

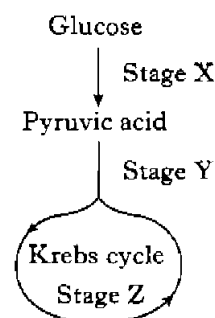
SECTION A

All questions in this section should be attempted.

Answers should be given on the separate answer sheet provided.

- The cell membrane is chiefly composed of
 - carbohydrates and lipids
 - carbohydrates and proteins
 - proteins and lipids
 - proteins and nucleic acids.
- Thirty percent of bases in a DNA molecule are adenine. The percentage of cytosine bases in the same molecule is
 - 20%
 - 30%
 - 40%
 - 70%.
- Which of the following must be present for glycolysis to occur?
 - Glucose and oxygen
 - ATP and oxygen
 - Glucose and ATP
 - ATP and pyruvic acid

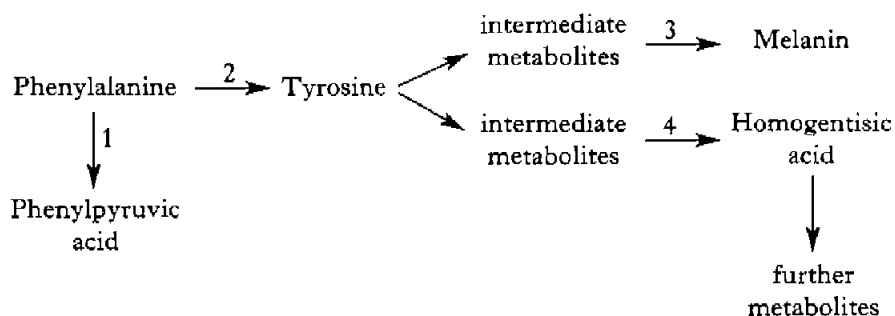
- Glycolysis takes place in the
 - nucleus
 - cristae of mitochondria
 - matrix of mitochondria
 - cytoplasm.
- The following diagram represents stages in the complete breakdown of glucose in aerobic respiration.



- At which stage, or stages, is carbon dioxide released?
- Stages X and Z
 - Stages X and Y
 - Stages Y and Z
 - Stage Z only

[Turn over

6. The diagram below shows part of a metabolic pathway. Each stage is controlled by an enzyme.



Phenylketonuria (PKU) is caused by a mutation of the gene required to make enzyme

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

7. A stock solution has a concentration of 1 M. 100 cm³ of a 0.6 M solution can be prepared by adding
- A 40 cm³ of stock solution to 60 cm³ of water
 - B 60 cm³ of stock solution to 40 cm³ of water
 - C 60 cm³ of stock solution to 100 cm³ of water
 - D 100 cm³ of stock solution to 60 cm³ of water.

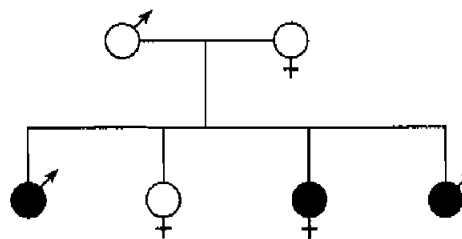
8. The table below shows some genotypes and phenotypes associated with forms of sickle-cell anaemia.

Genotype	Phenotype
Hb ^A Hb ^A	normal
Hb ^A Hb ^S	sickle-cell trait
Hb ^S Hb ^S	acute sickle-cell anaemia

A normal man marries a woman with the sickle-cell trait. What are the chances that any child born to them will have acute sickle-cell anaemia?

- A None
- B 1 in 1
- C 1 in 2
- D 1 in 4

9. The diagram below shows the transmission of the gene for albinism.



KEY

normal male		affected male	
normal female		affected female	

This condition is inherited as a characteristic which is

- A dominant and not sex-linked
- B recessive and not sex-linked
- C dominant and sex-linked
- D recessive and sex-linked.

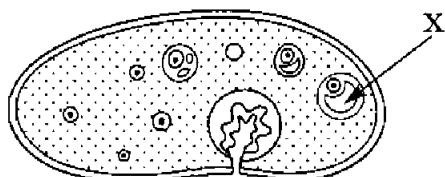
10. Colour-blindness is a recessive, sex-linked characteristic controlled by the allele b.

Two parents with normal vision have a colour-blind boy.

The genotypes of the parents are

- A X^BY and X^bX^b
- B X^bY and X^BX^B
- C X^bY and X^BX^b
- D X^BY and X^BX^b.

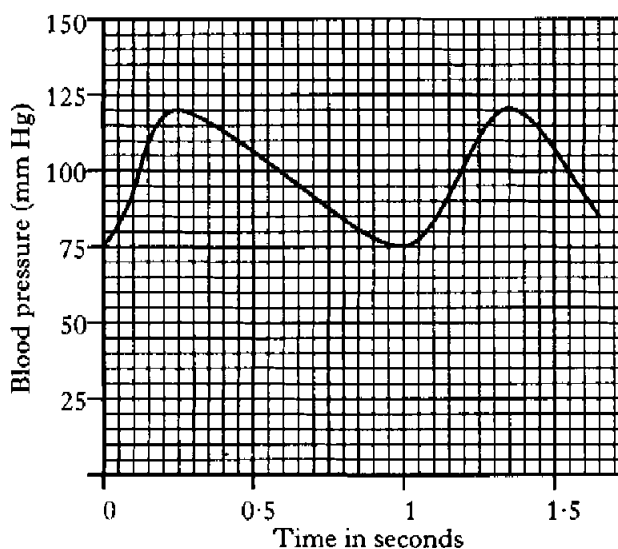
11. The function of the interstitial cells in the human testes is to
- A act as a store for sperm cells
 - B produce semen
 - C cause sperm cells to mature
 - D produce testosterone.
12. The diagram below shows a section through an ovary which contains developing eggs.



The structure labelled X is

- A the endometrium
 - B a Graafian follicle
 - C the amnion
 - D a corpus luteum.
13. Which of the following materials are exchanged between maternal and fetal blood by diffusion?
- A Oxygen and proteins
 - B Carbon dioxide and antibodies
 - C Oxygen and glucose
 - D Carbon dioxide and oxygen

14. The graph below represents an arterial blood pressure trace.



The blood pressure would be recorded as

- A $\frac{120}{75}$
 - B $\frac{75}{120}$
 - C $\frac{104}{75}$
 - D $\frac{75}{104}$
15. The percentage distribution of blood groups in Scotland is shown below.

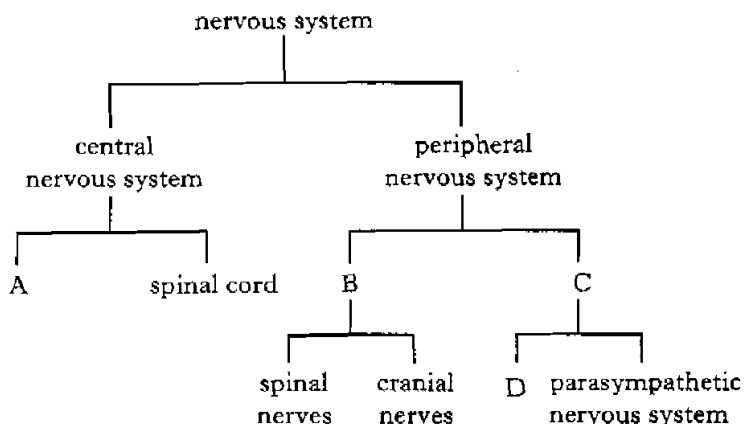
	Blood Group			
	O	A	B	AB
Scots (%)	51	35	11	3

What percentage of Scots could be given a blood transfusion of blood group A?

- A 35%
 - B 38%
 - C 51%
 - D 86%
16. A person produces 1.5 litres of urine in 24 hours. The urine contains 36 g of urea. What is the concentration of urea in the urine?
- A 1.0 g/100 cm³
 - B 2.4 g/litre
 - C 2.4 g/100 cm³
 - D 3.6 g/100 cm³

17. Stimulation of the sympathetic nerves causes
- A vasoconstriction of arterioles in the skin
 - B vasoconstriction of the coronary arterioles
 - C vasodilation of arterioles of the gut
 - D vasodilation of arterioles in the salivary glands.

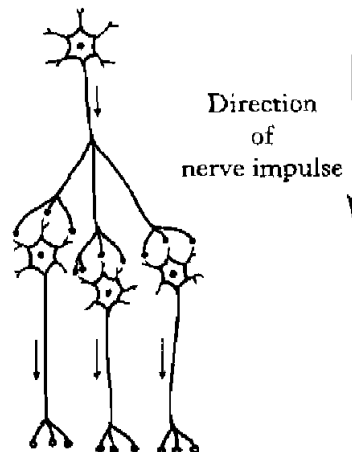
18. The flow chart shows the sub-divisions of the human nervous system. Which letter represents the autonomic nervous system?



19. The somatic nervous system controls the
- A skeletal muscles
 - B heart and blood vessels
 - C endocrine glands
 - D muscular wall of the gut.
20. The speed of impulse transmission along an axon is promoted by
- A diffusion of neurotransmitters
 - B converging neural pathways
 - C diverging neural pathways
 - D myelination of fibres.

21. Which of the following statements about diverging neural pathways is correct?
- A They accelerate the transmission of sensory impulses.
 - B They suppress the transmission of sensory impulses.
 - C They increase the degree of fine motor control.
 - D They decrease the degree of fine motor control.

22. The following diagram represents four neurones in a nervous pathway.

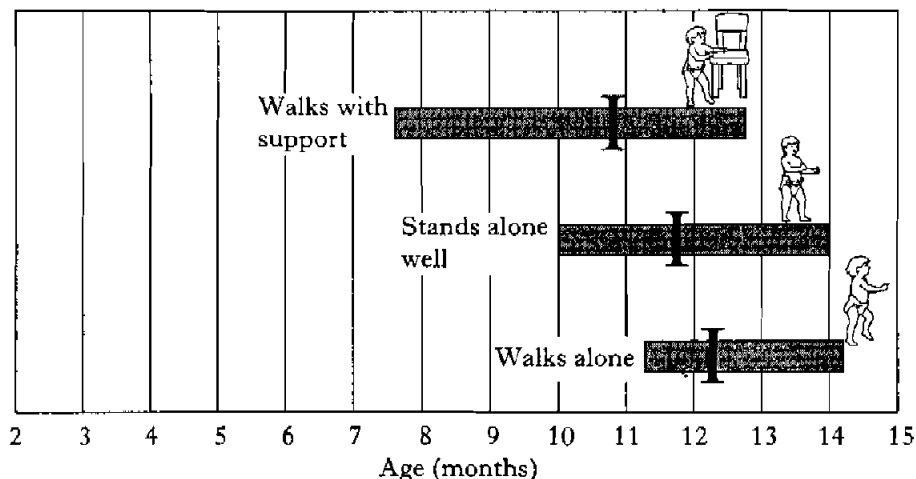


Which line of the table describes correctly the pathway?

Type of Pathway		
A	sensory	convergent
B	motor	convergent
C	sensory	divergent
D	motor	divergent

23. The retrieval of information from long term memory is often aided by remembering the situation in which the information was encoded. This is described as using
- A contextual cues
 - B chunking techniques
 - C rehearsal methods
 - D memory span.
24. A child, who was scratched by a black cat, now responds with a fear of all cats. This is an example of
- A shaping
 - B reinforcement
 - C generalisation
 - D discrimination.

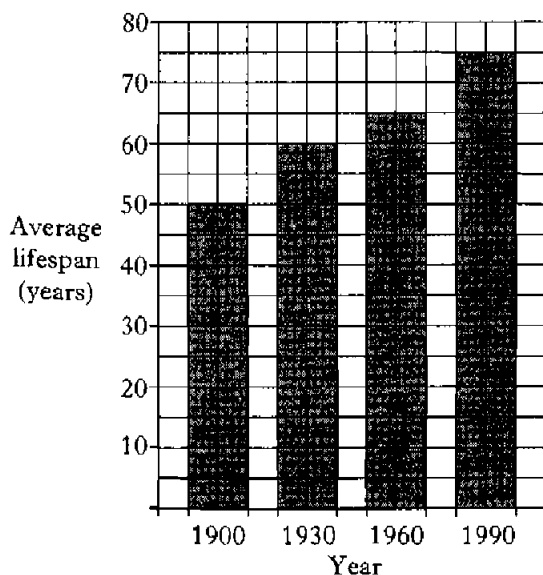
25. The diagram below shows the ages (in months) at which children reach various stages in their development. The left end of each bar indicates the age by which 25% of infants have reached the stated performance. The right end of each bar indicates the age by which 90% of infants have reached the stated performance. The vertical bar indicates the age by which 50% of infants have reached the stated performance.



A nine-month-old infant can stand without support but cannot walk without support. In what percentage of the population does this child lie?

- A Less than 25%
- B Around 25%
- C Around 50%
- D Greater than 50%

26. The diagram below shows the average lifespan of people in Britain between 1900 and 1990.



What is the percentage increase in lifespan during this period?

- A 25%
- B 45%
- C 50%
- D 75%

27. In the nitrogen cycle, which of the following processes is carried out by nitrifying bacteria?

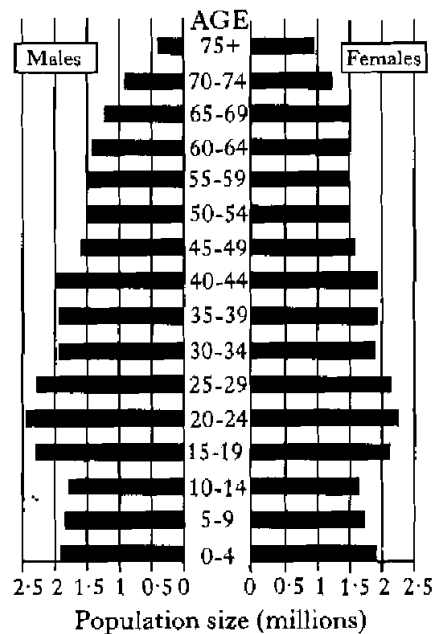
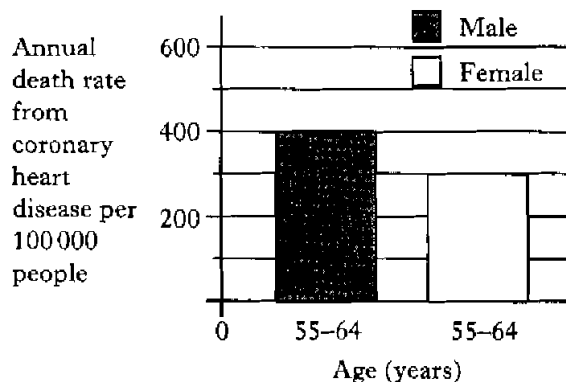
The conversion of

- A nitrate to ammonia
- B ammonia to nitrate
- C nitrogen gas to ammonia
- D nitrogen gas to nitrate.

28. In a river, samples of water from above and below a sewage outlet were compared. Which comparison is correct?

	<i>Sample above sewage outlet</i>	<i>Sample below sewage outlet</i>
A	high oxygen concentration	many bacteria
B	high oxygen concentration	few bacteria
C	low oxygen concentration	many bacteria
D	low oxygen concentration	few bacteria

29. The graphs below contain information about the population of Britain.



How many British women between 55 and 64 years of age die from coronary heart disease annually?

- A 300
- B 4500
- C 9000
- D 21 000

30. Which of the following pairs of gases are the principal contributors to the greenhouse effect?

- A Nitrogen and carbon dioxide
- B Carbon dioxide and methane
- C Ammonia and carbon dioxide
- D Nitrogen and methane

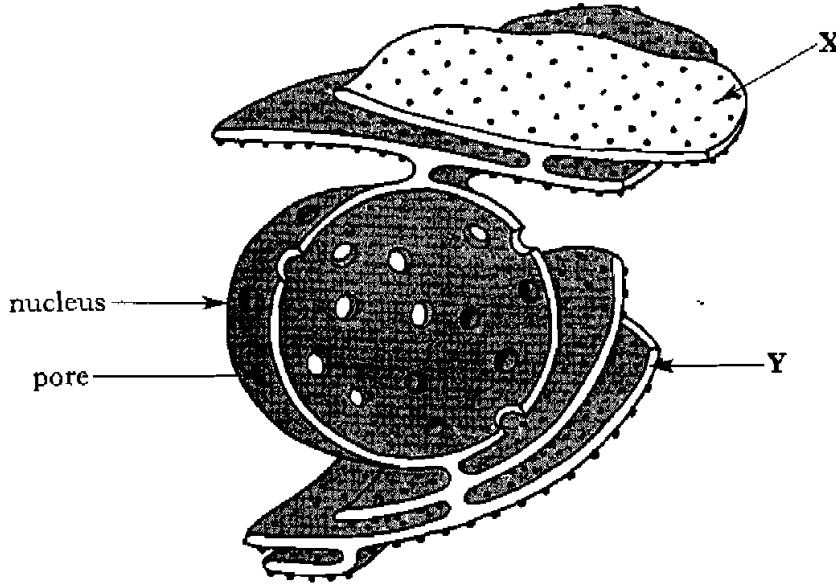
Candidates are reminded that the answer sheet MUST be returned INSIDE this answer booklet.

SECTION B

Marks

All questions in this section should be attempted.

1. The diagram below shows a section through a nucleus and associated cell structures.



- (a) (i) Name organelle X.

1

- (ii) What type of substance is manufactured by organelle X?

1

- (iii) Give an example of such a substance.

1

- (b) (i) The structure labelled Y is composed of sheets of membranes. What name is given to this structure?

1

- (ii) Structure Y can transport substances to another organelle within the cell.

Give an example of such an organelle and state its function.

Example _____

1

Function _____

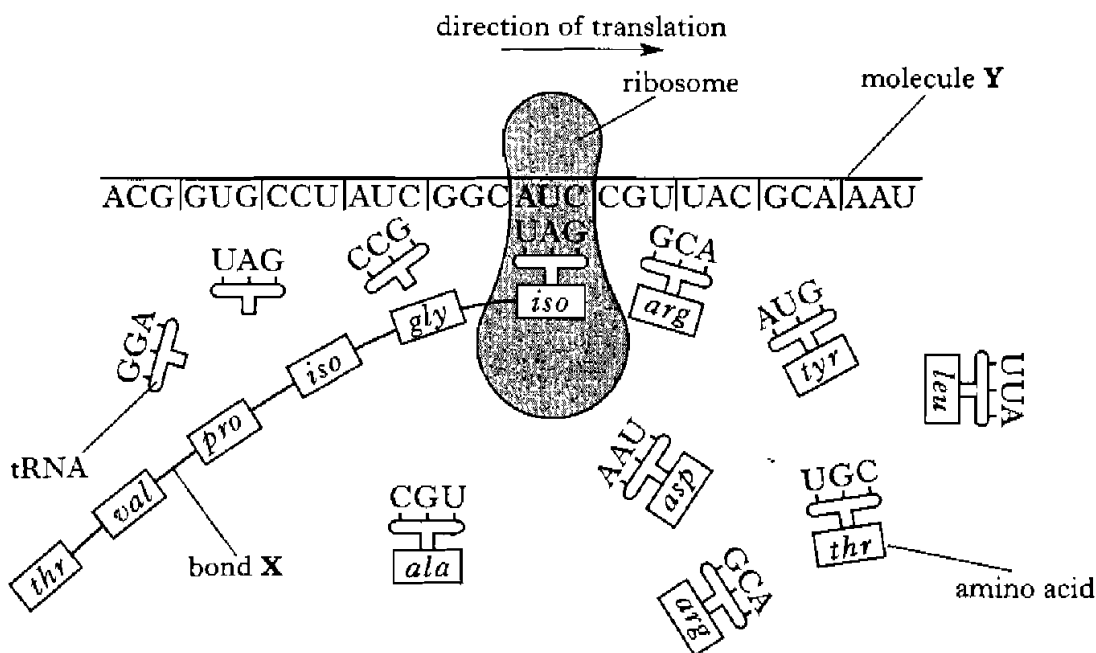
1

- (c) Why is it necessary to have pores in the nuclear membrane?

1

2. The diagram shows the synthesis of a peptide chain.

Marks



(a) Name bond X and molecule Y.

Bond X _____ Molecule Y _____ 2

(b) What term is used to describe the triplet code on the tRNA molecules?

_____ 1

(c) Give the abbreviated names of the next **four** amino acids which will be attached to complete the peptide chain.

iso → _____ → _____ → _____ → _____ 1

(d) What sequence of bases on a DNA molecule will code for the amino acid labelled *thr*?

_____ 1

(e) Amino acids are added to the peptide chain at the rate of 15 per second.

How long will it take for the complete synthesis of the peptide shown in the diagram above?

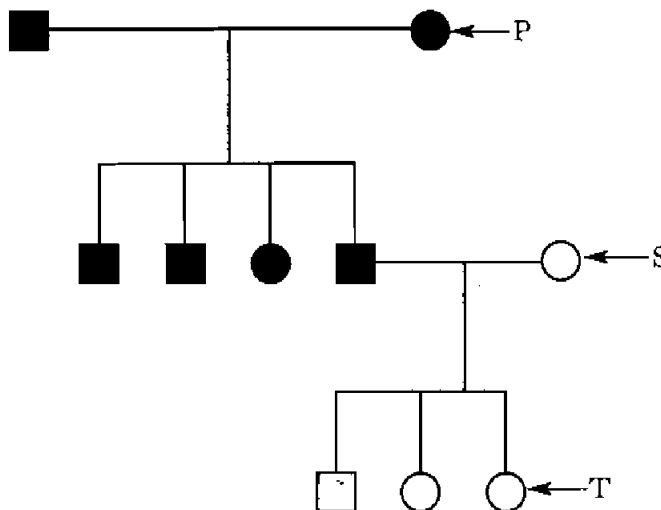
_____ s 1

[Turn over

3. The diagram below shows the inheritance of tongue-rolling ability in a family.

Marks

- Male tongue-roller
- Female tongue-roller
- Male non tongue-roller
- Female non tongue-roller



(a) (i) Using the symbol **R** to represent the allele for tongue-rolling, and the symbol **r** to represent the allele for non tongue-rolling, state the genotypes of individuals P and T.

P _____ T _____

1

(ii) How many individuals, shown in this family tree, have a genotype which is homozygous recessive?

1

(iii) Place a cross through a symbol in the family tree which represents a heterozygous male.

1

(iv) Female S is pregnant. Using information from the family tree, is it possible to predict whether the child will be a tongue-roller or not? Give a reason for your answer.

YES/NO _____

Reason _____

1

(b) Some characteristics are controlled by several genes.

(i) State the term used to describe this type of inheritance pattern.

1

(ii) Which **two** of the following human characteristics show this type of inheritance pattern? Underline the correct answers.

blood groups

cystic fibrosis

height

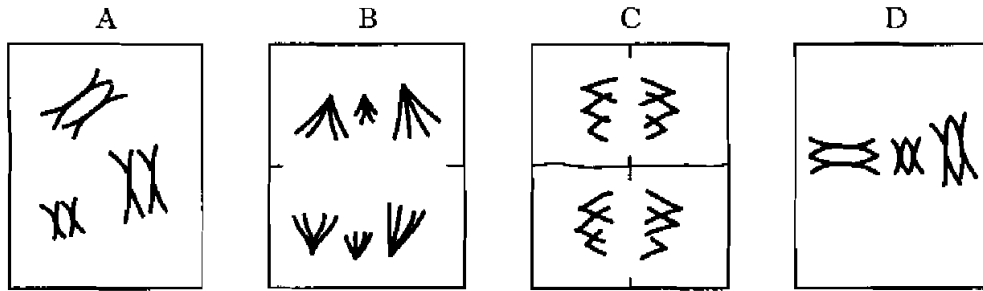
haemophilia

skin colour

1

4. Some stages in the process of meiosis are shown in the diagrams below.
Only 6 chromosomes are shown in each cell.

Marks



- (a) (i) Place the stages in the correct order.

_____ → _____ → _____ → _____

1

- (ii) At which stage could chiasmata form?

1

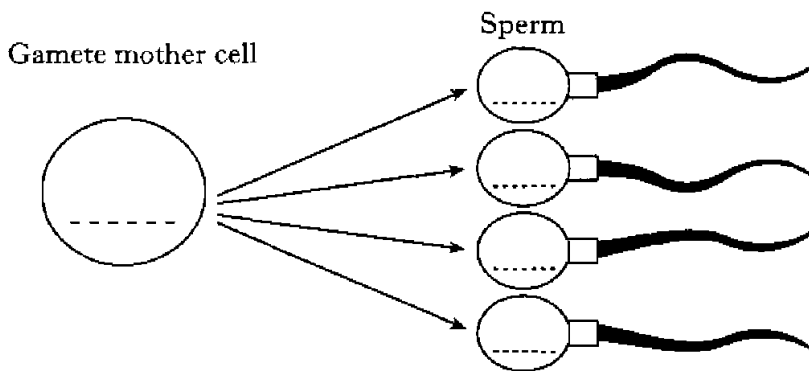
- (iii) Why are chiasmata important?

1

- (b) The diagram below shows a gamete mother cell and four sperm which would result from meiosis.

- (i) Complete the diagram by writing in the normal number of chromosomes found in each of the cells.

1



- (ii) In how many of these sperm will an X chromosome be found?

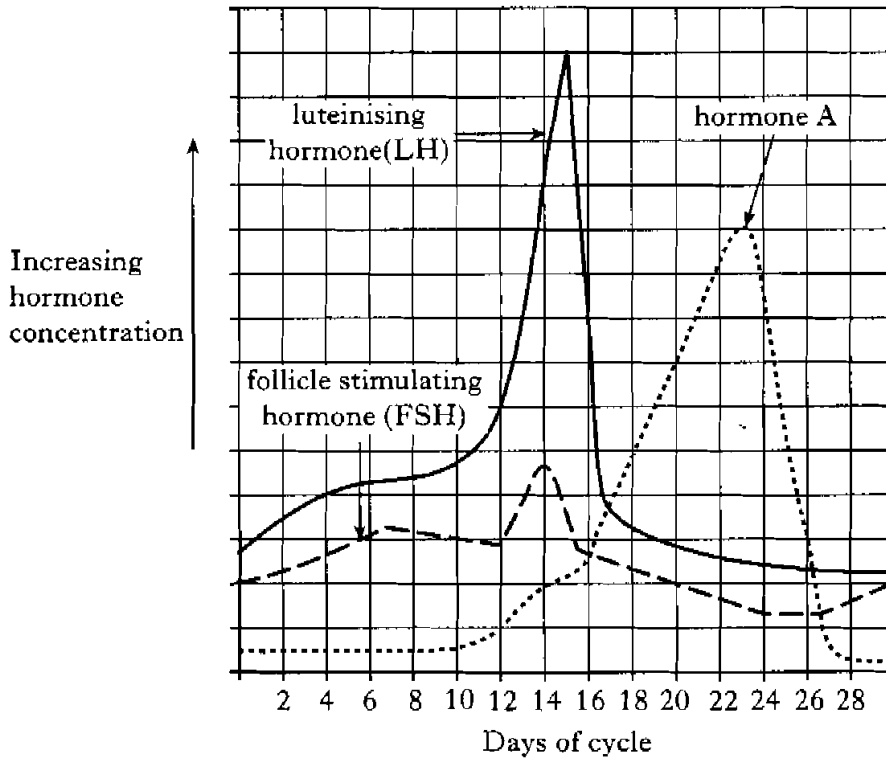
1

- (iii) Where in the testes does meiosis occur?

1

[Turn over

5. The graph below shows the relative concentrations of three hormones in the plasma of a woman during a normal 28-day menstrual cycle. Marks



- (a) Name hormone A.

1

- (b) What is the effect of the sudden increase in concentration of luteinising hormone?

1

- (c) During which time period is the endometrium likely to reach maximum thickness?

Underline the correct answer.

0-4 days

12-16 days

22-26 days

1

- (d) In what way would the line showing the concentration of FSH be different if fertilisation took place during this cycle? Give an explanation for your answer.

Difference _____

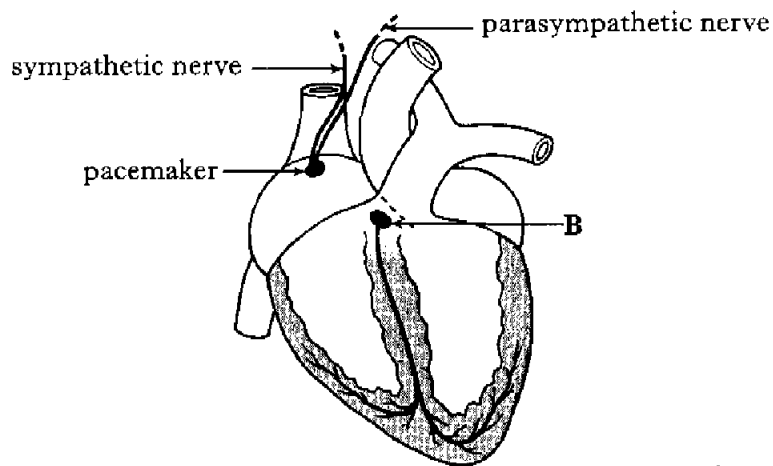
1

Explanation _____

1

Marks

6. The diagram below shows the heart and its associated nerves.



(a) On the diagram, mark with an **X** the chamber where the blood pressure is highest during the cardiac cycle.

1

(b) Describe the effect of impulses from the parasympathetic nerve on the heart.

1

(c) (i) Name the part of the heart labelled **B**.

1

(ii) Describe the role of **B** in the cardiac cycle.

1

(iii) An individual has a heart rate of 75 bpm. How long does one cardiac cycle last?

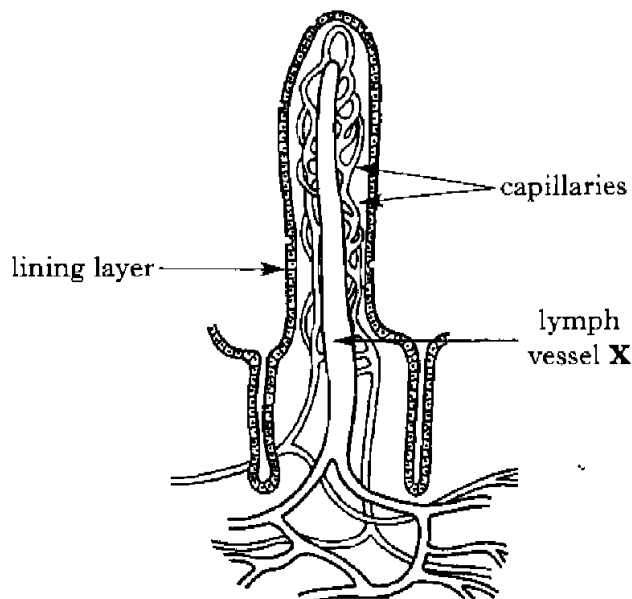
Space for calculation

_____ s 1

[Turn over

Marks

7. The diagram below shows the structure of a villus.



(a) (i) Name lymph vessel X.

1

(ii) Describe the role of lymph vessel X in the transport of nutrients.

1

(b) (i) Vitamin B₁₂ is absorbed into the blood capillaries of the villus.

Name the substance which must be present before vitamin B₁₂ can be absorbed.

1

(ii) Which type of body cell requires vitamin B₁₂ for its manufacture?

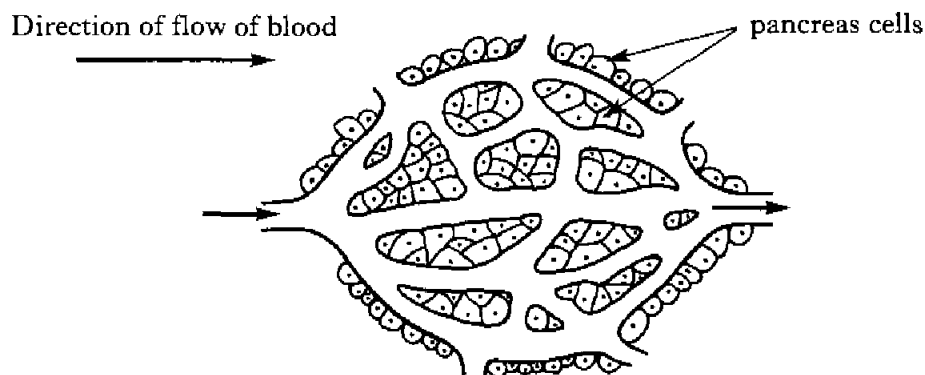
1

(c) Name the blood vessel which transports nutrient-rich blood away from the small intestine.

1

8. The diagram below shows blood flow through a capillary bed in the pancreas. The area shown is an Islet of Langerhans.

Marks



- (a) After a meal rich in carbohydrate, the composition of the blood changes as it flows through the pancreas.

Complete the table below using the words *increases* or *decreases* to indicate these changes.

Substance	Change
Oxygen	
Carbon dioxide	
Insulin	

2

- (b) (i) What effect does insulin have on the body?

1

- (ii) Name a hormone produced by the pancreas which has the opposite effect to insulin.

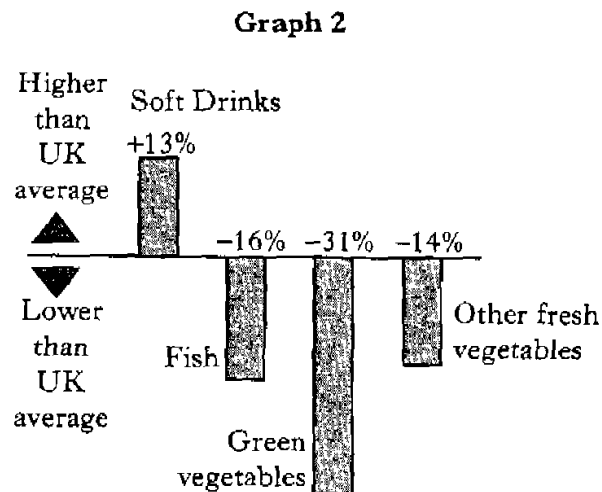
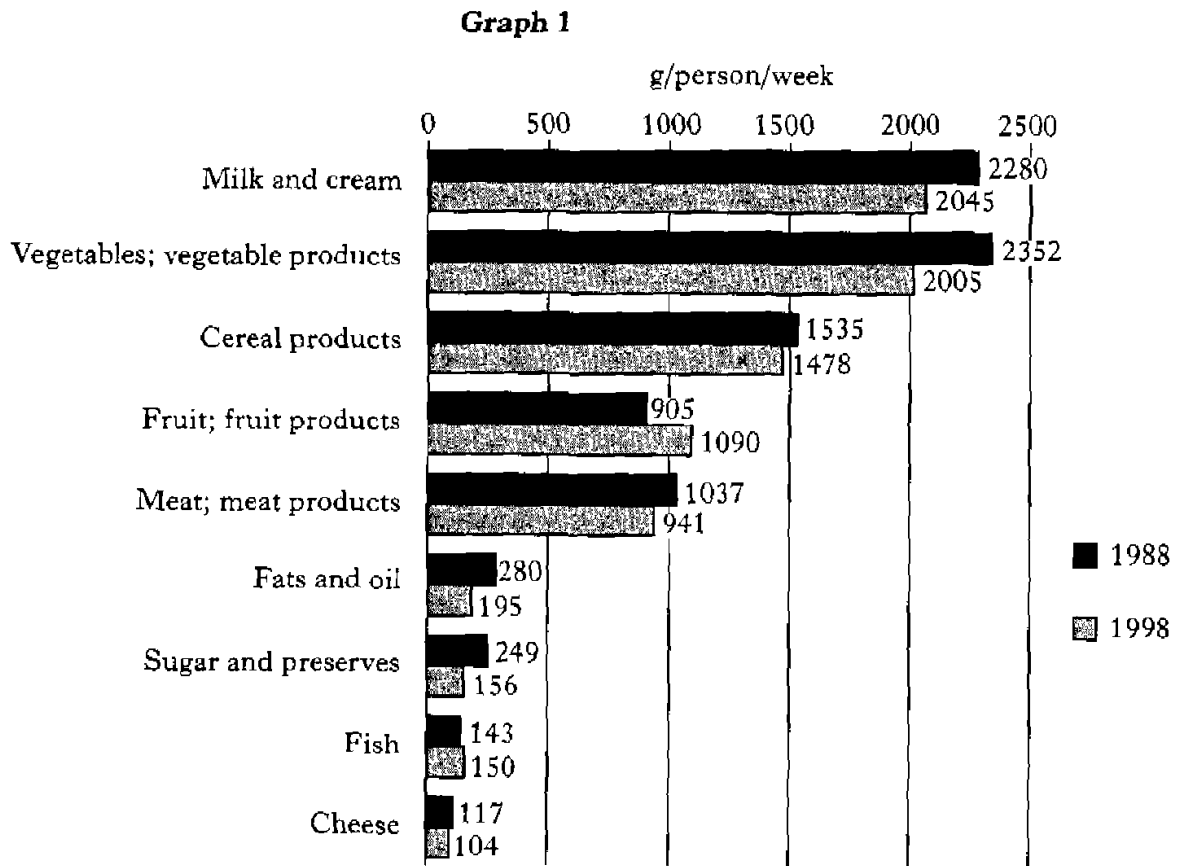
1

[Turn over

9. The graphs below contain information about diet in the UK.

Graph 1 shows how UK diet has changed between 1988 and 1998.

Graph 2 shows how Scottish consumption compares with the rest of the UK in 1998.



9. (continued)

Marks

- (a) (i) From **Graph 1**, what general conclusion can be drawn about UK diet in 1988 compared with 1998?

1

- (ii) What additional information would be required in order to draw a general conclusion about the Scottish diet over the same period of time?

1

- (iii) When collecting data to make comparisons of this type, state **two** variables which should be controlled.

1 _____

2 _____

2

- (b) From **Graph 1**, calculate the percentage reduction in milk and cream consumption over the decade.

Space for calculation

_____ %

1

- (c) With reference to **both** graphs, calculate the weekly fish consumption in Scotland in 1998.

Space for calculation

_____ g/person/week

1

- (d) The incidence of coronary heart disease in the UK over the ten-year period has decreased. From **Graph 1** give **two** pieces of evidence which may contribute to this decrease.

1 _____

2 _____

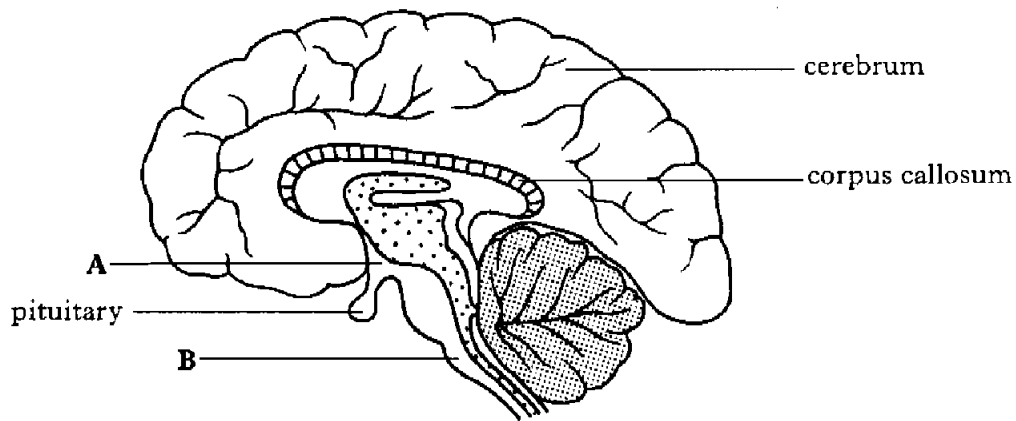
1

- (e) Information such as this can be used by governments to plan for the future. Suggest what use might be made of the information on diet shown in the graphs.

1

10. The diagram shows a section through the brain.

Marks



(a) Name parts **A** and **B** shown on the diagram.

A _____ **B** _____ 2

(b) (i) Name **two** areas of the cerebrum in which functions are localised.

_____ and _____ 1

(ii) Explain how the convoluted surface of the cerebrum contributes to its function.

_____ 1

(iii) What is the function of the corpus callosum?

_____ 1

(c) Parts of the brain are involved in memory storage. Complete the following sentences which relate to memory loss, using words from the list below.

- | | | |
|---------------------|----------------------|------------------|
| Alzheimer's | noradrenaline | limbic |
| Huntingdon's | acetylcholine | lymphatic |

A disorder particularly associated with memory loss is _____
disease. This disorder is due to the disappearance of cells which produce the
neurotransmitter _____ in the _____ system
of the brain. 2

Marks

10. (continued)

(d) The hormone ADH is produced by the pituitary gland.

Describe the role of ADH in restoring water balance after excess water has been lost from the body.

3

[Turn over

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11. A student carried out an experiment to investigate how quickly three groups of pupils completed a finger maze. Marks

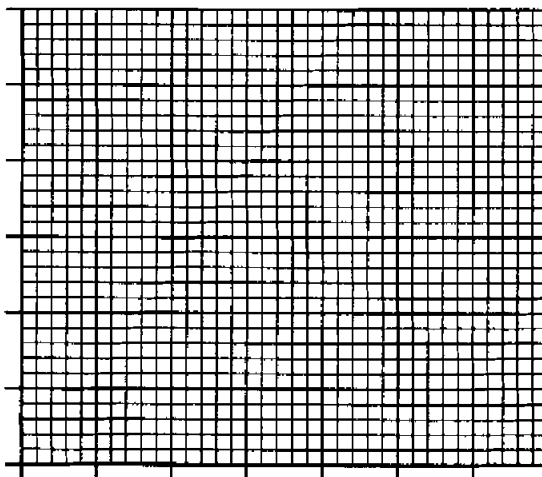
The table below shows the fastest times obtained by each group of pupils.

<i>Fastest time achieved in trials (s)</i>		
<i>8 year-olds</i>	<i>12 year-olds</i>	<i>16 year-olds</i>
11	7	7
12	8	8
9	6	7
6	10	9
11	8	6
10	7	-
12	12	-
13	6	-
-	7	-
-	6	-
average	10.5	7.4

- (a) Calculate the average time for the 12 year-old pupils and write your answer in the table above. 1

- (b) Construct a **bar graph** to show the **average** times for each age group of pupils.

(Additional graph paper, if required, will be found on page 30.)



2

11. (continued)

Marks

(c) (i) Explain why these average results are not reliable.

1

(ii) Identify another factor which would have to be considered in the design of this experiment to ensure that valid conclusions can be drawn.

1

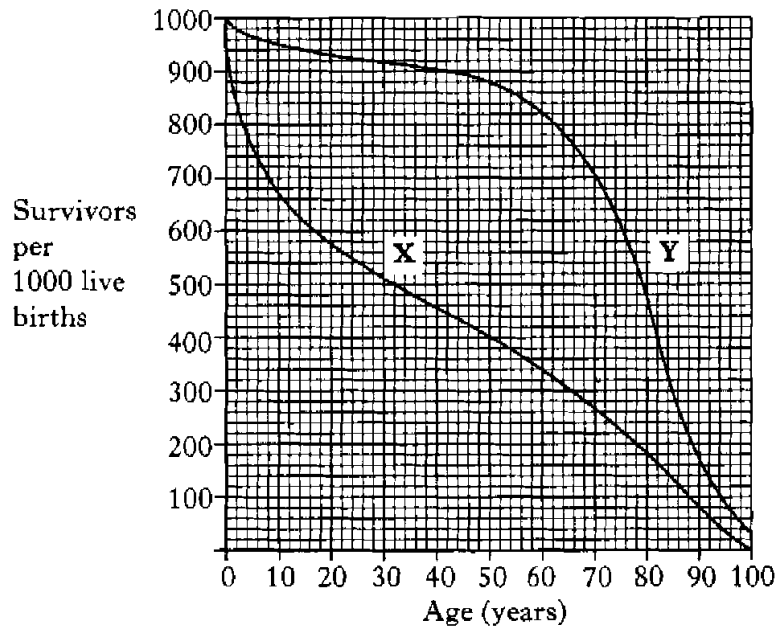
(d) It was found that some of the pupils performed better when they were being watched by other pupils. What term is used to describe this effect?

1

[Turn over

12. The graph below shows two survival curves for the UK population. The curves plot the number of people at each age who are still alive. One curve is from the year 1800 and the other from the year 1960.

Marks



- (a) Complete the table to identify each curve and give a reason for your selection.

Curve	Year
X	
Y	

Reason for selection

1

- (b) Suggest **two** reasons for the difference in the curves between the ages of 0 and 10.

1 _____

2 _____

1

12. (continued)

Marks

- (c) For each curve, express the numbers still alive at the age of 50 as a percentage of their original population.

Space for calculation

X _____ % Y _____ %

1

- (d) For each of the curves identify the ten-year period during which there is the highest mortality rate.

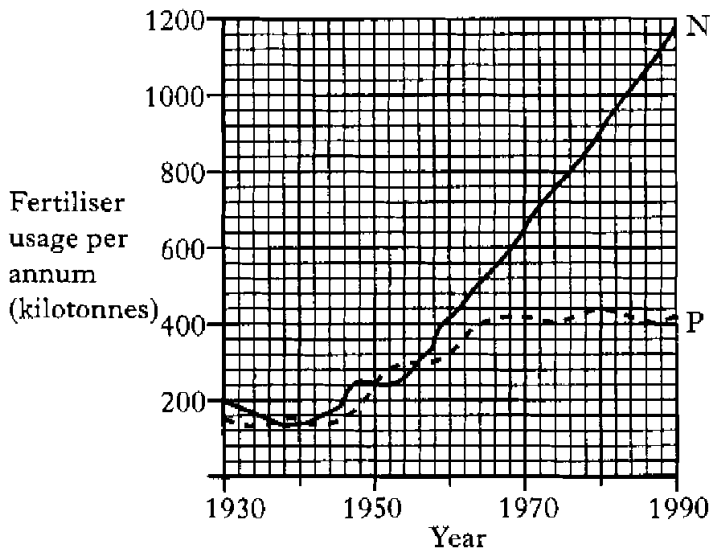
X _____ years Y _____ years

1

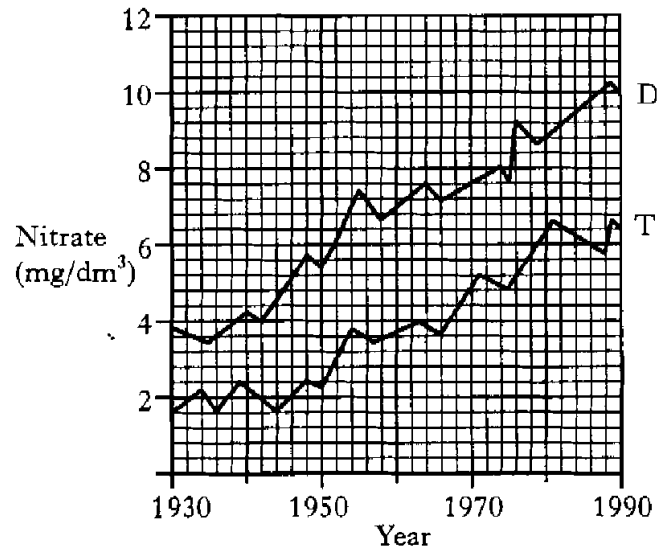
[Turn over

13. The graphs below relate to fertiliser use by farmers, and nitrate pollution of two rivers from 1930 to 1990.

Graph 1. The use of nitrogen (N) and phosphorus (P) in fertiliser.



Graph 2. The nitrate content of the rivers Dee and Tay.



N – Nitrogen
P – Phosphorus

- (a) From **Graph 1**, compare the change in use of nitrogen and phosphorus in fertiliser from 1930 to 1990.

Marks

2

- (b) From **Graph 2**, what was the nitrate concentration in the river Dee in the year 1970?

1

- (c) What evidence is there, from comparison of both graphs, that agricultural use of fertiliser is linked to nitrate pollution of the Dee and Tay?

1

DO NOT
WRITE
THIS
MARK

13. (continued)

Marks

(d) Describe **two** effects of increased nitrate pollution of fresh water.

1 _____

2 _____

2

(e) Name a source of nitrate and phosphate pollution other than farmland.

1

(f) Describe **one** way in which phosphorus is important to the structure or function of a cell.

1

[Turn over

SECTION C

Marks

Both questions in this section should be attempted.

Note that each question contains a choice.

Questions 1 and 2 should be attempted on the blank pages which follow.

Supplementary sheets, if required, may be obtained from the invigilator.

Labelled diagrams may be used where appropriate.

1. Answer **either** A or B.

A. Give an account of DNA under the following headings:

(i) DNA structure;

7

(ii) DNA replication.

3

(10)

OR

B. Give an account of immunity under the following headings:

(i) B-lymphocytes and T-lymphocytes;

7

(ii) Macrophages.

3

(10)

In question 2 ONE mark is available for coherence and ONE mark is available for relevance.

2. Answer **either** A or B.

A. Give an account of the life history of a red blood cell.

(10)

OR

B. Give an account of the influence of hormones on the growth and development of boys.

(10)

[END OF QUESTION PAPER]