



Paya Lebar Methodist Girls' School (Secondary)  
Preliminary Examination (2) 2014  
Secondary 4 Express

CANDIDATE  
NAME

CLASS

4	A
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INDEX NUMBER

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**BIOLOGY (SPA)**

**5158**

Paper 1 Multiple Choice

6 August 2014

Additional Materials: Multiple Choice Answer Sheet

1 hour

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**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

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

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

There are forty multiple choice 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 Answer Sheet

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.

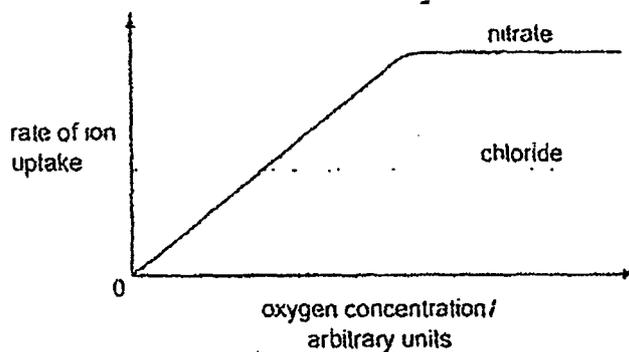
1 Which structures are present in a root hair cell?

	nucleus	chloroplast	
A	✓	✓	key
B	✓	X	✓ = present
C	X	✓	X = absent
D	X	X	

2 What is an example of active transport?

- A movement of glucose molecules into the cells of the villi
- B movement of glucose molecules down a concentration gradient
- C movement of ions in blood plasma
- D movement of water in the transpiration stream

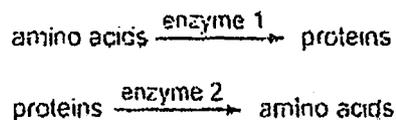
- 3 The roots of a plant are placed in a dilute solution containing chloride and nitrate ions. The graph shows how the rate of uptake of chloride and nitrate ions by the roots of the plant varies with oxygen concentration.



What can be concluded about how chloride and nitrate ions enter the roots?

	chloride	nitrate
A	active transport	active transport
B	active transport	diffusion
C	diffusion	active transport
D	diffusion	diffusion

- 4 Two enzyme-controlled reactions are shown.



From these reactions, what deduction can be made about enzymes?

- A Enzyme 1 has been changed to enzyme 2.
- B Enzyme 2 slows down the production of amino acids.
- C Enzymes only break down large molecules.
- D Enzymes can build up large molecules.

5 Four test tubes, each containing  $2\text{cm}^3$  of amylase solution are treated as follows:

- 1 boiled, then cooled to  $1^\circ\text{C}$
- 2 boiled, then cooled to  $25^\circ\text{C}$
- 3 frozen, then warmed to  $1^\circ\text{C}$
- 4 frozen, then warmed to  $25^\circ\text{C}$

$10\text{cm}^3$  of starch solution was then added to each tube and after 5 minutes, 2 drops of iodine solution was added to each tube.

Which row shows the results?

	1	2	3	4
A	black	black	black	yellow
B	black	yellow	black	yellow
C	yellow	black	yellow	black
D	yellow	yellow	yellow	black

6 Which statements are correct for all enzymes?

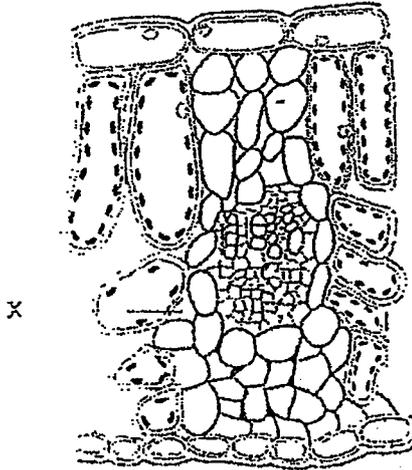
- 1 They are proteins.
- 2 They are secreted into the alimentary canal
- 3 They speed up biochemical reactions.
- 4 None of them work at low pH.

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

7 Which listed substances are all broken down by the liver?

- A alcohol, drugs and progesterone
- B drugs, adrenaline and urea
- C oestrogen, water and adrenaline
- D urea, alcohol and drugs

8 The diagram represents a cross section of part of a leaf.

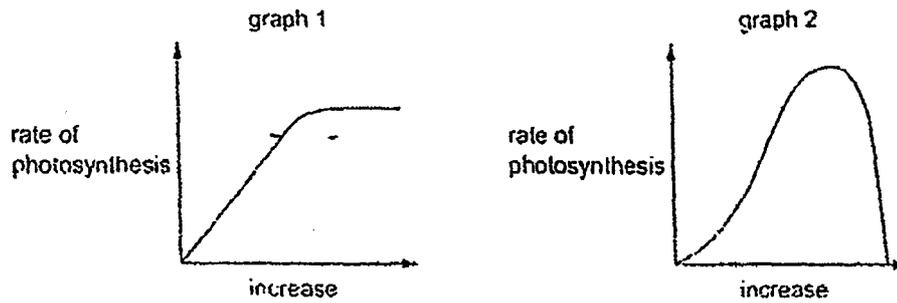


How does the oxygen content of the air at X compare to normal atmospheric air, when the leaf is in the light and when it is in the dark?

	in the light	in the dark
A	lower	the same
B	lower	higher
C	higher	the same
D	higher	lower

[Turn over

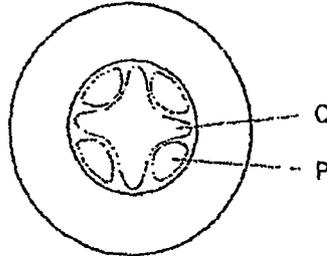
9 The graphs show how two different conditions affect the rate of photosynthesis.



Which conditions are being altered in graphs 1 and 2?

	graph 1	graph 2
A	carbon dioxide concentration	light intensity
B	carbon dioxide concentration	temperature
C	temperature	carbon dioxide concentration
D	temperature	light intensity

10 A herbaceous plant, growing in a nutrient solution, is placed in a well-lit experimental chamber through which humid air is being passed slowly. The diagram below shows a section through a part of the plant.



The speeds of movement of the fluids in tissues P and Q are measured. The humid air is then replaced by dry air and the speeds of movement of the fluids change.

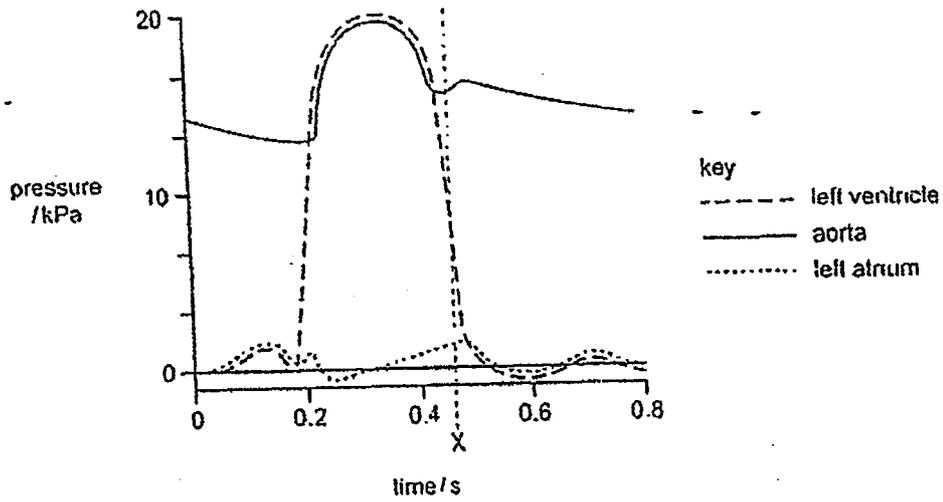
What are these changes?

	tissue P	tissue Q
A	greatly increased upward movement	greatly increased downward movement
B	greatly increased downward movement	little change
C	little change	greatly increased downward movement
D	little change	greatly increased upward movement

11 What contributes to the wilting of plant leaves?

- A the mesophyll cells lose turgor
- B the phloem stops translocating
- C the stomata close
- D the xylem fills with air

12 The diagram shows the pressures in the left side of the heart during one heart beat.



Which valves are open and which are closed at the time marked X?

	bicuspid	semi-lunar
A	closed	closed
B	closed	open
C	open	closed
D	open	open

13 The table refers to blood vessels in the human body

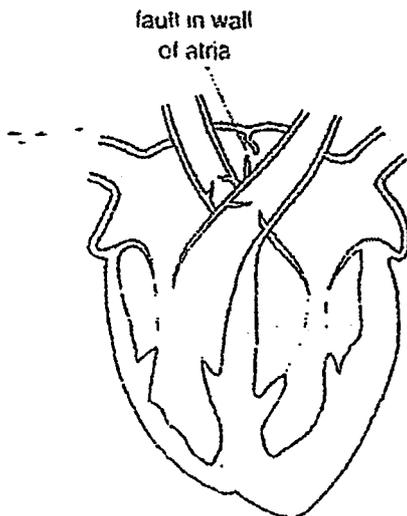
vessel	blood carried		oxygenated/ deoxygenated
	from	to	
aorta	P	all organs except lungs	oxygenated
pulmonary vein	lungs	heart	Q
hepatic artery	aorta	R	oxygenated
hepatic portal vein	alimentary canal	liver	S

What are P, Q, R and S?

	P	Q	R	S
A	left ventricle	deoxygenated	kidney	deoxygenated
B	left ventricle	oxygenated	liver	deoxygenated
C	right ventricle	deoxygenated	kidney	oxygenated
D	right ventricle	oxygenated	liver	oxygenated

[Turn over

14 The diagram shows a defect in the walls between the atria.



What effect would this defect have on the blood circulatory system?

- A increased pressure in the pulmonary artery
- B irregular heart beat
- C reduced oxygen saturation of haemoglobin
- D ventricular systole is delayed

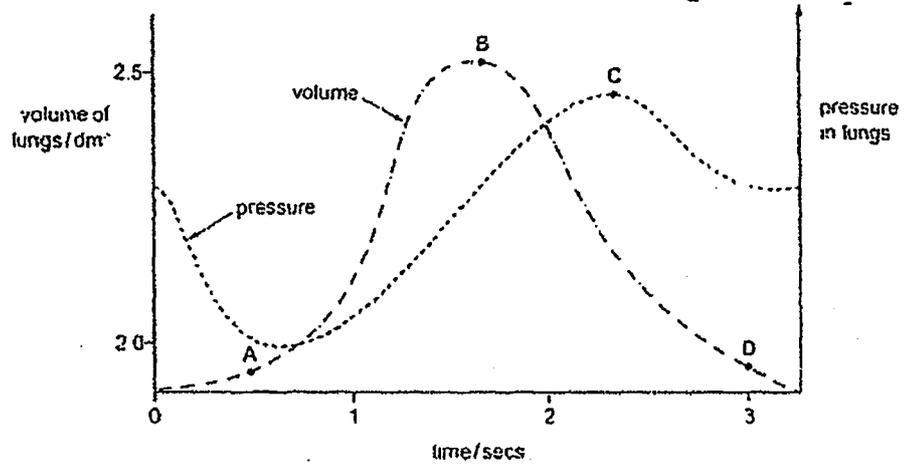
15 In the human breathing system, which features maintain the carbon dioxide gradient between the alveoli and the outside air?

- 1 blood continually pumped to the alveoli
- 2 breathing in and out
- 3 moist alveolar surfaces
- 4 thin alveolar walls

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

16 The graph shows how the pressure and volume inside the lungs change during one complete breath.

At which point are the muscles of the diaphragm starting to contract?

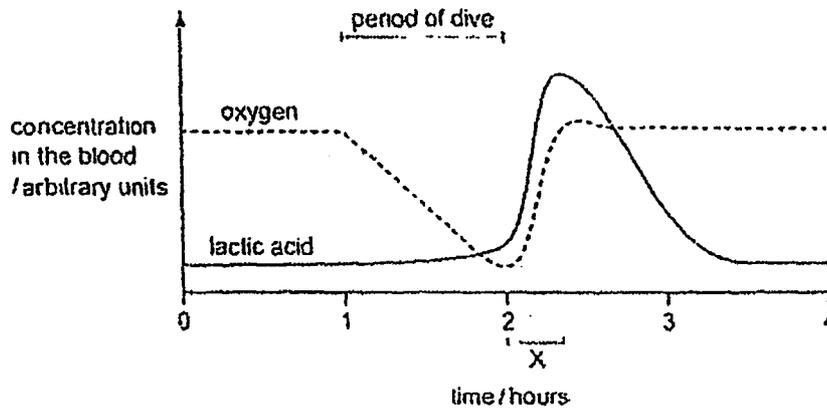


17 Which substance is lost from the body by the kidneys, lungs and skin?

- A carbon dioxide
- B excess ions
- C urea
- D water

18 Seals are marine mammals. When they dive under water, they are capable of respiring anaerobically for long periods. During this time, blood flow to the muscles is greatly reduced but the muscles are able to tolerate high concentrations of lactic acid.

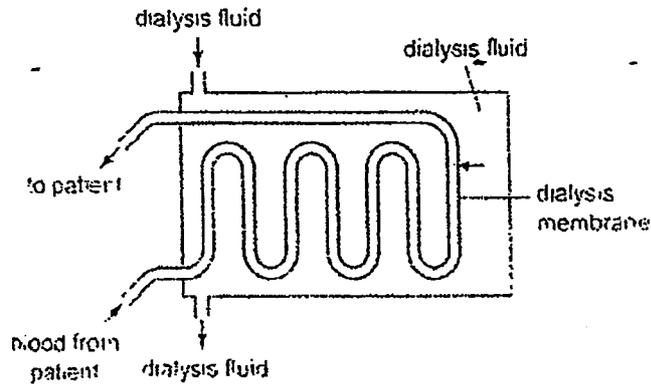
The graph shows the concentrations of lactic acid and oxygen in the blood of a seal before, during and after a dive



What explains the change in lactic acid concentration during time X?

- A increased lactic acid production
- B increased blood flow to the muscles
- C increased rate of aerobic respiration
- D reduced rate of anaerobic respiration

19 In a kidney dialysis machine, which substance cannot diffuse through the dialysis membrane?



- A glucose
- B insulin
- C sodium
- D urea

20 Which of these statements correctly describe control by negative feedback?

- A An injury to body tissue activates platelets in the blood and these activated platelets release chemicals which activate more platelets.
- B During the menstrual cycle, luteinising hormone stimulates the release of oestrogen which in turn stimulates the release of more luteinising hormone.
- C The onset of contractions during childbirth causes the release of a hormone, which stimulates further contractions.
- D When blood pressure is high, nerve impulses from the brain cause the blood vessels to dilate and blood pressure is reduced.

[Turn over

- 21 If the air temperature is higher than the core body temperature, which processes can increase heat loss from the body?

	shivering by muscles	evaporation of sweat	vasodilation in the skin	
A	✓	x	✓	key ✓ = can increase heat loss x = cannot increase heat loss
B	✓	x	x	
C	x	✓	✓	
D	x	✓	x	

- 22 Insulin is a hormone synthesised in the pancreas and distributed around the body by the blood.

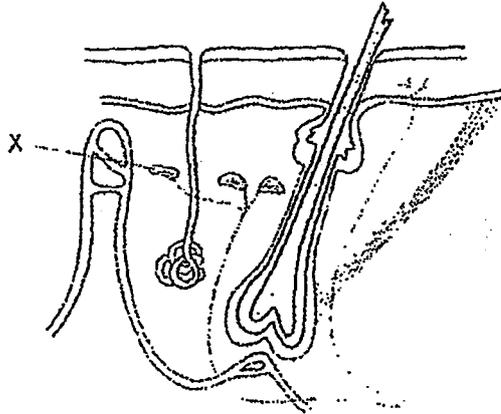
What describes its rate of secretion and concentration in the blood?

	rate of secretion	concentration in the blood
A	constant	constant
B	constant	varied
C	varied	constant
D	varied	varied

23 Which changes occur in the body when a person is shocked?

	increase in	decrease in
A	the diameter of the pupils in the eye	the speed of peristalsis
B	the rate of conversion of glycogen to glucose	the diameter of the pupils in the eye
C	the rate of urine formation	the rate of conversion of glycogen to glucose
D	the speed of peristalsis	the rate of urine formation

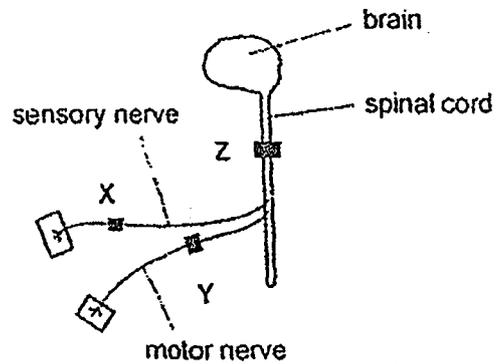
24 The diagram shows some of the structures seen in a section through human skin.



What is the function of structure X?

- A to cause capillaries to constrict
- B to detect changes in temperature
- C to receive impulses from the central nervous system
- D to stimulate sweat glands to release sweat

25 The diagram represents a central nervous system. X, Y, and Z show possible sites where the system can be blocked by a local anaesthetic.



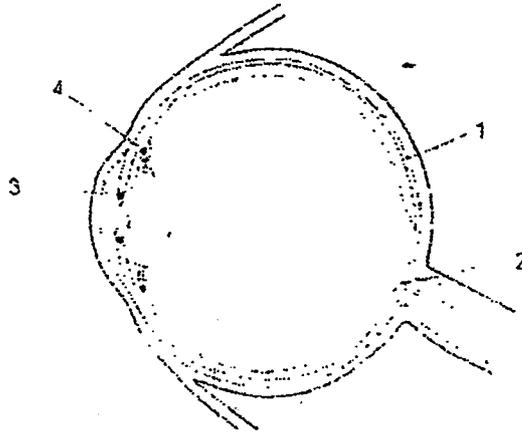
Of four men, one had no anaesthetic block and the other three had only one anaesthetic block at X, Y or Z.

One of the men can feel a pinprick on his leg but cannot move it.

Where is the anaesthetic block?

- A block is at X
- B block is at Y
- C block is at Z
- D no block

26 The diagram shows a section through an eye.

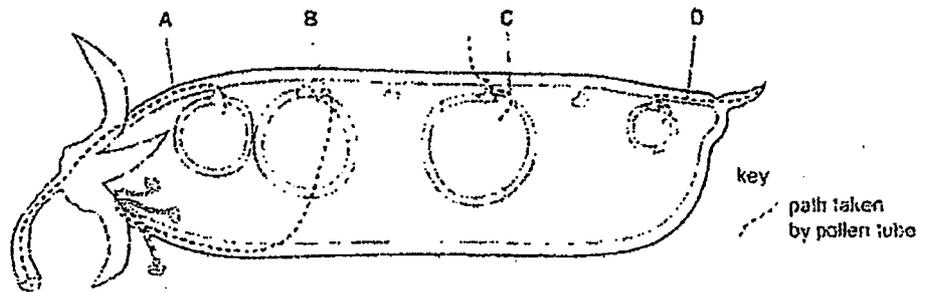


In the pupil reflex, which row gives the sites of the effectors and receptors involved?

	effectors	receptors
A	3	1
B	3	2
C	4	1
D	4	2

27 The diagram shows a pod from a pea plant.

Which line correctly shows the path that was taken by a pollen tube to an ovule?



[Turn over

28 Which plants are most likely to adapt successfully to a climatic change in their environment?

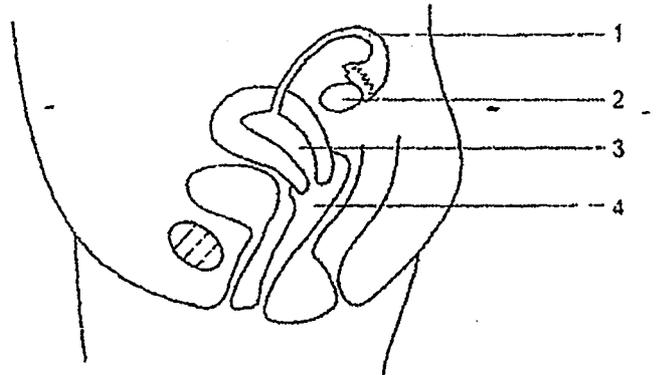
- A plants that are cross-pollinated
- B plants that do not rely on wind-pollination
- C plants that grow rapidly
- D plants that reproduce asexually

29 A natural method of birth control assumes that sperms live for three days after sexual intercourse, ovulation occurs between days 13-15 of the menstrual cycle and releases ova live for 36 hours.

On which day of the cycle should sexual intercourse not result in pregnancy?

- A day 7
- B day 11
- C day 12
- D day 16

30 The diagram shows a side view of the female reproductive system.



In which region are sperms released during sexual intercourse and where does fertilisation usually take place?

	sperms released	fertilisation
A	3	1
B	3	2
C	4	1
D	4	2

[Turn over

31 A couple has three children. The table shows some of the children's characteristics.

child	sex	blood group	sickle-cell / normal
1	male	B	sickle-cell
2	female	AB	normal
3	male	O	normal

What do the characteristics show?

- A continuous variation only
  - B discontinuous variation only
  - C both continuous and discontinuous variation
  - D neither continuous nor discontinuous variation
- 32 What is a result of natural selection?
- A dogs that are friendly to humans
  - B grapes that contain no seeds
  - C mosquitoes that are resistant to insecticides
  - D onion crops that have a pleasant taste
- 33 The genotype for the height of an organism is written as Tt. What conclusion may be drawn?
- A The allele for height has at least two different genes
  - B There are at least two different alleles of the gene for height
  - C There are two different genes for height, each having a single allele
  - D There is one allele for height with two different forms.

34 A scientist takes 4 pairs of samples from a wild cherry tree. In which pair of samples could there be cells with different genotypes?

- A two fruits
- B two leaves
- C two petals
- D two root cuttings

35 Six processes in genetic engineering are listed

- 1 The bacterium is cloned
- 2 The gene is copied.
- 3 The gene is switched on.
- 4 The gene is transferred into a bacterium.
- 5 The human gene is isolated
- 6 The protein, insulin, is synthesised.

Which four processes, in the correct order, show the production of human insulin by bacteria?

- A 2→3→5→6
- B 3→1→4→6
- C 5→3→2→6
- D 5→4→1→6

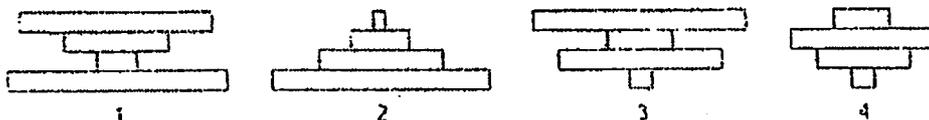
36 Which type of molecule is the end product of translation?

- A amino acid
- B mRNA
- C polypeptide
- D tRNA

37 Which statement about chromosomes is correct?

- A Chromosomes are long DNA molecules called genes, which are divided, into sections
- B Chromosomes include a long molecule of DNA divided into sections called genes.
- C Chromosomes include genes, which are divided into sections called DNA molecules.
- D Genes include long DNA molecules called chromosomes.

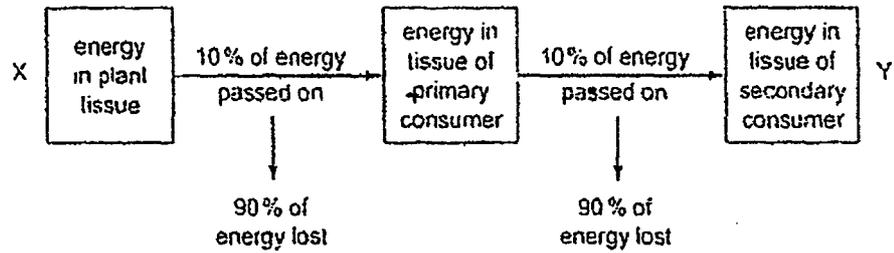
38 A tree has insect larvae burrowing in its leaves. The emerging insects are eaten by birds and the birds have parasitic fleas living amongst their feathers



Which is a pyramid of biomass and which is a pyramid of numbers for this food chain?

	pyramid of biomass	pyramid of numbers
A	1	3
B	1	4
C	2	3
D	2	4

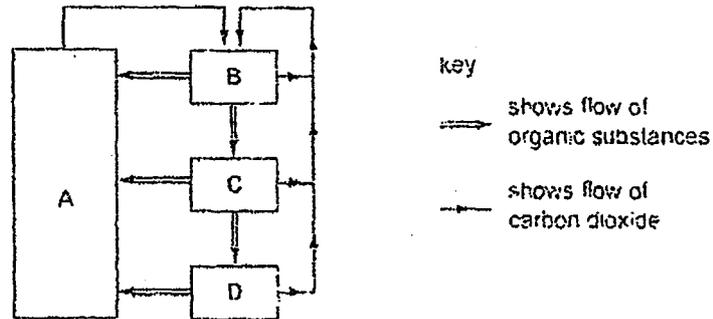
39 The diagram shows energy flow through a food chain from X to Y.

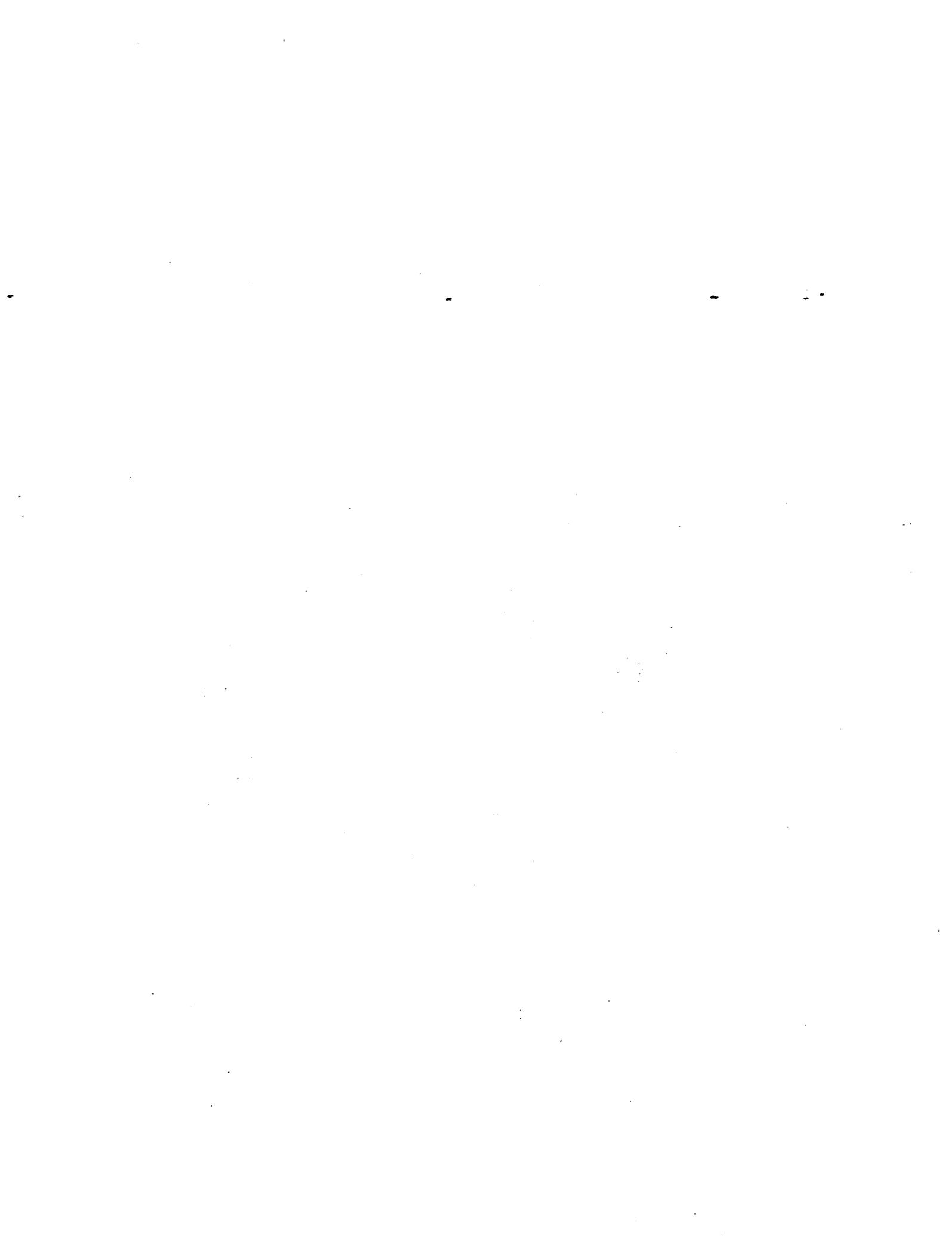


By which processes is energy lost between X and Y?

- A excretion and respiration
- B growth and excretion
- C growth and photosynthesis
- D photosynthesis and respiration

40 The diagram represents the flow of substances within a balanced ecosystem. The boxes are various trophic levels. Which box represents producers?







Paya Lebar Methodist Girls' School (Secondary)  
Preliminary Examination (2) 2014  
Secondary 4 Express

CANDIDATE  
NAME

CLASS

4 A

INDEX NUMBER

**BIOLOGY (SPA)**

5158

Paper 2

1 August 2014

1 hour 45 mins

**READ THESE INSTRUCTIONS FIRST**

Write your name and index number on all the work you hand in.  
Write in dark blue or black pen on both sides of the paper.  
You may use a soft pencil for any diagrams, graphs or rough working.  
Do not use staples, paper clips, highlighters, glue or correction fluid.

**Section A (50 marks)**

Answer all questions in the spaces provided in the question paper.

**Section B (30 marks)**

Answer all three questions, the last question is in the form either/or.  
Write your answers on the lined paper in this booklet and, if necessary, continue on separate answer paper.

At the end of the examination, fasten all your work securely together, if applicable.  
The number of marks is given in brackets [ ] at the end of each question or part question.

For Examiner's Use	
Section A	
Section B	
7	
8	
9	
Total	

**Section A**

**[50 marks]**

Answer all questions in this section.

Write your answers in the spaces provided.

- 1 A student was asked to make a model of a plant cell. She took a length of tubing made from a substance that allows only water molecules to pass through and enclosed it in a flexible permeable membrane as shown in Fig. 1.1.

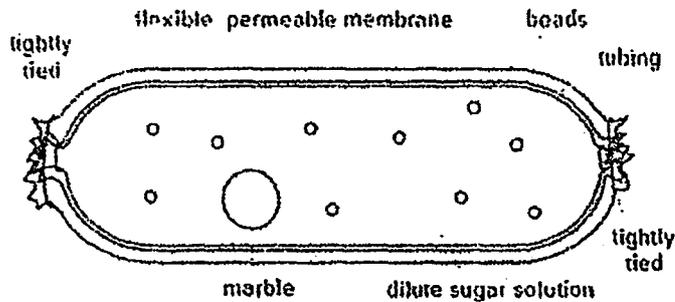


Fig. 1.1

- (a) Name the structures found in a plant mesophyll cell that are best represented by the following items used in the model of the plant cell.

Marble .....  
Beads .....  
Tubing ..... [3]

- (b) State a structure of a plant cell that is not represented in the student's model.

..... [1]



2 Fig. 2.1 shows how an alcoholic drink is produced in some countries.

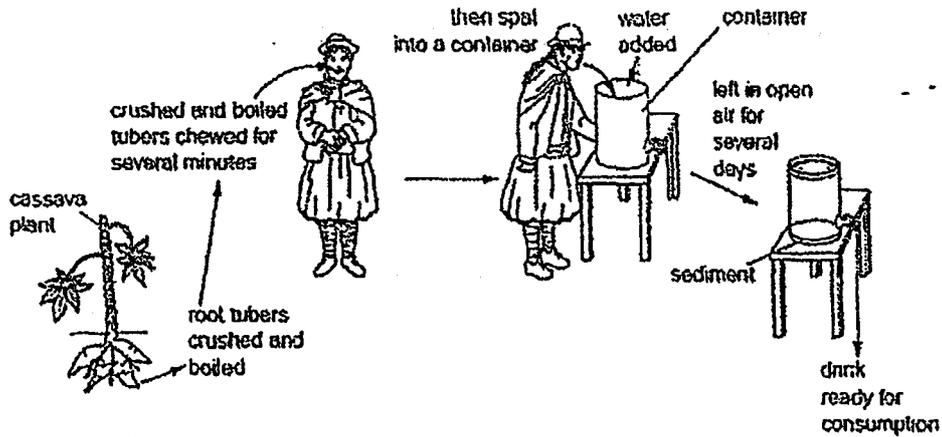


Fig. 2.1.

- (a) The root tubers of the cassava plant store starch. After removal from the plant, the tubers are crushed and boiled. Suggest the effect that crushing and boiling will have on the cells of the tubers.

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

[2]

- (c) After they have been crushed and boiled, the cassava tubers are chewed for several minutes. Explain what happens to the starch during this time.

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

[Total: 5m]

- 3 Fig 3.1(a) and Fig 3.1(b) each shows cells from the lining of a trachea. One is from a smoker and one is from a non-smoker.

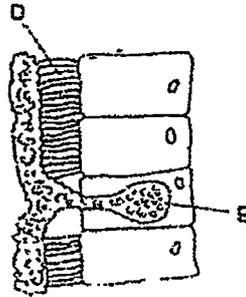


Fig 3.1(a)

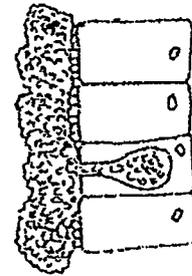


Fig 3.1(b)

- (a) (i) Identify structures D and E.

D .....  
 E ..... [2]

- (ii) Describe the function of D

.....  
 ..... [2]

Fig. 3.2(a) and Fig. 3.2(b) show the cross-sections through the alveoli of a smoker and a non-smoker.

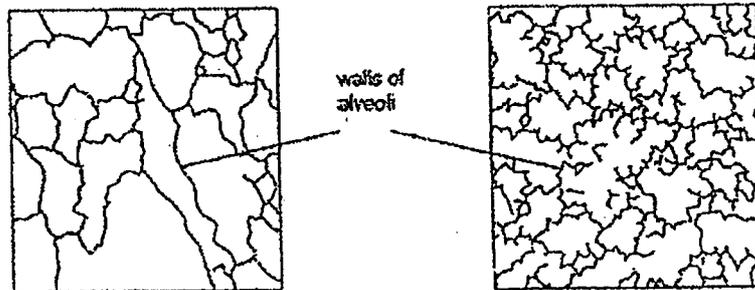
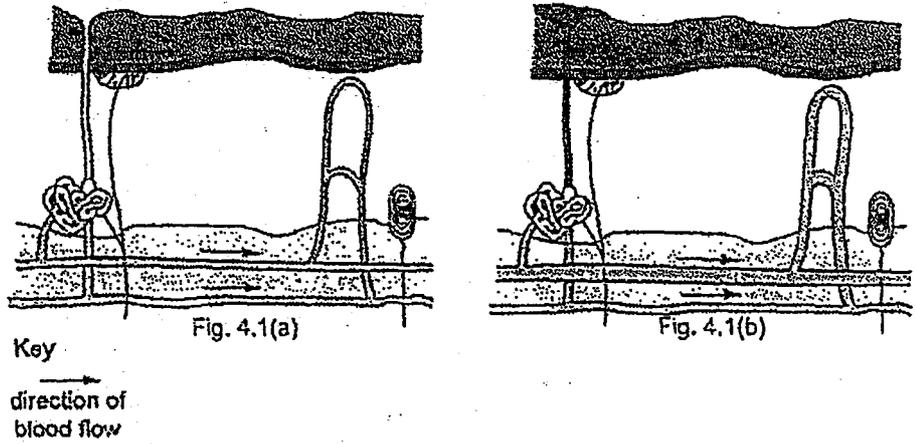


Fig. 3.2(a)

Fig. 3.2(b)



4 Fig. 4.1(a) and Fig. 4.1(b) shows a section through the skin of a person at two different temperatures.



(a) On Fig 4.1(a), identify and label the sweat gland and temperature receptor. [2]

(b) State what happened to the body temperature to cause the changes shown in Fig. 4.1(b) compared with Fig. 4.1(a). Explain your answer

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

[3]

[Total 5m]

- 5 Fig. 5.1 shows the average sweating rates of a person over a 4-hour period under different conditions.

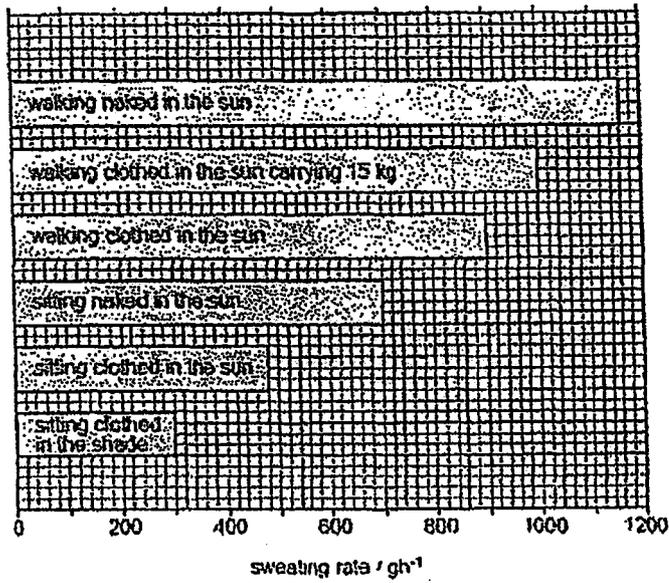


Fig. 5.1

- (a) State one way other than by sweating and urination in which a person might lose water.

[1]

- (b) (i) Suggest how the rates of sweating shown in Fig. 5.1 are different for the person when they are walking clothed in the sun with and without the 15 kg weight

[3]

- (b) (ii) Suggest why the person who is sitting clothed in the shade has the lowest sweating rate.

[2]

(c) Fig 5.2 shows the water gain and loss of a person over 24 hours.

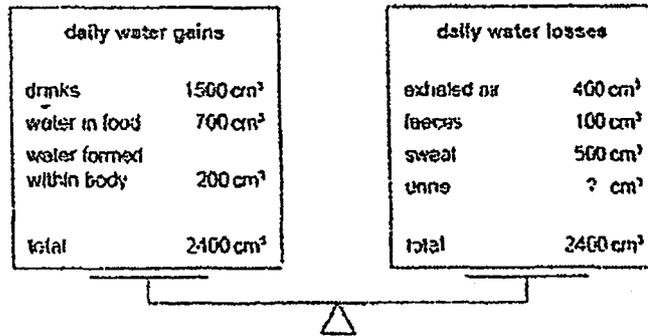


Fig 5.2

(i) Name a reaction in the body that produces water

[1]

(ii) Using the information in Fig. 5.2, calculate the volume of water a person must lose in the urine over 24 hours in order to maintain the volume of water in the body. Show your working in the space below.

Volume of water : ..... [1]

(iii) On a hot day, the volume of water loss as sweat will change. Suggest how sweating could affect the urine that a person produces.

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

[2]

[Total 10m]

6 Cultivated banana plants produce fruits with seeds that are infertile (unable to develop) while wild banana plants produce fruits with large, fertile seeds.

(a) State the type of reproduction usually found in cultivated bananas and wild bananas

Cultivated bananas: .....

Wild bananas: ..... [2]

(b) State one commercial advantage that results from the type of reproduction found in cultivated bananas

..... [1]

"Black sigatoka" is a fungal disease of banana leaves. The hyphae of the fungus spread through the intercellular spaces as shown in Fig 6.1

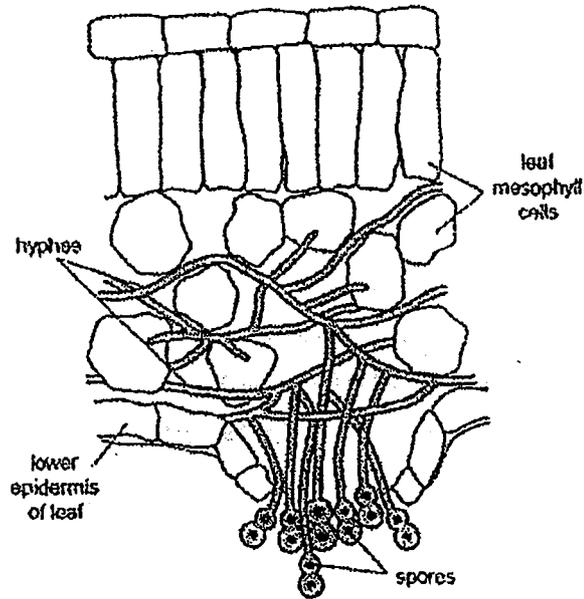


Fig. 6.1

(c) Suggest ways by which the fungus would eventually cause the leaf to die.

.....

.....

.....

.....

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.....

[4]

(ii) Explain why fungal diseases tend to kill a higher percentage of cultivated than of wild bananas.

.....

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.....

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.....

.....

[3]

[Total 10m]

Section B

[30 marks]

Answer three questions

Question 9 is in the form of an Either / Or question. Only one part should be answered.

- 7 Over a period of several months, a student recorded some activities of the wild life in a particular habitat. The following observations appeared in her notebook as seen in Fig. 7.1.

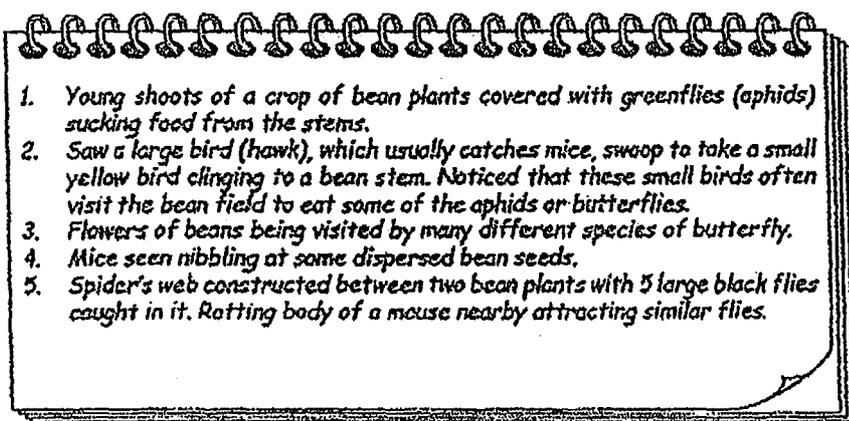


Fig. 7.1

- (a) In the space below, draw and label a pyramid of biomass for the hawks, mice and bean plants in this habitat (2)



8 Fig. 8.1 shows how genetic engineering with the use of yeast cells can be used to manufacture an enzyme (chymosin) that clots milk in the stomach of young mammals

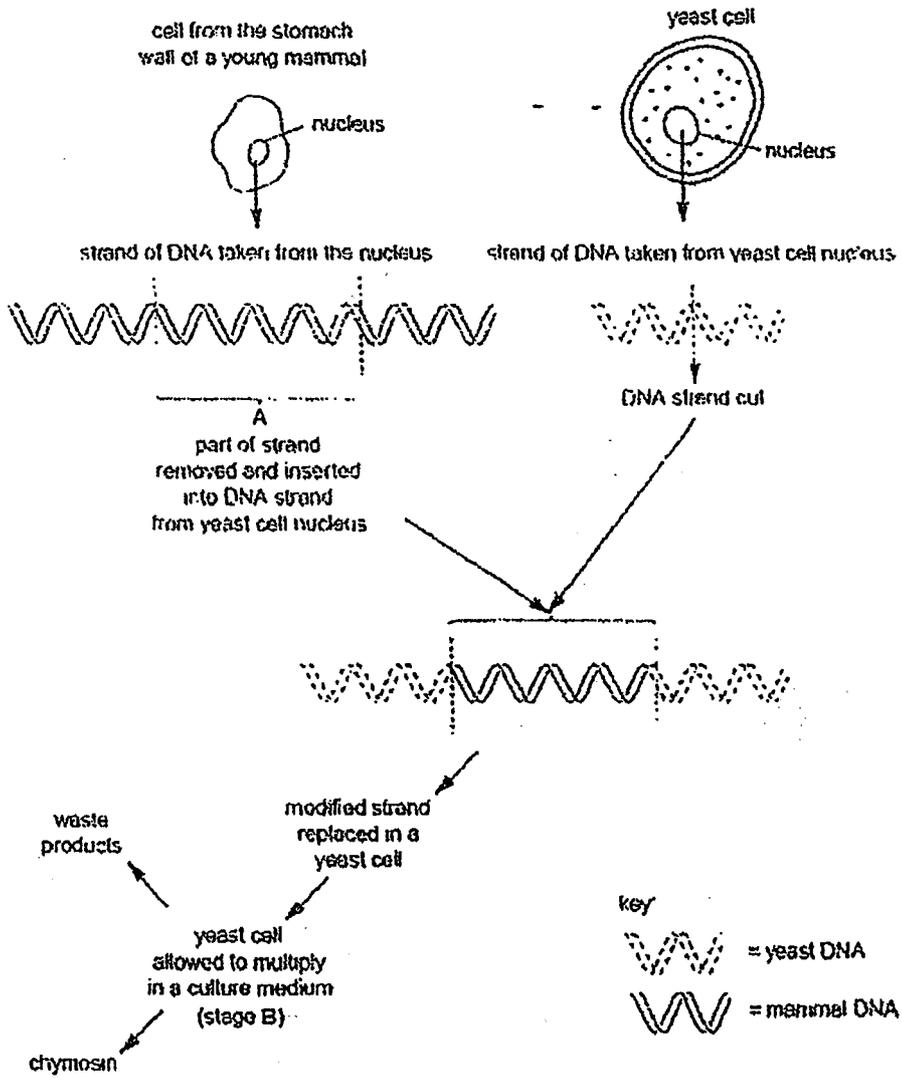


Fig. 8.1

(a) Name the part labelled A in the diagram above.

[1]



9 EITHER

(a) Fig. 9.1 shows a horizontal section of the human eye and the pathway taken by light rays as they leave a distant object.

Complete the diagram by continuing the lines from the object to show how the light rays produce a focused image on the retina. [3]

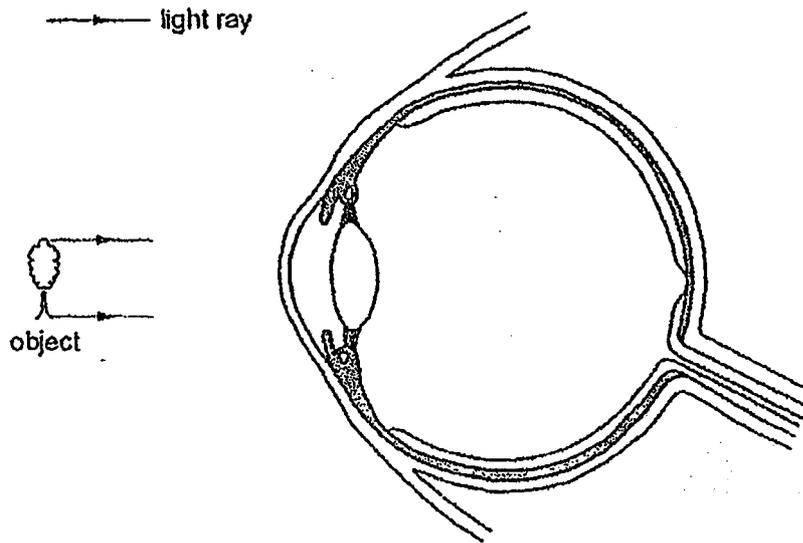


Fig 9 1



9 OR

- (a) In the inheritance of the colour of mouse fur, the allele for yellow fur (D) is dominant to the allele for grey fur (d).
- (i) Two heterozygous yellow-coloured mice produce offspring. Use a fully labelled genetic diagram to show how the colour of mouse fur is inherited by the offspring. State the expected genotypes and phenotypes in the offspring. [5]

- (ii) A particular combination of these alleles is known as a "lethal" combination. The offsprings that inherit this combination die in the uterus during the very early stages of development. This results in a 2:1 ratio of fur colour in the surviving offspring. Identify the lethal combination of alleles and explain how you reached this answer.

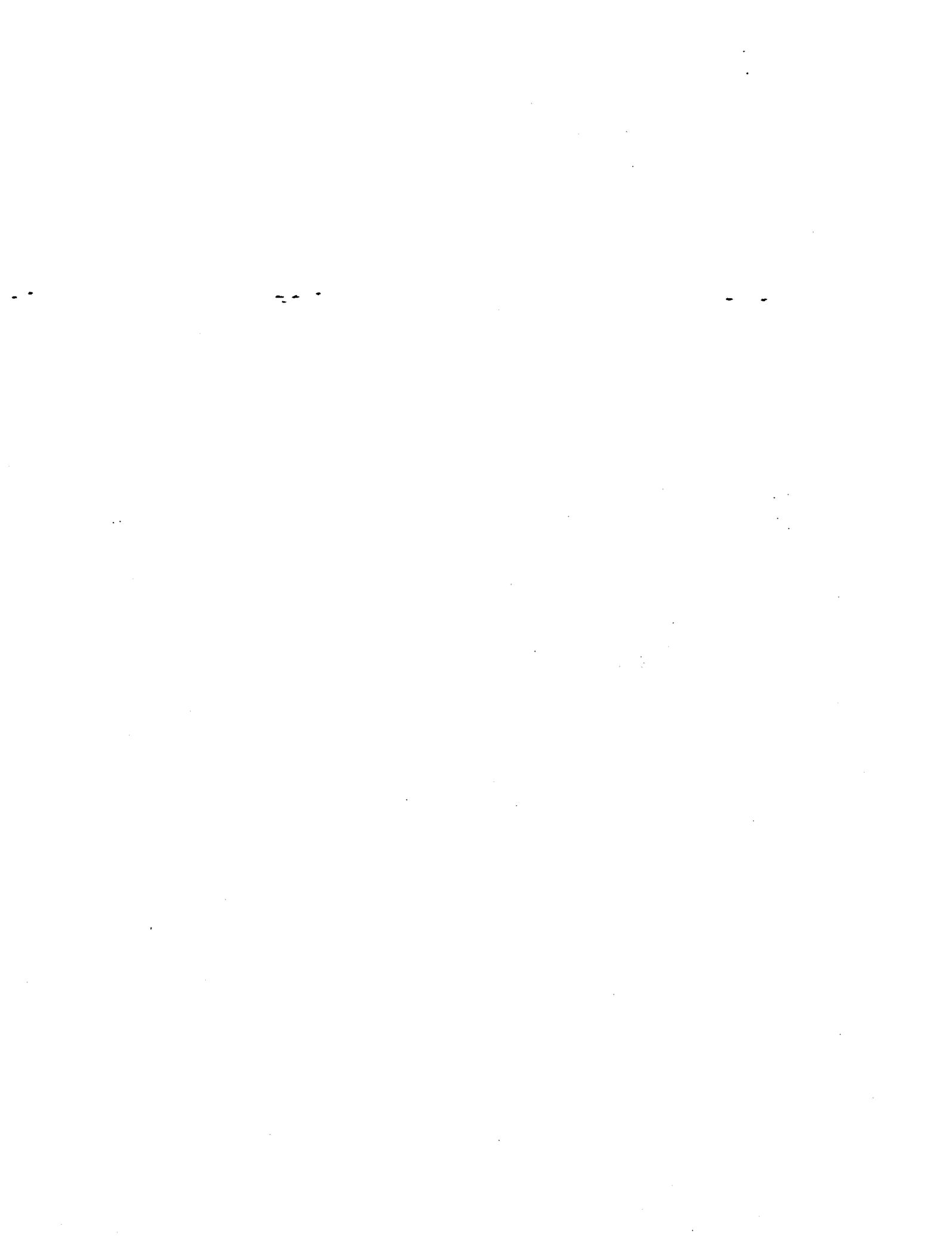
.....  
.....  
.....  
.....  
.....  
..... [3]

- (b) Recessive alleles of genes could be formed by mutation. State two causes of mutation.

.....  
.....  
..... [2]

[Total: 10m]

End of Paper



Sec 4 Biology Prelim 2 2014 Ans

Paper 1

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

## Answers

1 (a) nucleus, chloroplasts, (cell) membrane. [3]

1 (b) vacuole / ribosomes / mitochondria / tonoplast. [1]

1 (c) water leaves;

by osmosis;

ref. water potential (A any ref. to differential in concentration); -

cell / cytoplasm / protoplasm / model shrinks (R ref. vacuole);

ref. decreased pressure / turgidity / firmness / flaccidity;

tubing pulls away from permeable membrane OR cytoplasm or cell membrane pulls away from (cell) wall;

ref. plasmolysis;

selective permeability of tubing

no sugar leaves cell by diffusion / enters space between tubing and permeable membrane OR between

cell membrane and wall. [max 6]

2 (a) damage / breaks AW (cell's / tube)

ref. cell wall / membrane;

releasing (cell) contents / starch;

kills cells / denatures enzymes / stops metabolic reactions. [max 2]

2 (b) salivary amylase / carbohydrase.

digests / breaks down / hydrolyses • starch.

(to) maltose; [3]

3. (a) (i) D cilia, E goblet (cell) / mucus (-producing cell) / gland (cell); [2]

3 (a) (ii) ref. beating / AW;

moving mucus + towards throat / upwards / away from lungs,

containing germs / dirt; [2]

3 (b) (i) Fig. 3.1(b) + Fig. 3.2(a) [2]

3 (b) (ii) carcinogenic / AW;

lar + impervious to gases;

emphysema / break down of alveoli walls;

reduced surface area;

less O<sub>2</sub> absorption / to red blood cells / body cells;

irritants paralyse cilia lining the air passage;

dust particles trapped in the mucus lining the air passage cannot be removed;

increase the risks of chronic bronchitis [max 4]

4 (a). label line must touch the sweat gland; label line must touch some part of receptor under Malpighian layer; [2]

4 (b). (body temperature increases / rises; [1] R cooler / decreases

In either order: Activation of sweat glands to produce sweat;

dilation blood vessels / vasodilation/capillaries; increase blood flow near the surface of the

body; to radiate heat away from the body; [2] R veins

to allow the body to cool down. [1] (max 3 points)

5. (a) exhaling or breathing out/faeces/bleeding or crying or vomiting [1]

5 (b) (i) the rate of sweating is higher for a person who is carrying a weight of 15 kg at  $1000\text{gh}^{-1}$  as compared to a person who is not at  $900\text{gh}^{-1}$

The person who is carrying 15kg has more energy released/higher rate of respiration;  
More heat produced;

Increase in rate of sweating to cool the body [max 4]

5(b) (ii). For a person who is sitting in the shade, there is less work done from sitting; and less exposure to heat; hence. the person does not need to produce as much sweat to allow cooling of the body [max 2]

5 (c) (i). Respiration [1]

5 (c) (ii)  $1400\text{ cm}^3$

5 (c) (iii). volume of sweat produce will increase  
the volume of urine will decrease / less water;  
the concentration will increase / colour will be darker. [3 max]

6 (a) asexual/vegetative;  
sexual (ignore asexual); [2]

6 (b) any from:  
more certain, known quality/quantity of fruit or described\*,  
favourable conditions, greater % of fruit is flesh, faster,  
greater profit/higher yield. (\*allow ecf if wrong type of reproduction); [1]

6 (c) interferes with movement of gases/blocks stomata.  
interference with transpiration;  
digests cell contents/ref. enzymes/separates cells;  
takes nutrients from the plant;  
kills cells/protective toxins released by cells;  
no/less photosynthesis;  
blocks veins/vascular bundles/phloem/xylem; [max 4]

6 (d) (A reverse argument) cultivated plants are planted close together in a smaller area/designated farm; easier spread of fungal spores;  
genetically identical;  
little variation/mutation;  
all/very large numbers lack resistance; [max 3]

## Section B

7 (a) correct shape (A smooth-sided or stepped pyramid).  
all three levels correctly labelled ; {2}  
(upside-down pyramid with producer at top = 1 mark)

7 (b) large bird / hawk + spider ;  
small / yellow bird + (black) flies ;  
greenflies / aphids - butterflies - mouse / mice ; {1 mark per trophic level}

7 (c) ref. Sun,  
light (energy) to chemical energy;  
absorbed by / inside plants or producers / photosynthesis;  
named photosynthetic product;  
food for / eaten by + animals / herbivores / consumers / decomposers.  
lost as heat;  
(from) respiration / ref ATP;  
Energy does not pass back to producers / plants / Sun; {max 3}

7(d) This is due to bioaccumulation;  
When the mice feeds on the bean plants, the insecticide is not broken down in the mice and is accumulated in the mice that the hawk feeds on. Hence, the concentration of the insecticides increases up the trophic level and will affect the animals higher up in the trophic level more. {max 2 }

8 (a) gene / allele ; {1}

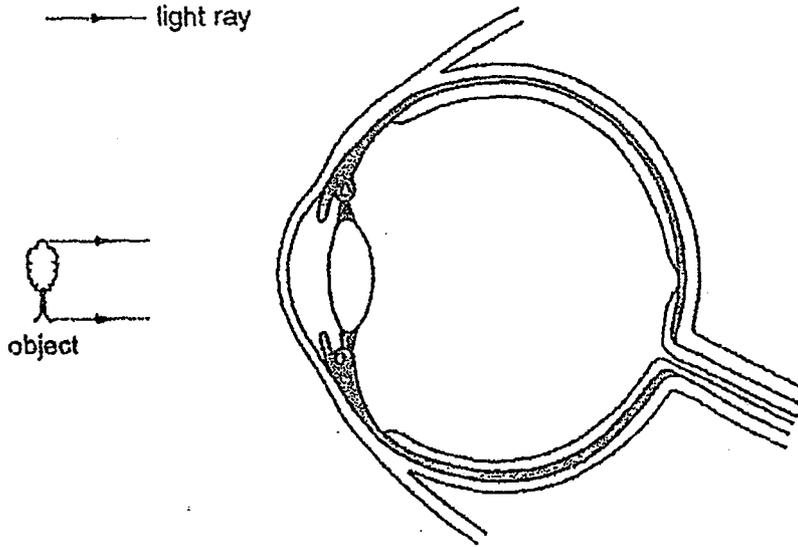
8 (b) sugar (or named) / nitrates (A amino acids) ;  
solution / broth / water ;  
suitable temperature / pH ;  
ref oxygen / air (A ref. [an]aerobic) ;  
( since respiration in yeast may be aerobic or anaerobic)  
fermenter / stirring / ref. sterility ( i.e. the mechanics of the process) ; {3 max}  
(A large / suitable container)

8 (c) excess glucose to glycogen  
correct ref liver / muscles .  
enhanced glucose uptake by cells / increased cell permeability .  
ref constant blood composition / concentration/reduction of blood glucose {2 max}

8 (c) (ii). Instead of using yeast, bacteria is used in the production of human insulin gene:  
unlike bacteria which is single-stranded, yeast is double stranded.  
both need the plasmid to be taken up by either the yeast or bacteria before they are placed in fermenter.  
Bacteria and yeast are both put into a nutrient broth that allows them to multiply and produce the insulin or chymosin;  
*Any other reasonable answers. (max 4)*

9 either

(a) rays continue parallel until hit cornea;  
rays converge at cornea;  
rays converge at lens;  
meet before retina - continue to hit retina; [3]



9 (b) (i). light intensity increases at I / gets brighter at I; [1]

1 increase in light intensity detected by retina;  
2 impulses to iris (via brain) to result in an involuntary action where  
3 (iris) circular muscles contract.  
4 (iris) radial muscles relax;  
5 making pupil smaller/constricted  
6 and therefore less light will enter the eyes.  
any three 1 mark each  
max 4

9 (b) (ii)

Pupil reflex is a  
fast / rapid / quick;  
reaction / response + (to) stimulus;  
automatic / involuntary / no involvement of conscious thought AW; / cannot be controlled [1]  
R no involvement of brain, too much light allowed to enter AW;  
damage to retina / rods / cones / light-sensitive cells; [2]

9 or

(a) (i)

Parental Phenotype

Heterozygous

x

Heterozygous

Parental Genotype

Dd

x

Dd

Gametes



Random fertilisation

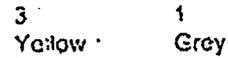
Offspring genotype



Genotypic ratio



Phenotypic ratio



1 mark for correct labels, 1 mark for each step ; max 5 marks;  
R if wrong symbols used

(a) (ii) DD (A e.c.f. for incorrect symbols)

ref. 1 in 4 would be DD .

leaves ratio 2 yellow : 1 grey , {3}

(A explanation on diagram - accept on (ai) so long as linked)

9 (b) Any two of the following

Mustard gas/formaldehyde/ ultra violet radiation/ exposure to alpha, beta and gamma rays