



National
Qualifications
2015

X740/76/02

**Human Biology
Section 1 — Questions**

WEDNESDAY, 13 MAY

1:00 PM – 3:30 PM

Instructions for the completion of Section 1 are given on *Page two* of your question and answer booklet.

Record your answers on the answer grid on *Page three* of your question and answer booklet.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not you may lose all the marks for this paper.

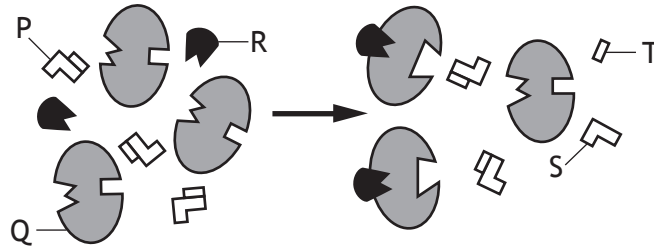


* X 7 4 0 7 6 0 2 *

SECTION 1 — 20 marks

Attempt ALL questions

1. The diagram below shows an enzyme-catalysed reaction taking place in the presence of an inhibitor.

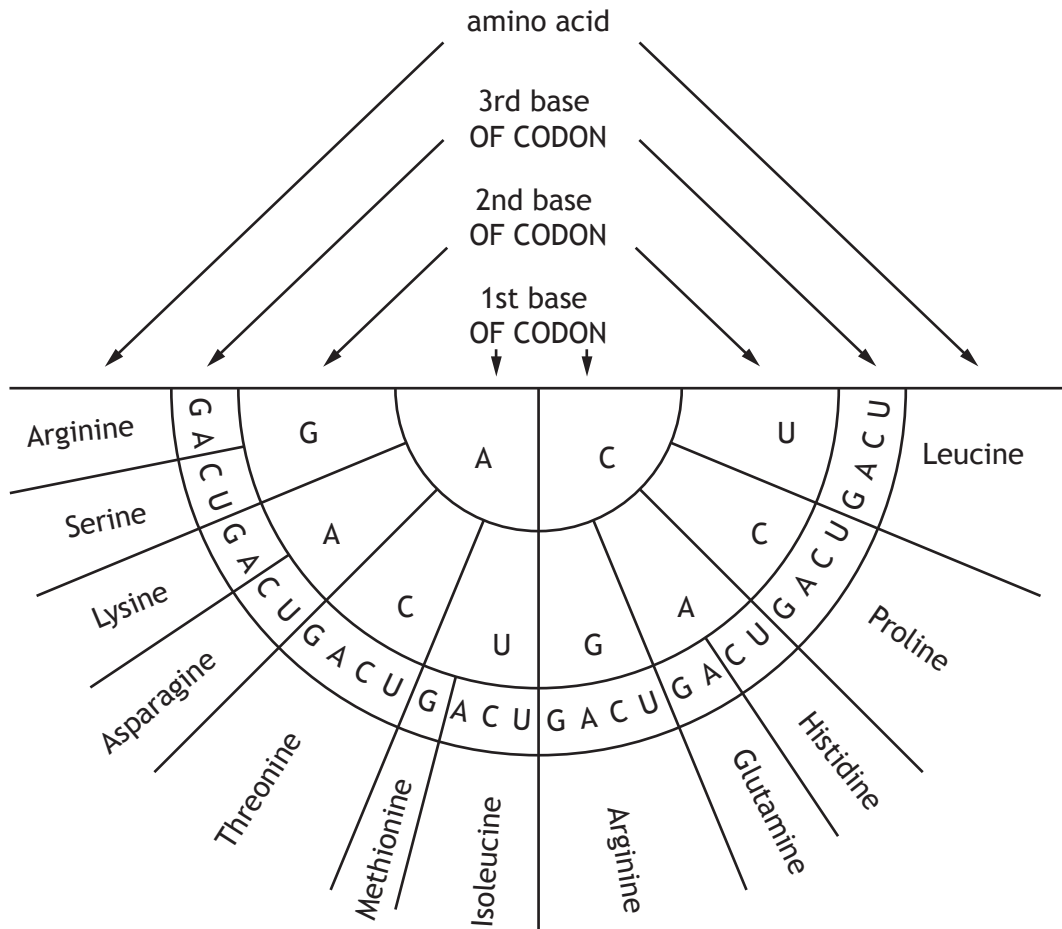


Which line in the table below identifies the molecules in the reaction?

| | <i>Inhibitor</i> | <i>Substrate</i> | <i>Product</i> |
|---|------------------|------------------|----------------|
| A | P | R | S |
| B | Q | P | S |
| C | R | P | T |
| D | R | Q | T |

2. A primary transcript is a strand of
- A RNA comprising just exons
 - B DNA comprising just exons
 - C RNA comprising introns and exons
 - D DNA comprising introns and exons.

3. The diagram below can be used to identify amino acids coded for by mRNA codons.



How many different amino acids are coded for by the following mRNA strand?

A U G C C A A C U C C U A G A C G A A U A

- A 4
- B 5
- C 6
- D 7

[Turn over

4. The following are descriptions of three single gene mutations.

Description 1: exon-intron codons are created or destroyed

Description 2: one amino acid codon is replaced with another

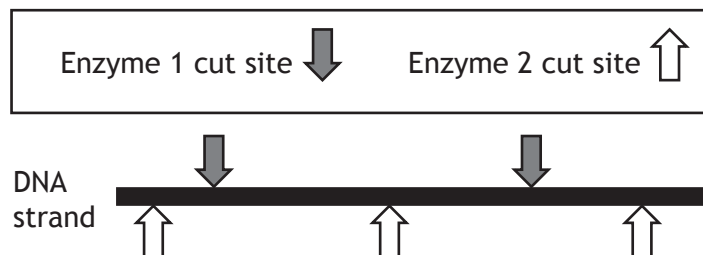
Description 3: one amino acid codon is replaced with a stop codon

Which line in the table below matches the descriptions with the correct gene mutation?

| | <i>Gene mutation</i> | | |
|---|----------------------|-----------------|--------------------|
| | <i>Missense</i> | <i>Nonsense</i> | <i>Splice site</i> |
| A | 1 | 2 | 3 |
| B | 1 | 3 | 2 |
| C | 2 | 1 | 3 |
| D | 2 | 3 | 1 |

5. DNA profiling may be used in criminal investigations.

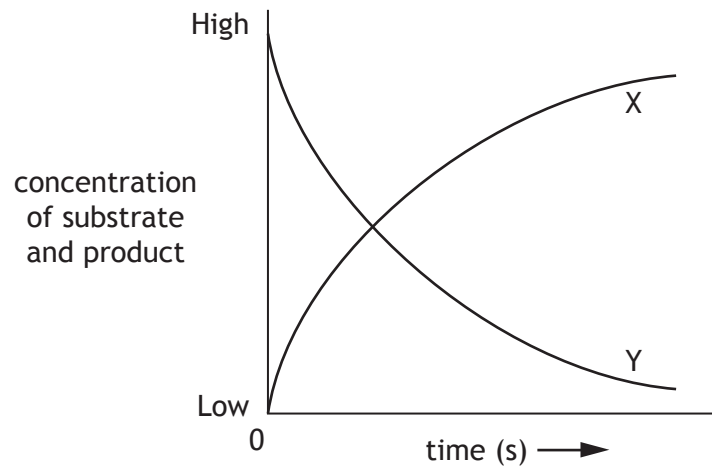
During this procedure DNA is cut into fragments by two different enzymes. Each enzyme cuts DNA at a specific point.



Which line in the table below gives the correct number of DNA fragments produced from this DNA strand?

| | <i>Number of fragments produced using</i> | | |
|---|---|----------------------|------------------------|
| | <i>enzyme 1 only</i> | <i>enzyme 2 only</i> | <i>enzymes 1 and 2</i> |
| A | 2 | 3 | 5 |
| B | 2 | 3 | 6 |
| C | 3 | 4 | 7 |
| D | 3 | 4 | 6 |

6. The graph below shows the changes to the concentrations of substrate and product during an enzyme-controlled reaction.

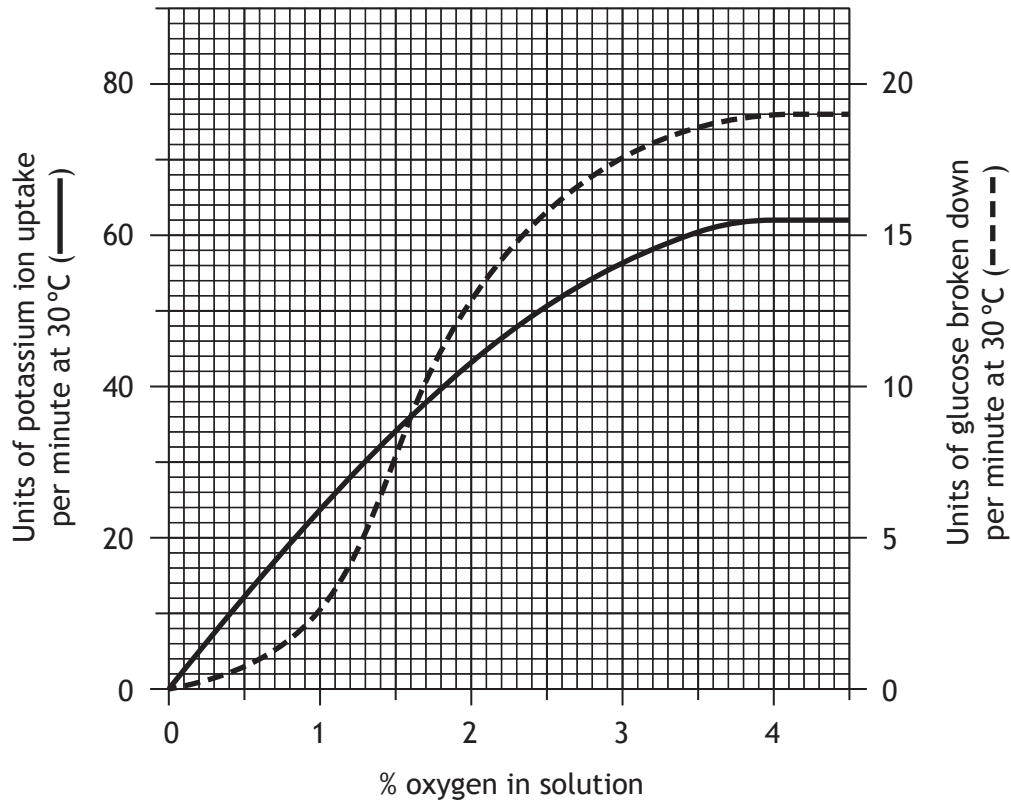


Which line in the table below identifies the substrate, product and the change in the rate of the reaction during the process?

| | <i>Substrate</i> | <i>Product</i> | <i>Rate of reaction</i> |
|---|------------------|----------------|-------------------------|
| A | X | Y | increasing |
| B | X | Y | decreasing |
| C | Y | X | increasing |
| D | Y | X | decreasing |

[Turn over

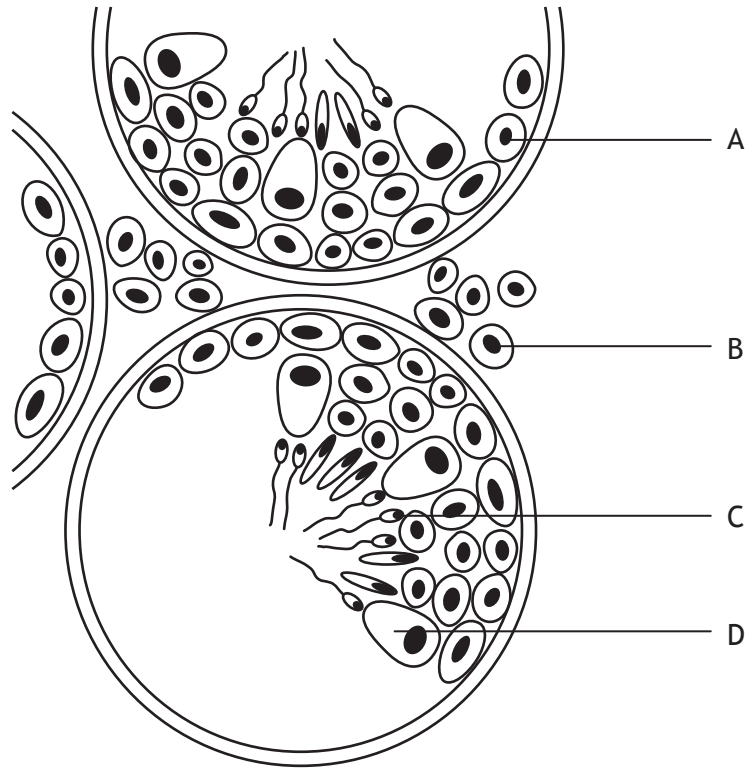
7. The graph below shows the rate of potassium uptake and glucose breakdown by muscle tissue in solutions of different oxygen concentrations.



How much glucose is broken down per minute when the oxygen concentration is 1%?

- A 2.5 units
 - B 6 units
 - C 10 units
 - D 24 units
8. A 40 g serving of a breakfast cereal contains 2 mg of iron. Only 25% of this iron is absorbed into the bloodstream.
- If a pregnant woman requires a daily uptake of 6 mg of iron, how much cereal would she have to eat each day to meet this requirement?
- A 60 g
 - B 120 g
 - C 240 g
 - D 480 g

9. The diagram below shows a section through part of the testes.



Which cells produce testosterone?

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

| <i>Genotype</i> | <i>Phenotype</i> |
|-----------------|---------------------------|
| AA | unaffected |
| AS | sickle-cell trait |
| SS | acute sickle-cell anaemia |

A woman with sickle-cell trait and an unaffected man have a child together. What are the chances that their child will have acute sickle-cell anaemia?

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

[Turn over

11. The events leading to formation of a blood clot are listed below.

1. Clotting factors are released.
2. An insoluble meshwork forms.
3. Fibrinogen is converted to fibrin.
4. Prothrombin is converted to thrombin.

The correct sequence of these events is

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

12. Which of the following statements describes the role of lipoprotein in the transport and elimination of excess cholesterol?

- A Low density lipoprotein transports excess cholesterol from the liver to the body cells.
- B Low density lipoprotein transports excess cholesterol from the body cells to the liver.
- C High density lipoprotein transports excess cholesterol from the liver to the body cells.
- D High density lipoprotein transports excess cholesterol from the body cells to the liver.

13. Which of the following describes typical features of Type 1 diabetes?

| <i>Feature of Type 1 diabetes</i> | | |
|-----------------------------------|------------------------|---------------------------------|
| A | occurs in childhood | cells unable to produce insulin |
| B | develops later in life | cells unable to produce insulin |
| C | occurs in childhood | cells less sensitive to insulin |
| D | develops later in life | cells less sensitive to insulin |

14. The following are types of neural pathways.

1. Diverging
2. Converging
3. Reverberating

Which of these pathways involve nerve impulses being sent back through a circuit of neurons?

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

15. After drinking, alcohol is removed from the blood at a constant rate.

The table below shows the average time it takes to remove different alcohol concentrations from the blood.

| <i>Blood alcohol concentration</i> (mg/100 cm ³) | <i>Removal time</i> (hours) |
|---|--------------------------------|
| 16 | 1.0 |
| 50 | 3.125 |
| 80 | 5.0 |
| 100 | 6.25 |
| 160 | 10.0 |
| 200 | 12.5 |

The legal maximum blood alcohol concentration for driving in some regions of the UK is 80 mg/100 cm³.

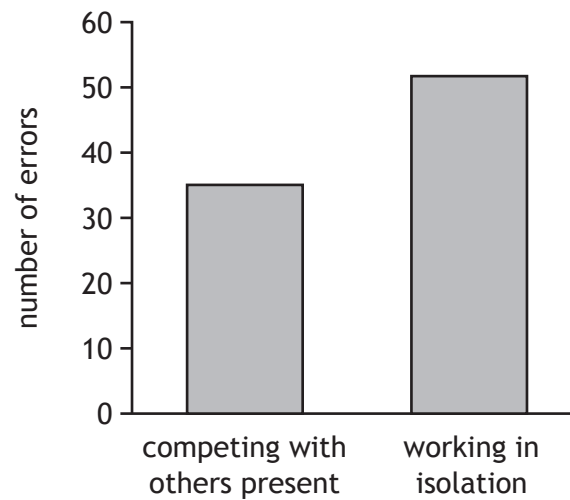
Predict how long it would take before a person with a blood alcohol concentration of 240 mg/100 cm³ would legally be able to drive in these regions.

- A 5 hours
B 10 hours
C 15 hours
D 20 hours

[Turn over

16. A number of students were trained to carry out a complex task. Some competed with one another, others worked in isolation.

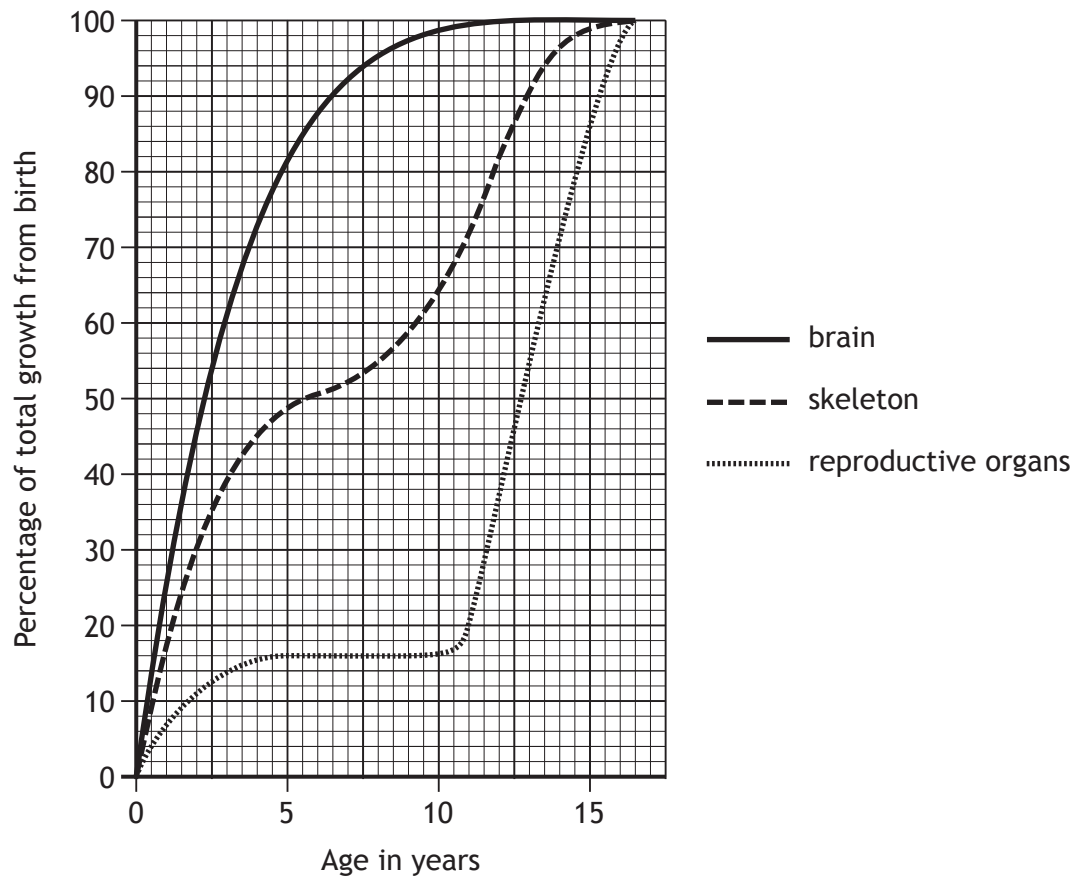
The graph below shows the number of errors recorded in the training process.



Which process is likely to have caused the difference in the results?

- A Deindividuation
 - B Social facilitation
 - C Shaping
 - D Internalisation
17. The pathogen for the disease tuberculosis (TB) evades the specific immune response by
- A surviving within phagocytes
 - B attacking lymphocytes
 - C attacking phagocytes
 - D antigenic variation.

18. The graph below shows the average growth rate of body organs in males.



What is the ratio of total growth of brain to skeleton in an 8 year old child?

- A 11 : 3
- B 3 : 11
- C 19 : 11
- D 11 : 19

19. Failure in regulation of the immune system leading to an autoimmune disease is caused by a

- A B lymphocyte immune response to self antigens.
- B T lymphocyte immune response to self antigens.
- C B lymphocyte immune response to foreign antigens.
- D T lymphocyte immune response to foreign antigens.

[Turn over for Question 20 on Page twelve

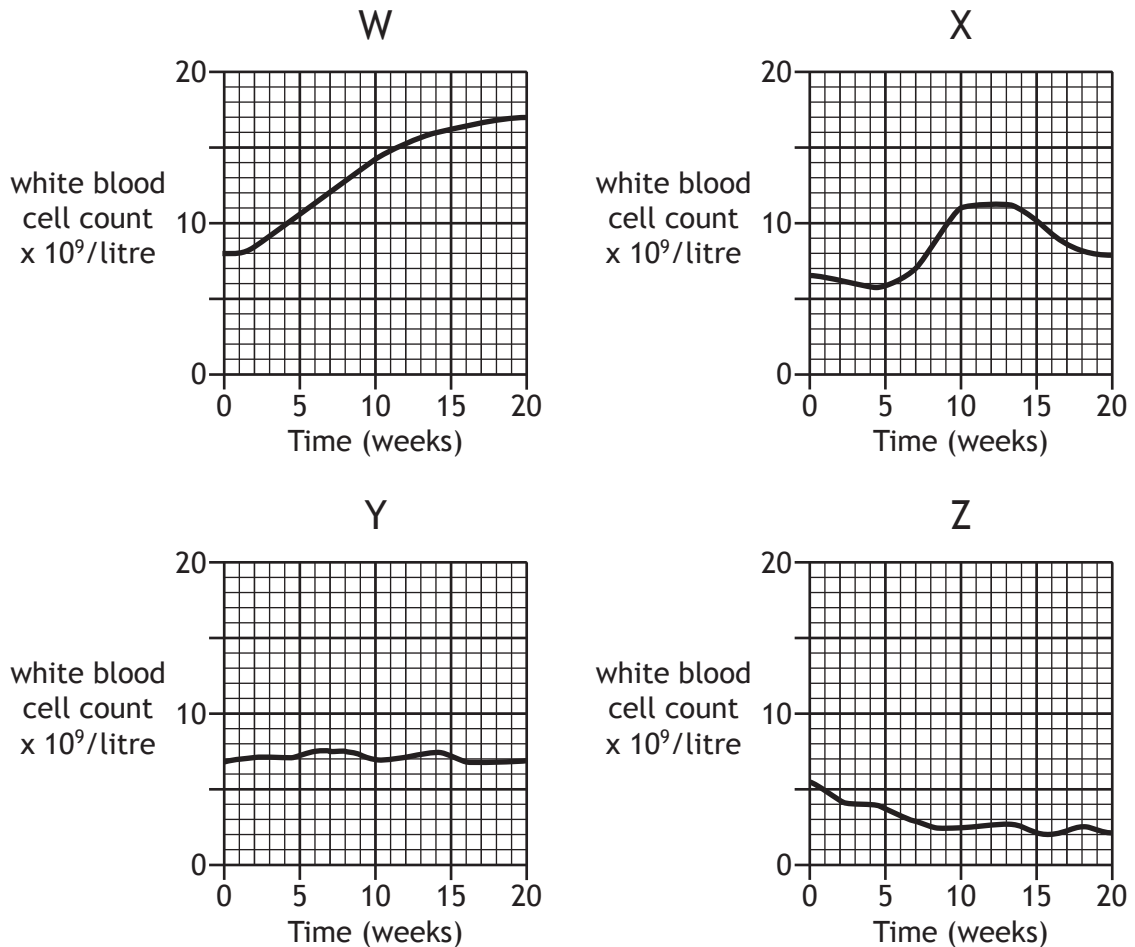
20. Blood tests to measure the number of white blood cells (leucocytes) are often used to indicate infection and/or illness.

Leucopenia, due to starvation or malnutrition, is indicated by white blood cell numbers dropping below $4 \times 10^9/\text{litre}$.

Leucocytosis, due to fever or tissue damage, is indicated by white blood cell numbers temporarily increasing to $11 \times 10^9/\text{litre}$.

Leukaemia, due to DNA damage and cell division, is indicated by white blood cell numbers permanently increasing.

The following graphs show the white blood cell count of four patients over 20 weeks.



From the graphs, identify the patients.

| | <i>Leukaemia</i> | <i>Leucocytosis</i> | <i>Leucopenia</i> |
|---|------------------|---------------------|-------------------|
| A | Y | X | Z |
| B | Z | W | Y |
| C | W | X | Z |
| D | W | Y | X |

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET.]