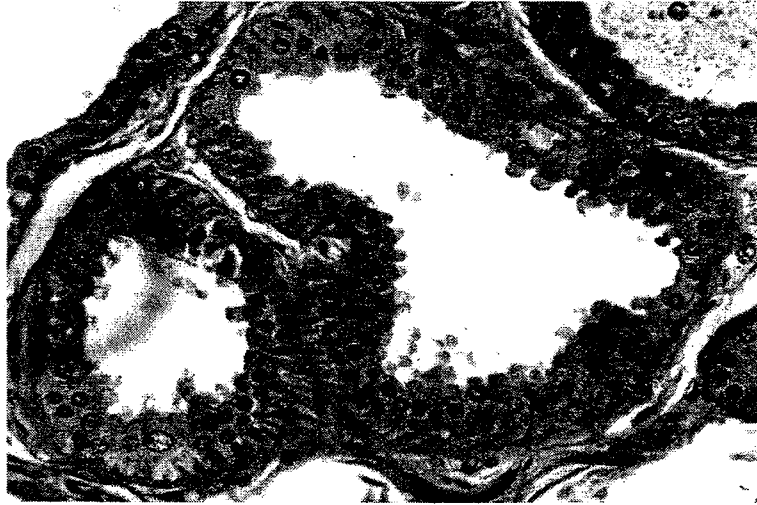


Fig. 5.1

- (a) (i) On Fig. 5.1, label the region that leads to the sweat duct as **W**. [1]
- (ii) Describe two differences between the homeostatic control of urine and sweat production.

.....

.....

.....

.....

[2]

- 5 (b) Fig. 5.2 shows the effect of exercise on sweat production of a 25-year old female over a 40 minutes period.

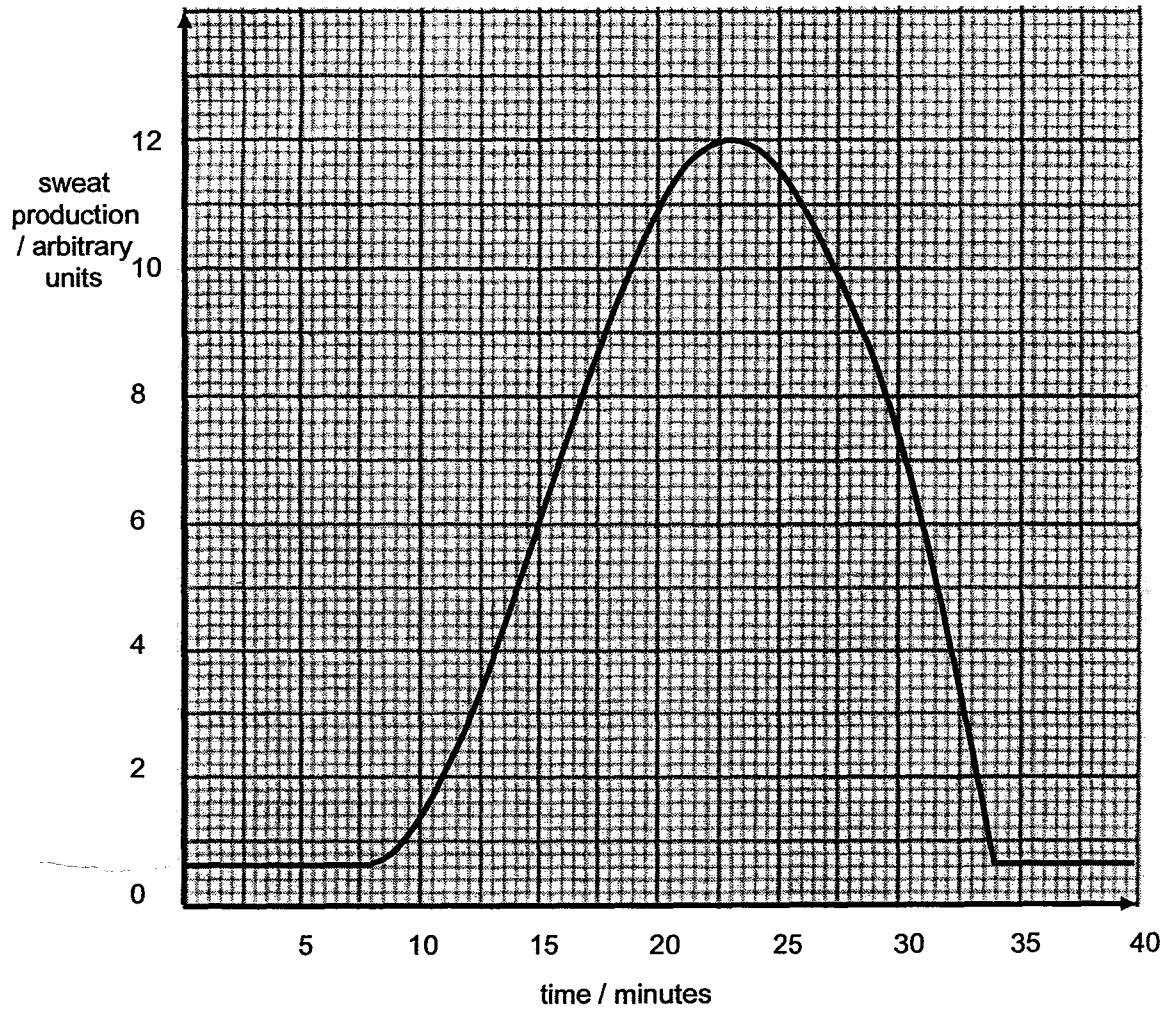


Fig. 5.2

- (i) With reference to Fig. 5.2, state the time at which the female starts sweating.

..... [1]

5 (b) (ii) With reference to Fig. 5.2, describe and explain the shape of the curve.

.....
.....
.....
.....
.....
.....
.....
.....
..... [3]

[Total: 7]

6 Cystic fibrosis is an autosomal recessive genetic disorder that results in the build-up of thick, sticky mucus that can damage the body's organs.

The allele N represents the normal condition while the allele n represents the cystic fibrosis condition.

Fig. 6.1 shows the homologous pair of chromosomes during a stage in meiosis in a carrier.

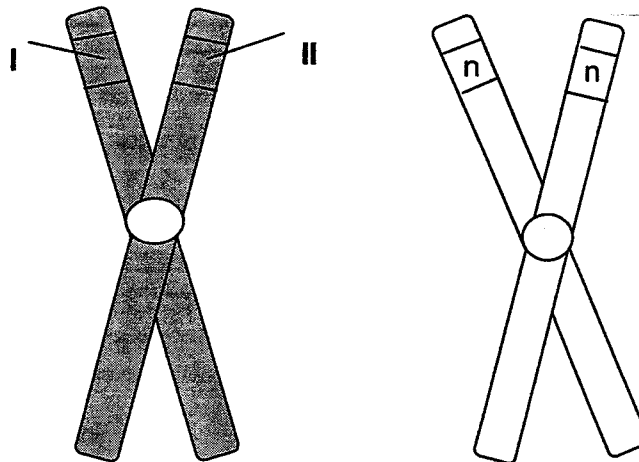


Fig. 6.1

(a) (i) State the identity of alleles I and II.

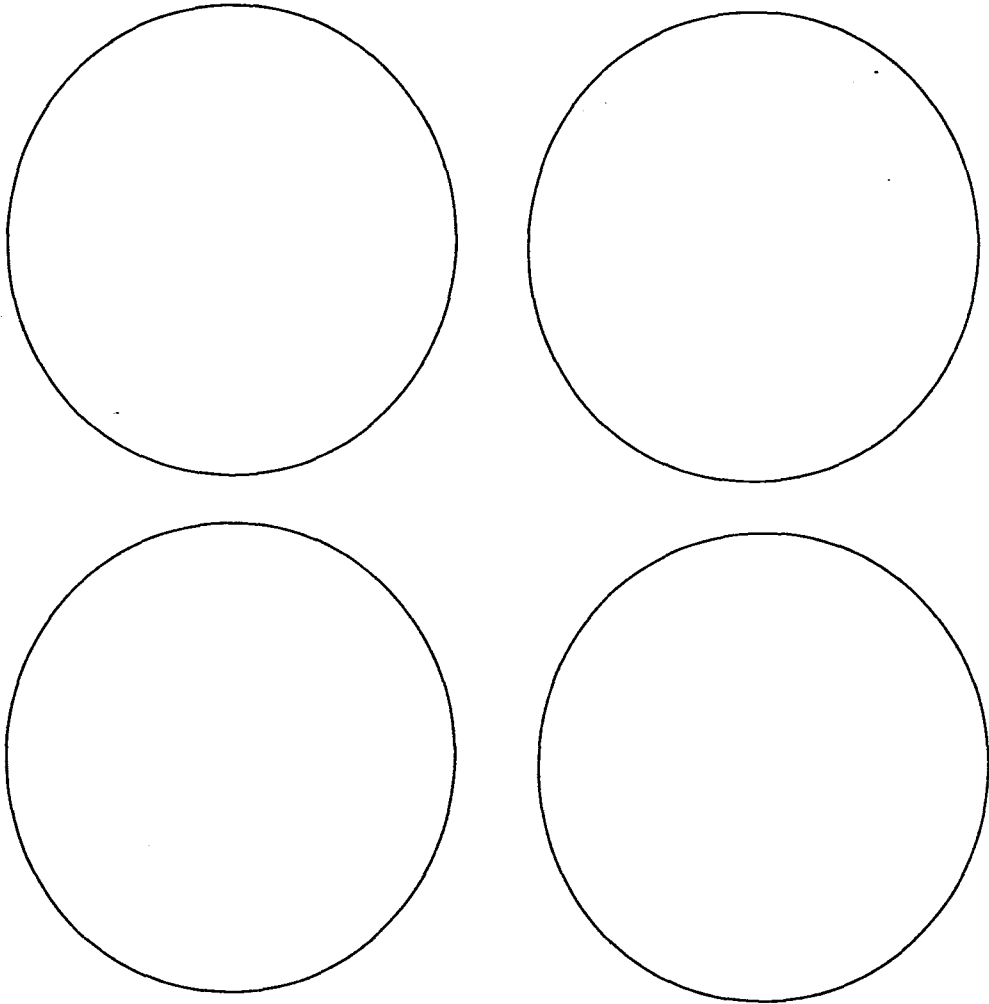
I
II

[2]

- 6 (a) (ii) Name the stage of meiosis shown in Fig. 6.1.

..... [1]

- (b) In the outline of the four gametes shown below, draw the chromosomes containing the cystic fibrosis gene found in the nuclei of the four gametes formed. Include the positions and identity of the alleles for the cystic fibrosis gene on the chromosomes.



[2]

- 6 (c) This individual married another individual who is also a carrier. With the aid of a genetic diagram, determine the probability the child would have cystic fibrosis.

[4]

[Total: 9]

- 7 Fig. 7.1 shows an activity involving the DNA molecule.

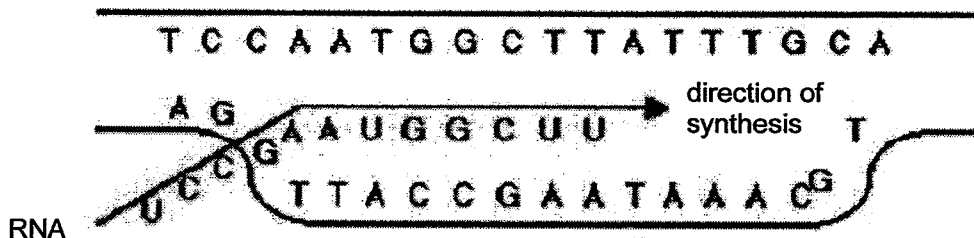


Fig. 7.1

- (a) (i) Name the activity shown in Fig. 7.1.

..... [1]

- (ii) Define the activity shown in Fig. 7.1.

.....

 [2]

7 (b) Table 7.1 shows the codons for specific amino acids.

Table 7.1

amino acid	mRNA code
alanine	GCG
glycine	GGU
lysine	AAA
proline	CCG
serine	UCC
tyrosine	UAU

Write the DNA sequence on the template strand needed to produce the following sequence:

alanine – lysine – proline – serine – tyrosine – proline – proline

..... [1]

(c) (i) In a protein, serine can be coded by UCC or UCU mRNA codons.

Name the process involved that led to the replacement of serine to tyrosine.

..... [1]

(iii) Suggest the effect of the change of amino acid on the protein structure.

.....
 [1]

[Total: 6]

Section BAnswer all **three** questions.

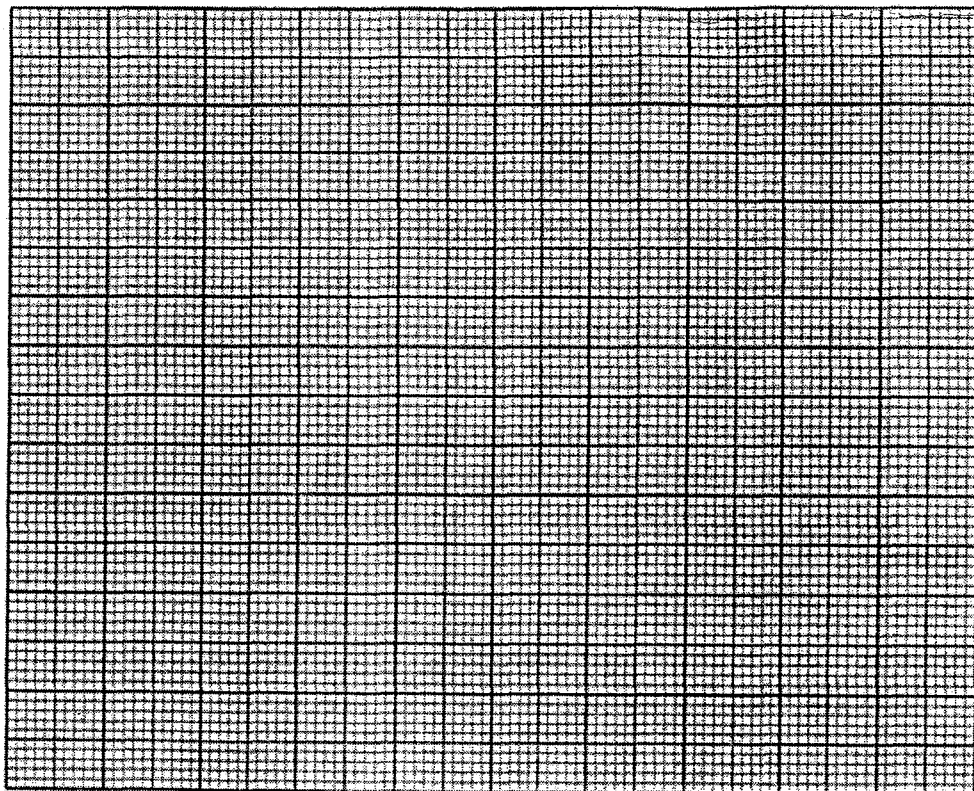
Question 10 is in the form of an Either/Or question. Only one part should be answered.

- 8 A survey to investigate the impact of smoking on the live birth weight of babies was conducted. It was administered to fifty females aged between 25 and 30 years. All participants of the survey were habitual smokers who continued smoking during the gestation period. Table 8.1 shows the results.

Table 8.1

average number of cigarettes smoked each day	average live birth weight of baby born / kg
0	2.78
1 - 2	2.60
3 - 4	2.45
5 - 6	2.33
7 - 8	2.20
9 - 10	2.12

- (a) (i) On the grid below, plot a bar chart of average live birth weight of baby born against average number of cigarettes smoked each day.



[3]

8 (a) (ii) Describe and explain the results shown in Table 8.1.

.....
.....
.....
.....
.....
.....

[3]

(b) State the source and outline the role of a named hormone in maintaining pregnancy.

.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total: 10]

9 Fig. 9.1 shows the food web found at Chesapeake Bay.

In each typical year, the number of Osprey and Bald Eagle hatchlings would be 115 and 89 respectively. In 1799, a new brand of pesticide was applied on all the farms of Chesapeake Bay and it was found that the eggs laid by Osprey and Bald Eagle were very soft and could not be hatched. The following year, the number of hatchlings of Osprey and Bald Eagle decreased to a historical low of 15 and 3 respectively.

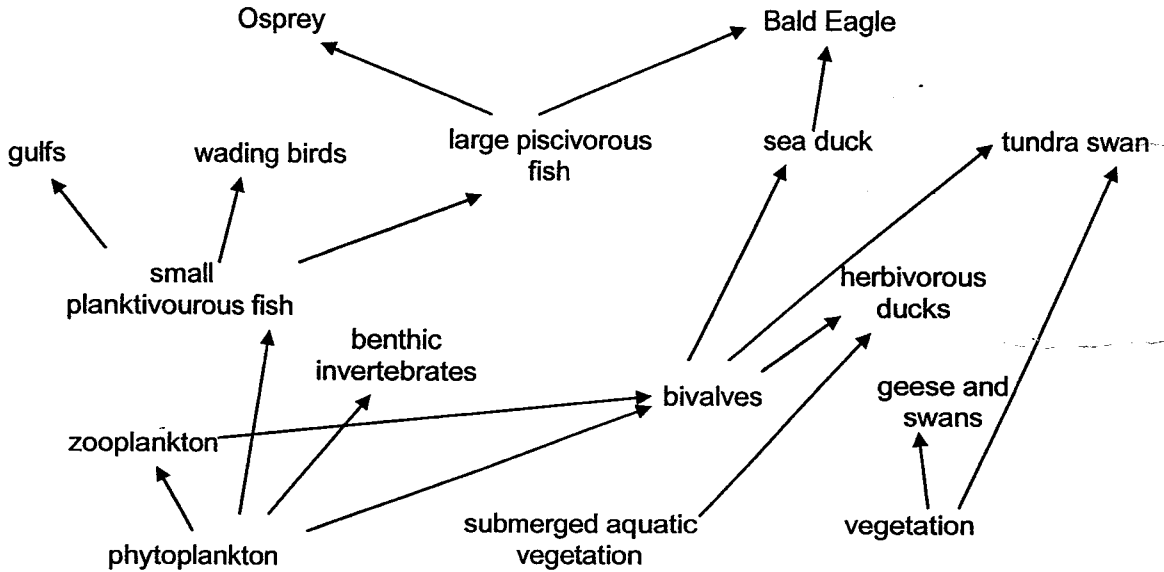


Fig. 9.1

(a) With reference to Fig. 9.1, explain why the use of the new brand of pesticide led to historical low numbers of hatchlings of Osprey and Bald Eagle in 1880.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[4]

-
- 9 (b) Usage of this brand of pesticide was stopped completely in 1882. However, it took 30 years before the number of Bald Eagle and Osprey returned to the usual numbers before the pesticide was used.

Explain why this was so.

.....
.....
.....
.....

[2]

- (c) Consider a food chain with phytoplankton as the primary producer.

Draw a pyramid of biomass to represent the food chain and explain its shape.

.....
.....
.....
.....

[4]

[Total: 10]

10 Either

- (a) In orchid culture, a piece of plant tissue was extracted and treated with alcohol before it is placed in a nutrient agar medium to form a mass of undifferentiated cells known as the callus.

Once the callus has grown to a suitable size, chemicals are added to the nutrient agar to cause the differentiation of the callus to form a young shoot.

The young shoot is then extracted and planted in soil to form new orchid plants.

Discuss the type of reproduction shown in the above example and give reasons to support your answer.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

- (b) Distinguish between the ovule, seed and embryo.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

10 (c) Using a specific example, describe how artificial selection is used in plant cultivation.

.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

[Total: 10]

10 Or

(a) (i) Rhode Island Red is a breed of chicken that produces a large number of small eggs. This breed of chicken produces less meat.

Broiler is a breed of chicken that grows very fast and produces a lot of meat. The chickens lay fewer eggs than other breeds of chicken.

Discuss how you would produce hens that produce a lot of meat and lay a lot of eggs.

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

[4]

-
- 10 (a) (ii) In a woody forest, there are two types of rabbits – white coat rabbits and brown coat rabbits.

Predict, with reasons, which type of rabbit will predominate in future generations.

.....

.....

.....

.....

.....

.....

.....

.....

.....

[3]

- (b) Using suitable examples, distinguish between continuous and discontinuous variation.

.....

.....

.....

.....

.....

.....

.....

[3]

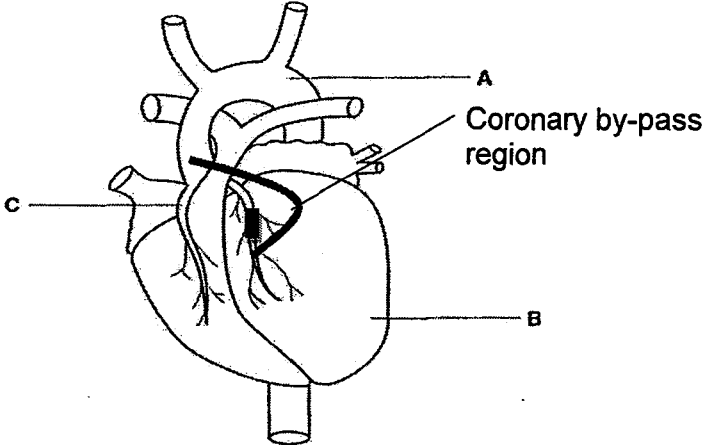
[Total: 10]

2016 Sec 4E Biology P1 Answer Scheme

Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
C	A	C	C	A	C	C	D	A	C
Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20
D	C	D	C	A	B	C	C	D	B
Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
B	C	A	B	C	C	C	C	B	B
Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40
B	D	D	C	D	C	B	C	D	B

2016 Sec 4E Biology P2 Answer Scheme

1ai	Proteins;	1
1aii	Presence of peptide bonds/linkages; Or Consists of two amino acids joined together;	1
1aiii	$ \begin{array}{ccccccc} & & \text{O} & \text{H} & \text{NH}_2 & \text{O} & \\ & & & & & & \\ \text{OH} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{C} & - & \text{OH} \\ & & & & & & & & & & \\ & & & & \text{H} & & \text{H} & & & & \end{array} $ $ \begin{array}{ccccccc} & \text{H} & & \text{CH}_2\text{C}_6\text{H}_5 & & \text{H} & \\ & & & & & & \\ \text{H} & - & \text{N} & - & \text{C} & - & \text{C} & - & \text{O} & - & \text{C} & - & \text{H} \\ & & & & & & & & & & & & \\ & & & & \text{H} & & \text{O} & & & & \text{H} & & \end{array} $ <p>0.5 mark each for each correct amino acid.</p>	
1ai	Proteins;	1
1b	Aspartame is much sweeter than sucrose. A smaller mass of sweetener – aspartame results in fewer calories.;	0.5 0.5
1c	Place a specified volume of water in a boiling tube. + burn a specified mass of substance sucrose or aspartame and place it near the boiling tube.;	1
	Measure initial temperature of water in boiling tube. + measure final temperature of water in boiling tube.;	1
	Energy content of food = mass of water x 4.2 / specific heat capacity of water x (final temperature of water – initial temperature of water);	1
2ai	X;	1

2aii	Larger surface area for absorption / Longer folds;	1
2b	Reduced surface area for absorption of nutrients; Slower rate of absorption of nutrients / less nutrients are absorbed at any one time;	1 1
2c	As gluten is absorbed across the folded surface of ileum; It is recognised by phagocytes/ lymphocytes; Phagocytes engulf and digest the folds and the gluten or; Antibodies produced by lymphocytes act on the gluten bound to the folded surface of the ileum.; Trigger an immune reaction; Max – 2 marks	0.5 0.5 1 0.5
3ai	X - Blood type O Y – Blood type A Z – Blood type B 1 mark each	
3aii	Presence of a specific antigen on the red blood cells will bind to the antibody for the same antigen. → This leads to agglutination; The presence of a specific antigen on the red blood cells will determine the blood type of the patient.;	1 1
3bi	A – pulmonary vein B – left ventricle (reject: cardiac muscle) All correct – 1 mark	1
3bii	Blood vessel labelled C is the coronary arteries + Which supply blood containing oxygen and nutrients; to the cardiac muscles.;	1 1
3biii	 <p style="text-align: center;">Fig. 1.1</p>	

4

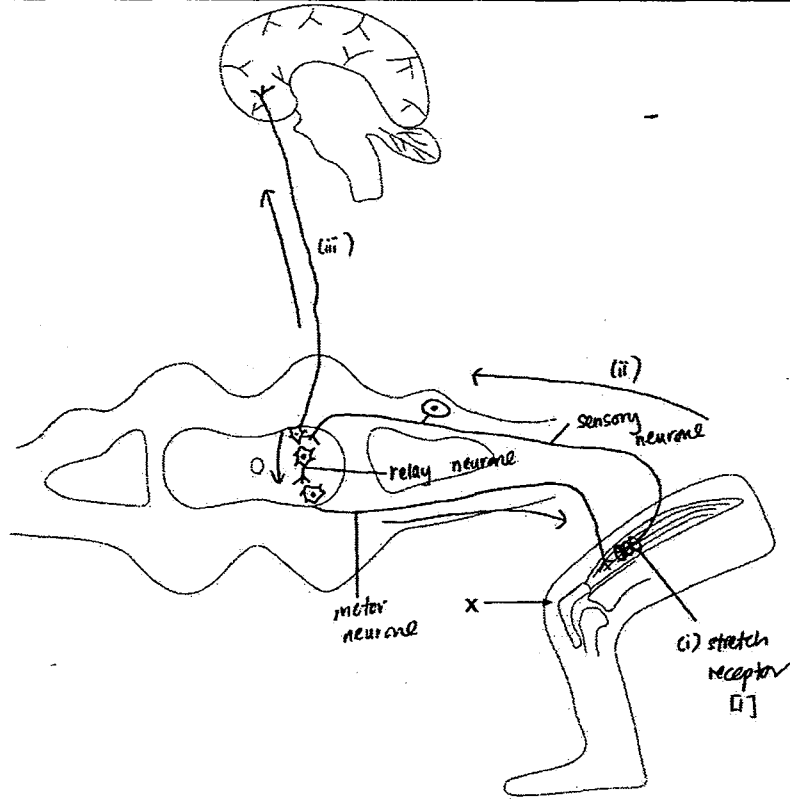


Fig. 4.1

4aai

0.5 mark for each neurone
0.5 mark for correct direction of nerve impulse transmission

2

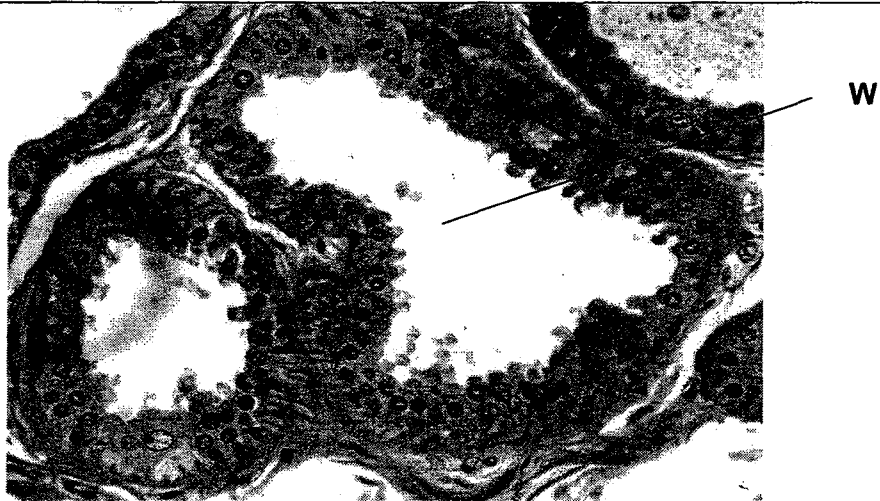
4b

Knee jerk reflex;
Knee jerk reflex involves a reflex arc – which is the shortest pathway for transmission of nerve impulse;

1

1

5ai

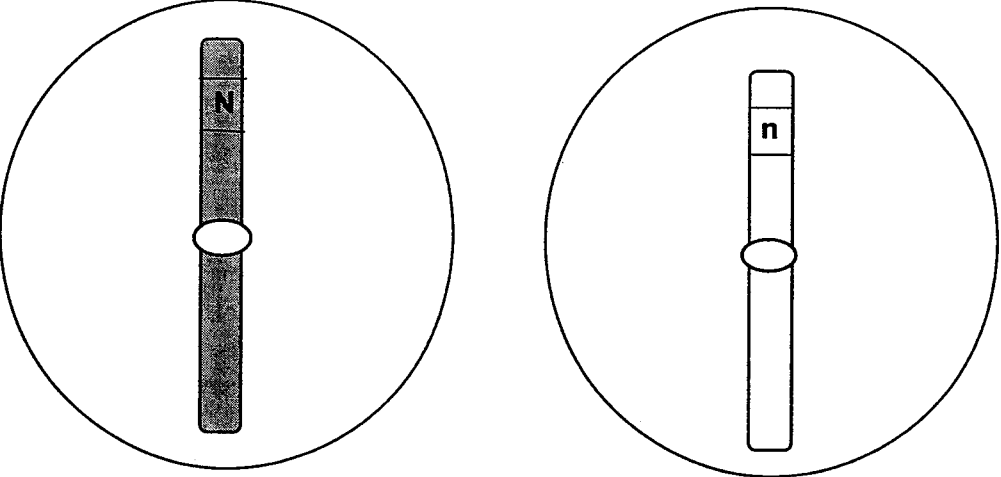


5aai

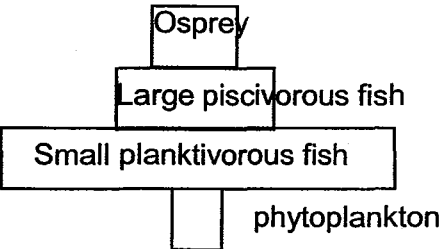
Urine production
Homeostatic response to regulate blood water potential.
Response is affected/controlled by

Sweat production
Homeostatic response to regulate body temperature.
Response is affected by nervous

1

	the amount of ADH produced/released.	impulses sent by hypothalamus.	1
5bi	8 mins		1
5bii	<p>Trend 1: When the body starts exercising, muscle cells release a lot of <u>heat</u>. Sweat production increases from 0.6 to 1.2 arbitrary units. Explanation of trend 1: <u>Hypothalamus</u> detects the increase in body temperature; And sends <u>nerve impulses</u> to the <u>sweat glands</u>. +Sweat glands become more active and produces more sweat which increases to 12 arbitrary units at t = 23 mins.;</p> <p>Trend 2: After t = 23 mins, the person stops exercising + Heat production slows down / sweat production reduces from 1.2 to 0.6 arbitrary units. Negative feedback to the sweat glands to reduce sweat production + Sweat production decreases from 12 arbitrary units to 0.6 arbitrary unit.;</p>		1 0.5 0.5 1 1
6ai	I – N; II – N;		1 1
6aiii	Prophase I;		1
6b			0.5m each

<p>8ai</p>	<p>Correct plotting of points. Correct axes Correct scale Best fit line</p>	<p>1 0.5 0.5 1</p>
<p>8aii</p>	<p>As the number of cigarettes smoked increases from 0 to 10 sticks per day, the average live birth weights of a baby decreases from 2.78 to 2.12 kg.; Cigarette smoke contains nicotine.; Nicotine constricts blood vessels, including umbilical blood vessels.; Less blood containing oxygen and nutrients are transported to the developing foetus; Leading to reduced average live birth weights.;</p>	<p>0.5 0.5 1 1</p>
<p>8b</p>	<p>Progesterone Initially, <u>corpus luteum</u> releases <u>progesterone</u>; + <u>maintains the thickness of the uterine lining</u>.; When the placenta develops; More progesterone is released that causes further thickening of uterine lining and the thickness is maintained during pregnancy.</p>	<p>1 1 1 1</p>
<p>9a</p>	<p>Residue pesticides are washed into the rivers and taken up the primary producers such as phytoplankton.; The pesticides are non-biodegradable and they accumulate in the tissues of living organisms.; The pesticides are accumulated as it passes along the food chain from <u>phytoplankton, small planktivorous fish, large pscivorous fish to Osprey or Bald Eagle</u> ; In increasing concentrations up the food chain. / Process is known as</p>	<p>1 1 1</p>

	bioaccumulation.; At the Osprey or Bald Eagle, the concentration of pesticides is exceedingly high and the eggs laid have soft shells and cannot be hatched.;	1 1
9b	The pesticides are non-biodegradable and they remain in the tissues of the living organisms for a long period of time.+ persistent bioaccumulation as long as organisms containing the pesticides survive.; Small numbers of surviving Osprey and Bald Eagle; Require a longer period of time to reproduce to produce a larger number of offspring.; Max 2 marks	1 1 1
9c	 <p>Suitable food chain + Correct shape 1 mark Correct labels 1 mark</p>	
9c	Inverted because phytoplankton is microscopic but it is able to support the food chain due to its <u>high productivity</u> .; Around 10% of energy is transferred from one trophic level to the next, less energy is available to the next consumer. Thus total biomass of consumers higher up the food chain decreases.; Most energy is lost as heat during respiration, egestion and sweating and also heat is trapped in uneaten body parts.;	1 0.5 0.5
10E a	Asexual reproduction; Does not involve the fusion of gametes; Involves regeneration of parent tissue ; To form identical cells as parents.; Max 3 marks	1 1 1 1
10E b	Ovule is the structure inside the ovary + contains the female gamete, ie ovum.; A seed is formed from a fertilised ovule.; A embryo is formed from the zygote.;	1 1 1
10E c	Artificial selection to produce sugar cane that is both disease resistant and produces a lot of sugar.; Cross a wild-type disease resistant sugar cane species with a sugar cane species that produce a lot of sugar.; Crossing is completed by transferring pollen grains from one species to stigma of another species. ; Plant the seeds from the fruits formed and select hybrids with desired	1 1 1

	characteristic.;		1
	Reproduce the hybrids asexually or by selfing.;		1
100	Artificial selection;		1
ai	Mate Rhode Island Red with Broiler.;		1
	From the hatchlings, select offsprings which grow fast and produce large number of eggs.;		1
	Sibling mate these offsprings to continue the production of hens which grow fast and produce large numbers of eggs.;		1
100	Brown coat rabbits / The rabbits evolve into brown coat;		1
aii	Brown coat rabbits can camouflage better in the surroundings.;		1
	Fewer numbers of brown coat rabbits are predated as compared to white coat rabbits. / Brown coat rabbits are selected by nature;		1
	And they survive to reproductive age producing a larger number of offspring as compared to white coat rabbits ;		1
100	Continuous variation	Discontinuous variation	
b	No distinct or clear cut phenotypes, With intermediates	Distinct with clear cut phenotypes	
	Phenotype is affected by genotype and environment	Phenotype is affected by genotype only	
	Skin pigmentation	Blood type	
	Point to point comparison – 1 mark each Correct examples for both – 1 mark		

