SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2014
SECONDARY FOUR

BIOLOGY 5158/01

Paper 1 Multiple Choice

Tuesday 12 August 2014 1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Shade your answers in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, class and index number on the Answer Sheet in the spaces provided.

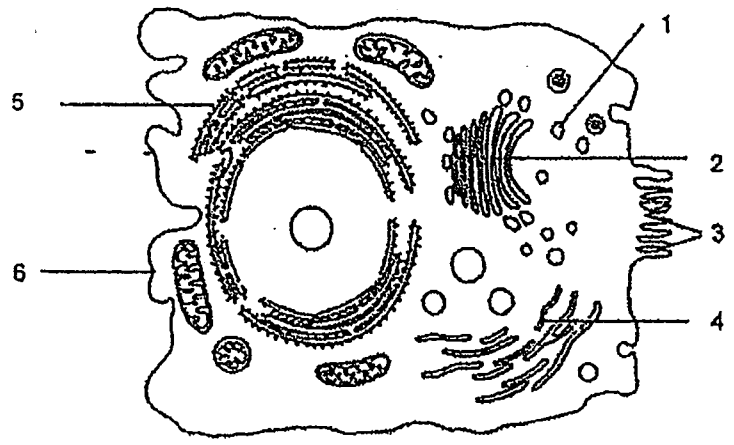
There are forty questions on this paper. Answer all questions. For each question there are four possible answers A, B, C and D.
Choose the one you consider correct and record your choice in soft pencil on the separate Answer Sheet.

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 question paper.

This question paper consists of 17 printed pages, inclusive of this cover page.

1 The diagram shows a section of a generalized animal cell as seen under the electron microscope.



Where are the proteins and lipids synthesised and transported, packaged and secreted?

	synthesised and transported		packaged	secreted
	proteins	lipids	proteins and lipids	proteins and lipids
A	2	5	4	3
B	4	5	2	1
C	5	4	2	1
D	5	6	2	3

2 The statements describe some of the properties of water.

1. absorbs and retains a lot of heat
2. requires a lot of heat to evaporate
3. is able to form bonds with other water molecules
4. is able to form bonds with molecules of substances other than water

Which properties are important for the transport of water in xylem?

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

3 Which feature of xylem vessels allows them to have reduced resistance to water flow?

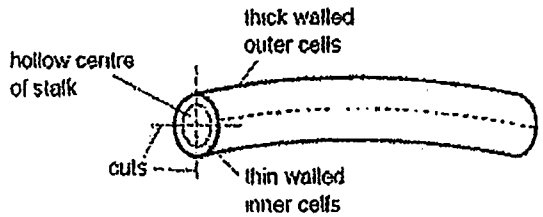
A cellulose cell walls are thickened with lignin
B empty lumen without cross walls or protoplasm
C new vessels carry extra water as a plant grows
D vessel elements join to form narrow tubes

4 A concentrated solution of sucrose and sucrase were mixed together and incubated at 30°C. Samples of the mixture were tested with two reagents at the start of the experiment and after 24 hours.

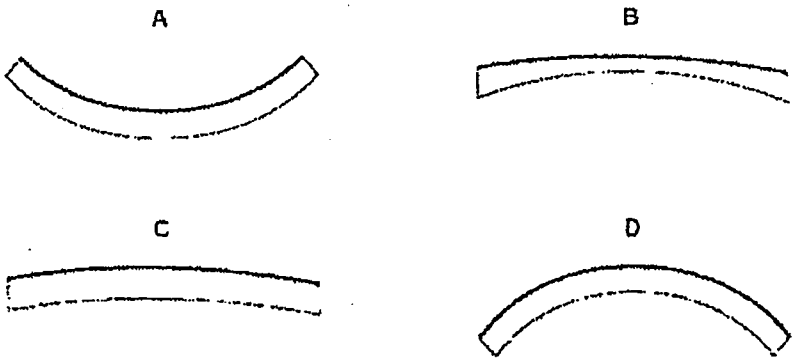
What colours would be expected?

	reagent added at the start		reagent added after 24 hours	
	Biuret solution	Benedict's solution and heated	Biuret solution	Benedict's solution and heated
A	blue	blue	blue	brick red
B	blue	brick red	blue	blue
C	violet	blue	violet	brick red
D	violet	brick red	blue	brick red

5 The stalk of wild garlic is a hollow tube. Pieces of the stalk are cut as shown and placed in sucrose solutions of different water potentials.



Which diagram shows the piece that is placed in the sucrose solution with the highest water potential?



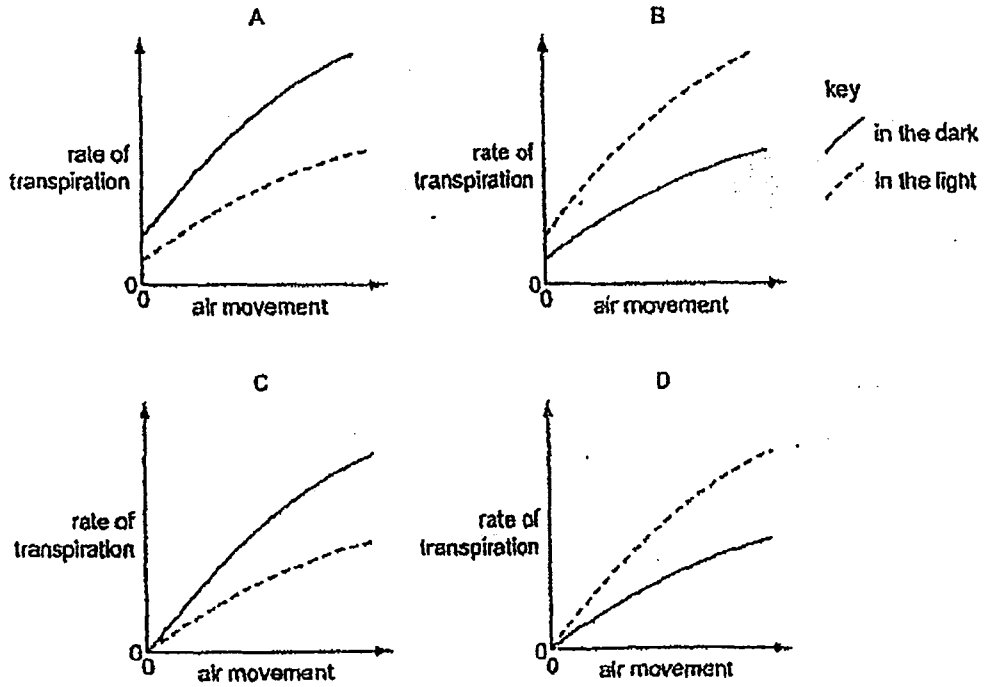
6 What determines the rate of water movement from the roots to the leaves?

A absorption of water through the root hairs
B development of higher leaf water potential
C evaporation of water from the mesophyll cell walls
D osmosis of water through the stomata

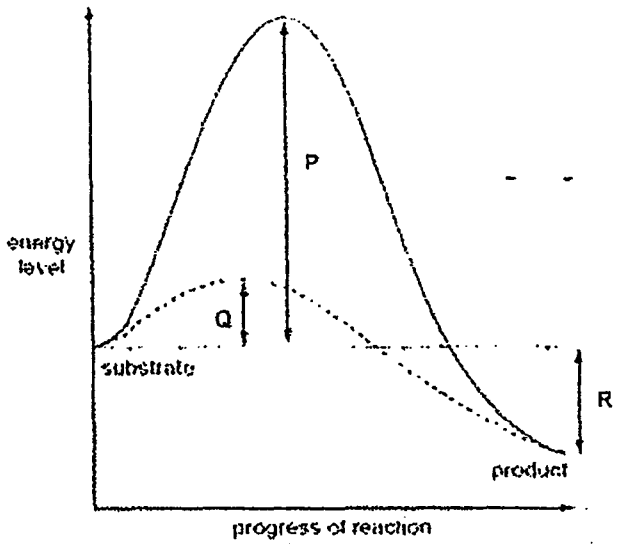
7 The photomicrograph shows a section of the spongy mesophyll and the lower epidermal tissues of a leaf.

At which point will the concentration of carbon dioxide be lowest when the plant is exposed to a high light intensity?

8 Which graph shows the effect of increasing air movement on the rate of transpiration of a plant in light and in dark conditions?



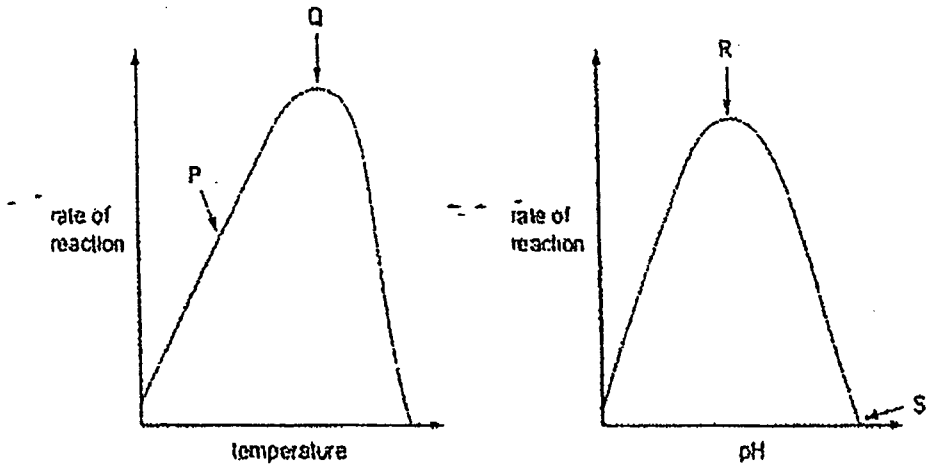
9 The graph shows the energy changes in an enzyme-controlled reaction.



Which option represents the activation energy of the reaction with and without the enzyme?

	with enzyme	without enzyme
A	Q	P
B	P + Q	Q
C	Q	P − Q
D	Q + R	P + R

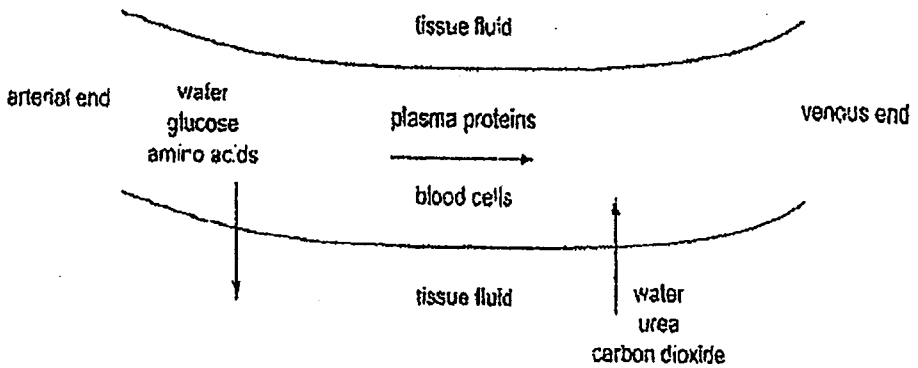
10 The graphs show the effects of temperature and pH on enzyme activity.



Which statement correctly explains the enzyme activity at the point shown?

A At P, bonds are formed between enzyme and substrate.
B At Q, enzyme activity is occurring at the highest temperature.
C At R, peptide bonds in the enzyme begin to break.
D At S, the substrate is completely denatured.

11 The arrows on the diagram show the direction of movement of some of the substances in plasma as they enter and leave a capillary.



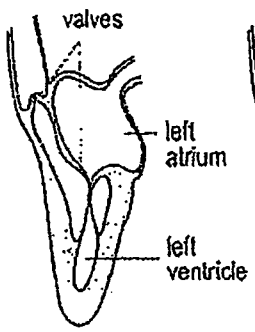
Which two factors help water to re-enter the capillary at the venous end?

	plasma water potential	blood pressure in the capillary
A	decreased	decreased
B	decreased	increased
C	increased	decreased
D	increased	increased

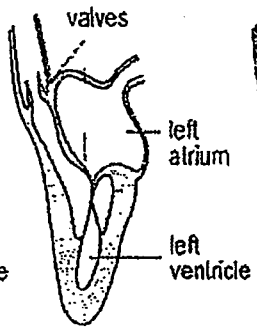
12 The diagrams show sections through the left side of the heart.

Which diagram correctly shows the position of the atrioventricular and semilunar valves during a ventricular contraction?

A



B



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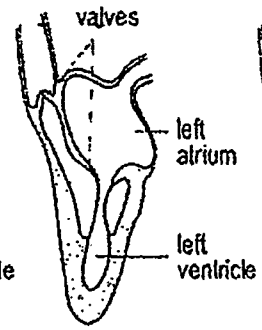
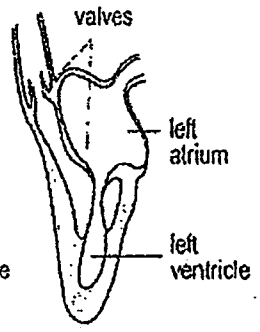
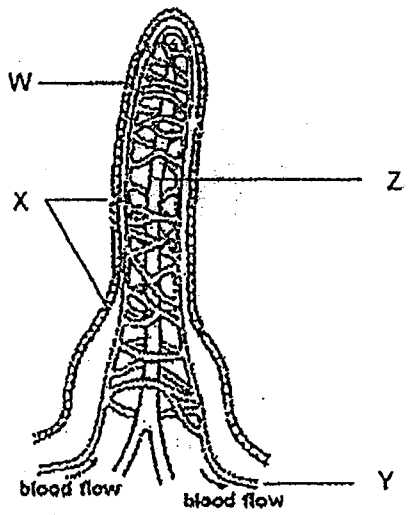


D



13 The diagram shows a section through a villus in the small intestine.



Which of the following statements about the parts W, X, Y and Z is/are correct?

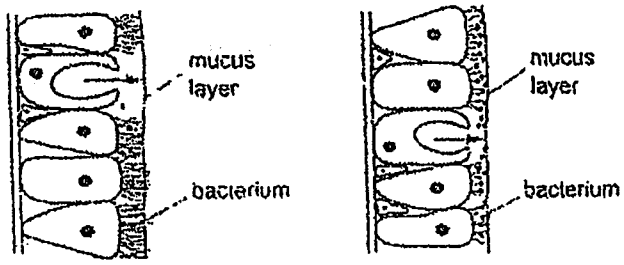
1. Cells similar to W have numerous microvilli and mitochondria.
2. Cells similar to X secrete mucus and digestive enzymes.
3. Vessel Y transports digested fats absorbed by diffusion.
4. Vessel Z transports digested food to the hepatic portal vein.

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

14 What are the changes to the concentration of the various substances in the red blood cells when carbon dioxide diffuses from respiring cells?

	carbonic anhydrase	hydrogen carbonate ions (HCO_3^-)
A	decreases	no change
B	increases	increases
C	no change	decreases
D	no change	increases

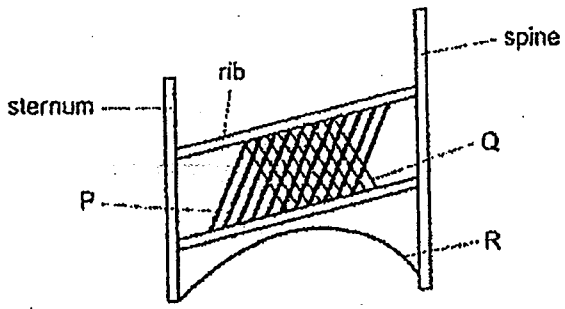
15 The diagrams show the epithelium lining the bronchioles in a non-smoker and a smoker.



As a result of the changes, what will the smoker experience?

A more lung infections
B more mucus running down the nose
C the bronchioles become wider
D the cilia will beat more rapidly

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



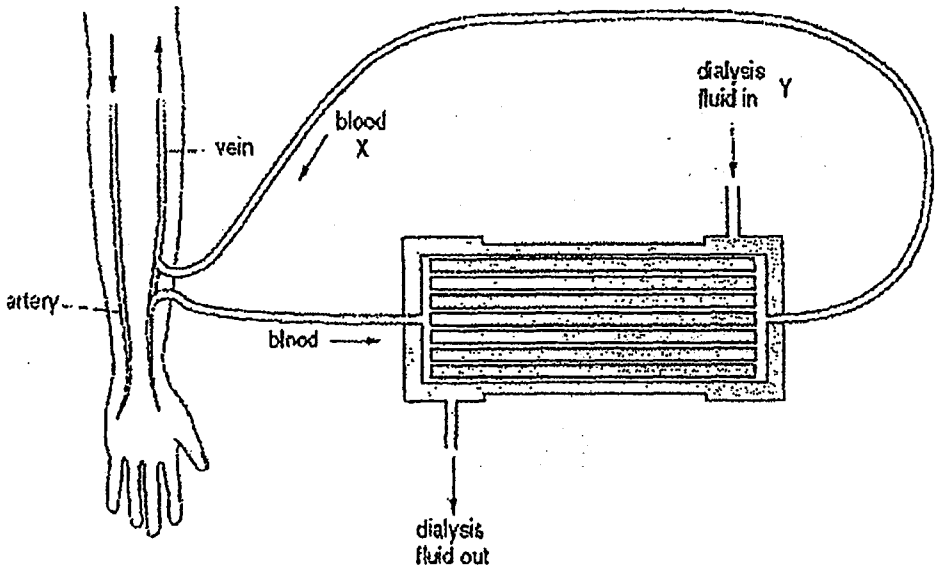
Which muscles are contracting during breathing in?

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

17 Which option shows the substances ultra-filtered and selectively reabsorbed in the kidney tubules in a healthy human?

	ultra-filtered from blood	some selectively reabsorbed into blood	all selectively reabsorbed into blood
A	glucose	protein	water
B	protein	water	salt
C	salt	glucose	protein
D	water	salt	glucose

18 The diagram represents the flow of blood and dialysis fluid through a kidney machine.



Which substances have the lowest concentration at X and the highest concentration at Y?

	lowest at X	highest at Y
A	glucose	salts
B	salts	glucose
C	urea	water
D	water	urea

19 When a person is frightened in an emergency, which substance causes an increase in the blood sugar levels?

A adrenaline
B amylase
C gastrin
D glycogen

20 Which of the following changes occur when a person is immersed in a hot water bath for 15 minutes?

1. Dilation of skin arterioles
2. Increased metabolism of fat
3. Increased production of sweat

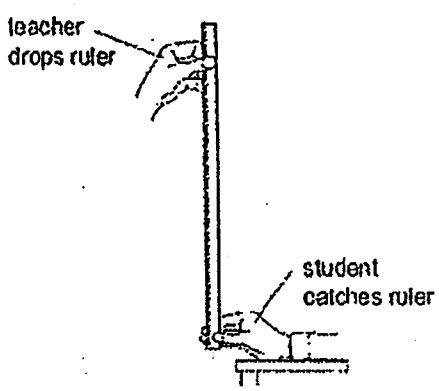
A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

21 A man injures his hand in an accident. Afterwards, he can feel the objects touching his hand, but he cannot move his hand away from them.

What could cause this?

A Receptors in his hand are damaged.
B Relay neurones in his hand no longer function.
C The nerve connection is cut only between the receptors in his hand and his central nervous system.
D The nerve connection is cut only between his central nervous system and the effectors in his arm.

22 The reaction time of a student is determined by measuring the distance a ruler falls before it is caught by the student. A teacher drops the ruler as shown.



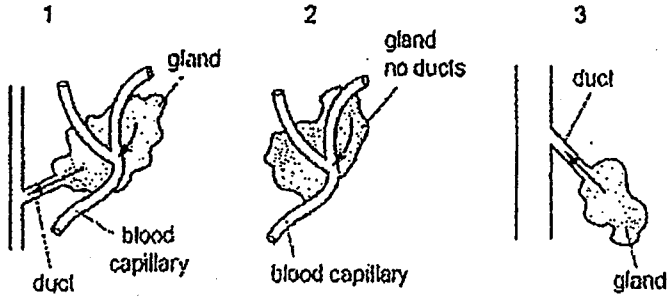
Which path is taken by nerve impulses from the student's eyes to the muscles of his hand?

A optic nerve → retina → spinal cord → brain → spinal nerve
B optic nerve → retina → spinal cord → spinal nerve → brain
C retina → optic nerve → brain → spinal cord → spinal nerve
D retina → optic nerve → spinal nerve → brain → spinal cord

23 Which of the options shows the states of the circular and radial iris muscles and the ciliary muscles in the eye for the corresponding viewing action?

	viewing action	circular muscles	radial muscles	ciliary muscles
A	a distant object in bright light	relaxed	contracted	contracted
B	a distant object in dim light	contracted	relaxed	relaxed
C	a near object in bright light	contracted	relaxed	contracted
D	a near object in dim light	relaxed	contracted	relaxed

24 The diagram shows the basic plan of three types of glands. The arrows show how their secretions pass from them into other parts of the body.



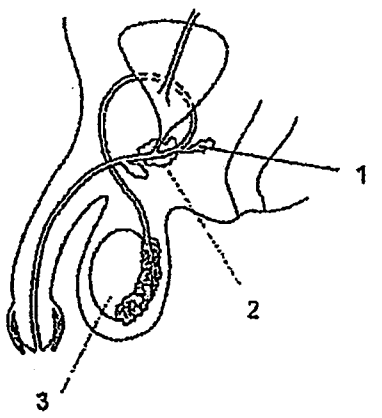
In which type of gland would secretions of sebum, insulin and oestrogen be produced?

	sebum	insulin	oestrogen
A	1	2	3
B	1	3	2
C	3	2	1
D	3	1	2

25 Which option shows the correct functions of both oestrogen and progesterone?

	oestrogen	progesterone
A	causes repair of uterus lining after menstruation	prevents release of eggs during pregnancy
B	maintains uterus lining	helps stimulate release of eggs from ovary
C	promotes menstruation	prevents menstruation
D	prevents release of eggs during pregnancy	promotes menstruation

26 The diagram shows part of the male urino-genital system.



What are the functions of the labelled parts?

	hormone production	seminal fluid production
A	1 and 2	3 only
B	1 and 3	2 only
C	2 only	1 and 3
D	3 only	1 and 2

27 What is the most important function of the amniotic fluid during pregnancy?

A It allows space for the growth of the fetus.
B It enables the fetus to get rid of waste products.
C It protects the fetus by ensuring an even distribution of pressure.
D It provides nourishment for the growth of the fetus.

28 Dioecious plant species are adapted to transfer pollen effectively to the stigma of another individual.

Which adaptations are used in wind pollination?

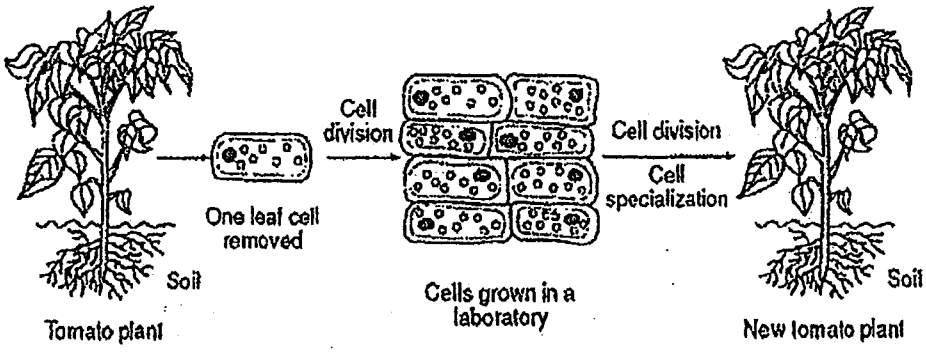
1. anther enclosed in petal
2. filament pendulous
3. feathery stigma
4. pollen rough
5. pollen small
6. stigma sticky knob

A 1, 4 and 5 only
B 1, 2, 3 and 6
C 2, 3 and 5 only
D 2, 4 and 6 only

29 Which characteristics of a population would most likely indicate the lowest potential for evolutionary change in that population?

A asexual reproduction and few mutations
B asexual reproduction and many mutations
C sexual reproduction and few mutations
D sexual reproduction and many mutations

30 The diagram represents a technique used to produce new plants.



Which statement is best supported by the information in the diagram?

A The one leaf cell removed formed a zygote that developed into a new plant by mitotic cell division.
B The cell taken from the leaf produced eight cells, each having one -half of the genetic material of the original leaf cell.
C The new tomato plant will not be able to reproduce sexually because it was produced by mitotic cell division.
D The procedure can be used to produce new tomato plants that are clones of the original tomato plant.

31 What are the similarities between traditional plant breeding and genetic engineering?

1. increase chance of mutation
2. involve selection of genetic traits
3. must involve closely related species
4. transfer genes

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

32 Some stages in the production of human insulin from genetically modified bacteria are listed.

1. A bacterial plasmid is cut open.
2. The bacterium is grown in a fermenter.
3. The insulin gene is cut out from human DNA.
4. The insulin gene is inserted into a plasmid.
5. The plasmid is inserted into a bacterium.

What is the correct sequence of these statements?

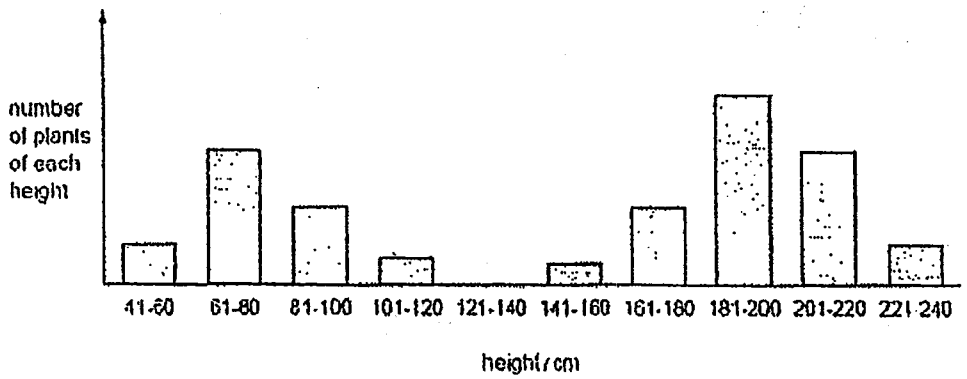
A 2 → 3 → 5 → 4 → 1
B 2 → 5 → 3 → 1 → 4
C 3 → 1 → 4 → 5 → 2
D 3 → 1 → 5 → 4 → 2

33 It has been found that some species of disease-causing bacteria that could previously be killed by antibiotics are now resistant to these drugs.

Which of the following statements best explains the origin of this resistance?

A Antibiotics cause mutations in bacteria proteins, resulting in resistance.
B Generations of bacteria adapt and become resistant to antibiotics.
C Random changes in the sequence of bacterial DNA bases.
D Resistant bacteria survive as a result of natural selection.

34 The heights of 500 pea plants of the same age were measured to the nearest 20 cm. The results are shown in the chart below.



Variation in height of these pea plants shows

A continuous variation only.
B discontinuous variation only.
C both continuous and discontinuous variation.
D neither continuous and discontinuous variation.

35 In which natural cycles do photosynthesis and respiration both play a part?

	carbon cycle	water cycle
A	✓	✓
B	✓	×
C	×	✓
D	×	×

Key
✓ = yes
× = no

36 The diagram shows a terrestrial food chain.

mahogany tree → caterpillar → small bird → owl

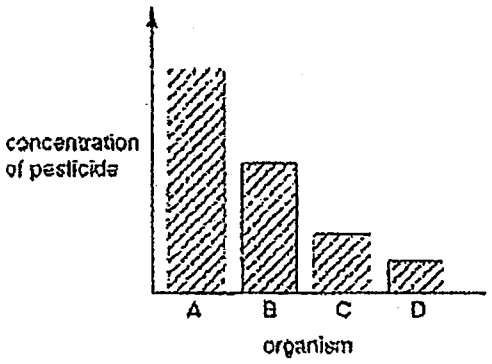
In this food chain, which population has the largest biomass and which has the largest population size?

	largest biomass	largest population size
A	owl	mahogany tree
B	owl	small bird
C	mahogany tree	caterpillar
D	mahogany tree	Owl

37 The diagram shows part of a food chain in a lake.

single-celled photosynthetic organisms → small shrimps → frog → carnivorous bird

The chart below shows the concentration of a pesticide in the bodies of each organism in the food chain. Which organism on the chart is the frog?



38 A student wrote the following statements about meiosis.

1. Homologous chromosomes pair up and cross-over.
2. Homologous chromosomes undergo independent segregation
3. Crossing-over occurs between chromatids of non-homologous chromosomes

Which statements are features of meiosis which contribute to variation?

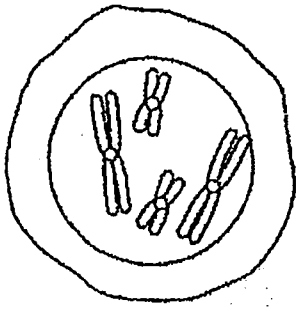
A 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

39 A cell containing two sets of chromosomes divides by meiosis.

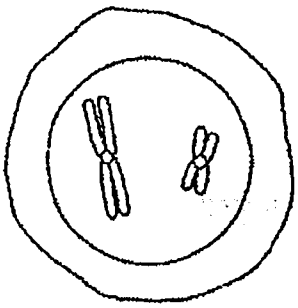
Which diagram shows prophase II?

A

B



C



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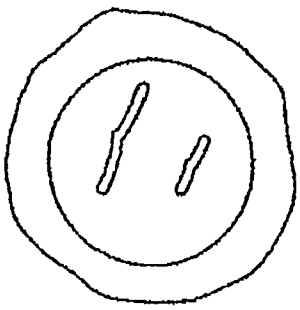
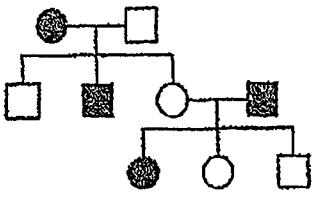


40 The inheritance patterns of four conditions are shown.

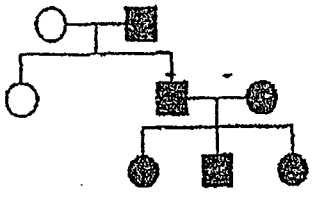
Which inheritance pattern proves that the condition is not caused by a recessive allele?

A

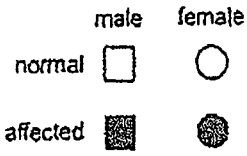


left-handedness

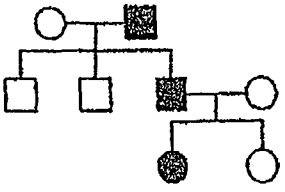
B



polydactyly

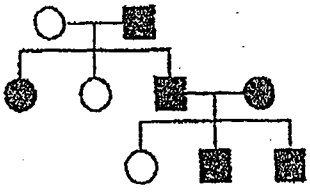


C



short-sightedness

D



white forelock

Index Number	Name	Class

SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION 2014

BIOLOGY 5158/02

Paper 2

Wednesday 30 July 2014 1 hour 45 minutes

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST
Write your index number, name 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, highlighters, glue or correction tape or fluid.

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.
Write an E (for Either) or an O (for Or) next to the number 10 in the grid below to indicate which question you have answered.

The use of an approved scientific calculator is expected, where appropriate.
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	
Section A	/ 50
Section B	
8	/ 9
9	/ 11
10	/ 10
Total	

This question paper consists of 20 printed pages, inclusive of this cover page.

Section A
Answer all questions.
Write your answers in the spaces provided.

1. Barley plants were grown in a culture solution that contained various ions. As the plants grew, they absorbed both ions and water from the solution. Fig. 1.1 shows the concentrations of some of these ions in the cell sap and culture solution.

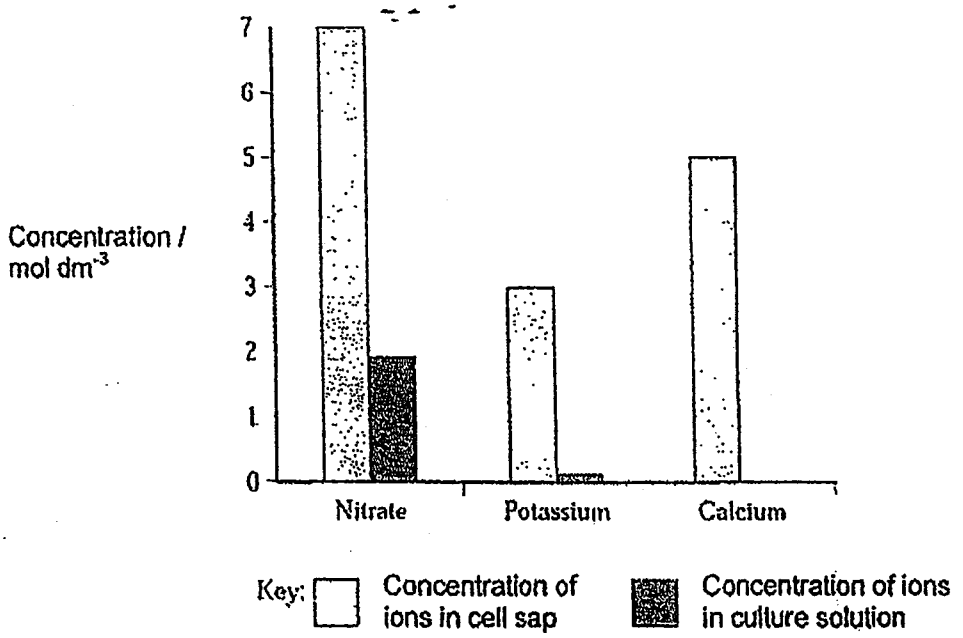


Fig. 1.1

a) (i) With reference to Fig. 1.1, explain how the potassium ions were taken in by the plant cells. [2]

(ii) Calcium ions are taken in via diffusion. Draw on Fig. 1.1, the expected initial concentration of calcium ions in the culture solution, which enables diffusion to take place. [1]

b) Fig. 1.2 shows how blood and water flow through the gills of a fish. The numbers represent the concentration of oxygen, expressed in arbitrary units.

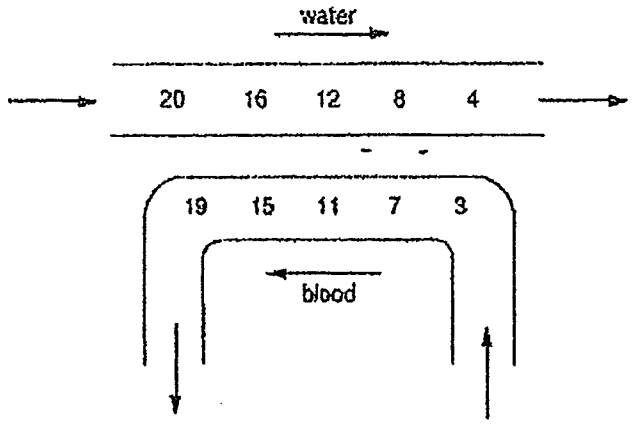


Fig. 1.2

(i) With reference to Fig. 1.2, describe how the blood flows, relative to water. [1]

(ii) Explain how your answer to b (i) facilitates efficient gaseous exchange. [1]

[Total: 5]

2. The liver and the pancreas produce secretions involved in the processing of fats in the body.

a) Some scientists have developed a fat substitute that they called lipoleum, in response to consumer demands for low-fat and low-calorie foods.

Lipoleum has a similar structure to a natural fat, but it cannot be digested by enzymes in the body.

(i) Describe one physical change that would occur to both lipoleum and natural fats while they are in the duodenum and explain how this change is brought about. [2]

(ii) State one chemical change that would occur to natural fats in the duodenum, but not lipoleum. [1]

b) Chronic pancreatitis is a condition where the pancreas becomes permanently damaged due to inflammation. Signs and symptoms include repeated episodes of severe abdominal pain and production of greasy, foul-smelling faeces. Diabetes is a common complication.

Suggest why patients with the condition

(i) usually discharge oily faeces. [2]

(ii) could also suffer from diabetes. [2]

[Total: 7]

3. The two graphs in Fig. 3.1 show the oxygen uptake and the lactic acid concentration in the blood of a man before, during and after a short period of physical exercise.

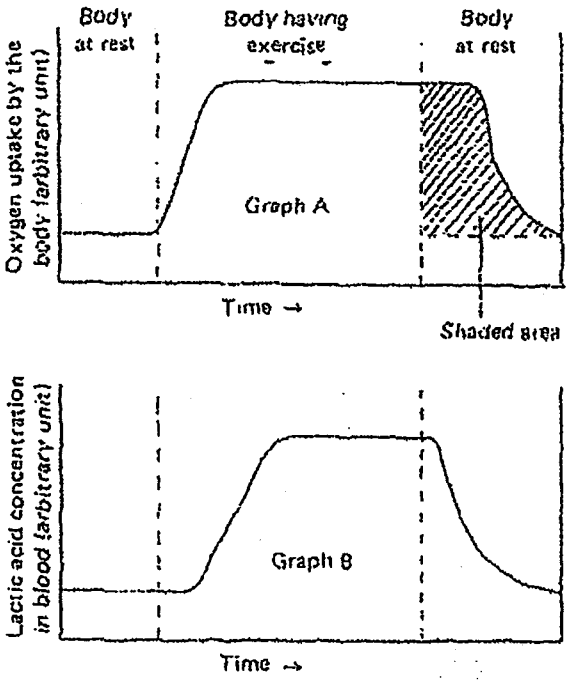
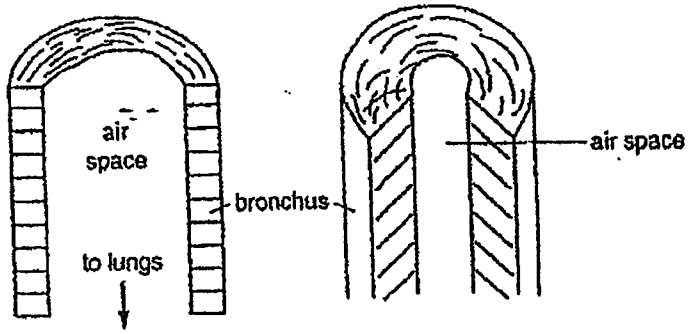


Fig. 3.1

a) (i) Explain the increase in lactic acid concentration in the blood at the beginning of exercise. [2]

(ii) Explain why the oxygen uptake remains high even when the body is at rest after exercise as shown by the shaded region for a period of time. [1]

b) A patient suffers from asthma and is allergic to cigarette smoke. When the patient breathes in the cigarette smoke, it causes the muscles of his bronchi to contract, triggering an asthma attack. This is shown in Fig 3.2.



Before breathing in cigarette smoke

After breathing in cigarette smoke

Fig. 3.2

(i) Explain how the asthma attack would affect the patient's breathing. [2]

(ii) The patient developed emphysema due to prolonged exposure to cigarette smoke. State one way in which the structure of the alveoli differs in the patient compared to a normal person. [2]

[Total: 7]

4. Fig. 4.1 shows two processes taking place in a cell.

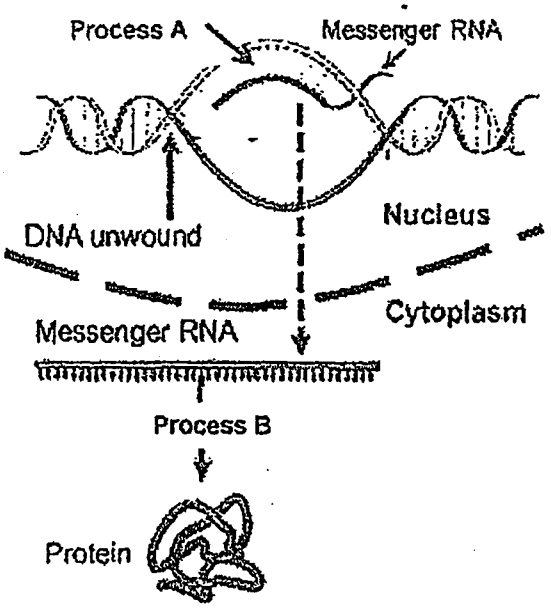


Fig. 4.1

a) Name the two processes in Fig. 4.1. [1]

Process A _____

Process B _____

b) Part of the unwound DNA has this nucleotide sequence:

-- AATCATGGTAGCATGCGCCATTA --

Write the resulting sequence of the messenger RNA produced by process A. [1]

_____

c) Suggest why process A does not take place in the cytoplasm. [1]

_____

d) In the 1950s, Erwin Chargaff determined the relative quantities of the four bases in DNA in different organisms. His results provided important evidence for the model of DNA proposed by James Watson and Francis Crick in 1953. Some of Chargaff's data is shown in Table 4.1.

Organism	% Adenine	% Thymine	% Guanine	% Cytosine
Yeast	31.3	32.9	18.7	17.1
Wheat	27.3	27.2	22.7	22.8
Octopus	33.2	31.6	17.6	17.6

Table 4.1

(i) With reference to Table. 4.1, explain how the data suggest that nitrogenous bases form complementary pairs. [1]

(ii) Suggest another conclusion that can be drawn from the Table 4.1. [1]

Table 4.2 shows Chargaff's data for a virus.

Organism	% Adenine	% Thymine	% Guanine	% Cytosine
Virus	24.0	31.2	23.3	21.5

Table 4.2

(iii) Suggest the structure of the viral DNA based on the information given in Table 4.2. [1]

[Total: 6]

5. a) Distinguish between the terms

(i) genes and alleles [2]

(ii) phenotype and genotype [2]

b) The presence of thorns on the stems of a species of rose plant is controlled by a single pair of alleles. A heterozygote of this species with thorny stem is crossed with homozygote with smooth stem. Draw a genetic diagram to show the phenotypic ratio of the F_1 generation. Using the letter 'T' to represent the dominant allele of thorny stem. [4]

[Total: 8]

6. An experiment was conducted to investigate the movement of substances within a plant. Fig. 6.1 shows a shoot at the start of an experiment..

The stem was cut at C to remove some of the tissues as in the cross section shown in Fig. 6.2.

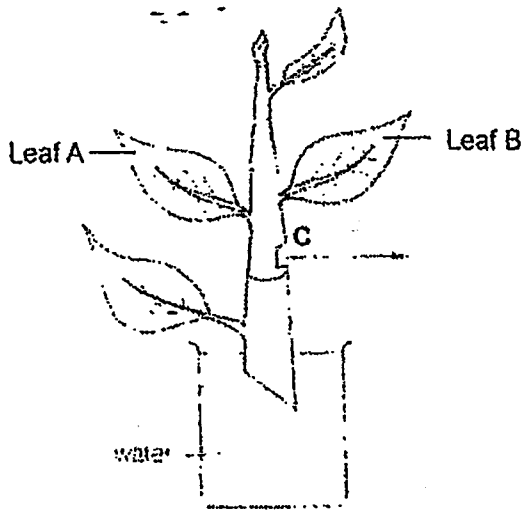


Fig. 6.1

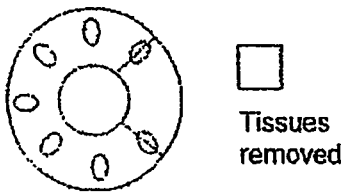


Fig. 6.2

a) (i) Suggest how the appearance of leaf A might differ from that of leaf B after a few hours. Explain your answer. [2]

Appearance

_____

_____

explanation

_____

_____

(ii) Describe what would be observed at the cut region just above C after a few days. Explain your answer. [2]

Appearance

_____

_____

explanation

_____

_____

b) Fig. 6.3 shows a section through the ovary of a flower of the herbaceous plant.

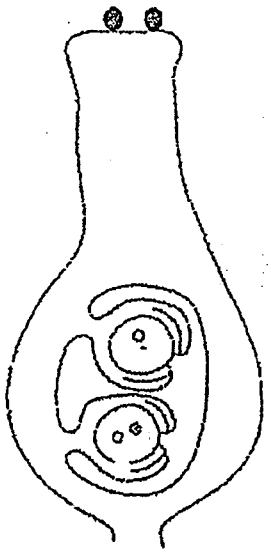


Fig. 6.3

(i) Draw the pathway taken by the male gametes to one of the ovules, and indicate the position they would occupy just before they enter the ovule. [2]

(ii) Label clearly, on Fig. 6.3, the following structures:

ovary wall, ovule, pollen tube, micropyle, male gametes. [2]

(iii) State what happens to the ovum if it is not fertilised. [1]

_____

[Total: 9]

7. Fig. 7.1 shows a food chain in an ocean. The energy content of each trophic level is shown in the boxes.

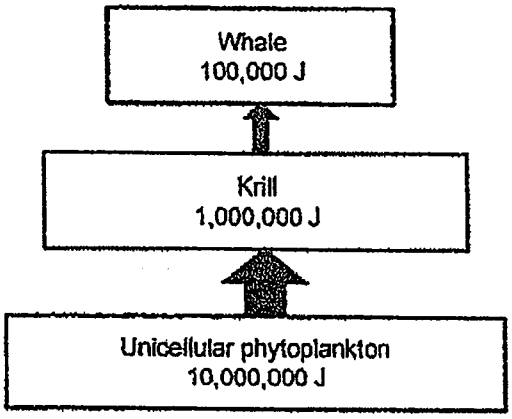


Fig. 7.1

a) (i) Calculate the percentage decrease in energy content from unicellular phytoplankton to krill. Show your working in the space below. [1]

(ii) Will the pyramid of energy shown in Fig. 7.1 achieve ecological stability? Explain your answer. [2]

b) In shifting agriculture, plots of forests are cleared to grow crops. The trees are then burnt and the ash is dispersed throughout the field as fertilisers. When the soil loses its fertility after some years of crop-growing, the land will be abandoned and allowed to recover while the farmer moves on another plot of land.

(i) "Forests are important carbon sinks." Explain this statement. [2]

(ii) To prevent the land from becoming infertile, fertiliser was added to the soil. This resulted in fishes dying in the nearby rivers. Explain how this happened. [3]

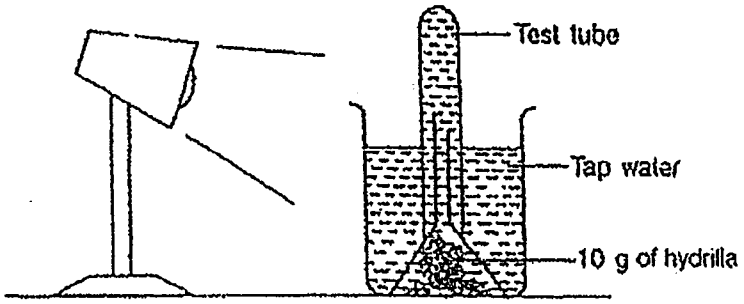
[Total: 8]

Section B
Answer three questions.

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

8. A student used the set-up below to investigate the effect of light intensity on the rate of photosynthesis. She counted the number of bubbles given off in one minute by the aquatic weed (*Hydrilla*) at different distances from the lamp.

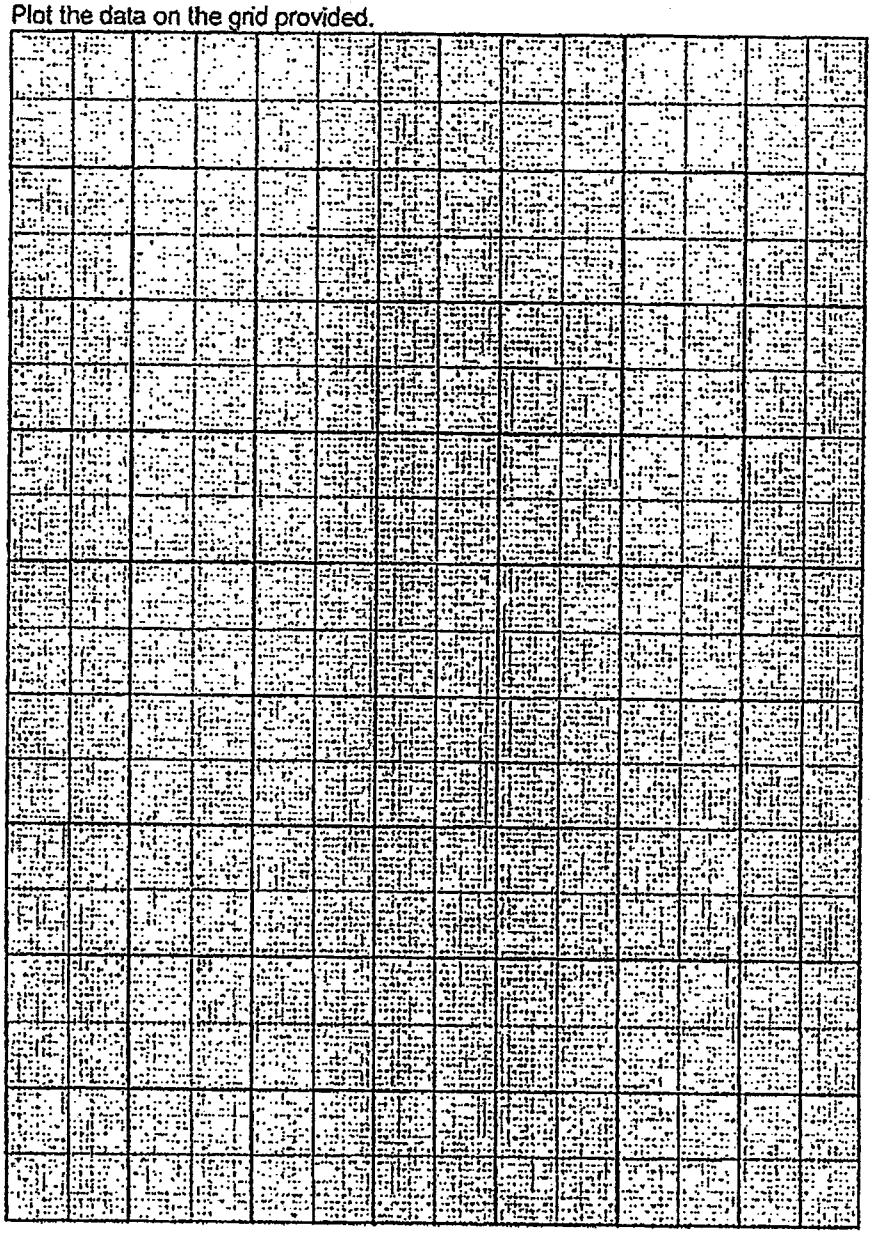
The table shows the results of the investigation.



Distance between lamp and plant (cm)	0	10	20	30	40	50	60
Production of gas (number of bubbles collected per minute)	30	29	27	22	18	13	7

a) State the word equation for photosynthesis. [1]

b) Plot the data on the grid provided. [3]



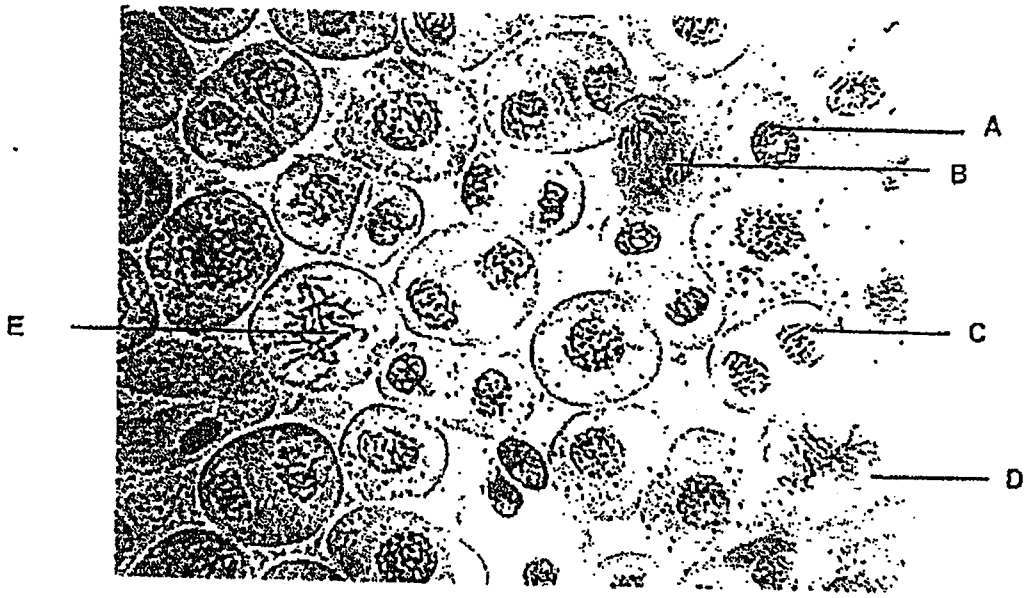
c) Describe and explain the trend in the graph obtained. [3]

d) Sketch an additional graph on the same grid to show the expected results if tap water containing hydrogencarbonate was used instead. [1]

e) State one possible source of error in this experiment. [1]

[Total: 9]

9. The photomicrograph below shows onion root cells in different stages of the cell cycle.



a) Complete the table below. Identify the stages in the cell cycle of cells A to E. Describe one characteristic feature shown that enabled you to identify each stage. [5]

Cell	Name of stage	Description of features
A		
B		
C		
D		Chromosomes align at the middle of cell/equator
E		

b) (i) Define the terms *haploid and diploid.* [2]

(ii) State and describe one difference between prophase in mitosis and prophase I in meiosis. [2]

(iii) Explain why gametes have to be haploid. [2]

[Total: 11]

10 EITHER

Human blood consisting of blood cells, platelets and plasma is kept in circulation mainly by the pumping action of the heart.

a) (i) Describe how blood flows through the circulatory system, starting from the blood vessels in the lungs until it reaches the kidneys. [4]

(ii) Describe the part played by white blood cells in defending the body against diseases. [2]

b) When transfusions are given, choice of blood type is crucial. For instance, if a patient of blood type A requires a blood transfusion, blood type AB is not suitable for the transfusion but blood type O is. Explain why. [4]

[Total: 10]

10 OR

a) A student consumed a high-protein shake diluted with 600 cm^3 of water over half an hour on a cool day.

Describe how the balance of water in her body is achieved, after consuming the shake. [6]

b) Describe how amino acids in the protein shake are assimilated in the body. [4]

[Total: 10]

END OF PAPER

MS

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

☺ END ☺

1ai) K+ enter cell sap via active transport against concentration gradient (AW from region of lower concentration to region of higher concentration);
This is because the concentration of potassium ions in the cell sap, 3 mol/dm3, is greater than the concentration of potassium ions in the culture solution by 10X (AW);
aii) 6.5 mol / dm^3
bi) The direction of flow of oxygen in the water is opposite to that of its flow in the fish's blood;
bii) The concentration of the oxygen in the water is always higher in the water which ensures that a diffusion gradient is constantly maintained/ensured (OWTTE) between the water and the fish's blood;

2ai) Broken up into small droplets/emulsified by bile;
Lower the surface tension and reduce their attractive forces between the fat molecules;
aii) Natural fats will would be converted to glycerol and fatty acids by lipases.
bi) Fats in food not fully digested/partially digested;
as not enough lipases secreted by pancreas thus stools ended up more oily.
bii) Pancreas secrete lower levels of insulin;
and thus insulin is unable to stimulate liver cells to convert excess glucose to glycogen resulting in diabetes.

3ai) Oxygen cannot be delivered to the muscles fast enough and muscle cells respire anaerobically producing lactic acid;
which accumulates and diffuses into blood stream ;
aii) Oxygen is required to oxidise/break down lactic acid is shown by the shaded region;
bi) Lumen of bronchus is narrowed / smaller air space;
Air flow to the lungs is reduced (OWTTE) and the patient has to breathe harder/difficulty breathing/gasping for air/wheeze
bii) Partition walls between the alveoli break down due to persistent , violent coughing;
Thus decrease surface area for gaseous exchange;

4a
A – Transcription
B – Translation
b) UUAGUUCCAUCGUACGCGGUAAU
c) DNA does not exit / remains in the nucleus / too large to exit the nucleus during process A.
di) Percentage of A approximates percentage of T or
Percentage of C approximates percentage of G
dii) Any 1:
The A : T and C:G ratio (or complementary base pairing rule) is conserved (OWTTE) among species
The C+T and A+G percentages are always 50%;
Percentage of A & T greater than C & G;
Genetic code is universal;
diii) The virus is a single-stranded DNA virus as
A does not bind to T OR
C does not bind to G OR

Ratio of A and T/C and G is not the same.
Not a double Helix

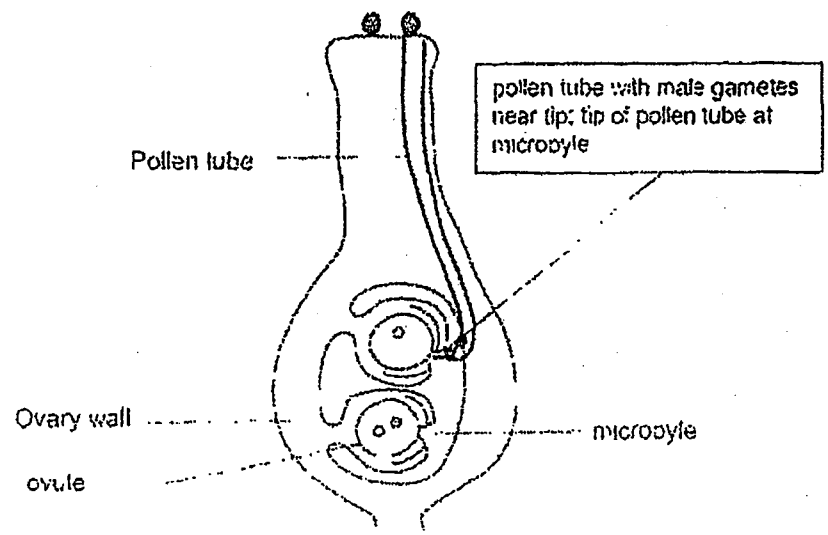
5ai) Gene are hereditary factors /unit of inheritance found on a particular locus in a chromosome that controls a particular characteristics;
Alleles are alternate/different forms of a gene that occupy the same relative positions/locus on a pair of homologous chromosomes;
aii) Phenotype refers to the expressed trait in an organism/outward appearance of an organism;
Genotype is the genetic makeup of an organism/combination of alleles in an organism;
b)

Parental Phenotype	Thorny	x	Smooth
Parental Genotype	Tt		tt

Gametes	T	t	t	t
Random Fertilisation				
F_1 genotype	Tt	Tt	tt	tt
F_1 phenotype	Thorny	Thorny	Smooth	Smooth

Phenotypic ratio Thorny: Smooth = 1:1

6ai) Leaf A remains firm while leaf B has wilted;
Leaf B loses water faster than can be replenished (AW: rate of transpiration faster than rate of water uptake);
Flow of water along xylem from stem to leaf (B) is disrupted since tissue was removed;
Any one of 2
aii) Swelling above the girdled region;
sugars (/ photosynthates) made during photosynthesis unable to move down as the phloem tissue has been removed;
bi and ii)



biii) It will degenerate.

7ai) (10 000 000 - 1000 000)/ 10 000 000 x 100 = 90%
aii) Yes. In an ecosystem, energy flow is non-cyclic/linear;
About 10% of energy is passed down to the next trophic level, thus, resources are sufficient for each trophic level/sustain the next level and biological balance is achieved.
bi) Atmospheric carbon dioxide is absorbed by the plants and use in photosynthesis;
Large amount of carbon compounds are stored in trees, and when trees die, their remains form coal which are fossil fuels; OR store carbon for an indefinite amount of time;
Store more carbon than they release;
bii) Eutrophication leads to excessive algae bloom (OWTTE) at the nearby rivers;
Overcrowding of algae prevent sunlight from reaching the submerged aquatic plants (OWTTE) and these submerged plants die;
Bacteria feed on decaying organic matter, which compete with fishes for oxygen (OWTTE), resulting in fishes dying due to lack of oxygen ;oxygen;

8a) Carbon dioxide + water -> oxygen + glucose, in the presence of chlorophyll and light
b) Refer to graph behind
c) Increasing vol of oxygen produced with decreasing distance;
Increasing the distance decreases the light intensity. With lower light intensisty, the rate of photosynthesis is lower and less oxygen is produced;
Light intensity is inversely proportional to distance (i.e relationship is not linear)
Volume of oxygen collected levels off when light intensity is no longer a limiting factor; when distance is 4cm or less;
(Any 3)
d) Steeper curve with higher max rate of oxygen produced.
e) As the lamp is placed nearer, the temperature is higher – can affect enzyme reactions.
The size of bubble varies;
Unable to determine if the bubble is made up of pure O2.
Some of the gas / bubbles dissolved in the water;
Some bubbles may be hidden and thus not counted;

9a)
A: Interphase; No distinct chromosomes
B: Anaphase; Chromosomes attached to spindle / sister chromatids pulled towards opposite poles
C: Telophase; 2 distinct nuclei in one cell membrane
D: Metaphase
E: Prophase; DNA (coil and shorten) / condenses into chromosomes or, nuclear membrane not visible / disintegrated
bi) 1m – diploid (the state of having two copies of each chromosome)
1m – haploid (the state of having one copy of each chromosome, or having a single set of chromosomes, e.g. gametes (egg and sperm cells) are haploid.)
ii) Pairing of homologous chromosomes occurs in prophase I in meiosis but not prophase in mitosis;
or

Crossing over between homologous chromosomes occurs in prophase I in meiosis but not prophase in mitosis;
Exchange of genetic material between non-sister chromatids of homologous chromosomes (to give new combinations of genes / genetic variation);
iii) 2 haploid gametes will fuse during fertilisation, to form a diploid zygote;
Number of chromosomes in the species is conserved;

10 Either
ai) Capillaries in lungs → pulmonary veins → left atrium;
left atrium contracts → blood emptied into left ventricle;
left ventricle contracts → blood pumped out into aorta; →
renal artery; Back flow prevented by action of valves; [max. 4]
ii) The phagocyte enters the site of injury, ingest and engulf foreign body/bacteria;
The lymphocytes produce antibodies that bind to bacteria, clumping the bacteria, or destroying the bacteria
b) Plasma of patient of blood type A contains anti-B antibodies;
Anti-B antibodies will bind to antigen B in type AB blood;
Agglutination/Clumping of red blood cells occurs;
Blood group O has no antigens and so will not clump with patient's anti-B antibodies;
Note: student should express the meaning of agglutination correctly.
Correct notation for antigens and antibodies should be given.

10 Or
a) Water potential of blood plasma increases;
Detected by the hypothalamus;
Stimulates the pituitary gland to secrete less ADH;
Less water is reabsorbed from the kidney tubules into the bloodstream;
Resulting in a high volume of dilute urine;
Water potential of blood plasma returns to the norm;
This is a form of negative feedback as there is a corrective mechanism to restore the norm;
b) Amino acids are utilized for growth and building of protoplasm/synthesis of enzymes/hormones / antibodies (any 2 or any other specific examples);
Excess amino acids are deaminated to form urea;
In the liver;
Reject growth and repair