Preliminary Examination (2016)
Secondary 4 Express/ 5 Normal Academic

Candidate			
	Name	**Register No**	**Class**

Biology (SPA)
5158/01

Date: 29 August 2016

Duration: 1 hour

READ THESE INSTRUCTIONS FIRST

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

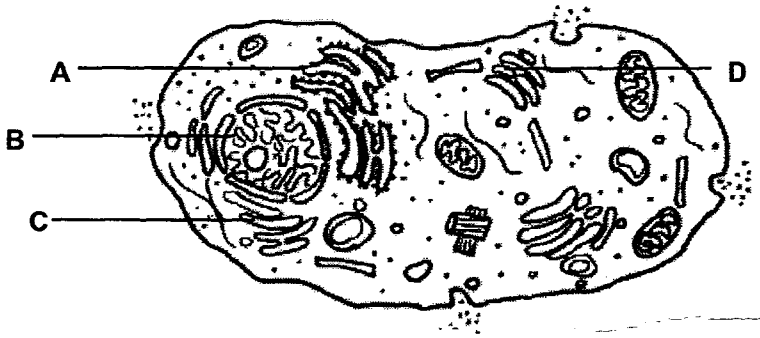
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the one you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 booklet.

Setter :
This paper consists of 11 printed pages, INCLUDING the cover page.

1. The figure below shows a generalized animal cell.

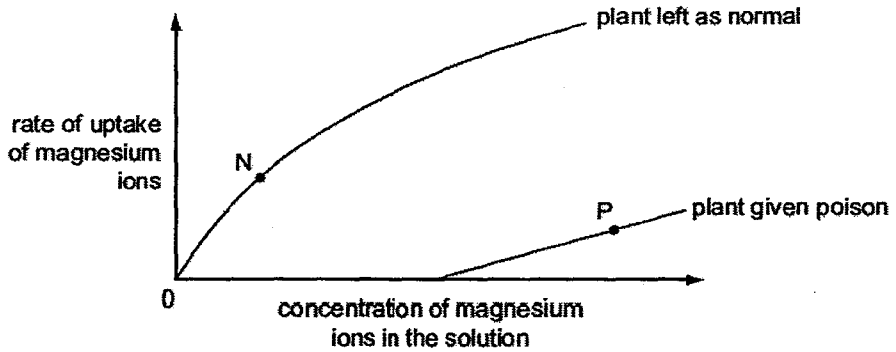


Which structure is involved in the modification and packaging of proteins?

2. The nucleus of a unicellular organism e.g. Amoeba was removed carefully in a laboratory. The cell survived and was watched carefully for a few days. Which one of the following activities of the organism will cease due to the nucleus being removed?

A Locomotion
B Ingestion
C Excretion
D Asexual reproduction

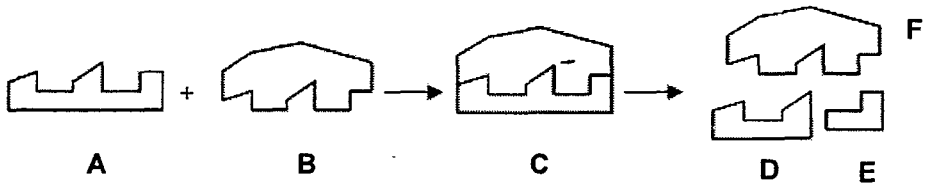
3. An experiment measured the rate at which plants take up magnesium ions from solution. One plant was given a poison that stops respiration. Another plant was left as normal. The graph below shows the result.



How are the magnesium ions being absorbed by the plants at points **N** and **P**?

	Point **N**	Point **P**
A	Active transport	Active transport
B	Active transport	Diffusion
C	Diffusion	Active transport
D	Diffusion	Diffusion

4. Study the chain of reaction represented by the diagram below.



Which of the following statements are true as represented in the diagram?

(1) It is an anabolic reaction.
(2) **A** and **B** are sensitive to temperature and pH.
(3) **C** is the product.
(4) **D** and **E** may not be formed all the time in this reaction.
(5) **F** is the enzyme-substrate complex.

A (1) and (2)
B (2), (3) and (5)
C (1), (2) and (4)
D None of the above.

5. Which one of the following most correctly describes the denaturation of an enzyme?

A Bursting of the cell containing the enzyme.
B A change in the 3-dimensional structure of the enzyme.
C A decrease in the kinetic energy of the enzyme molecule.
D A change in the type of substrate that the enzyme works on.

6. Which of the following is **not** a function of liver?

A Formation of urea.
B Regulation of blood glucose level.
C Regulation of amount of amino acids in blood.
D Formation of red blood cells.

7. A fresh piece of potato is smashed and some of its extract is added to a starch solution. After 20 minutes, Benedict's test on the mixture revealed a brick-red precipitate. Which of the following is/are necessary if we were to conclude that the extract contains an enzyme that had digested the starch?

(1) The extract has to be tested with Benedict's solution.
(2) The same test is repeated using saliva instead of fresh potato extract.
(3) The extract is boiled and then added to the starch solution in a separate investigation.

A (2) only
B (3) only
C (2) and (3) only
D (1) and (3) only

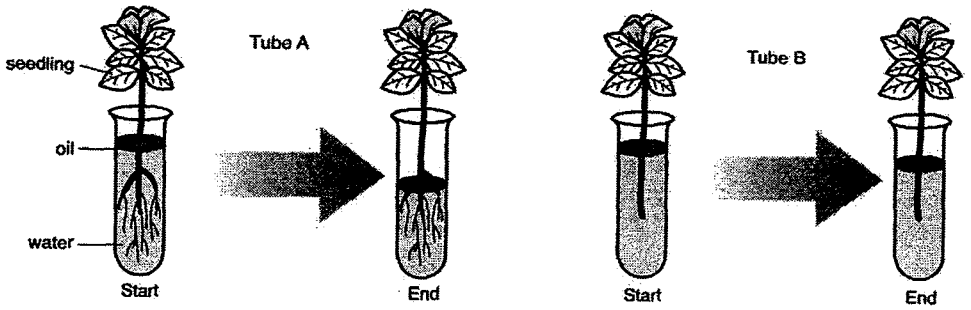
8. Gall stones can block bile duct, stopping bile from leaving the gall bladder. Bile pigments escape into the bloodstream, causing jaundice which is a condition that results in yellowing of the skin.
Which of the following observation would be **least** expected in patients with jaundice?

A Fat digestion stops.
B Bile is excreted in urine, colouring it instead of faeces.
C Faecal matter becomes oily and pale in colour.
D Fat digestion and absorption rates are slowed down.

9. In the light dependent stage of photosynthesis, light is required to .....

A split water molecules
B denature chlorophyll
C reduce carbon to sucrose
D absorb water from soil

10. What is the reason for the difference observed?



A A plant cannot absorb water if it does not have any roots.
B The rate of water absorption by a plant is directly proportional to the surface area available.
C When the roots are removed, a plant needs to absorb less water.
D The rate of mineral absorption by a plant is dependent only on the concentration gradient.

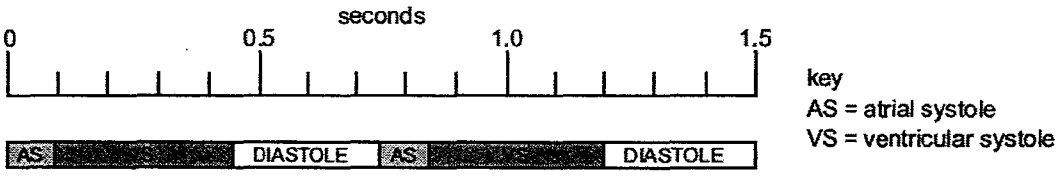
11. Which of the following molecule is **not** found in blood?

A Fibrinogen
B Platelets
C Glycogen
D Thyroxin

12. Which of the following is correct in the reaction catalyzed by carbonic anhydrase?

	Location	Reactant	Product
A	Red blood cell	$H_2O + CO_2$	H_2CO_3
B	Plasma	$H_2O + CO_2$	H_2CO_3
C	Plasma	H_2CO_3	$H_2O + CO_2$
D	Alveolar cell	H_2CO_3	$H_2O + CO_2$

13. The diagram shows two cardiac cycles of a student, with the sequence of events set against a time scale.



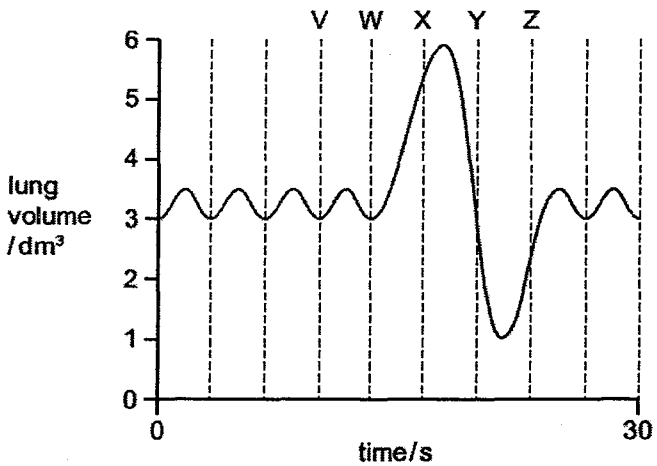
How many times per minute is the student's heart beating?

A 72 **B** 75
C 80 **D** 90

14. What does respiration in living organisms always involve?

A Carbon dioxide production **B** Gaseous exchange
C Energy release **D** Oxygen consumption

15. The graph shows changes in the amount of air in a person's lungs over a period of 30 seconds.



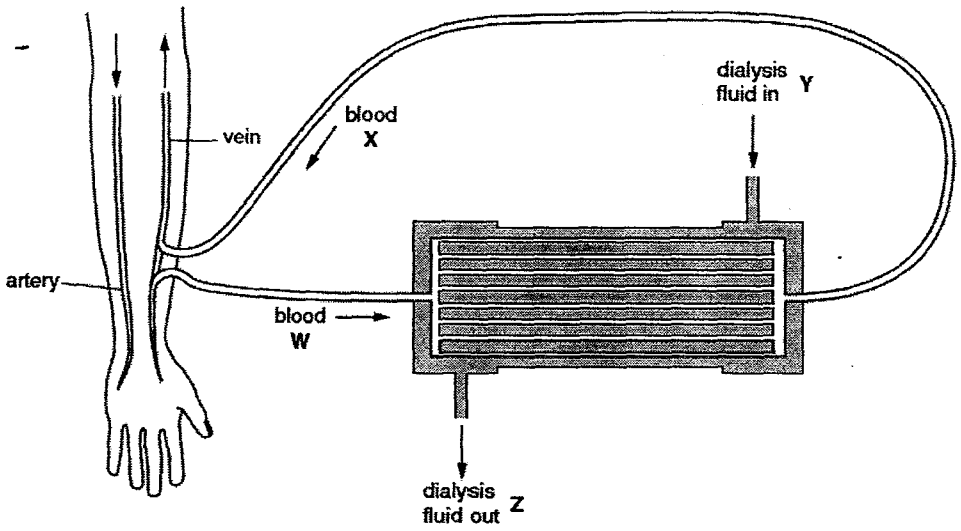
Between which time periods is the rate of breathing fastest?

A Y to Z **B** W to X
C V to W **D** X to Y

16. Normally, concentrations of proteins (of large molecular size) are high in plasma .....

A and the glomerular filtrate but absent in urine.
B and usually absent in glomerular filtrate and urine.
C the glomerular filtrate and the urine.
D absent in glomerular filtrate but present in urine.

17. The diagram shows the flow of blood and dialysis fluid through a kidney machine.



Where would the concentration of urea be the highest?

A W and X
B X and Y
C Y and Z
D W and Z

18. Which of the following fluids must be kept in a state of homeostasis?

(1) Blood plasma
(2) Tissue fluid
(3) Urine
(4) Seminal fluid

A (1) and (2)
B (2) and (4)
C (1) and (3)
D (1), (2) and (4)

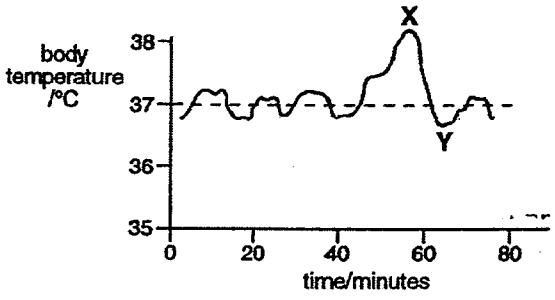
19. Four processes that take place in the human body are listed below.

(1) Absorption of amino acids through the villi
(2) Maintenance of constant body temperature
(3) Production of lactic acid in muscles
(4) Regulation of blood glucose concentration

Which two processes are directly controlled by negative feedback?

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

20. The graph shows the change in a person's body temperature plotted against time.



What causes the change in temperature between **X** and **Y**?

A Increased air temperature
B Increased evaporation of sweat
C Reduced blood flow through surface capillaries
D Shivering

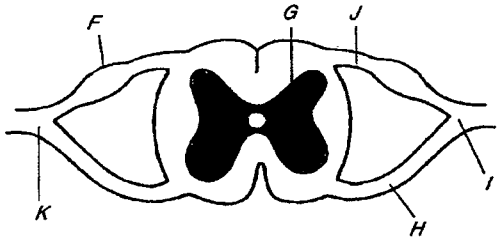
21. Which of the following structure is **not** part of a neuron?

A Neurilemma **B** Synapse
C Axon **D** Dendrites

22. Which of the following statements about mammalian skin receptors is incorrect?

A All skin receptors are connected to sensory neurons.
B Nervous impulses from these receptors may trigger reflex actions via motor neurons before reaching the brain.
C All skin receptors are connected directly to motor neurons which carry the information to the brain.
D The centres of feeling, which interpret the impulses from these receptors, are all in the brain.

23. The diagram below which shows the transverse section of the spinal cord.



In which regions are the cell bodies of **(I)** receptor **(II)** relay and **(III)** effector neurones found?

	(I)	(II)	(III)
A	G	G	G
B	F	G	H
C	H	G	F
D	F	G	G

24. Hormones can be made from the following molecules except .....

A Proteins
B Peptones
C Nucleic acids
D Steroids

25. Which of the following statements about visual purple is correct?

(1) It is sensitive to the perception of the colour, purple.
(2) It is concentrated in the photoreceptors present in the fovea.
(3) It is responsible for vision in dim light.
(4) Its deficiency is a cause of colour blindness.

A (1) and (3)
B (2) and (3)
C (1) and (4)
D None of the above.

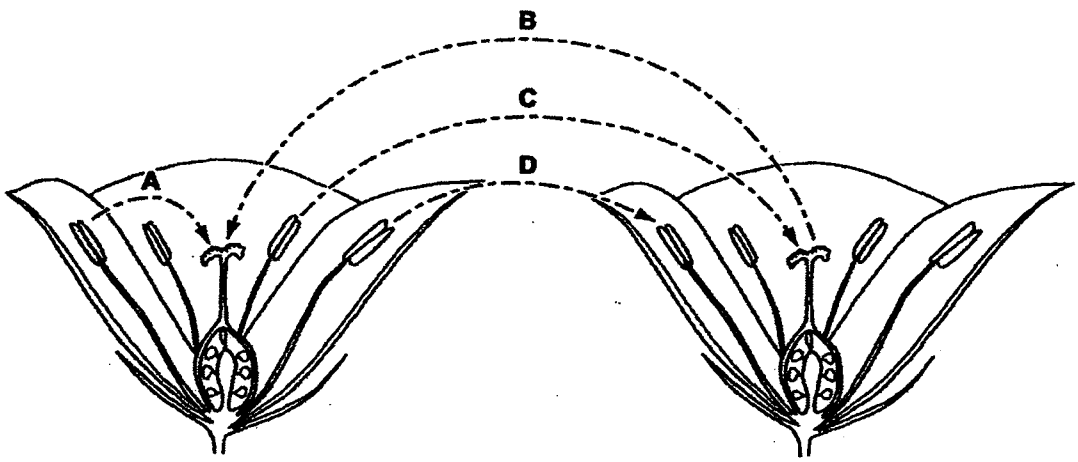
26. Which structures cover the pupil of a human eye?

A Conjunctiva and Cornea
B Cornea and Retina
C Conjunctiva and Sclera
D Retina and Sclera

27. Which statement is true of asexual reproduction in plants?

A Insects are needed to transfer pollen.
B New plants grow from seeds.
C Offspring are genetically identical to their parents.
D Two types of gametes are involved.

28. The diagram below shows two flowers of the same species.



Which letter represents cross-pollination?

29. The fertile period of a woman is said to be three days before and three days after ovulation.This is because .....

A the uterus lining is the thickest during that time.
B it takes three days for the sperm to fertilise an egg.
C it takes about 3 days for sperms to travel up the vagina into the uterus to the fallopian tube.
D a living male or female gamete may be present in the fallopian tube up to 72 hours for fertilisation to occur.

30. How do condoms reduce the risk of HIV infection?

A They prevent the formation of seminal fluid.
B They prevent virus particles crossing the placenta.
C They prevent sperm from entering the vagina.
D They prevent seminal fluid from coming into contact with the vagina wall.

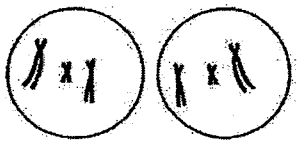
31. Which one of the following events of cell division is very different in animal and plant cells?

A Prophase **B** Metaphase
C Anaphase **D** Cytokinesis

32. The diagram below shows chromosomes in a cell nucleus.

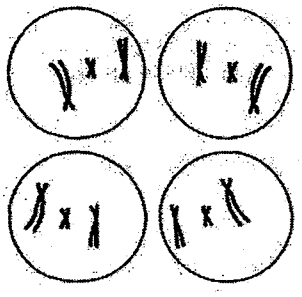
Which of the following shows the stage at the end of Meiosis I?

A

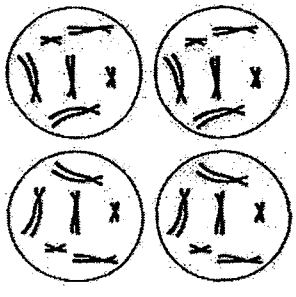


B

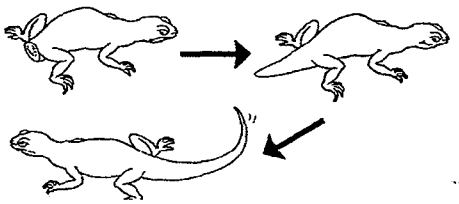
C



D



33. The figure below shows a lizard in various stages of regeneration of its tail. Which cellular process is directly responsible for this regeneration?



A Meiosis
B Mitosis
C Transpiration
D Respiration

34. Which one of the following listed below is an example of codominance in genetic traits?

A A tall pea plant and a short pea plant produce a tall pea plant.
B A cream coloured cat and a black cat produce a cream-and-black kitten.
C A blue-eyed man and a brown-eyed woman produce a blue-eyed child.
D A colour-blind woman and a man with normal vision produce a colour-blind son.

35. A mutation occurs in the petals of a certain flowering plant. The mutation .....

A can be passed on if it occurs before pollination.
B can be passed on if it occurs in the maternal plant.
C can be passed on if it occurs before fertilisation.
D cannot be passed on.

36. Genetic information for a chicken breed is shown below.

Genotype	Phenotype
FF	Normal fowl (normal feathers)
Ff	Frizzle fowl (curly feathers)
ff	Feather Shedder fowl (Loses feathers easily)

Which one of the following crosses will produce only chickens with curly feathers?

A Normal x Frizzle
B Frizzle x Frizzle
C Normal x Feather Shedder
D Feather Shedder x Feather Shedder

37. For the DNA strand 5'-TACGA-3' the correct complementary DNA strand is .....

A 3' – ATGCT – 5'
B 3' – AUGCU – 5'
C 3' – TATAC – 5'
D 3' – TACGA – 5'

38. A farmer saves the best seeds from his maize crop to sow for next year's crop. Which of the following best describes this practice?

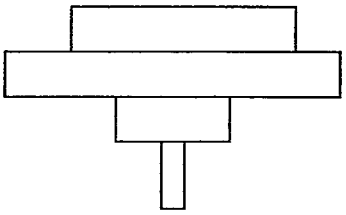
A Artificial selection
B Genetic engineering
C Continuous Variation
D Natural selection

39. Study the food chain below.

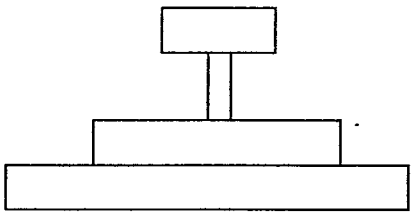
tree ⟶ aphid ⟶ insectivorous bird ⟶ bird of prey

Which of the following correctly represents the pyramid of biomass for the food chain?

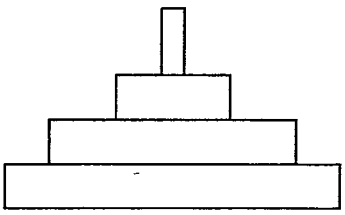
A



B



C



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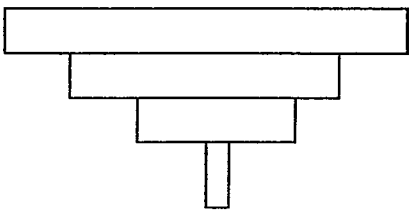


40. The table shows the bacterial count, oxygen level, and numbers of green plants and of fish, in rivers flowing through five towns.

Town	Bacterial count	Oxygen level	Green plants	Fish
A	High	High	Few	Few
B	High	High	Few	Many
C	High	Low	Few	Few
D	Low	Low	Many	Few

Which town has the most polluted river?

The End

Preliminary Examination (2016)
Secondary 4 Express/ 5 Normal Academic

Candidate			
	Name	**Register No**	**Class**

Biology (SPA) **Date: 25 August 2016**
5158/02

Duration: 1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

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

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

Section B
Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.
Write an E (for Either) or an O (for Or) next to number 8 in the grid below to indicate which question you have answered.

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

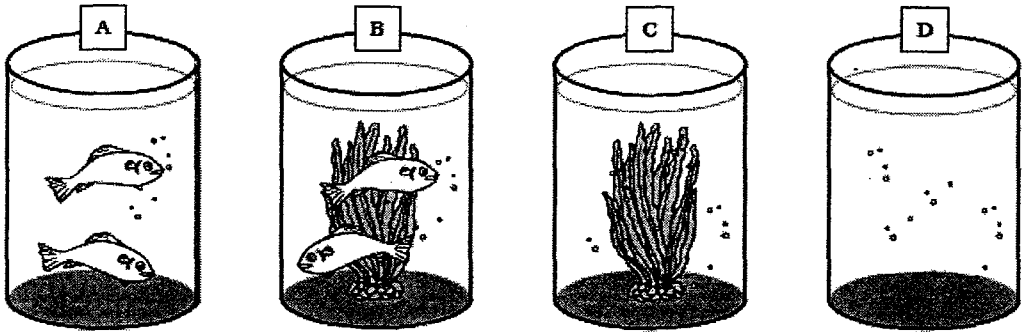
For Examiner's Use			
Section A			
Section B			
6			
7			
8			
Total			

Setter:
This paper consists of 11 printed pages, INCLUDING the cover page.

Section A (50 marks)

Answer **all** questions.
Write your answers in the spaces provided.

1. **(a)** Four containers were set up as shown in the diagram below. All four containers were exposed to light for 48-hour period.



(i) State which container would have the highest concentration of carbon dioxide. [1]

.....

(ii) Explain why. [2]

.....

.....

(iii) Explain why container **B** would show a negligible increase in carbon dioxide concentration. [2]

.....

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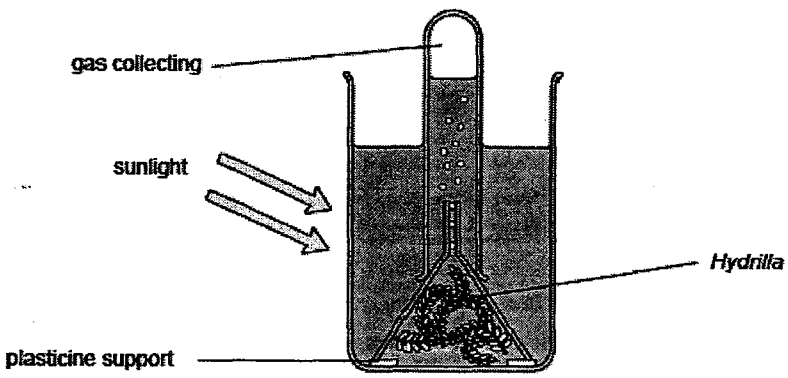
(b) The set up below is to demonstrate photosynthesis in a water plant.



(i) Explain why a small amount of sodium bicarbonate must first be dissolved in water of the set up? [1]

.....

(ii) Suggest a factor, other than light intensity, to be changed to increase the rate of effervescence observed. Explain why. [4]

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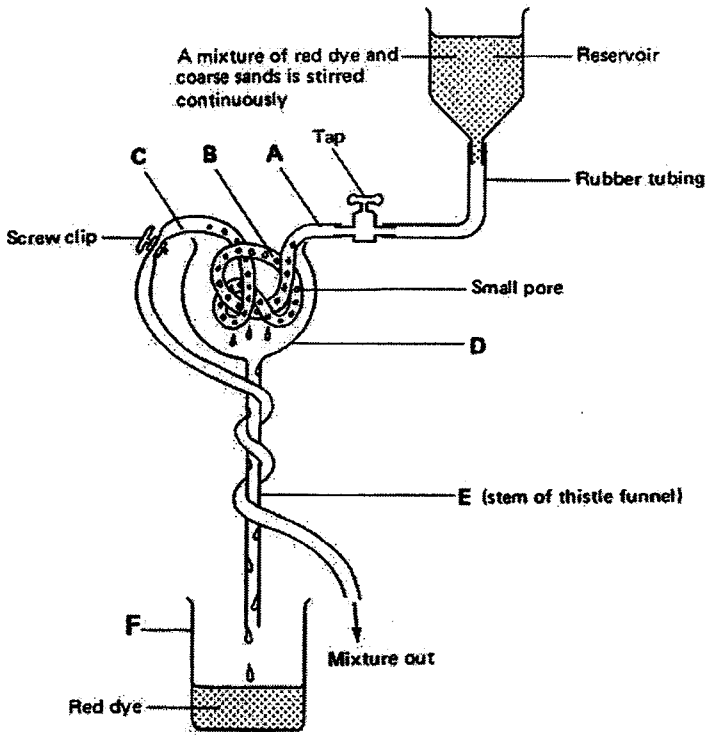
2. The diagram shows the model of a nephron to demonstrate its functioning in the production of urine in human.



(a) Name the structures **A** and **D** respectively. [2]

A ..... **D** .....

(b) The experiment starts by turning on the tap and tightening the screw clip. Explain the significance of the action with regard to functioning of the glomerulus. [2]

.....

.....

(c) (i) Explain why only red dye is collected in the beaker at the end of the experiment. [1]

.....

(ii) Suggest **two** substances found in the mammalian body that are represented as the coarse sands in the mixture. [2]

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(d) Name the other process that is **not demonstrated** in the above diagram. Explain its significance in the production of urine. [3]

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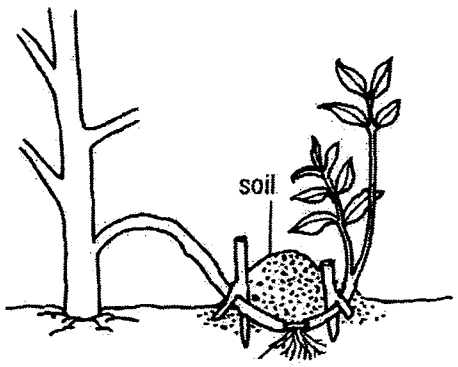
3. The diagram below shows a type of reproduction in plant.



X

(a) State the type of reproduction shown above. [1]

.....

(b) Describe **three** advantages of the type of reproduction named in **(i)**. [3]

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(c) Explain why it is necessary to remove a ring of bark at **X**. [3]

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(d) (i) Indicate with a line, on the above diagram, to show where a cut should be made to obtain a new plant. [1]

(ii) Suggest and explain when the cut should be made. [2]

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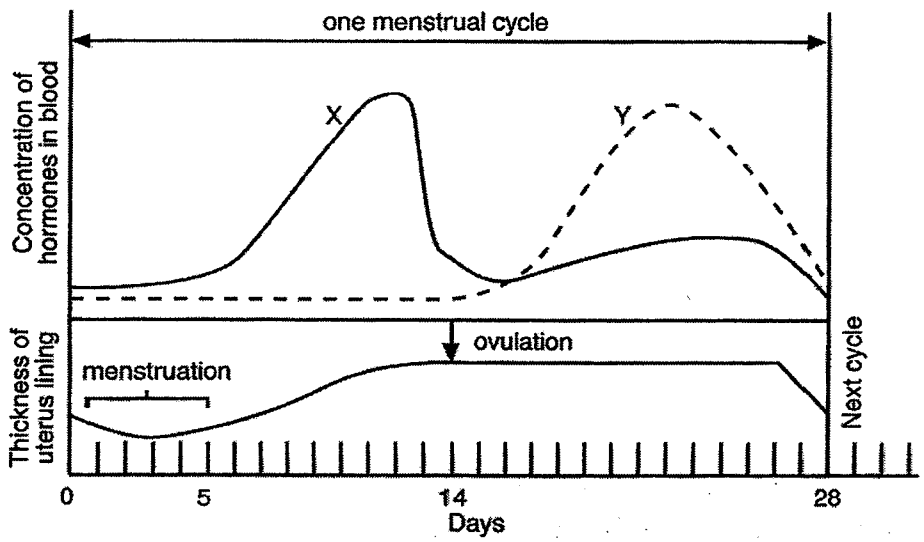
4. The graphs below show the main events that occur during a menstrual cycle.



(a) Identify hormone **X** and **Y** respectively. [2]

X ..... **Y** .....

(b) State the source of hormone **Y**. [1]

.....

(c) Describe **two** effects of **X** on the uterus lining. [2]

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(d) Explain what happens when concentration of hormone **Y** drops. [2]

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(e) Discuss **three** measures that have been implemented to reduce risk of sexually transmitted infections (STIs). [3]

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5. Tomato plants produce fruits of two different shapes, spherical and pear-shaped. The shape of the fruit is controlled by a pair of alleles. In a study, two separate crosses were performed and the results are shown below.

Cross	Parent Plants	No of daughter plants	
		Pear-shaped	Spherical-shaped
A	Pear-shaped X Spherical-shaped	48	42
B	Pear-shaped X Spherical-shaped	0	84

(a) State the fruit shape that is controlled by the dominant allele. Provide a reason for your answer. [2]

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.....

(b) State the genotype of the parent plant with spherical fruits in cross **B**. [1]

.....

(c) The parent plant with spherical-shaped fruits in cross **A** is self-crossed. Use a genetic diagram to represent the crossing. [4]

(d) (i) Define gene mutation. [2]

.....

.....

(ii) Give an example of a mutagen that can cause the production of new phenotypes in the tomata plants. [1]

.....

End of Section A

Section B (30 marks)
Answer **three** questions.

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

6. The table below shows the blood glucose level of a healthy person and a person suffering from diabetes mellitus after eating a meal containing bread (at 0 min).

Time/min	Blood glucose concentration/ mg per dm^3	
	Person A	Person B
0	130	85
30	135	90
60	220	120
90	215	115
120	212	100
150	195	86
180	185	88
210	175	90
240	170	90

(a) Plot two different graphs on the same piece of graph paper provided. [4]

(b) Given that the normal range of blood glucose level is between 70 and 120 mg/dm^3, identify the person who has *Diabetes mellitus*. [1]

.....

(c) Account for the delay between eating the meal and the rise in blood glucose level. [2]

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(d) Describe and explain the differences between graphs of person **A** and **B**. [3]

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7. **(a)** Explain how the following structures are related to their function in photosynthesis.

(i) Palisade mesophyll cells [2]

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(ii) Spongy mesophyll cells [2]

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.....

(iii) Guard cells [2]

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(b) Explain the importance of carbon cycle to living organisms. [4]

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8. EITHER

(a) Suggest why human insulin produced by genetically modified bacteria is useful in medicine. [4]

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(b) List the differences between artificial selection and natural selection. [4]

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(c) Explain Darwin's theory of natural selection. [2]

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8. OR

(a) Explain what is meant by the following terms.

(i) allele; [2]

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.....

(ii) homologous chromosome; [2]

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(iii) recombinant plasmid. [2]

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(b) Describe **four** ways how DNA replication is different from transcription. [4]

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End of Section B

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

Preliminary Examination (2016)
Secondary 4 Express/ 5 Normal Academic

Candidate			
	Name	**Register No**	**Class**

Biology (SPA) **Date: 25 August 2016**
5158/02

Duration: 1 hour 45 minutes

READ THESE INSTRUCTIONS FIRST

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

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

Section B
Answer **all** questions.
Write your answers in the spaces provided in the Question Paper.
Write an E (for Either) or an O (for Or) next to number 8 in the grid below to indicate which question you have answered.

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

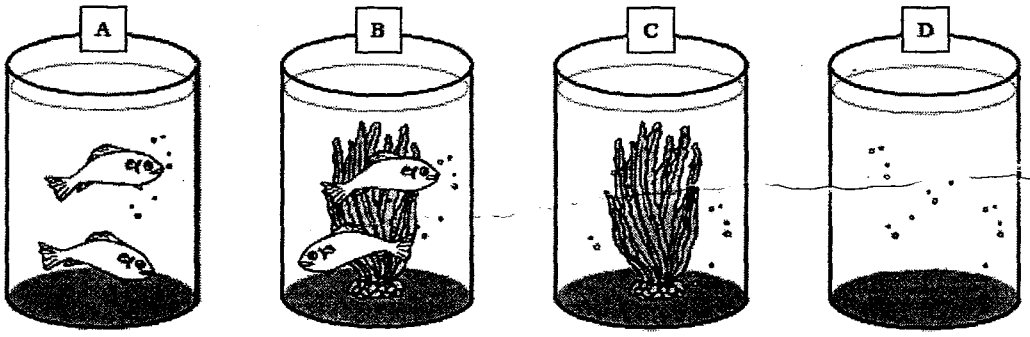
For Examiner's Use			
Section A			
Section B			
6			
7			
8E	**O**		
Total			

Setter:
This paper consists of 11 printed pages, INCLUDING the cover page.

Section A (50 marks)

Answer **all** questions.
Write your answers in the spaces provided.

1. **(a)** Four containers were set up as shown in the diagram below. All four containers were exposed to light for 48-hour period.



(i) State which container would have the highest concentration of carbon dioxide. [1]

- Container A

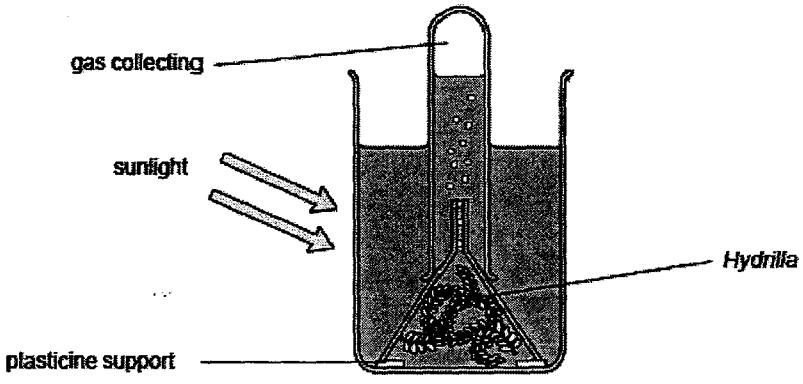
(ii) Explain why. [2]

- There is no plant to absorb the dissolved carbon dioxide during photosynthesis.
- Fishes respire which releases carbon dioxide.

(iii) Explain why container **B** would show a negligible increase in carbon dioxide concentration. [2]

- Carbon dioxide released by fishes during respiration + Used by plants undergoing photosynthesis.
- No net change in carbon dioxide concentration.

(b) The set up below is to demonstrate photosynthesis in a water plant.



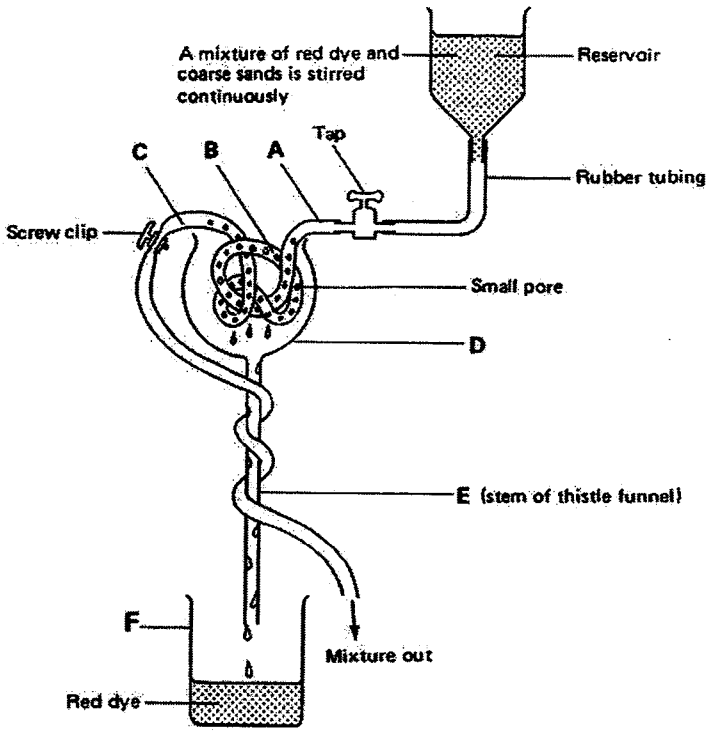
(i) Explain why a small amount of sodium bicarbonate must first be dissolved in water of the set up? [1]

- To provide the source of dissolved carbon dioxide

(ii) Suggest a factor, other than light intensity, to be changed to increase the rate of effervescence observed. Explain why. [4]

- Factor: Temperature
- Photosynthesis is an enzyme-controlled reaction.
- Increase in temperature leads to increase in enzyme activity which leads to increase rate of photosynthesis.
- Increase in number of bubbles containing oxygen observed.

2. The diagram shows the model of a nephron to demonstrate its functioning in the production of urine in human.



(a) Name the structures **A** and **D** respectively. [2]

- **A** afferent arteriole
- **D** Bowman's capsule

(b) The experiment starts by turning on the tap and tightening the screw clip. Explain the significance of the action with regard to functioning of the glomerulus. [2]

- Screw cap is tightened to signify the high hydrostatic pressure which develops since diameter of efferent arteriole is smaller than afferent arteriole.

- Ultrafiltration takes place within glomerulus.

(c) (i) Explain why only red dye is collected in the beaker at the end of the experiment. [1]

- Red dye molecules dissolved in water are small enough to pass through the small pores of the glomerulus.

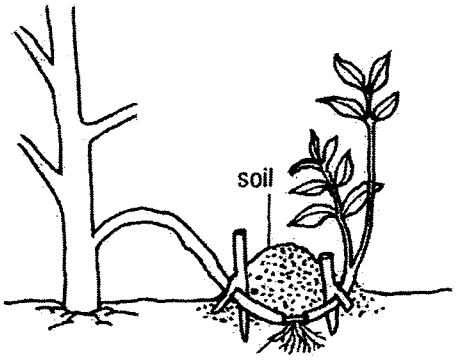
(ii) Suggest **two** substances found in the mammalian body that are represented as the coarse sands in the mixture. [2]

- Red blood cells/White blood cells
- Plasma proteins

(d) Name the other process that is **not demonstrated** in the above diagram. Explain its significance in the production of urine. [3]

- Selective reabsorption
- Useful materials like salts and glucose are absorbed by diffusion and active transport from filtrate into blood
- Excess salts, nitrogenous waste and excess water are collected as urine.

3. The diagram below shows a type of reproduction in plant.



X

(a) State the type of reproduction shown above. [1]

- Vegetative propagation OR Asexual reproduction

(b) Describe **three** advantages of the type of reproduction named in **(i)**. [3]

- Only one parent is required.
- Offspring are genetically identical to parent plant.
- Shorter period of time to reproduce.
- Not dependent on pollinators for reproduction. ***Any three***

(c) Explain why it is necessary to remove a ring of bark at **X**. [3]

- Remove the phloem tissue at X.
- Food produced by the leaves accumulate around the cut.
- Source of nutrients and energy to stimulate root development.

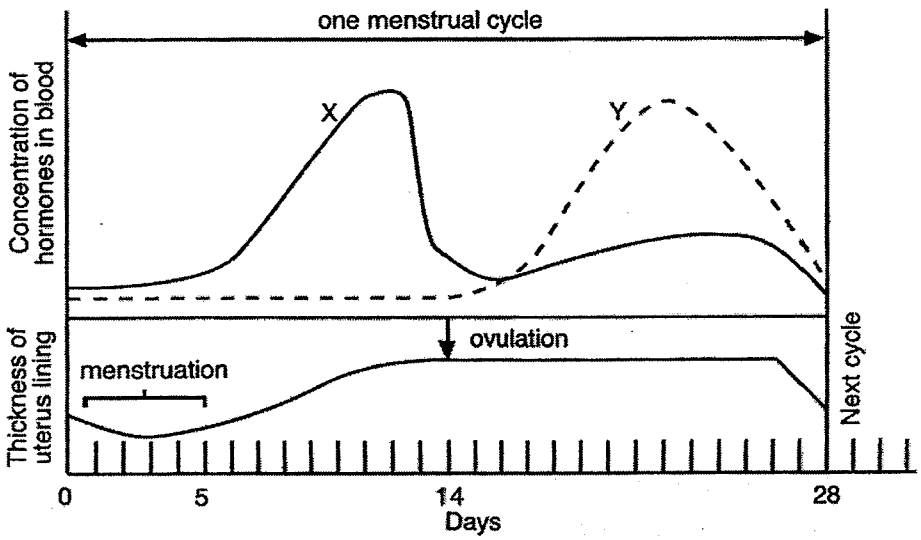
(d) (i) Indicate with a line, on the above diagram, to show where a cut should be made to obtain a new plant. [1]

Refer to diagram above.

(ii) Suggest and explain when the cut should be made. [2]

- Roots have grown from the exposed portion.
- New plant can obtain its own supply of water and mineral salts from soil.

4. The graphs below show the main events that occur during a menstrual cycle.



(a) Identify hormone **X** and **Y** respectively. [2]

- **X** Oestrogen
- **Y** Progesterone

(b) State the source of hormone **Y**. [1]

- Corpus luteum

(c) Describe **two** effects of **X** on the uterus lining. [2]

- Repairs the uterus lining
- Develops blood vessels

(d) Explain what happens when concentration of hormone **Y** drops. [2]

- Menstruation starts.
- Pituitary gland is stimulated to secrete FSH for development of follicles and a new egg.

(e) Discuss **three** measures that have been implemented to reduce risk of sexually transmitted infections (STIs). [3]

- Discourage promiscuous behaviour.
- Have one sexual partner.
- Use condom during sexual intercourse.
- Attend regular check-ups if one is sexually active.

**Any three. Accept any reasonable answers.*

5. Tomato plants produce fruits of two different shapes, spherical and pear-shaped. The shape of the fruit is controlled by a pair of alleles. In a study, two separate crosses were performed and the results are shown below.

Cross	Parent Plants	No of daughter plants	
		Pear-shaped	Spherical-shaped
A	Pear-shaped X Spherical-shaped	48	42
B	Pear-shaped X Spherical-shaped	0	84

(a) State the fruit shape that is controlled by the dominant allele. Provide a reason for your answer. [2]

- Spherical-shaped allele
- Dominant allele is expressed in 100% of offspring from Cross B.

(b) State the genotype of the parent plant with spherical fruits in cross **B**. [1]

- AA **Accept any letters of representation.*

(c) The parent plant with spherical-shaped fruits in cross **A** is self-crossed. Use a genetic diagram to represent the crossing. [4]

- Parents' Genotype: Aa x aa
- Correct headings
- Gametes are circled
- Ratio of 3:1

(d) (i) Define gene mutation. [2]

- A gene mutation is an alteration to the DNA structure at a single locus on a chromosome,
- Change of characteristics coded by the gene. The change may be inherited if alteration occurs to a gene on a chromosome in a gamete cell.

(ii) Give an example of a mutagen that can cause the production of new phenotypes in the tomato plants. [1]

- X-rays/Radiation **Accept any reasonable answers.*

End of Section A

Section B (30 marks)
Answer **three** questions.

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

6. The table below shows the blood glucose level of a healthy person and a person suffering from diabetes mellitus after eating a meal containing bread (at 0 min).

Time/min	Blood glucose concentration/ mg per dm^3	
	Person A	Person B
0	130	85
30	135	90
60	220	120
90	215	115
120	212	100
150	195	86
180	185	88
210	175	90
240	170	90

(a) Plot two different graphs on the same piece of graph paper provided. [4]

- ☐ Labelled axes
- ☐ Points are correctly plotted
- ☐ Best-fit curve (Person A)
- ☐ Best-fit curve (person B)

(b) Given that the normal range of blood glucose level is between 70 and 120 mg/dm^3, identify the person who has *Diabetes mellitus*. [1]

- ☐ Person A.

(c) Account for the delay between eating the meal and the rise in blood glucose level. [2]

- ☐ Time needed for starch to be broken down into glucose in small intestine
- ☐ Then absorbed in villi of small intestine to be transported by blood

(d) Describe and explain the differences between graphs of person **A** and **B**. [3]

- ☐ Person A has consistent higher glucose concentration difference of 45-100 mg/dm^3 compared to person B.
- ☐ Person's B blood glucose level took about 150 mins to return to norm but Person's A blood glucose level took more than 240 mins.
- ☐ Person A has either insufficient insulin or target cells are not sensitive to insulin for uptake and conversion to glycogen.

7. **(a)** Explain how the following structures are related to their function in photosynthesis.

(i) Palisade mesophyll cells [2]

- Contain many chloroplasts to absorb light energy for conversion to chemical energy for photosynthesis.
- Long and arranged perpendicular to leave axis for maximum absorption of light energy.

(ii) Spongy mesophyll cells [2]

- Loosely arranged to have any air spaces between for faster diffusion of gases across the leaf.
- Cells are lined with a thin film of moisture to allow gases to dissolve then diffuse.

(iii) Guard cells [2]

- Has an uneven cellulose thickening to control size of stomata.
- Contain chloroplast to absorb light energy for photosynthesis to control water potential of cells in regulating stomatal opening/closing.

(b) Explain the importance of carbon cycle to living organisms. [4]

- Carbon from carbon dioxide is reduced to carbohydrates by plants during photosynthesis.
- Plants form the first trophic level in food chain or food web; consumed by animals.
- Food provides energy for consumers for growth and reproduction.
- Carbon dioxide is released into atmosphere from respiration of all living things which provides the raw material for plants.

8. EITHER

(a) Suggest why human insulin produced by genetically modified bacteria is useful in medicine. [4]

- Bacteria are easily cultured in a fermenter.
- Bacteria can be reproduced in large quantities.
- Insulin produced is identical to human insulin; hence it will not pose allergic risk or other side effects.
- Cultivating bacteria to obtain the insulin gene is cheaper relative to getting insulin from animals.

(b) List the differences between artificial selection and natural selection. [4]

	Natural selection	Artificial selection
Selection pressure	Environment	External factors i.e man who chooses the desirable traits to be expressed in offspring
Method	Not intensive	Intensive to meet demands
Identity of offspring	No variation.	Variation exists, creating a larger gene pool for natural selection to act on
Speed of mating	Slow since choice of mates is random	Fast since choice is interfered by man

(c) Explain Darwin's theory of natural selection. [2]

- Organisms that are <u>better adapted</u> to the environment are <u>more likely to survive and breed</u>,
- <u>Pass on beneficial traits</u> to the offspring and the subsequent <u>generations</u>. The less adapted organisms will fail to survive to breed hence their numbers will slowly decline.

8. OR

(a) Explain what is meant by the following terms.

(i) allele; [2]

- Allele refers to the different forms of a gene;
- Usually comes in pair as a dominant or a recessive allele though at times more than 2 for a gene.

(ii) homologous chromosome; [2]

- Homologous chromosomes are of same shape and length + due to the same number of gene loci arranged on each chromosome.
- One of the chromosomes in a pair comes from a male gamete and another from a female parent containing paternal and maternal genes respectively.

(iii) recombinant plasmid. [2]

- Contains a gene of interest from same or different species
- Within the bacterial plasmid; sealed by ligase.

(b) Describe **four** ways how DNA replication is different from transcription. [4]

	Replication	**Transcription**
Process	It involves copying both strands of DNA in the double helix	It involves the copying of specific region of one strand of the double helix DNA
Base	Base thymine (T) is used in replication to base pair with base adenine (A)	Base uracil (U) is used in replication to base pair with base adenine (A)
Enzyme	The enzyme DNA polymerase is required	The enzyme RNA polymerase is required
End product	A new double helix DNA is formed	A single strand mRNA is formed

Differences must be written in full statement; each showing the contrasting points.

End of Section B