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**SINGAPORE SPORTS SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR EXPRESS**

CANDIDATE
NAME

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CLASS

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INDEX
NUMBER

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Biology (SPA) 5158

5158/01

Paper 1 Multiple Choice

28 AUGUST 2017

1 hour

Additional materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, 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 on the question paper.

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

- 1^U The relative amounts of mitochondria, chloroplasts and endoplasmic reticulum in four cells are shown in Table 1. The number of "+" indicates the relative amount of the sub-cellular structure while "-" indicates its absence.

Table 1

A	+	++	+
B	+++	-	+
C	+++	-	+++
D	+	+++	+

Which cell is found in the spongy mesophyll of a leaf?

Refer to the following information to answer Questions 2 and 3.

Fig. 1 shows an experiment on osmosis using a potato tuber. The bottom of a washed potato was cut to form a base. A well was made and 10% sucrose solution was added to the well. The whole potato was then placed into a beaker containing distilled water. The setup was left for a day.

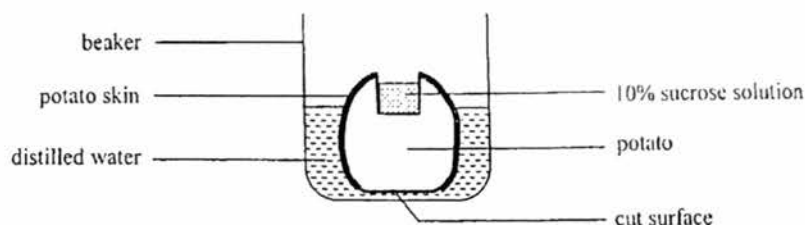


Fig. 1

- 2^A Well level increased because _____.
- A potato cell sap moved through the cell membrane and into the well
 B water was drawn mainly from cells in contact with the sucrose solution
 C water moved through the cell membrane of potato cells into the well
 D water moved along the cell wall of the potato cells into the well
- 3^A Which of the following changes will lead to a higher final level of the sucrose solution in the well?
- (1) using 5% sucrose solution instead of 10% sucrose solution
 (2) using 20% sucrose solution instead of 10% sucrose solution
 (3) removing all the potato skin
- A (1) and (2)
 B (2) and (3)
 C (1) and (3)
 D (1), (2) and (3)

4^U Which of the following shows that a washing powder contains biological catalysts that act on lipids?

- A negative Benedict's test
- B negative ethanol emulsion test
- C positive biuret test
- D positive iodine test

5^A A sample of food was tested and the food test results are shown below.

Benedict's solution	blue
ethanol and water	white emulsion
iodine solution	blue-black colour
sodium hydroxide and copper (II) sulfate solution	violet colour

What food could this be?

- A steamed rice with cod fish
- B milk chocolate
- C steamed tofu
- D veggie burger

6^K Lactase catalyses the hydrolysis of lactose to glucose and galactose. According to the "lock and key" hypothesis, which is the "lock" and which is the "key"?

A	lactose	glucose and galactose
B	lactose	lactase
C	lactase	galactose
D	lactase	lactose

- 7^A Fig. 2 shows how pH affects the activity of four different enzymes extracted from a human.

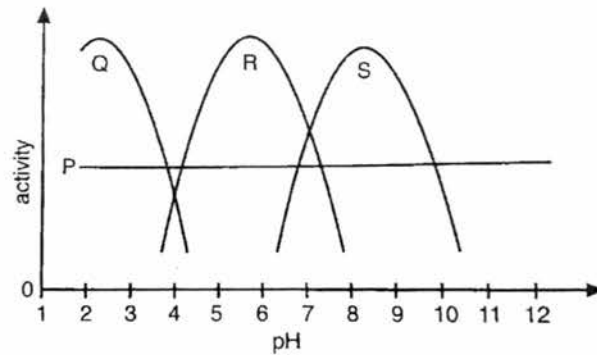


Fig. 2

Which of the following statements is true?

- A Q cannot digest proteins and P can function anywhere in the human alimentary canal.
 - B S is most likely secreted by intestinal cells and P is not affected by pH.
 - C Both R and S work best in the small intestine.
 - D S is likely to be sucrase while Q is likely to be a lipase.
- 8^K Fig. 3 shows part of the digestive system and blood vessels connected to organs shown.

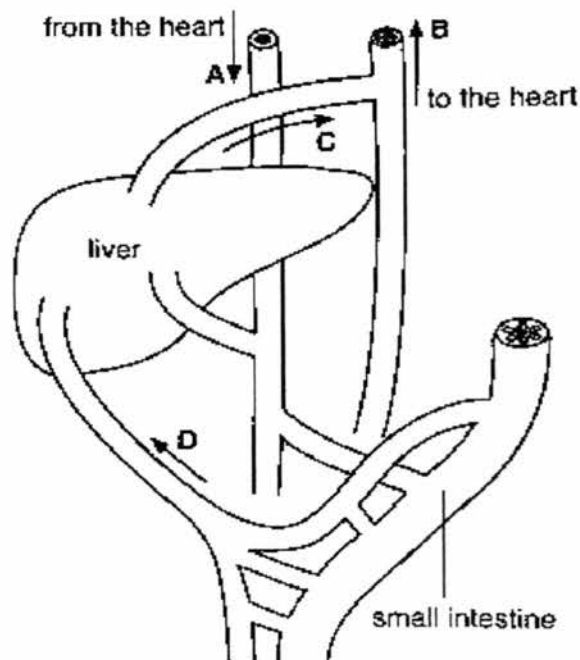


Fig. 3

After a meal which blood vessel will contain blood with the highest concentration of glucose?

Refer to the following information to answer Questions 9 to 11.

Fig. 4 shows a set-up used to determine the rate of photosynthesis of a green plant. During the entire study, the position of the plunger remained unchanged.

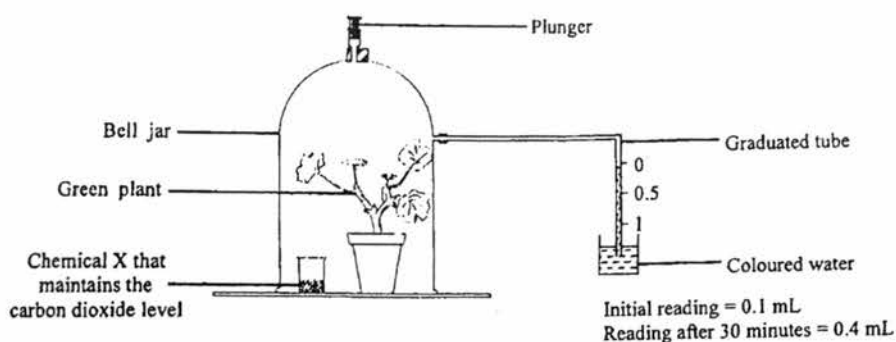
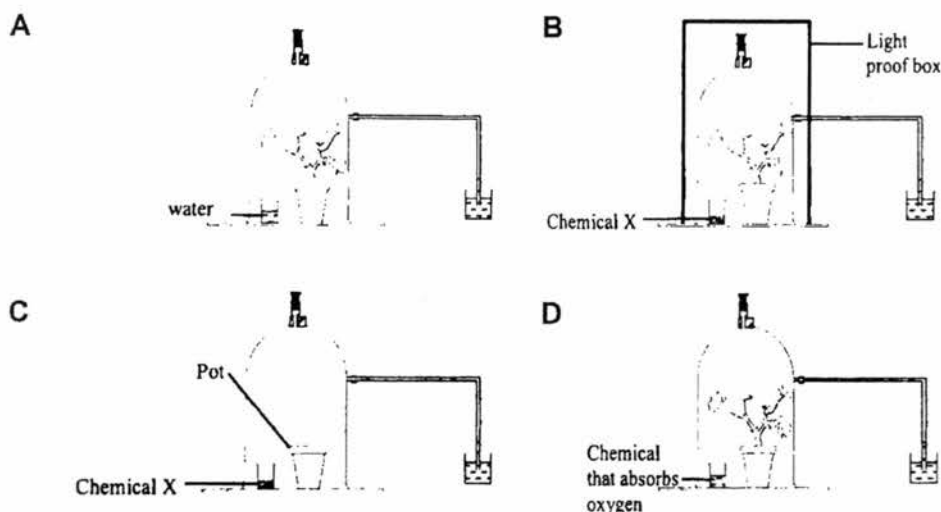


Fig. 4

- 9^A Based on the results, what was the rate of photosynthesis of this plant?
- A 0.4 ml carbon dioxide absorbed per hour
 - B 0.3 ml oxygen released per hour
 - C 0.6 ml oxygen released per hour
 - D 0.8 ml oxygen released per hour
- 10^A The rate of photosynthesis measured was lower than the actual rate of photosynthesis of the plant. What could be the reason for this observation?
- A The plant was respiring throughout the study.
 - B The plant was also carrying out transpiration during the study.
 - C The plant was making new plant parts during the study.
 - D The atmospheric pressure could have changed during the study.
- 11^U Which of the following set-ups is suitable to be used as a control experiment to find out the actual rate of photosynthesis?



- 12^A The transverse section of the human heart (Fig. 5.1) is made to show the atria-ventricular valves and semi-lunar valves in a certain stage during the cardiac cycle.

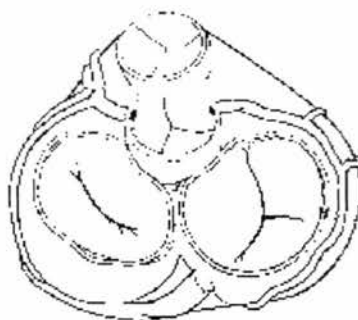


Fig. 5.1

The graph in Fig. 5.2 shows pressure changes in the left side of the heart during part of the cardiac cycle.

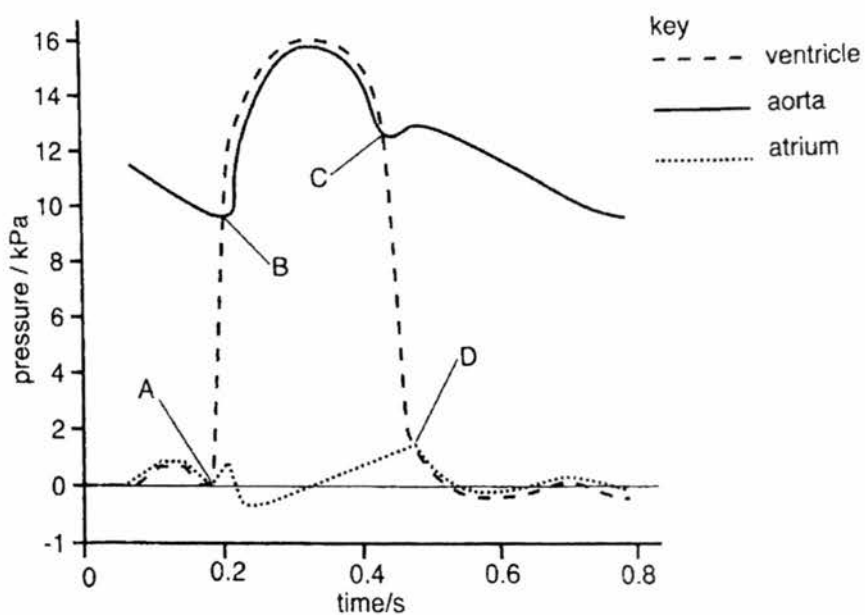


Fig. 5.2

Which point on the graph corresponds to the state of the heart in Fig. 5.1?

13^U Fig. 6 shows two blood vessels found in the human body.



Fig. 6

If blood vessel X is connected with the lung, which of the following is true?

- A It carries oxygenated blood towards the heart.
- B It carries deoxygenated blood towards the heart.
- C It carries oxygenated blood towards the lung.
- D It carries deoxygenated blood towards the lung.

14^A During a construction accident, four workers were seriously injured and were in need for blood transfusion. Upon arrival at the hospital, an houseman attended to the four workers.
To work out which blood each worker was to receive, the houseman drew up a table to instruct the assisting nurses.

Which of the following is correct?

A	B	O	A	AB
B	B	AB	A	O
C	A	O	B	AB
D	A	AB	B	O

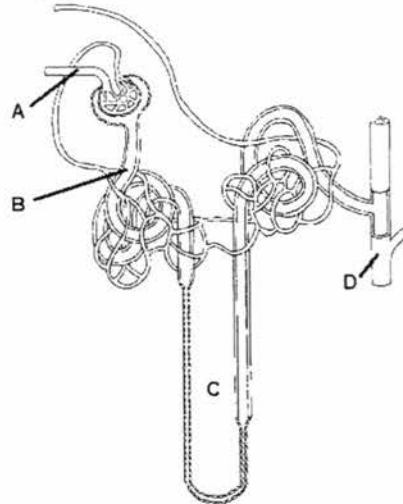
15^A An experiment was carried out to investigate the rate of water loss from a leaf surface of a particular plant species. It is known that the lower leaf surface of this plant species has more stomata than the upper leaf surface.

Vaseline was applied to leaf surfaces and the percentage loss in weight was calculated after five days.

Which leaf had only its lower surface covered with Vaseline?

A	0
B	3
C	7
D	15

- 16^U Caffeine is a known diuretic that works by increasing renal blood flow and the rate of glomerular filtrate formation, as well as decreasing sodium and chloride reabsorption. Which part of the nephron would not be affected when we consume high caffeine energy drinks?



- 17^A The graphs in Fig. 7 show the effect of drinking equal volumes of water and dilute salt solution on the urine output of a healthy person.

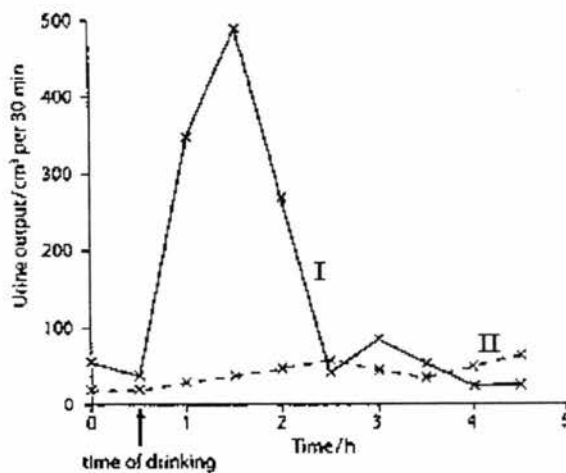


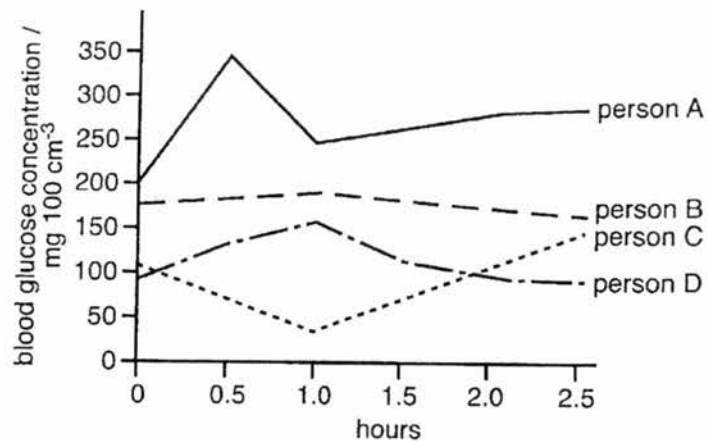
Fig. 7

Which of the following is correct?

A	I	II	less ADH secreted with water intake
B	I	II	more ADH secreted with water intake
C	II	I	less ADH secreted with salt solution intake
D	II	I	more ADH secreted with salt solution intake

- 18^A The blood glucose concentration of four people was measured over a 2.5 hour period after drinking a concentrated glucose solution. The changes are shown in Fig. 8.

Fig. 8



Which person is least likely to have problems with insulin secretion?

- 19^A Fig. 9 shows changes in air pressure in the lungs of a man.

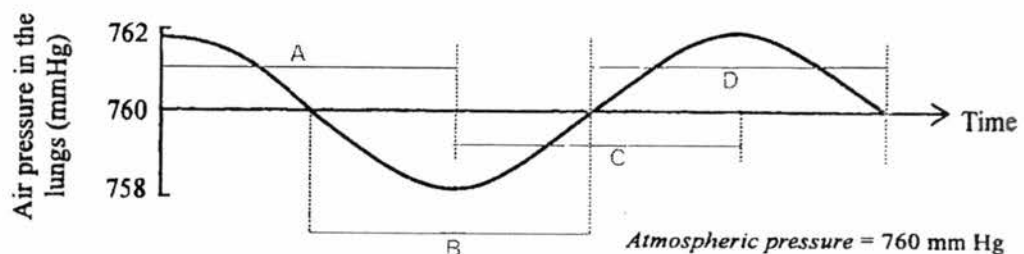


Fig. 9

During which period are his diaphragm muscles in a state of contraction?

- 20^A Oral pain killers reduce pain by blocking the transmission of nerve impulses. Which of the following might work as a painkiller?
- A a chemical that slows down heartbeat
 - B a chemical that slows down the reaction of effectors
 - C a chemical that prevents neurotransmitter secretion
 - D a chemical that speeds up the respiration rate

- 21^A Fig. 10 shows the relationship between the average age at death and the number of cigarettes smoked.

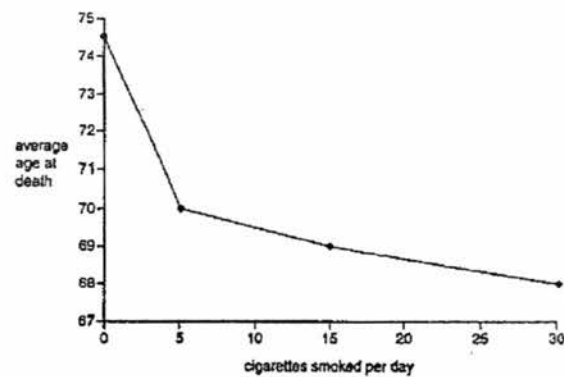


Fig. 10

Which of the following is a correct conclusion from the graph?

- A Most people smoking 30 cigarettes a day die from lung disease.
 - B People smoking 5 cigarettes a day live longer than those smoking 15 cigarettes a day.
 - C Non-smokers live at least 4.5 years longer than people who smoke.
 - D Most people living longer than 74 years are non-smokers.
- 22^U Fig. 11 shows a section of the human eye.

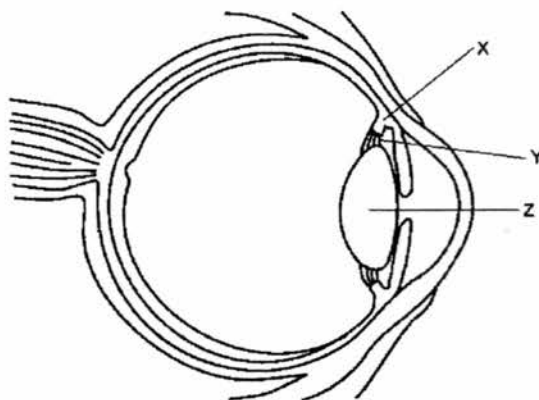
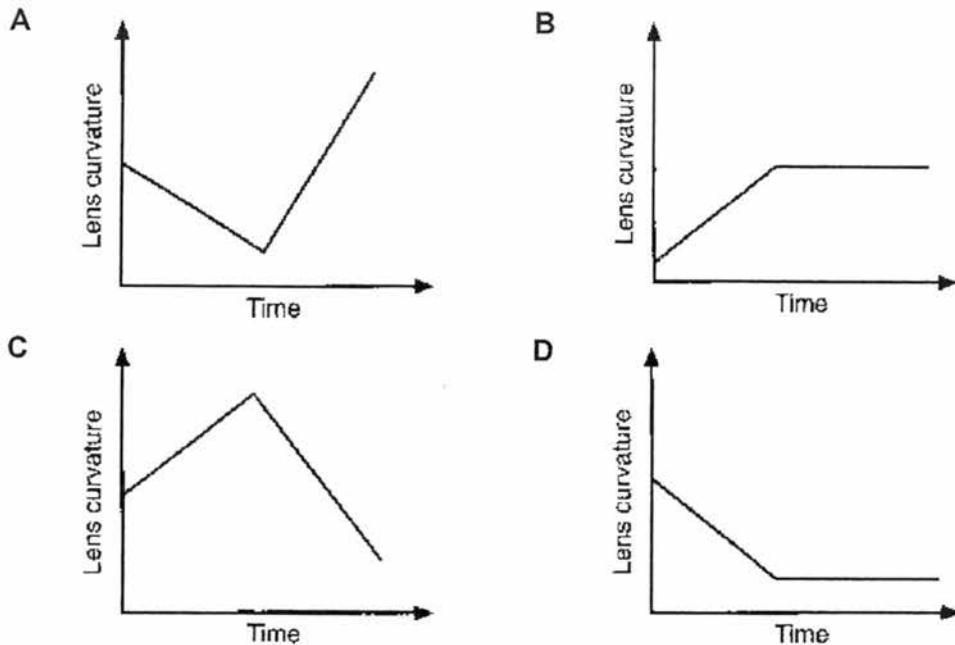


Fig. 11

When a person ages, the person will probably have difficulty focusing on a _____.

- A nearby object because structure Z cannot thicken fully
- B nearby object because structure Y cannot contract fully
- C distant object because structure X cannot be pulled taut
- D distant object because structure Y cannot relax fully

- 23^A A girl standing on a station platform watches a train arrives at the platform. Which of the following graphs correctly shows the change in the curvature of the lens of her eye?



- 24^U Endotherms like mammals are able to use all the following homeostatic mechanisms to raise their body temperature except for _____.

- A depositing fats in adipose tissues under the skin
- B increasing their metabolic rate
- C reducing blood flow to their skin
- D decreasing activity of sweat glands

- 25^U Fig. 12 shows part of the placenta in a pregnant woman.

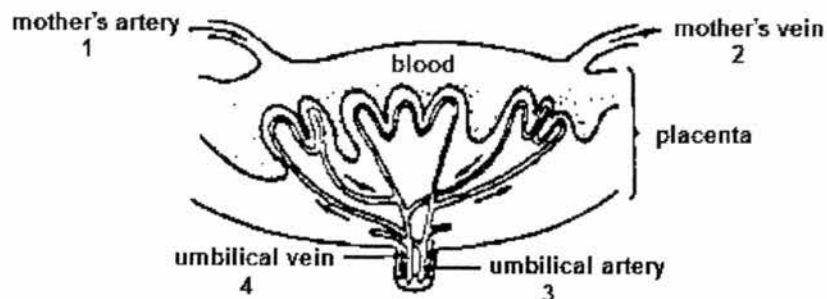


Fig. 12

In which parts does the blood contain the most oxygen and nutrients?

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

- 26^A Changes to the thickness of a woman's endometrium were monitored from 28 Mar to 2 May on a chart (Fig. 13).

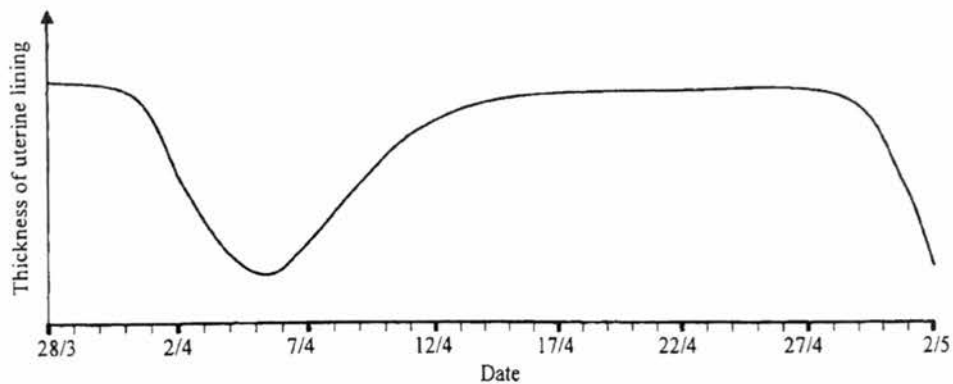


Fig. 13

During which period would pregnancy most likely to occur?

- | | |
|---------------------------|---------------------------|
| A 28 Mar to 1 Apr | B 4 Apr to 8 Apr |
| C 11 Apr to 15 Apr | D 18 Apr to 21 Apr |

Refer to the following information to answer questions 27 and 28.

The bar chart in Fig. 14 shows variation in style length in a certain species of flowering plant. This plant species has the androecia and gynoecia on different flowers.

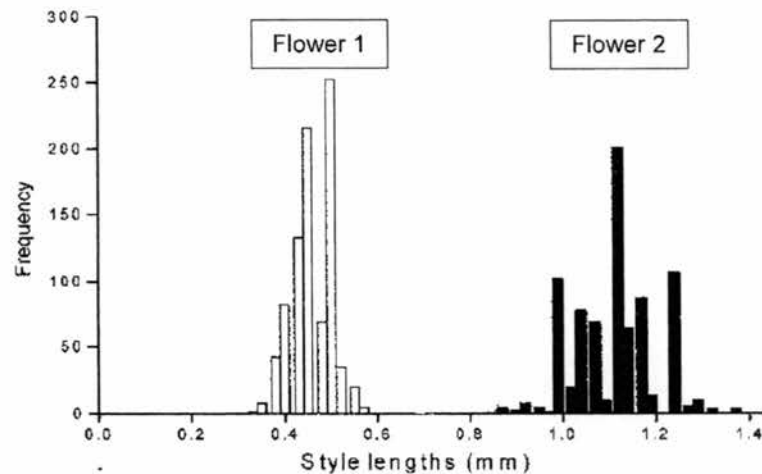


Fig. 14

- 27^A Which of the following deductions about the flowers of this particular species could be drawn from this information?
- A** Flower 2 has longer styles than Flower 1.
 - B** All flowers of this plant species would develop fruits when pollinated.
 - C** This plant is wind pollinated.
 - D** Flowers of this plant species will have large conspicuous petals.

- 28^A Which of the following deductions about the plant species is true?
- A "Long style" genotype is homozygous while "short style" genotype is heterozygous.
 - B "Long style" phenotype is dominant over "short style" phenotype.
 - C Style length is influenced more strongly by environment than by genes.
 - D Style length shows continuous variation.
- 29^U Which subcellular component would have the highest rate of synthesis of messenger RNA?
- A Golgi apparatus
 - B nucleus
 - C ribosome
 - D rough endoplasmic reticulum
- 30^A An artificially constructed DNA segment made up of 2400 nucleotides is transcribed and translated from the seventh nucleotide to the end. How many amino acids would the resulting polypeptide contain?
- A 398
 - B 400
 - C 800
 - D 1200
- 31^A A person's karyotype map is shown below in Fig. 15.

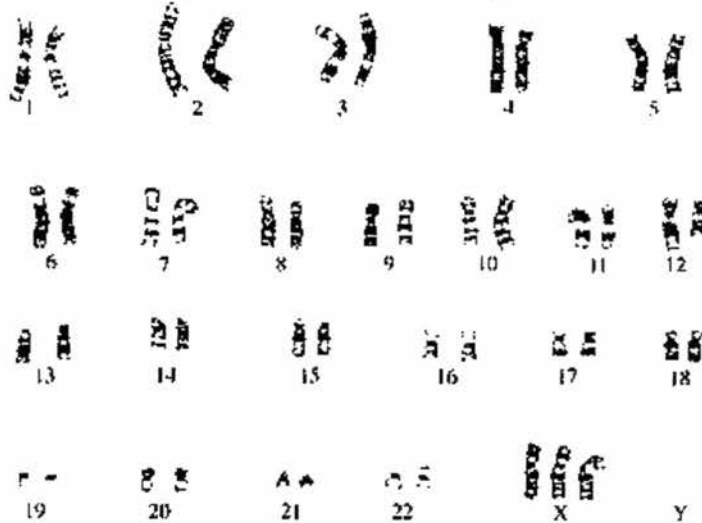


Fig. 15

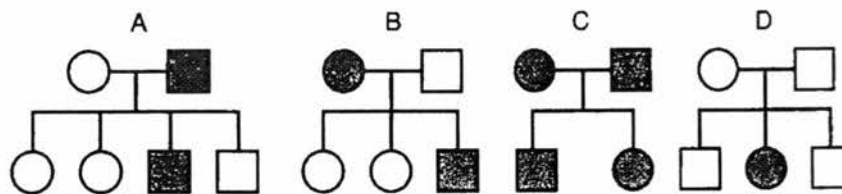
What type of mutation is observed?

- A chromosome addition mutation
- B chromosome deletion mutation
- C gene addition mutation
- D gene deletion mutation

- 32^A A cell undergoing meiosis has its DNA content measured. It starts off with 18 picograms of DNA at prophase I. What is the DNA content of each daughter nucleus at the end of meiosis I and II?

A	9 picograms	9 picograms
B	9 picograms	4.5 picograms
C	18 picograms	9 picograms
D	18 picograms	18 picograms

- 33^A In each of the following pedigree trees, persons with a genetic disease are indicated by shaded boxes. Which pedigree shows an inherited genetic disease as a recessive trait?



- 34^U Which of the following is a result of natural selection?

- | | | | |
|---|---------------|---|-------------------------------|
| A | Angus cows | B | antibiotic-resistant bacteria |
| C | navel oranges | D | seedless grapes |

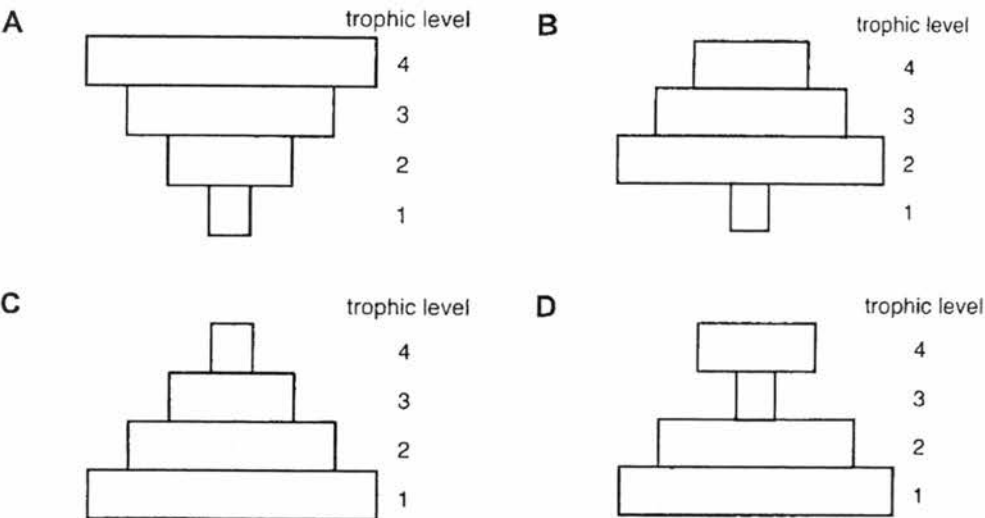
- 35^A A genetic experiment was carried out on green and yellow seeds of a pea species. The results obtained indicated that the allele for green (G) was dominant over the allele for yellow (g). 250 hybrid plants were crossed and 6000 seeds were gathered in the F₁ generation. What was the likely number of yellow seeds among all seeds gathered?

- | | | | |
|---|-------|---|-------|
| A | 900 | B | 1 500 |
| C | 3 000 | D | 4 500 |

36^K The following shows a terrestrial and a marine food chain respectively.

tree → aphid → sparrow → eagle
 phytoplankton → zooplankton → herring → tuna

Which of the following correctly represent the pyramid of energy in both food chains?



37^U Fig.17 shows the flow of carbon compounds in the carbon cycle.

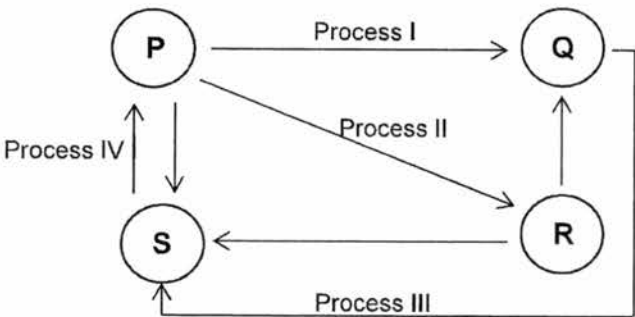


Fig. 17

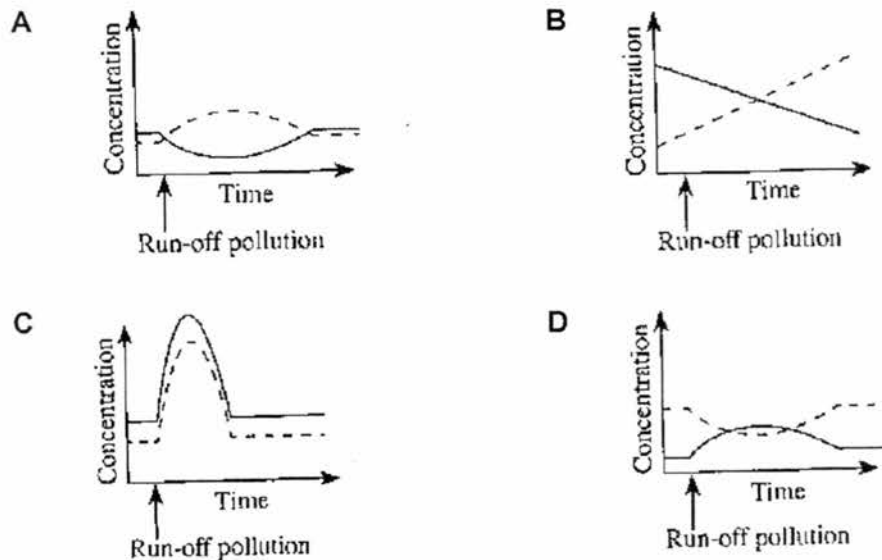
What do the letters P, Q, R and S represent?

	P	Q	R	S
A	P	Q	R	S
B	Q	P	S	R
C	R	P	Q	S
D	S	Q	P	R

38^K Which of the following is true when the number of producers in a food chain decreases?

- A more energy flows through the food chain
- B more animals migrate to the area
- C total biomass decreases
- D total number of consumers increases

39^A Run-off pollution of a particular river resulted from dumping of products from a chemical fertiliser manufacturing plant upstream. Which of the following graphs correctly show the resulting changes in levels of oxygen and bacteria in this river?
(— Oxygen --- Bacteria)



40^A Fig. 18 shows the feeding relationships between populations in a certain habitat.

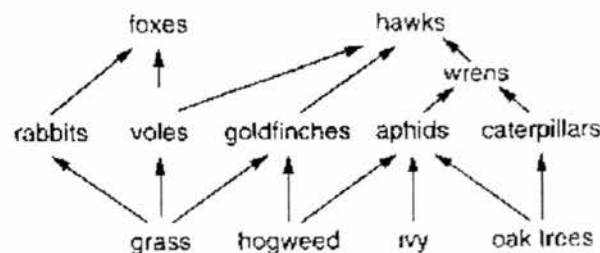


Fig. 18

A pesticide is applied to the oak trees. Which organism would have the highest level of pesticide accumulated after some time?

- A aphids
- B caterpillars
- C hawks
- D wrens

SINGAPORE SPORTS SCHOOL PRELIMINARY EXAMINATION SECONDARY FOUR EXPRESS

CANDIDATE
NAME

CLASS

INDEX
NUMBER

Biology (SPA)

5158

Paper 2

24 AUGUST 2017
1 hour 45 minutes

Additional materials: NIL

READ THESE INSTRUCTIONS FIRST

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

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

You may use a soft pencil for any diagrams, graphs, tables 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 on the Question Paper.

Section B

Answer **all** the questions.

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

Electronic calculators may be used.

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

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

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

For Examiner's Use	
Section A	
Section B	
7	
8	
9 Either / Or	
Total	80

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

- 1 The electron photomicrograph in Fig. 1 shows part of several pancreatic islet cells.

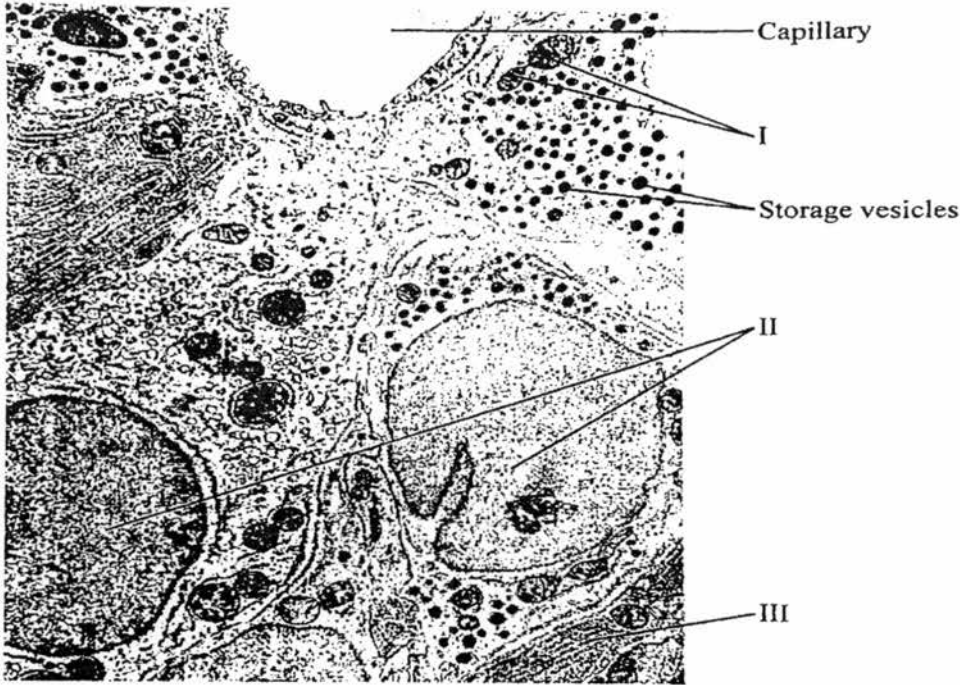


Fig. 1

- (a) Identify the structures labelled **I**, **II** and **III** in Fig. 1 and state their functions. [3]^K

- (b) The storage vesicles store products of the cells that are released into the capillaries of the pancreas. [3]^U
- (i) Suggest the identity of the product made by the cells here.

- (ii) What class of substance is the product contained in the black vesicles? Describe their mode of action.

[Total: 6m]

- 2 Fig. 2.1 shows a section of part of the human alimentary canal. Fig. 2.2 shows another section of the same part with blood vessels stained.



Fig. 2.1



Fig. 2.2

- (a) Which part of the alimentary canal is shown in both figures? Support your answer with evidence. [2]^U

- (b) For each of the above figures, describe **ONE** observable feature and explain how it is related to the function of this part of the alimentary canal.

(i) Fig. 2.1

[2]^U

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(ii) Fig. 2.2

[3]^U

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- (c) Crohn's disease causes inflammation and erosion of the intestines of the human alimentary canal. Depending on where the disease occurs, different symptoms are observed but a common symptom is weight loss.

[3]^U

Based on your understanding of the functions of this region of the alimentary canal, suggest why weight loss is observed.

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[Total: 10m]

- 3 The photographs below (Figs. 3.1 and 3.2) show a potted plant in two different states. Fig. 3.1 shows it in a wilted state while Fig. 3.2 shows the same plant in a healthy state.



Fig. 3.1



Fig. 3.2

- (a) What could be the environmental conditions that led to the plant's appearance in Fig. 3.1? [1]^U
-
-
- (b) Suggest two treatments that could have been used to revive the plant. [2]^U
-
-
- (c) In another experiment, three young plants of the same species were grown in separate pots **A**, **B** and **C**. Each pot was handled differently.
- (i) Plant **A** was not watered. Two days later, the plant resembled Fig. 3.1. Explain what happened. [2]^A
-
-
-
-

- (ii) Plant **B** was watered with a very concentrated solution of fertilizer. [2]^A
After 3 hours, the plant wilted. Suggest why wilting happened here.

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- (iii) Plant **C** was transplanted from the pot into soil in a garden. The [3]^T
soil was well-watered. After an hour, the plant wilted but it
recovered the next day.
Suggest why wilting occurred in this case and how the plant
managed to recover overnight.

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[Total: 10m]

- 4 The volume of urine produced by a person over a 5-hour period was measured over two different days. His water intake and activity levels were kept constant for these two days. His results are tabulated below.

	Day 1	Day 2
	100	350

- (a) Explain the difference in the amount of urine produced on these two days. [4]^A

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- (b) A commonly abused party drug Ecstasy causes brain cells to swell, increasing pressure on the brain stem and resulting in coma and death. It is found that Ecstasy stimulated ADH production in the drug abuser's body. [3]^T

Explain how Ecstasy can cause swelling of brain cells.

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[Total: 7m]

- 5 Fig. 5.1 shows a pair of chromosomes during meiosis in a cell in the human testis. The position of the alleles of some genes is indicated.

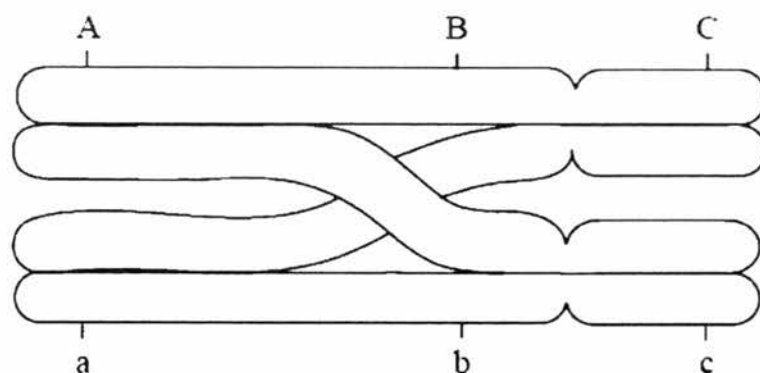


Fig. 5.1

- (a) Deduce, with reasons, whether the chromosomes are autosomes or sex chromosomes; [4]^U
- (i)
-
-
- (ii) homologous or non-homologous;
-
-
- (b) State the stage of meiosis this cell is undergoing. [1]^K
-
- (c) At the end of meiosis, each of the chromatids shown in Fig. 5.1 will be in a different haploid cell. [2]^A
- Fig. 5.2 represents the chromatids inside the haploid cells. Determine the combinations of alleles that would be present on each chromatid by indicating the gene sequence in Fig. 5.2.

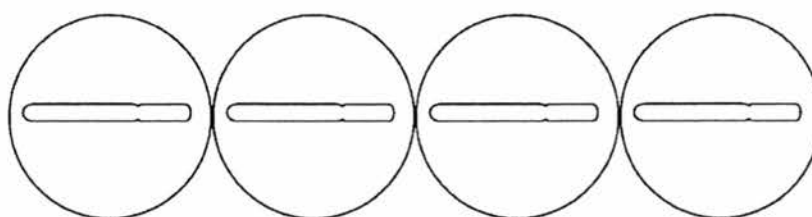


Fig. 5.2

[Total: 7m]

- 6 The red-billed oxpecker is a bird native to the African savannahs. It feeds on ticks found on herbivorous mammals such as the impala shown in Fig. 6. The impala grazes on the grass in the savannah.



Fig. 6

- (a) With the information provided, construct a food chain for the savannah. [2]^A
-
- (b) Draw and label a pyramid of numbers for this food chain. [4]^A
-
-
-
-
-
-
-
-
-
-
- (c) Which is the secondary consumer in this food chain? [1]^K
-

(d) Explain how energy passes through this food chain.

[3]^A

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[Total: 10m]

Section BAnswer **three** questions.Question 9 is in the form of an **Either/Or** question. Only one part should be answered.

- 7 During a health examination, the heart rate of a patient was measured based on the number of "lub-dub" sounds heard for 5 seconds. This measurement was taken every minute for 7 minutes. The counts were recorded in Table 7 below.

Table 7: Heart rate of patient

Number of "lub-dub" sounds every 5 s	6	6	9	12	9	7	6	5
Heart rate / min ⁻¹								

- (a) Calculate the heart rate of the patient and fill up Table 7.
Plot the heart rate of the patient in the grid below.

[4]^A

- (b) Explain how the “lub-dub” sounds are generated in the heart. [2]^K

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- (c) Suggest an activity the patient could be carrying out during this period. [1]^A

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- (d) Give a detailed explanation how a named hormone could cause this change observed in the patient during the health examination. [3]^A

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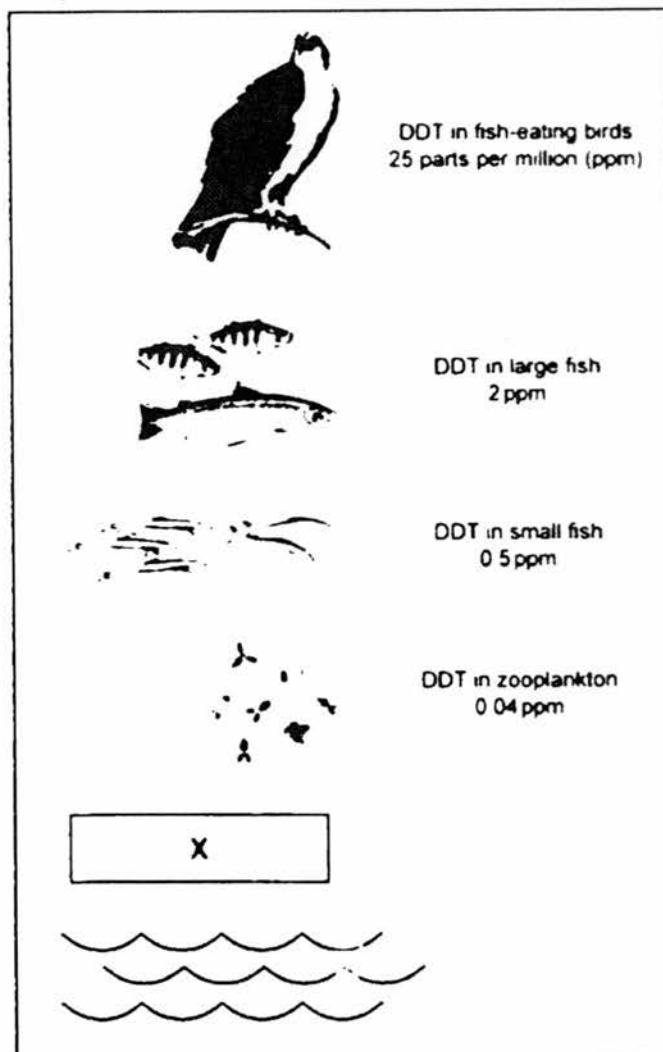
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[Total: 10m]

- 8 Dichlorodiphenyltrichloroethane (DDT) was a widely used pesticide in agriculture. Due to its negative impact on the ecosystem, its large-scale use is banned by the 2001 Stockholm Convention on Persistent Organic Pollutants. However, the long-lasting effect of DDT continues to be seen in the ecosystem.

In Fig. 8 below, the concentration of DDT at different trophic levels of a food chain is illustrated.

Fig. 8: Levels of concentration of DDT in food chain



[Source: adapted from Cunningham, Cunningham and Sargo (2003) *Environmental Science* 7th ed. McGraw Hill]

- (a) (i) Identify the main source of energy for the food chain in Fig. 8.

[1]^K

(ii) State the trophic level **X** in Fig. 8. [1]^K

(b) With reference to the idea of **bioaccumulation** and **bioamplification**, outline how the concentration of DDT has changed along this food chain. [4]^A

(c) (i) State the relationship between large and small fish in Fig. 8. [1]^U

(ii) Outline how this relationship may be beneficial to the populations of both fishes. [3]^T

[Total: 10m]

9 Either

Agrobacterium tumefaciens is a soil-dwelling bacterium that naturally infects plants, causing the formation of plant tumours. Within the bacterium is a large plasmid (Ti plasmid) that contains a segment of DNA that allows the plasmid to insert itself into the plant's DNA.

The Ti plasmid is used in genetic engineering to create transgenic plants by replacing the tumour-inducing gene with foreign genes that could give the transgenic plant an advantage. An example is the introduction of the potato leafroll virus (PLRV) resistance gene to potato plants by infecting them with transformed Ti plasmids bearing the desired gene.

- (a) Outline the steps involved in creating this transgenic potato plant that is resistant to PLRV. [7]^A

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- (b) Suggest how scientists could test if the infected potato plants are successfully incorporated with the PLRV resistance gene. [3]^A

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[Total: 10m]

9 Or

Collagen is a naturally occurring protein found in the flesh and connective tissues of mammals.

- (a) Describe the sequence of events when collagen in a piece of meat passes through the mouth, stomach and small intestine. [8]^U

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- (b) Collagen supplements are touted to improve joint mobility and skin elasticity. Do you think these claims are true? Give a reason for your answer, based on your understanding. [2]^T

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[Total: 10m]

----- End of Paper -----

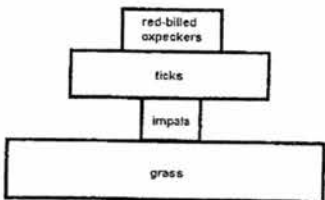
Paper 1

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

Paper 2

Section A

1	(a)		Structure	Function	[3] ^K
		I	mitochondria	release energy during aerobic respiration	
		II	nucleus	control cellular activities	
		III	RER	protein synthesis	
	(b) (i)	insulin / glucagon; R: proteins			[1] ^U
	(ii)	hormones; chemical messengers that are transported in bloodstream directly to target organs to effect an action, destroyed in the liver after they complete their action.			[2] ^U
	(a)	ileum; presence of villi;			[2] ^U
	(b) (i)	finger-like projections; R: other features provide large surface area to volume ratio for more efficient absorption of digested food substances;			[2] ^U
2	(ii)	dense capillary network; continuous blood flow; maintain steep concentration gradient; absorbed food transported away quickly; facilitates efficient absorption of digested food substances;			[3] ^U
	(c)	small intestine responsible for complete digestion and absorption of digested food; diseased section cannot digest nor absorb digested food; malnutrition / lack of nutrients;			[3] ^U

3	(a)	too hot / too much sun / windy / too dry; (any 2)	[1] ^U
	(b)	added water / removed from sunny spot / removed from hot place;	[2] ^U
	(c) (i)	more water lost than water absorbed / high transpiration rate; plant A wilted; plant cells lost water and become flaccid; to prevent further water loss;	[2] ^A
	(ii)	higher water potential in root hair cell sap than soil; water left root hair cells; by osmosis; less water absorbed than water lost; cells become flaccid;	[2] ^A
	(iii)	roots probably damaged during the transplanting; unable to absorb water; new root growth happened overnight; able to absorb water;	[3] ^T
4	(a)	Day 1 warm/hot day, Day 2 cool/cold day; Day 1: sweating; hypothalamus detects lower blood water potential; pituitary gland secretes more ADH; increases permeability of tubules for more water reabsorption; less urine; Day 2: no sweating; hypothalamus detects higher blood water potential; less ADH secreted; less water reabsorbed; dilute urine;	[4] ^A
	(b)	more ADH production leads to more water reabsorbed; dilute blood plasma; water enters brain cells by osmosis; causes cells to swell, increasing pressure on brain stem;	[3] ^T
5	(a) (i)	autosomes; both chromosomes of same length/size/genes; X and Y chromosomes have different length/size/genes	[2] ^U
	(ii)	homologous; paired to form bivalent / crossing over between chromosomes / same genes, same sequence / same size & shape	[2] ^U
	(b)	prophase I	[1] ^K
	(c)	ABC ; abc ; Abc ; aBC	[2] ^A
6	(a)	grass → impala → ticks → oxpecker	[2] ^A
	(b)		[4] ^A
	(c)	ticks	[1] ^K

	(d)	energy flows in one direction from grass all through to oxpecker; either utilized or lost to its surroundings but not recycled ; grass traps sunlight through photosynthesis and convert it to chemical energy in the food it produces; when consumers feed, chemical energy transferred to it; used for growth, metabolic and biological processes;	[3] ^A
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Section B

7	(a)	calculation 1m; correct axes and scale 1m; correct plot points 1m; best fit curve 1m;	[4] ^A
	(b)	"lub" formed by closing of AV valves; atrial diastole + ventricular systole; "dub" formed by closing of SLV; ventricular diastole;	[2] ^K
	(c)	name any example of exercise that would result in rise in heart rate;	[1] ^A
	(d)	secretion of adrenaline by adrenal gland; into bloodstream and carried to heart; stimulates increase in heart rate and rise in blood pressure; liver cells convert glycogen to glucose; more glucose in bloodstream; oxygen and glucose carried faster to muscles; increased aerobic respiration to release more energy;	[3] ^A
8	(a) (i)	Sun	[1] ^K
	(ii)	producers	[1] ^K
	(b)	DDT non-biodegradable; DDT on the producers transferred to zooplankton when feeding; in turn transferred from zooplankton to small fish; DDT not excreted nor broken down by organisms; increased DDT conc in bodies of small fish; bioaccumulation; DDT passed along food chain by feeding; increases conc in bodies of organisms along trophic levels; bioamplification;	[4] ^A
	(c) (i)	predator – prey relationship / large fish preys on small / small fish eaten by large fish;	[1] ^U
	(ii)	this relationship helps to keep both population size in balance; no. of small fish increase, more food and more large fish; too many large fish, small fish population drops and in turn large fish population also decreases; cyclical relationship;	[3] ^T

9	Either (a)	isolate PLRV resistance gene from the virus; by cutting with restriction enzyme; cut Ti plasmid with same restriction enzyme to remove tumour forming gene; insert PLRV resistance gene to cut Ti plasmid; join them together with ligase; insert recombinant plasmid into <i>Agrobacterium tumefaciens</i>; using electric shock or heat treatment; infect potato plant with transgenic bacteria; recombinant Ti plasmid incorporated into plant DNA; grow the infected plants and test for PLRV resistance;	[7] ^A
	(b)	infect the infected potato plant with a known amount of PLRV; set up a control experiment using a non-infected potato plant; grow both plants under same conditions; record extent of leaf damage after a number of days; transgenic plant should not show leaf damage; unlike control plant;	[3] ^A
9	Or (a)	<i>Mouth: meat chewed into small pieces but no protein digestion;</i> <i>Stomach: pepsin activated by HCl; pepsin catalyses hydrolysis of collagen into shorter polypeptide chains;</i> <i>partial digestion of collagen;</i> <i>Small intestine (Duodenum): trypsin activated by enterokinase;</i> <i>trypsin catalyses digestion of shorter polypeptide chains and remaining proteins into peptides;</i> <i>peptidases catalyse digestion of peptides into amino acids;</i> <i>Jejunum and ileum: amino acids from digested collagen pass through villus walls into blood capillaries;</i> <i>enter bloodstream by diffusion and active transport;</i> <i>transported via bloodstream to liver;</i> <i>via hepatic portal vein;</i>	[8] ^U
	(b)	<i>Answer; and reasonable supporting argument;</i> <i>Yes + supply of amino acids which could be lacking in the body to build collagen</i> <i>No + collagen consumed digested into amino acids and if not required by body, would be deaminated / amino acids from digested collagen may not be used to build new collagen by body cells;</i>	[2] ^T