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National Qualifications 2019

X840/76/12

Human Biology
Paper 1 — Multiple choice

TUESDAY, 30 APRIL

INSTRUCTIONS TO CANDIDATES

Candidates should enter their surname, forename(s), date of birth, Scottish candidate number and the name and Level of the subject at the top of their first answer sheet.

Total marks — 25

Attempt ALL questions.

Instructions for the completion of Paper 1 are given below.

1. The answer to each question is **either** A, B, C or D. Decide what your answer is, then write the question number and your answer on your answer sheet.

2. There is **only one correct** answer to each question.

Sample question

The thigh bone is called the

A humerus

B femur

C tibia

D fibula.

The correct answer is **B** — femur. You write: Question 7.B

Changing an answer

If you decide to change an answer, cancel your first answer by brailling it out and write the answer you want.

An OW in the margin indicates a new question.

Questions marked with an asterisk differ in some respects from those in the printed paper.

Total marks — 25

Attempt ALL questions

1. A section of DNA containing 8000 bases has 1200 cytosine bases.
The number of adenine bases in this section of DNA is

A 800
B 1200
C 1400
D 2800.

2. Identify the RNA codon and anticodon for the DNA base sequence GAT.

	RNA codon	RNA anticodon
A	CTA	GAT
B	GAT	CTA
C	CUA	GAU
D	GAU	CUA

3. The following sequence shows the order of bases in a segment of mRNA.

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

How many different amino acid molecules are coded for by this segment of mRNA?

A 6
B 7
C 8
D 24

*** 4.** Refer to the diagram for Question 4. The diagram shows three of the stages involved in gene expression.

Which row in the table identifies these stages?

	Stage X	**Stage Y**	**Stage Z**
A	translation	RNA splicing	transcription
B	RNA splicing	transcription	translation
C	transcription	translation	RNA splicing
D	transcription	RNA splicing	translation

*** 5.** Refer to the diagram for Question 5. The diagram shows the base sequence for a section of a gene and a mutated version of this section.

This is an example of

A a deletion mutation

B an insertion mutation

C a substitution mutation

D a translocation mutation.

*** 6.** Refer to the diagram for Question 6. Enzymes can be used to cut strands of DNA into fragments.

The diagram shows the cutting sites of two different enzymes on a DNA strand that is 40 kilobases (kb) long.

What length of fragments (kb) would be produced if the DNA strand was cut with enzyme X only?

A 12, 20

B 12, 28

C 20, 20

D 12, 8, 20

7. Three applications of human genomics are listed.

1. Comparing genomes to settle paternity disputes
2. Screening a genome for a particular sequence to diagnose disease
3. Using genome information in the choice of effective drug treatments

Which of these applications are examples of pharmacogenetics?

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

*** 8.** Refer to the diagram for Question 8. The diagram shows molecules involved in an enzyme controlled reaction.

Which row in the table identifies these molecules?

	Molecule X	**Molecule Y**	**Molecule Z**
A	substrate	non-competitive inhibitor	enzyme
B	non-competitive inhibitor	enzyme	substrate
C	substrate	competitive inhibitor	enzyme
D	competitive inhibitor	non-competitive inhibitor	substrate

*** 9.** Refer to the diagram for Question 9. The graph shows the results of an investigation into the effects of two different inhibitors on enzyme activity.

Which of the following conclusions can be drawn from this graph?

A Inhibitor Z is a competitive inhibitor
B There is a steady increase in enzyme activity with no inhibitor
C Inhibitor Y has less effect on enzyme activity than inhibitor Z
D Increasing substrate concentration increases the effect of both inhibitors

10. At the end of the electron transport chain hydrogen ions and electrons combine with

A NAD

B ATP

C water

D oxygen.

11. Which row in the table describes the generation of ATP in slow-twitch muscle fibres?

	Generation of ATP	**Relative number of mitochondria**
A	aerobic respiration	many
B	aerobic respiration	few
C	glycolysis only	many
D	glycolysis only	few

***12.** Refer to the diagram for Question 12. Two athletes took part in different training programmes. One undertook regular training sessions while the other undertook high intensity interval training (HIIT) sessions.

The graph shows the time taken to complete a run before and after each training programme.

The improvement in performance as a result of HIIT training compared to regular training is

A 30 s

B 40 s

C 50 s

D 80 s.

***13.** Refer to the diagram for Question 13. The diagram represents the female reproductive system.

Which letter indicates the location where an intra-uterine device would be positioned to prevent pregnancy?

***14.** Refer to the diagram for Question 14. The diagram shows the inheritance of haemophilia, a blood clotting disorder, in three generations of a family.

Haemophilia is caused by a sex-linked recessive allele.

Individuals P and Q are expecting a third child.

What is the percentage chance that this child will have haemophilia?

A 0 %

B 25 %

C 50 %

D 75 %

***15.** Refer to the diagram for Question 15. The graph shows how increasing oxygen uptake affects heart rate and stroke volume.

What is the cardiac output when the rate of oxygen uptake is 0·6 litres/minute?

A 1·50 cm^3/min

B 8000 cm^3/min

C 9600 cm^3/min

D 10 000 cm^3/min

16. Increased blood flow within an artery is the result of smooth muscle

A relaxation causing vasodilation

B contraction causing vasodilation

C relaxation causing vasoconstriction

D contraction causing vasoconstriction.

***17.** Refer to the diagram for Question 17. The graph and the table below contain information about the population of the United Kingdom.

Age (years)	Male population size (millions)	Female population size (millions)
0–9	3·7	3·6
10–19	4·2	3·7
20–29	4·5	4·3
30–39	4·0	4·0
40–49	3·6	3·6
50–59	3·0	3·0
60–69	2·6	3·0
70+	1·3	2·1

How many males aged between 50–59 years die from coronary heart disease annually in the United Kingdom?

A 400

B 9000

C 12 000

D 21 000

18. Which row in the table identifies components of the central and peripheral nervous systems?

	Central nervous system		Peripheral nervous system	
A	spinal cord	brain	somatic	medulla
B	brain	spinal cord	sympathetic	somatic
C	parasympathetic	brain	spinal cord	sympathetic
D	sympathetic	parasympathetic	brain	spinal cord

19. Transfer of information between cerebral hemispheres occurs through the

A medulla

B glial cells

C myelin sheath

D corpus callosum.

20. The following statements refer to events that occur at a synapse.

1. An impulse is generated
2. Acetylcholine diffuses across the synaptic cleft
3. Acetylcholine is broken down by an enzyme
4. Acetylcholine is released from storage vesicles

In which sequence do these events occur?

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

21. A function of glial cells is the production of

A axons
B myelin
C dopamine
D noradrenaline.

22. A drug trial was carried out to study the effect of a drug on mice.

A group of mice, with an average body mass of 20 g, were given 1 mg per kg of their body mass of the drug. The drug was given twice a day for 15 days.

What was the total mass of drug given to each mouse over the 15 days?

A 0·02 mg
B 0·04 mg
C 0·30 mg
D 0·60 mg

23. Multiple sclerosis (MS) is an autoimmune disease in which lymphocytes destroy the myelin sheath.

Which row in the table shows the type of lymphocyte involved and the effect on the speed of nerve impulse transmission?

	Type of lymphocyte	**Speed of nerve impulse transmission**
A	B	increased
B	B	decreased
C	T	increased
D	T	decreased

24. The table shows the number of cases of a disease and the number of deaths resulting from this disease in a country over four years.

In which year did the greatest percentage of deaths occur?

	Year	Number of cases	Number of deaths
A	2014	1070	45
B	2015	420	12
C	2016	1960	60
D	2017	2290	90

25. Four elements involved in designing clinical trials are listed below.

1. Randomisation
2. Double blind trials
3. Placebo-controlled protocols
4. Large sample size

Which of these elements help to eliminate bias in clinical trials?

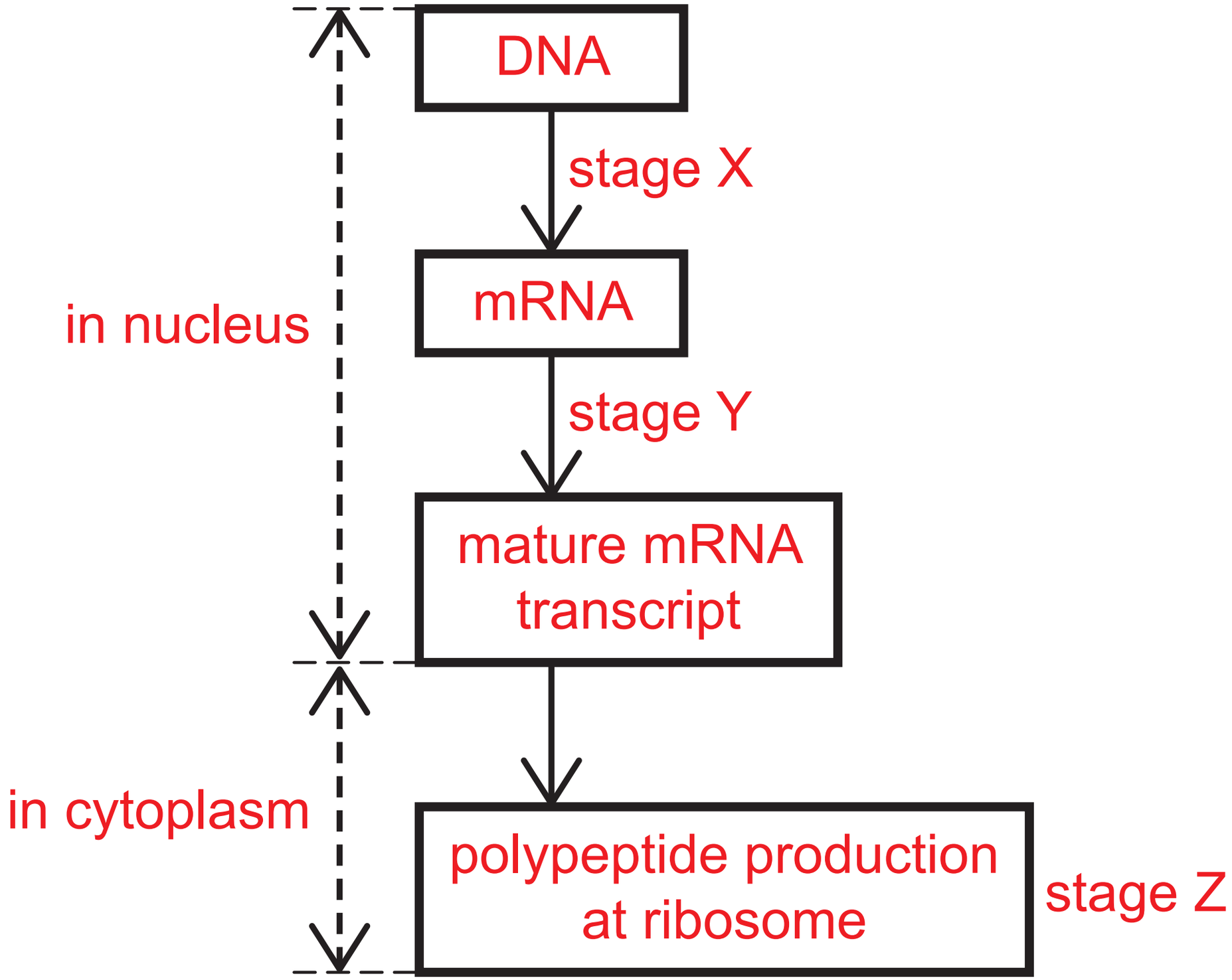
A 1 and 4 only
B 1 and 2 only
C 1, 3 and 4 only
D 1, 2, 3 and 4

[END OF QUESTION PAPER]

SPACE FOR ROUGH WORK

SPACE FOR ROUGH WORK

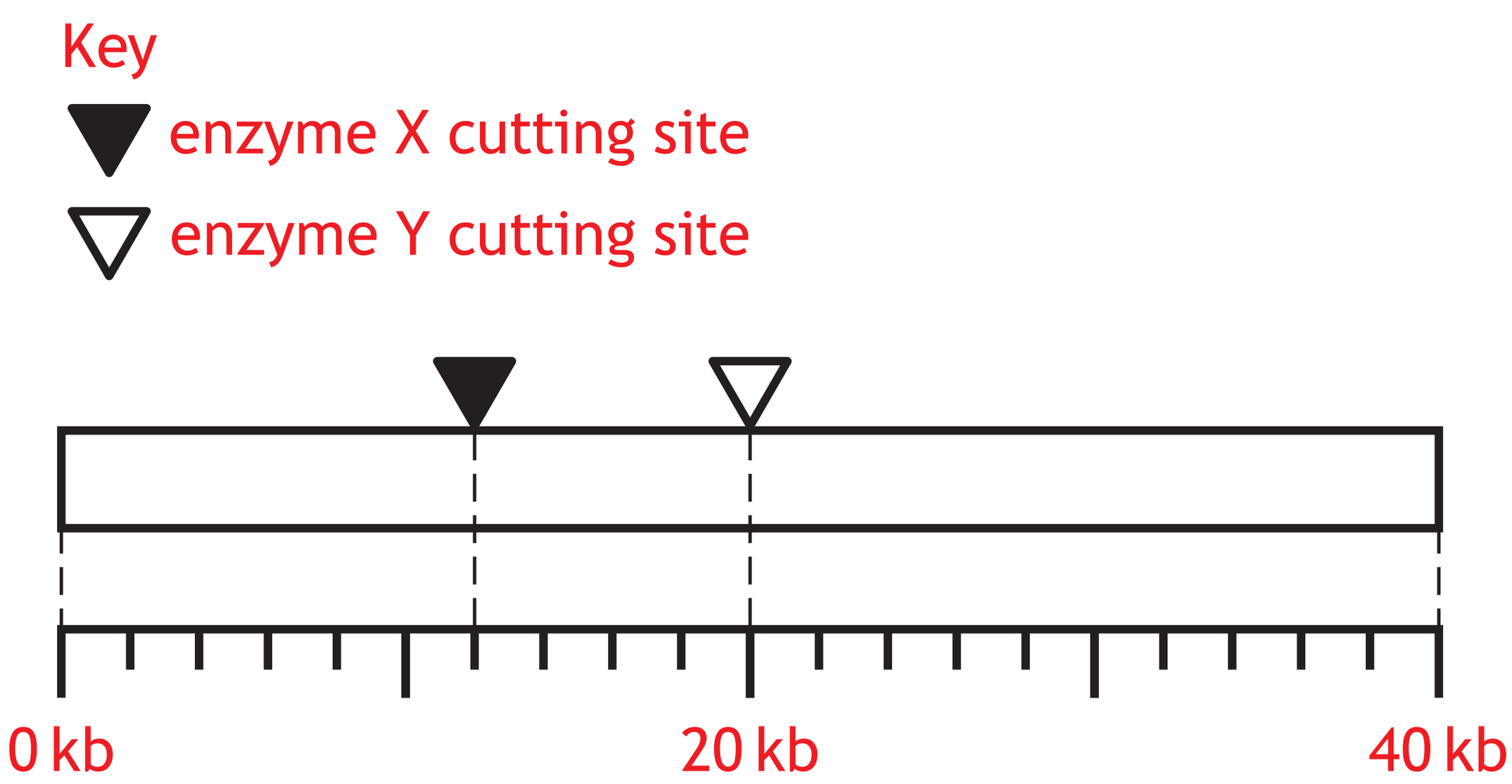
Q4


DNA
stage X
mRNA
in nucleus
stage Y
mature mRNA transcript
in cytoplasm
polypeptide production at ribosome
stage Z

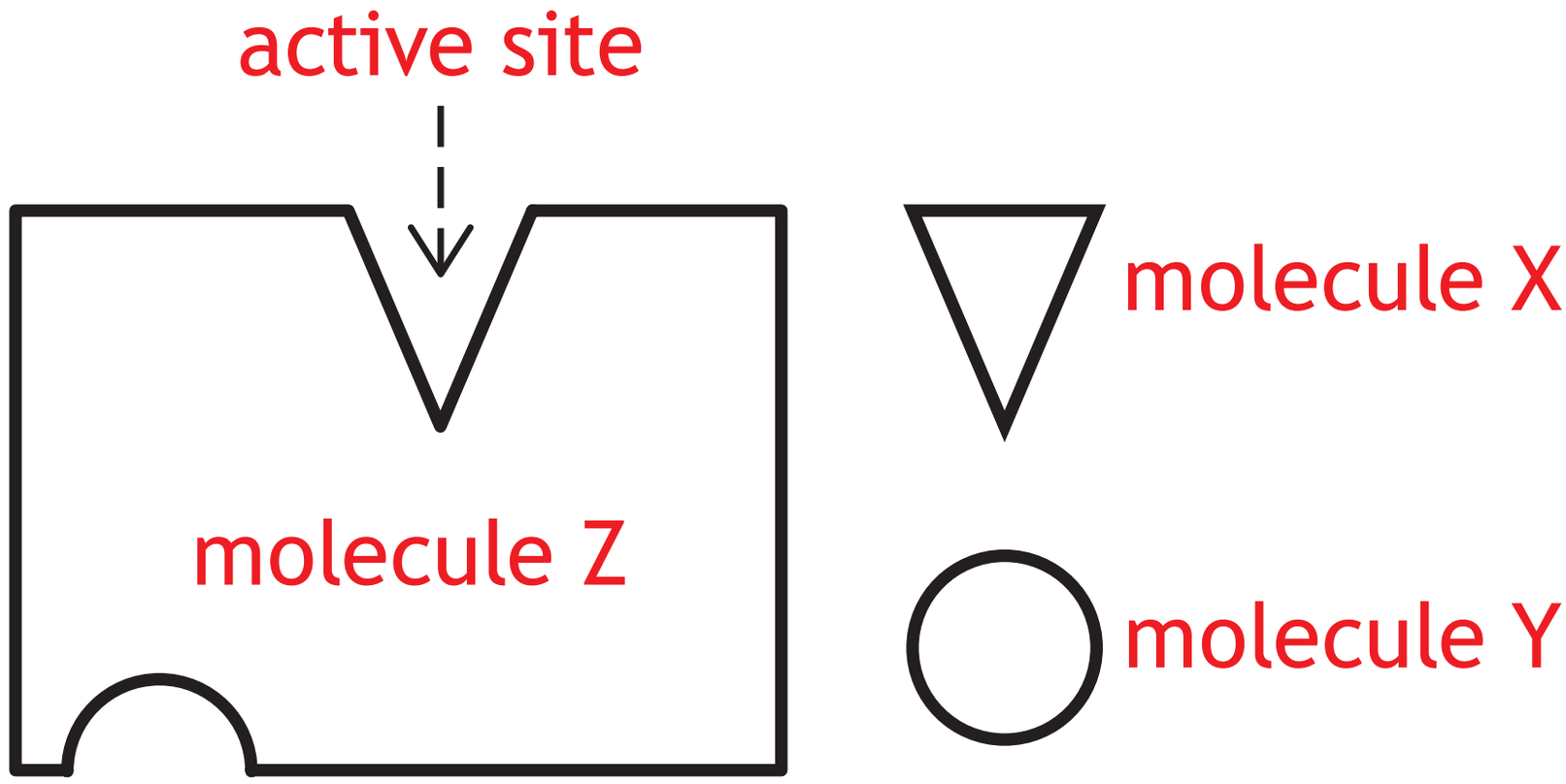
section of gene: T C C T A T G C C C C T G A C

mutated version: T C C T A T C T C C C T G A C

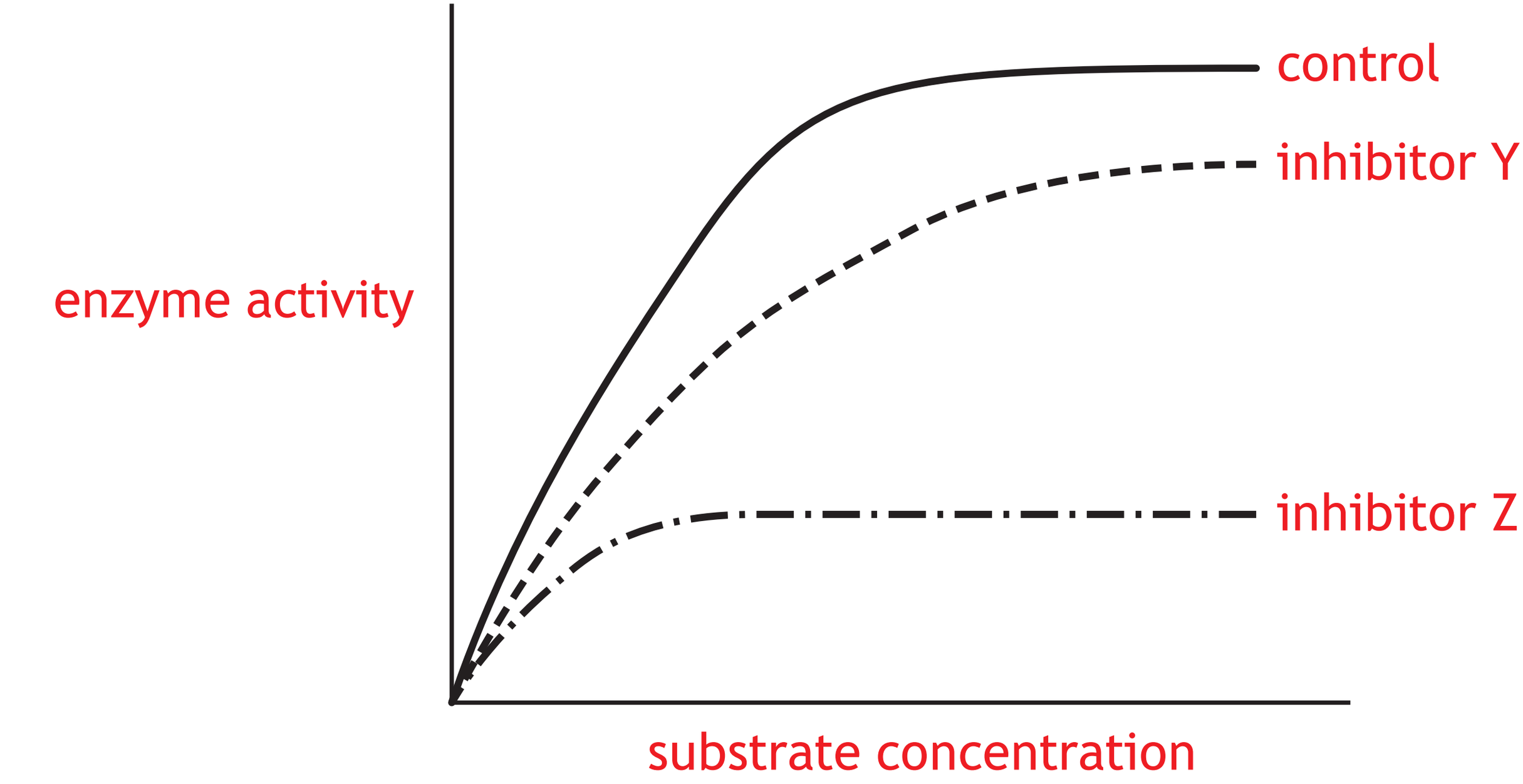
Q6

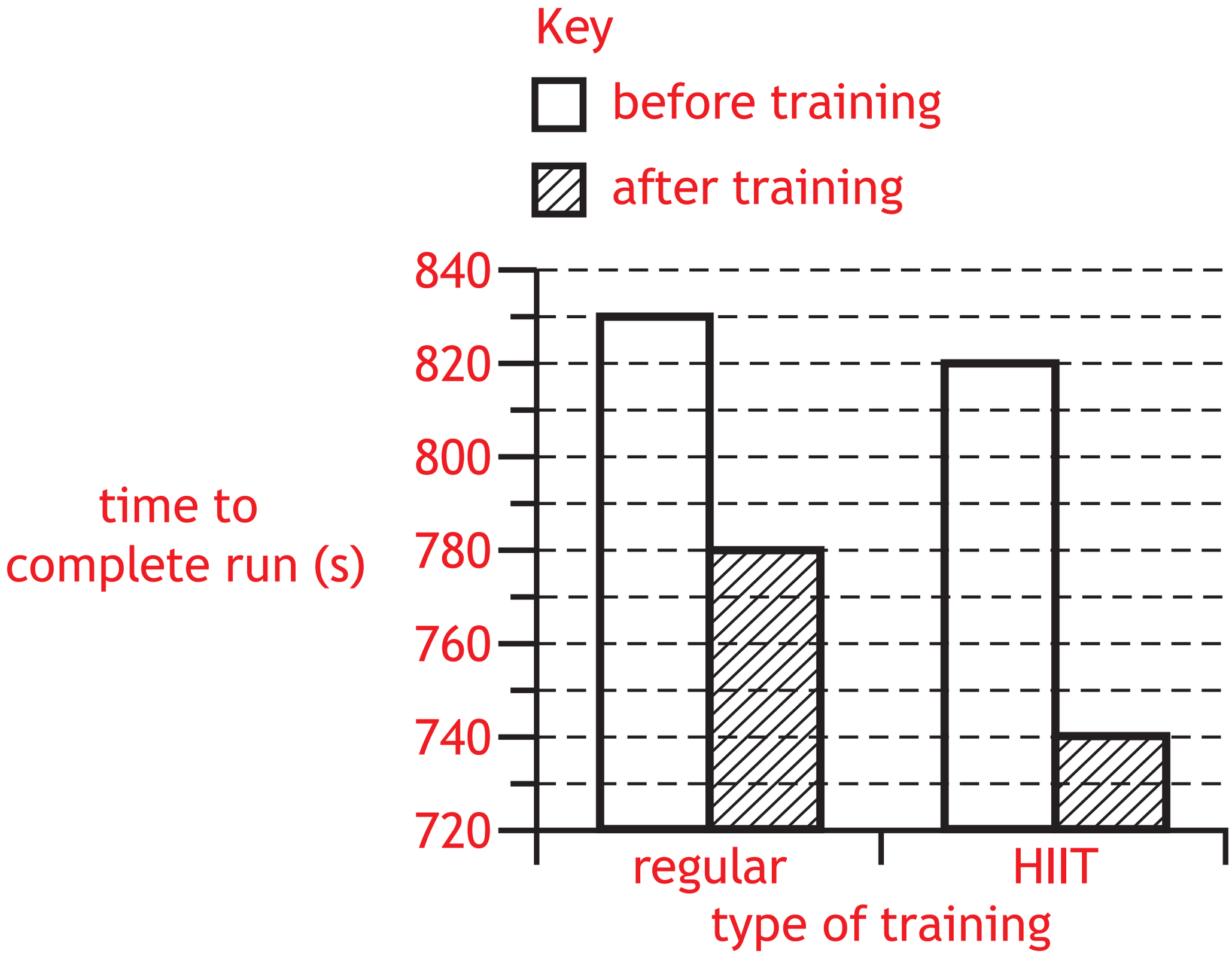

Key
enzyme X cutting site
enzyme Y cutting site
0 kb
20 kb
40 kb

Q8

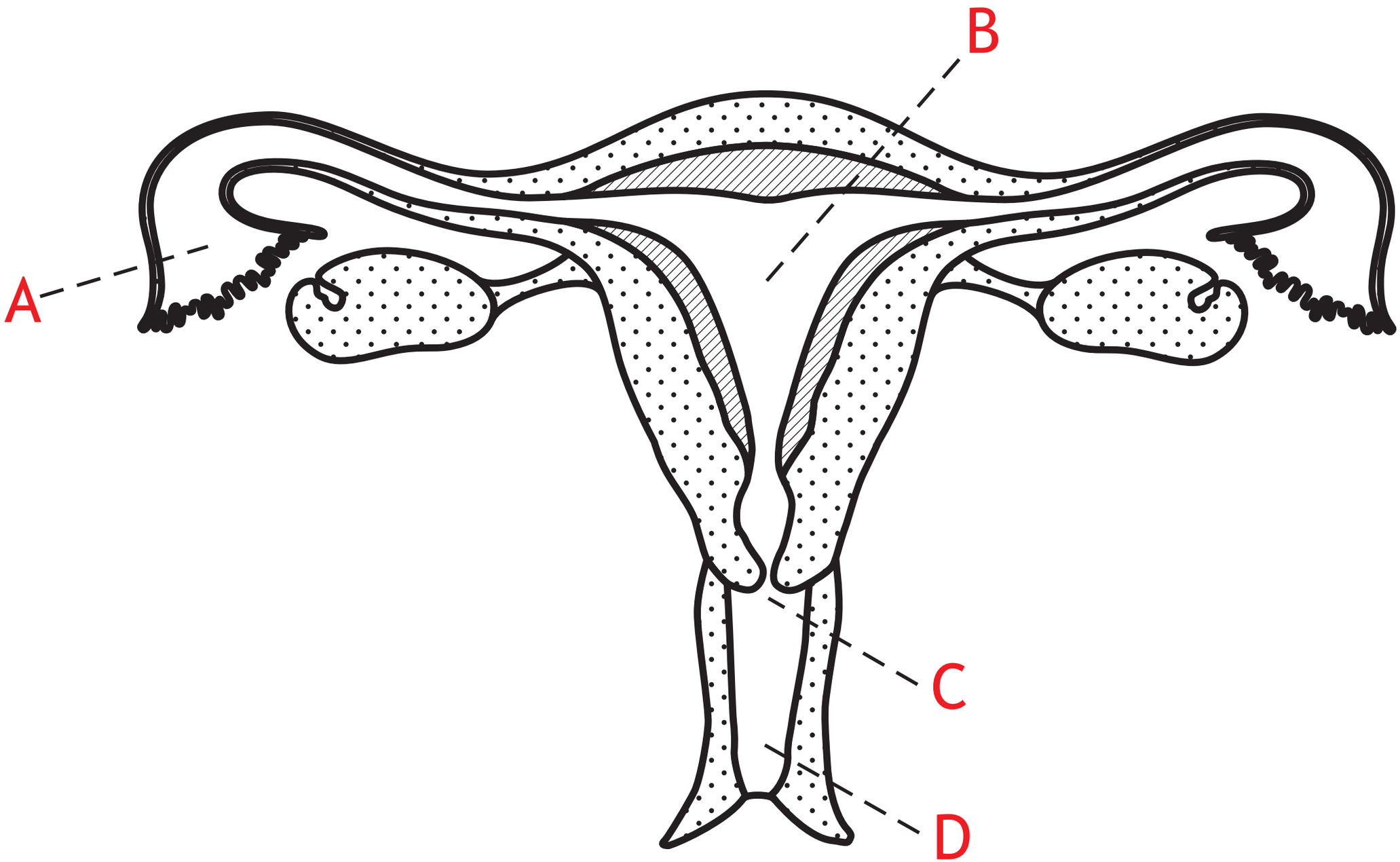


Q9


enzyme activity
control
inhibitor Y
inhibitor Z
substrate concentration


Key
before training
after training
840
820
800
780
760
740
720
time to complete run (s)
regular
HIIT
type of training

Q13



Q14

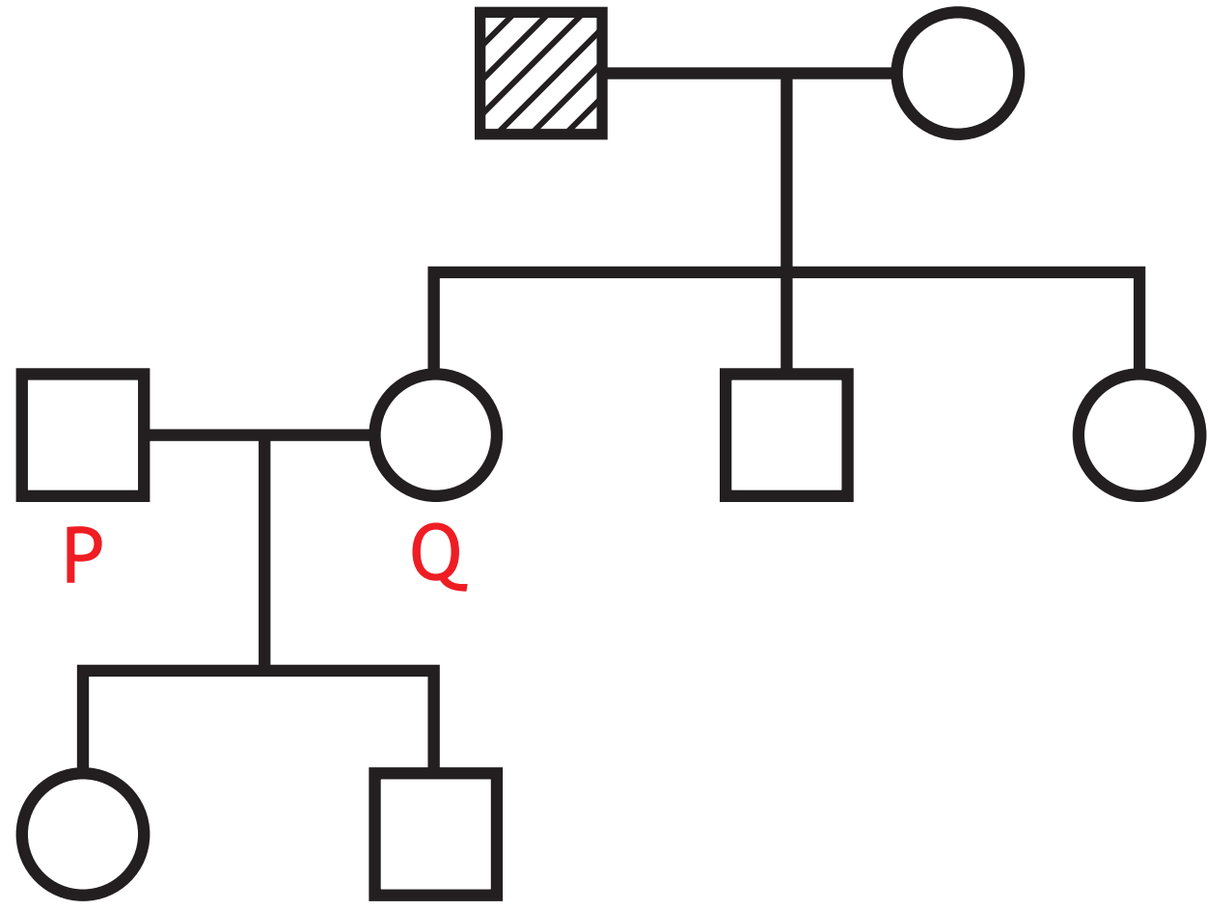
Key

unaffected male

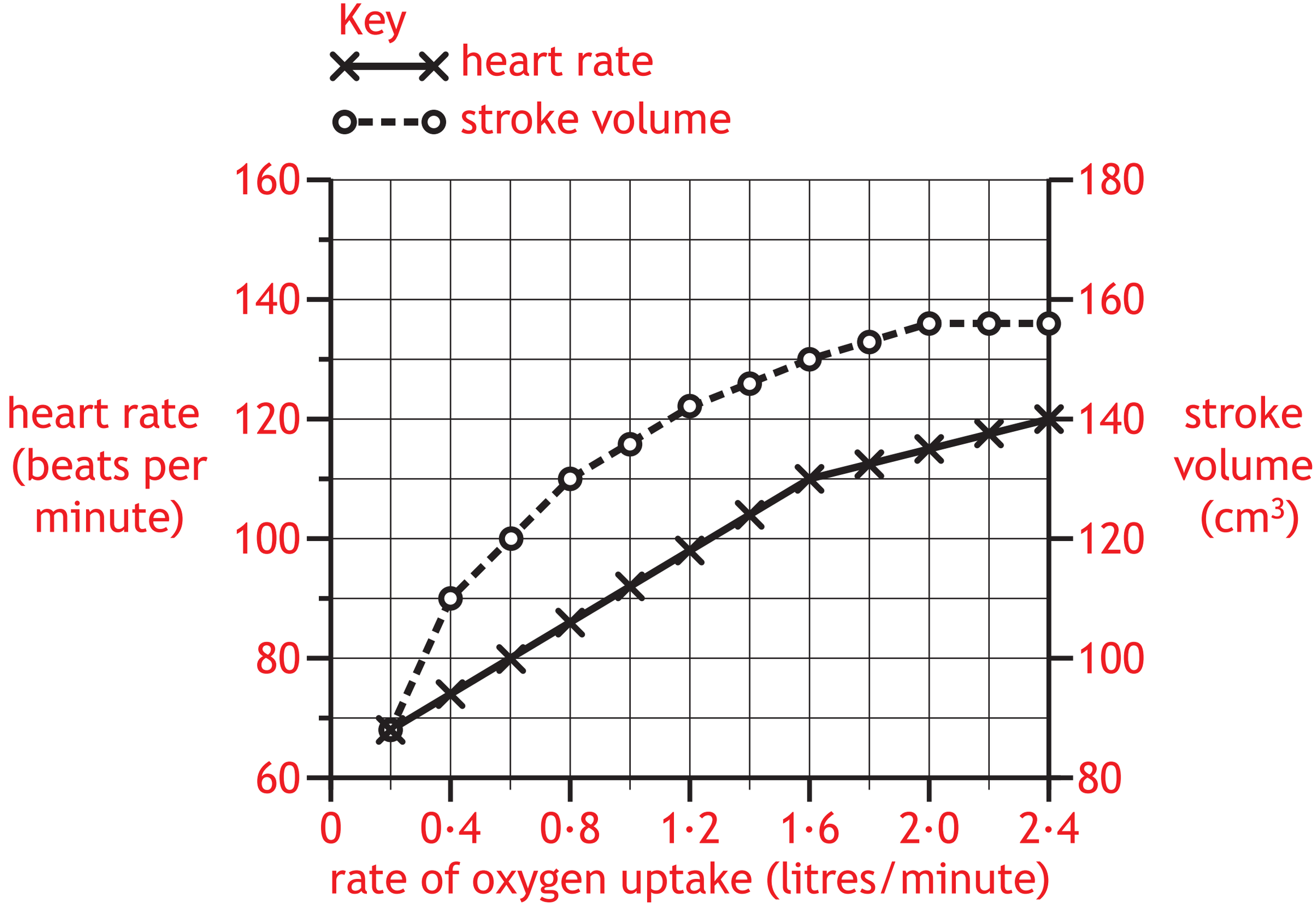
unaffected female

affected male

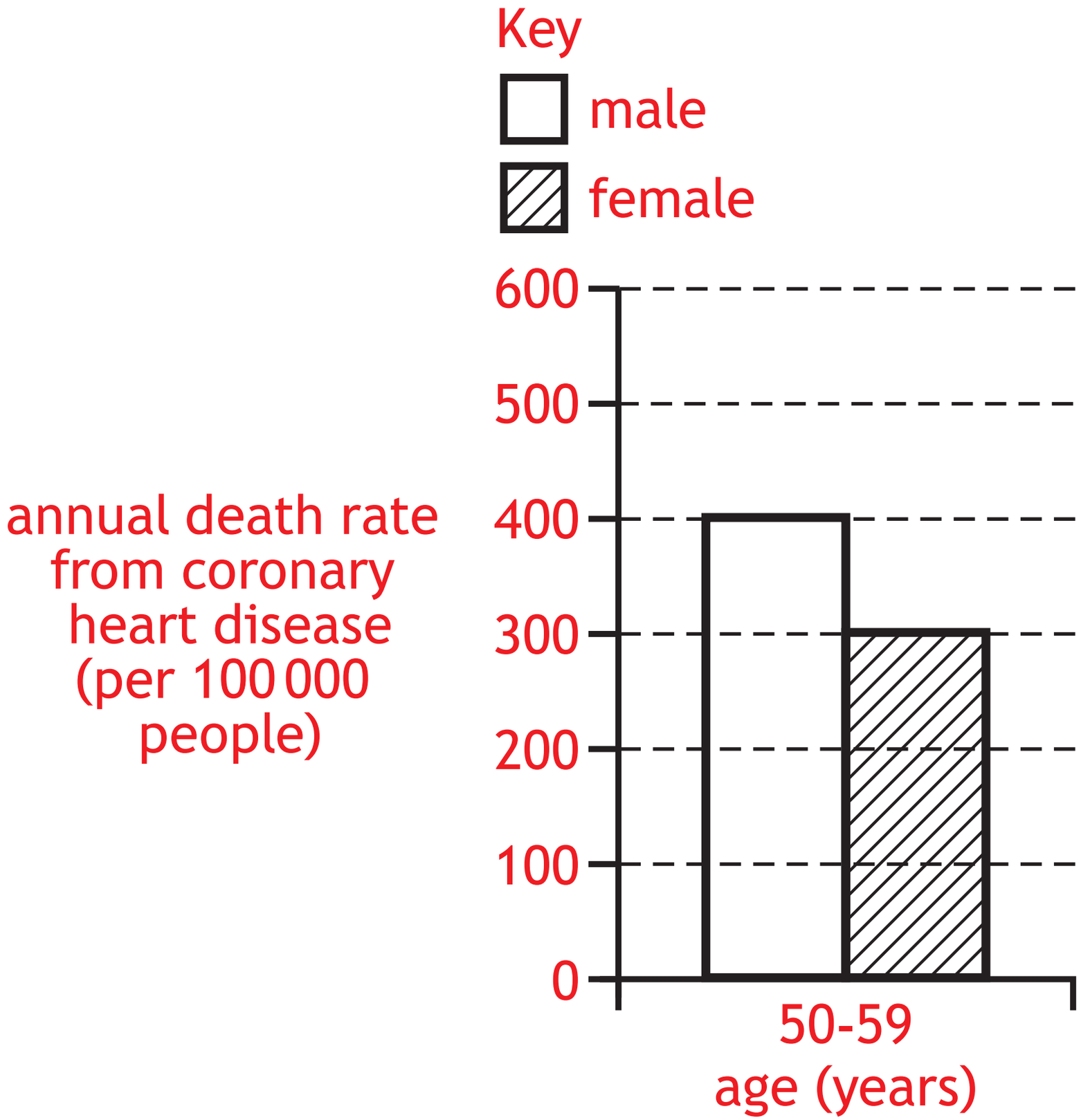
affected female



Q15


Key
heart rate
stroke volume
heart rate (beats per minute)
stroke volume (cm3)
160
140
120
100
80
60
180
160
140
120
100
80
0
0·4
0·8
1·2
1·6
2·0
2·4
rate of oxygen uptake (litres/minute)

Q17


Key
male
female
600
500
400
300
200
100
0
annual death rate from coronary heart disease (per 100 000 people)
50-59
age (years)

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National Qualifications 2019

X840/76/01

Human Biology Paper 2

TUESDAY, 30 APRIL

INSTRUCTIONS TO CANDIDATES

Candidates should enter their surname, forename(s), date of birth, Scottish candidate number and the name and Level of the subject at the top of their first answer sheet.

Total marks — 95

Attempt ALL questions.

You may use a calculator.

Question 14 contains a choice.

Write your answers clearly on your answer sheet. Clearly identify the question number you are attempting. Any rough work must be written on your answer sheet.

An OW in the margin indicates a new question.

Questions marked with an asterisk differ in some respects from those in the printed paper.

Marks are shown in square brackets at the end of each question or part question.

Total marks — 95

Attempt ALL questions

Question 14 contains a choice

*** 1.** Following fertilisation, the fertilised egg divides and forms a hollow ball of cells. At this early stage in the development of a human embryo, embryonic stem cells form a mass on one side of this hollow ball.

(a) (i) The embryonic stem cells shown can differentiate into all body cell types.

State the term that describes this feature of these cells. **[1 mark]**

(ii) Explain why embryonic stem cells can differentiate into all cell types. **[1 mark]**

(b) State the number of chromosomes in the nuclei of cells produced when germline stem cells divide by meiosis. **[1 mark]**

(c) Stem cells can be cultured in the laboratory for research purposes.

State **one** way in which stem cells are used in research. **[1 mark]**

(d) Scientists have recently found a way of converting skin cells into embryonic stem cells.

Suggest why this is an advantage from an ethical viewpoint. **[1 mark]**

*** 2.** The polymerase chain reaction (PCR) is a process used to help solve crimes.

(a) Each stage of PCR is temperature dependent.

(i) Give a reason why DNA is firstly heated to 95 °C. **[1 mark]**

(ii) Identify the correct temperature for the replication of DNA during PCR. **[1 mark]**

(b) Each PCR cycle produces two copies of a section of DNA.

This PCR cycle takes 3 seconds.

Calculate how long it would take for at least 2000 copies of the original section to be produced. Give your answer in seconds. **[1 mark]**

(c) Describe the role of primers during PCR. **[2 marks]**

(d) PCR was first used to help solve a crime in 1986.

Suggest why PCR can now be used to help solve a crime committed in 1980, where only a small blood spot was found as evidence. **[1 mark]**

*** 3.** Refer to the diagram for Question 3. The diagram shows some of the stages in the breakdown of alcohol by the liver.

(a) Use information from the diagram to explain how alcohol can be used as a substrate in respiration. **[2 marks]**

(b) Some individuals cannot produce enough fully functioning enzyme 2.

(i) In these individuals an altered form of enzyme 2 is produced due to a missense mutation.

Suggest why this altered form of enzyme 2 works less well than the unaltered form. **[1 mark]**

(ii) Explain why these individuals are less tolerant of alcohol. **[1 mark]**

(c) A drug that acts as a competitive inhibitor of enzyme 2 can be prescribed to treat alcoholism.

Explain how this drug will affect the enzyme. **[1 mark]**

*** 4.** A protein supplement is used by some people who take part in sport. They believe its use increases muscle mass and therefore improves performance in sporting activities such as weightlifting.

An investigation was carried out to test if protein supplements improved the ability of the upper leg muscles to raise weights. This was tested using gym apparatus. The subject is seated and a weighted bar is placed in front of their ankles. At rest, their lower leg is bent in a normal seated position at 90°. The subject then has to use their upper leg muscles to straighten their legs and raise the weighted bar.

A class of 20 students was divided into two groups, A and B. The groups were balanced for age, gender, fitness level and body mass.

Each student carried out 10 weeks of regular training on the apparatus.

Students in group A took a daily dose of a protein supplement.

Students in group B took a daily dose of a placebo.

All students had their results recorded every 2 weeks for 10 weeks, by measuring the maximum weight that could be raised using the apparatus described above.

(a) State **two** additional variables, other than those described above, that would need to be controlled during this investigation. **[2 marks]**

4. (continued)

*(b) (i) Refer to the diagram for Question 4 (b). The results from the investigation are shown in **Table 1** and are also plotted in **Graph 1**.

Table 1

	Average maximum weight raised (kg)	
Time (weeks)	**A (protein supplement)**	**B (placebo)**
0	52	50
2	60	55
4	65	60
6	70	65
8	85	75
10	95	80

1. State the label that should be added to describe the dependent variable plotted on the *y*-axis. **[1 mark]**
2. State the label that should be added to a key to identify the set of results plotted with open circles and a dotted line. **[1 mark]**
3. One of the values for group A has been misplotted. Identify the time in weeks for the misplotted point. **[1 mark]**

(ii) State the conclusion that can be drawn from these results. **[1 mark]**

(iii) Suggest a reason for the increase in performance of Group B. **[1 mark]**

(c) The average body mass and percentage body fat of the students was measured at the start of the investigation and after 10 weeks.

The measurements for each group are shown in **Table 2**.

Table 2

Group	Measurement	Start (0 weeks)	After 10 weeks
A (protein supplement)	body mass (kg)	60·7	62·5
	body fat (%)	28·3	23·8
B (placebo)	body mass (kg)	60·5	61·3
	body fat (%)	27·9	25·8

Use the data to explain why taking protein supplements resulted in a greater increase in muscle mass. **[2 marks]**

*** 5.** Refer to the diagram for Question 5. The diagram is a summary of part of a respiratory pathway in a cell.

(a) Give evidence from the diagram that confirms stage X is the energy pay-off phase. **[1 mark]**

(b) State the function of dehydrogenase enzymes. **[1 mark]**

(c) Name a hormone that is involved in pathway Y. **[1 mark]**

(d) Some individuals are unable to produce the enzyme glucose-6-phosphate dehydrogenase.

Use information from the diagram to explain why this would reduce cell division in these individuals. **[2 marks]**

*** 6.** (a) (i) State where testosterone is produced in the testes. **[1 mark]**

(ii) Describe two functions of testosterone. **[2 marks]**

(iii) Describe how negative feedback control raises the concentration of testosterone in the blood if it has fallen to a low level. **[2 marks]**

(b) Artificial insemination (AI) and intra-cytoplasmic sperm injection (ICSI) are fertility treatments that may be used if a man has a low sperm count.

Describe how each of these treatments increases the chance of fertilisation. **[2 marks]**

*** 7.** Refer to the diagram for Question 7. Data from *in vitro* fertilisation (IVF) clinics is used to indicate how a woman's age can affect the success rate of IVF.

(a) The graph shows the effect of age on pregnancy and birth rate after using IVF. The data refers to women using their own eggs.

(i) State **one** similarity and **one** difference in the trends for pregnancy and birth rate. **[2 marks]**

(ii) Calculate how many 34 year old women in a sample of 1000 would be predicted to get pregnant using IVF. **[1 mark]**

(b) Some women are given the option to use eggs from a donor when undergoing IVF. This can increase their chances of becoming pregnant and giving birth.

(i) The table shows the birth rates for women of different ages after undergoing IVF using donor eggs.

Age (years)	22	26	30	34	38	42	46
Birth rate (%)	46	64	60	58	54	48	40

Using data in the table and graph, calculate the difference in birth rate for women aged 38 when using donor eggs rather than their own eggs. **[1 mark]**

(ii) Suggest why older women undergoing IVF are more likely to produce a child when using donor eggs rather than their own eggs. **[1 mark]**

(c) Some women undergoing IVF consent to pre-implantation genetic diagnosis (PGD) of their embryos.

Explain why PGD is offered to some women. **[1 mark]**

*** 8.** Refer to the diagram for Question 8. Adenosine deaminase (ADA) deficiency is an autosomal recessive disorder that affects the immune system. It is caused by a mutation in the gene that codes for this enzyme.

(a) Describe the difference between an autosomal disorder and a sex-linked disorder. **[1 mark]**

(b) The chart shows the inheritance of ADA deficiency in two families.

(i) State the genotype of individual P using 'a' to represent the allele for ADA deficiency. **[1 mark]**

(ii) Individuals Q and R plan to have a child together.

Use information from the chart to explain why it is difficult to predict the chances of their child having the disorder. **[1 mark]**

(c) Individuals with ADA deficiency have severely reduced numbers of lymphocytes. They can be treated by a bone marrow transplant.

Suggest how this treatment can help to restore a functional immune system. **[1 mark]**

(d) Amniocentesis and chorionic villus sampling (CVS) are examples of antenatal tests that can be carried out.

Describe an advantage and a disadvantage of using amniocentesis rather than chorionic villus sampling (CVS). **[2 marks]**

*** 9.** Refer to the diagram for Question 9. A man had a glucose tolerance test to indicate if he had type 2 diabetes.

The graph shows changes in the concentrations of glucose and insulin in his blood during 150 minutes, after drinking the glucose solution.

(a) State the man's blood insulin concentration when his blood glucose concentration was 200 mg/100 cm^3. Give your answer in units/litre. **[1 mark]**

(b) The man's blood glucose concentration will eventually return to its original value.

Predict how much longer this will take after 150 minutes. Give your answer in minutes. **[1 mark]**

(c) This man's body contains 5 litres of blood.

Calculate the total mass of glucose in his bloodstream at 60 minutes. Give your anser in mg. **[1 mark]**

(d) (i) The glucose tolerance test indicated that this man had type 2 diabetes.

Explain why production of insulin did not lower his blood glucose concentration in the first hour of the test. **[2 marks]**

(ii) Suggest **one** reason why this man's blood glucose concentration started to decrease after 60 minutes. **[1 mark]**

(e) Describe evidence from the graph that indicates this man does **not** have type 1 diabetes. **[1 mark]**

(f) Apart from reducing the sugar intake in his diet, suggest another way in which this man could control his blood glucose levels. **[1 mark]**

10. (a) The table shows the death rate from cardiovascular disease (CVD) in groups of men and women in England and Scotland between 2001 and 2013.

	Death rate from CVD (per 100 000)			
	England		Scotland	
Year	Men	Women	Men	Women
2001	603	402	684	476
2005	490	337	577	406
2009	392	271	450	316
2013	324	221	396	275

(i) Identify the group that shows the greatest percentage decrease in death rate from CVD between 2001 and 2013. **[1 mark]**

(ii) Death rates have decreased in all groups between 2001 and 2013.

State another conclusion that can be drawn from the data in the table. **[1 mark]**

(iii) Express, as a simple whole number ratio, the death rate from CVD in English men compared to Scottish men in 2013. **[1 mark]**

(iv) Explain how the data in the table allows a valid comparison of deaths from CVD between England and Scotland to be made, despite their populations being different sizes. **[1 mark]**

(b) Three thousand men took part in a clinical trial to investigate the effect of a cholesterol reducing drug. Half the men were given the cholesterol reducing drug while half were given a placebo.

(i) Describe how a double-blind design could be achieved when setting up the clinical trial. **[1 mark]**

(ii) State what aspect of the design of the study increased the reliability of the results. **[1 mark]**

(iii) Researchers concluded that taking the cholesterol reducing drug decreased risk of death from CVD, as it lowered the concentration of LDLs in the blood.

Explain why having a lower LDL concentration in the blood decreases the risk of death from CVD. **[2 marks]**

11. (a) The water flea, *Daphnia pulex*, is a small invertebrate animal that lives in ponds.

Water fleas can be used as model organisms to investigate the effect of chemicals on heart rate. Heart contractions are visible when viewed under a microscope.

A student carried out an investigation to find out how caffeine concentration affects the heart rate of water fleas.

A water flea was placed in a small container of pond water and left for 5 minutes. The container was then placed under a microscope and the water flea videoed for a period of time. The video was analysed and the heart rate of the water flea calculated. This procedure was then repeated using different concentrations of caffeine solutions.

The results of the investigation are shown in the table.

Caffeine concentration (g/l)	Heart rate of water flea (bpm)
0	135
0·2	185
0·4	220
0·6	245
0·8	270
1·0	270

(i) Suggest why the student left the water flea in the solution for 5 minutes before videoing its heart rate. **[1 mark]**

(ii) Suggest why the student videoed the water flea rather than simply counting its heart beat at the time. **[1 mark]**

(iii) Use data from the table to describe the changes that occur in the heart rate as the caffeine concentration increases. **[2 marks]**

(iv) State how the reliability of the results from this investigation could be improved. **[1 mark]**

(b) In humans, describe how the autonomic nervous system increases the heart rate. **[3 marks]**

12. Endorphins and dopamine are neurotransmitters that affect mood and behaviour.

(a) (i) State **one** activity that increases endorphin production. **[1 mark]**

(ii) State **one** function of endorphins. **[1 mark]**

(b) Parkinson's disease is associated with a loss of dopamine-producing neurons in the brain. It cannot be treated by taking dopamine.

Describe a possible mode of action of a drug that could be used to treat this disease. **[1 mark]**

***(c)** Refer to the diagram for Question 12 (c). The diagram shows synapses from the brains of two individuals.

Individual X has never taken recreational drugs while individual Y has used a recreational drug for a long time.

(i) Describe how the recreational drug has acted on the synapse of individual Y. **[1 mark]**

(ii) Describe how changes to the synapses of individual Y will affect their drug-taking behaviour. **[1 mark]**

***13.** A section of human skin is punctured by a splinter of wood. The splinter punctures through a layer of epithelial cells. Below the epithelial cells, blood is carried in a vessel X. The wall of vessel X is composed of a single layer of cells.

(a) (i) Describe **one** way in which these epithelial cells defend the body against pathogens. **[1 mark]**

(ii) Name structure X. **[1 mark]**

(b) The inflammatory response involves the release of the chemical histamine.

(i) Name the cells that release histamine. **[1 mark]**

(ii) Explain why the skin around a puncture wound often becomes red and swollen. **[1 mark]**

(c) Lymphocytes are part of the specific defence system of the body.

(i) Explain how a lymphocyte is able to recognise a particular pathogen. **[1 mark]**

(ii) Describe how T lymphocytes destroy infected body cells. **[1 mark]**

*****(d) Refer to the diagram for Question 13 (d). The graph shows the concentrations of the HIV virus and T lymphocytes in the blood of an individual in the years following HIV infection.

(i) Suggest a reason for the decrease in HIV concentration during the first year after infection. **[1 mark]**

(ii) Explain why the T lymphocyte concentration is decreasing between 1 and 5 years after infection. **[1 mark]**

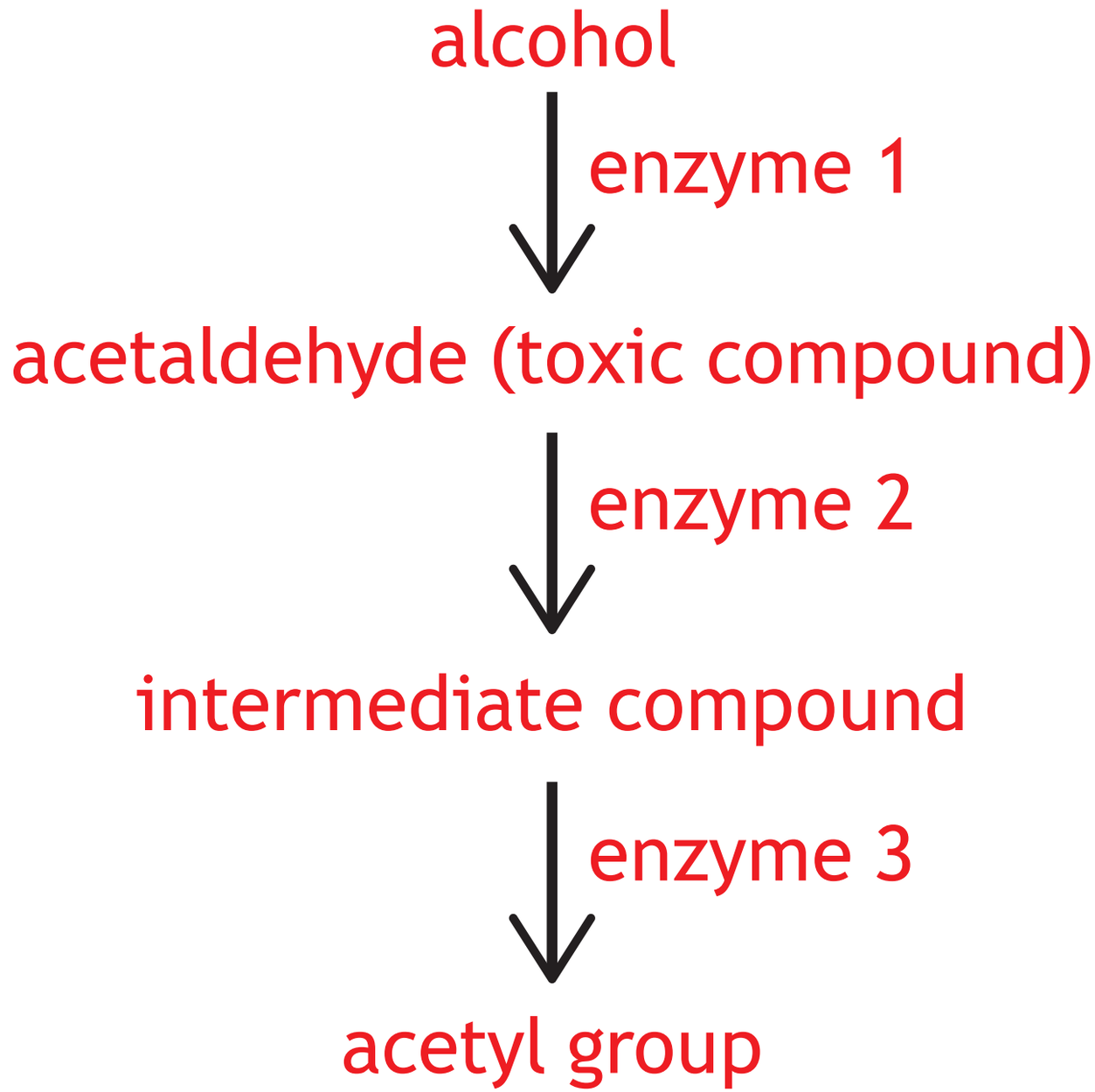
14. Attempt **either** A **or** B.

A Discuss the encoding, storage and retrieval of information in memory. **[9 marks]**

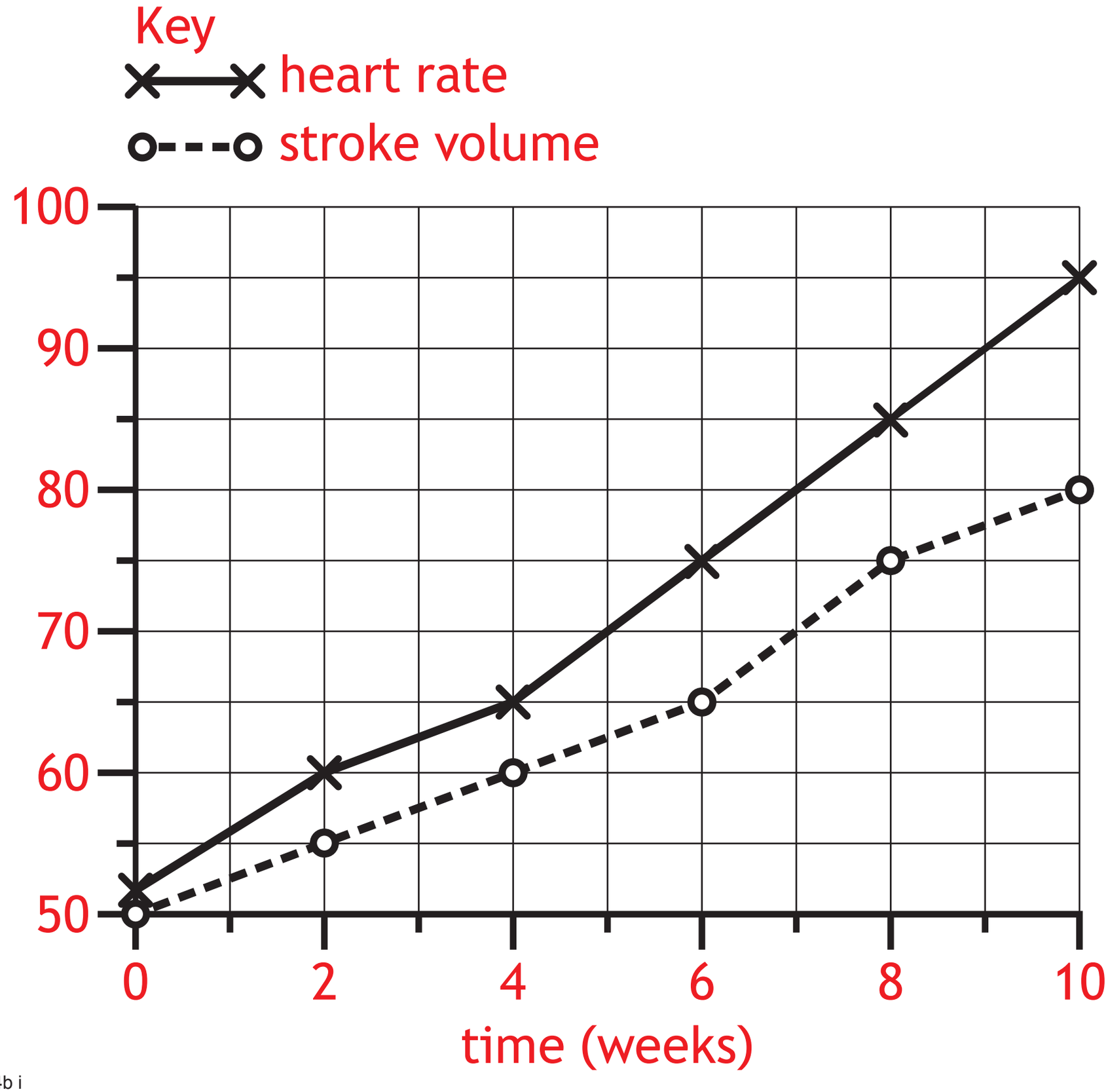
OR

B Describe vaccination and discuss its role in establishing herd immunity in a population. **[9 marks]**

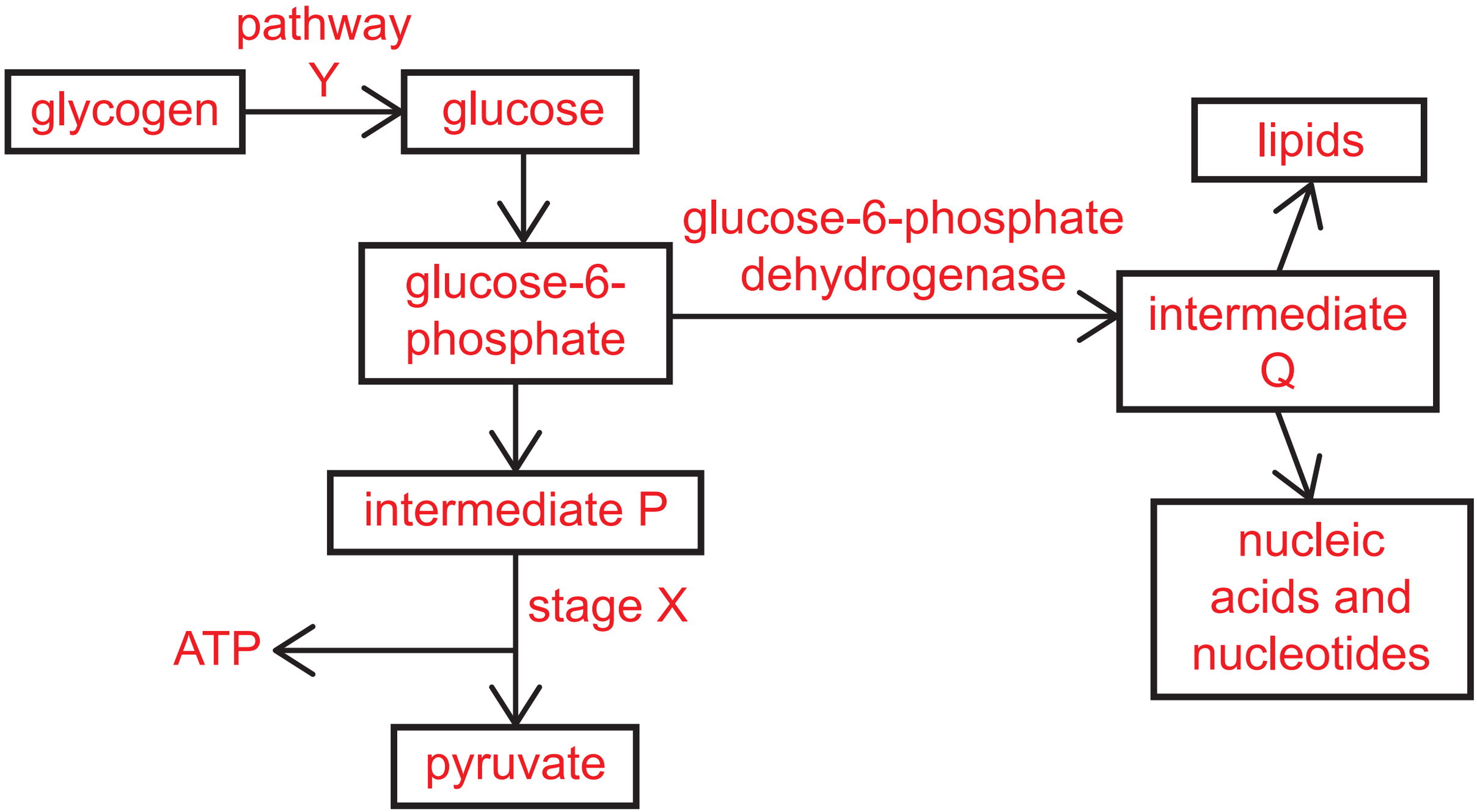
[END OF QUESTION PAPER]


alcohol
enzyme 1
acetaldehyde (toxic compound)
enzyme 2
intermediate compound
enzyme 3
acetyl group

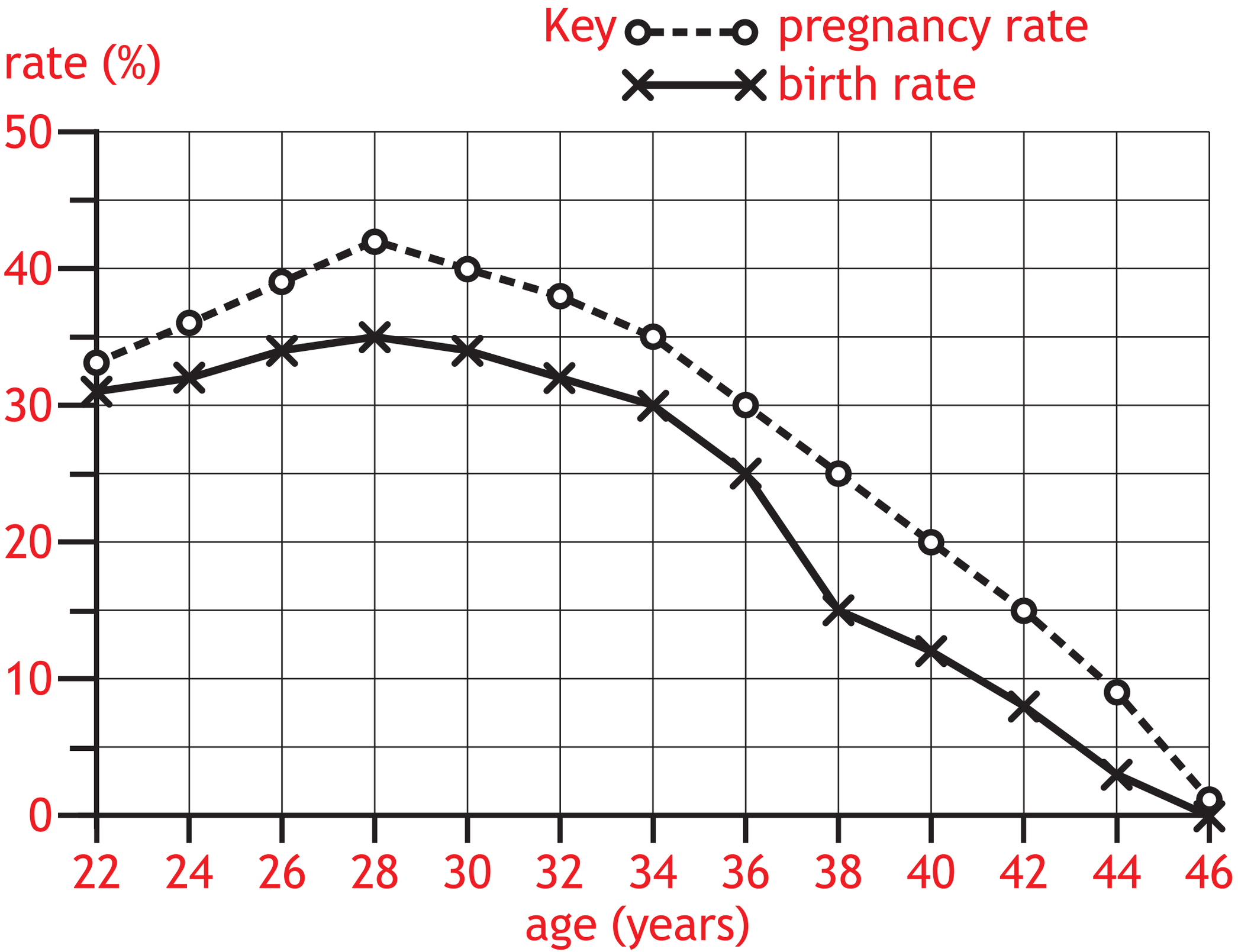
Q4b i


Key
heart rate
stroke volume
100
90
80
70
60
50
0
2
4
6
8
10
time (weeks)

Q5


glycogen
pathway Y
glucose
glucose-6-phosphate
glucose-6-phosphate dehydrogenase
lipids
intermediate Q
nucleic acids and nucleotides
intermediate P
stage X
ATP
pyruvate

Q7


Key
pregnancy rate
birth rate
rate (%)
50
40
30
20
10
0
22
24
26
28
30
32
34
36
38
40
42
44
46
age (years)

Key

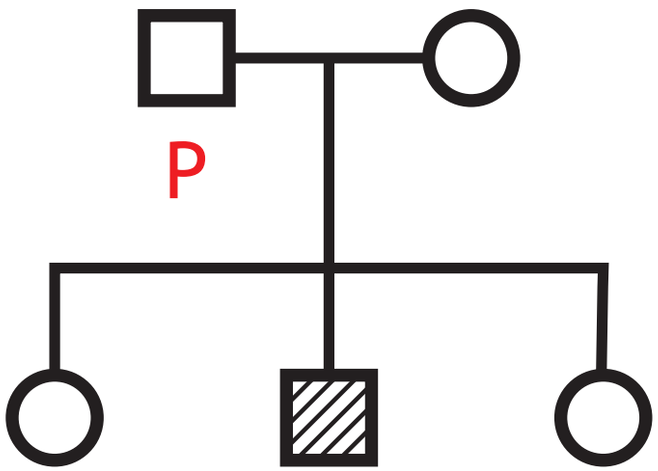
affected male

affected female

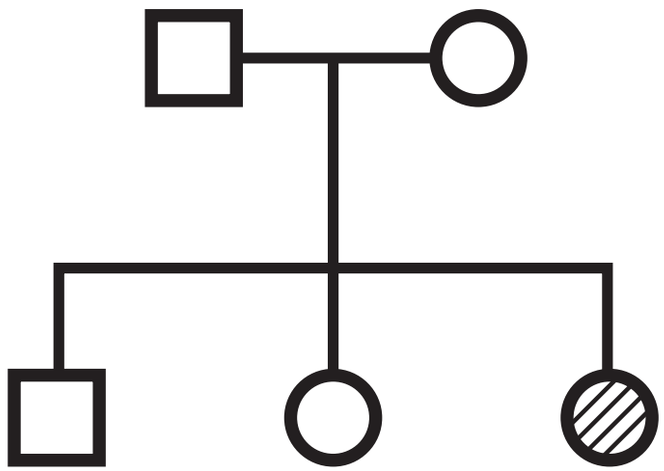
unaffected male

unaffected female

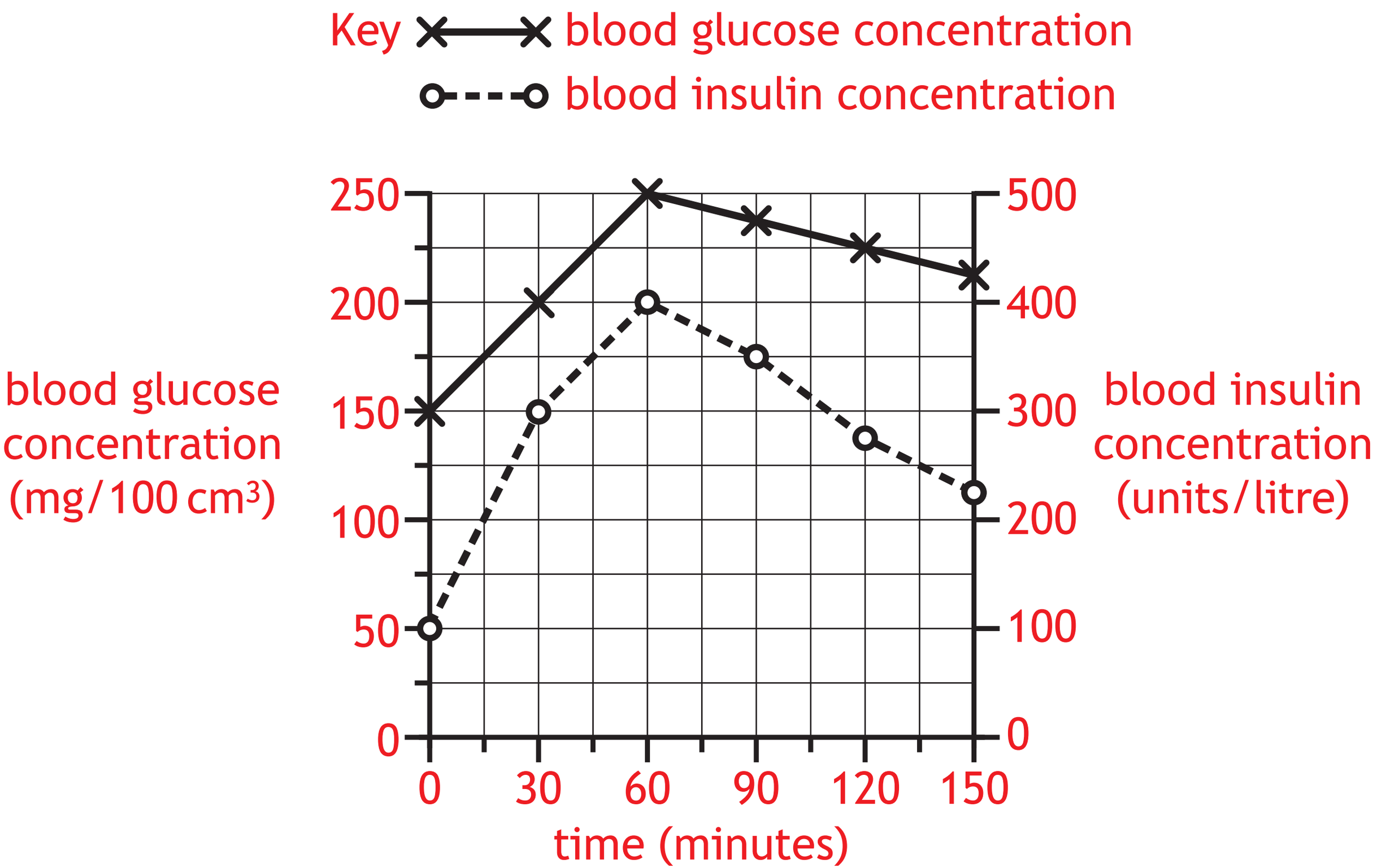
family 1



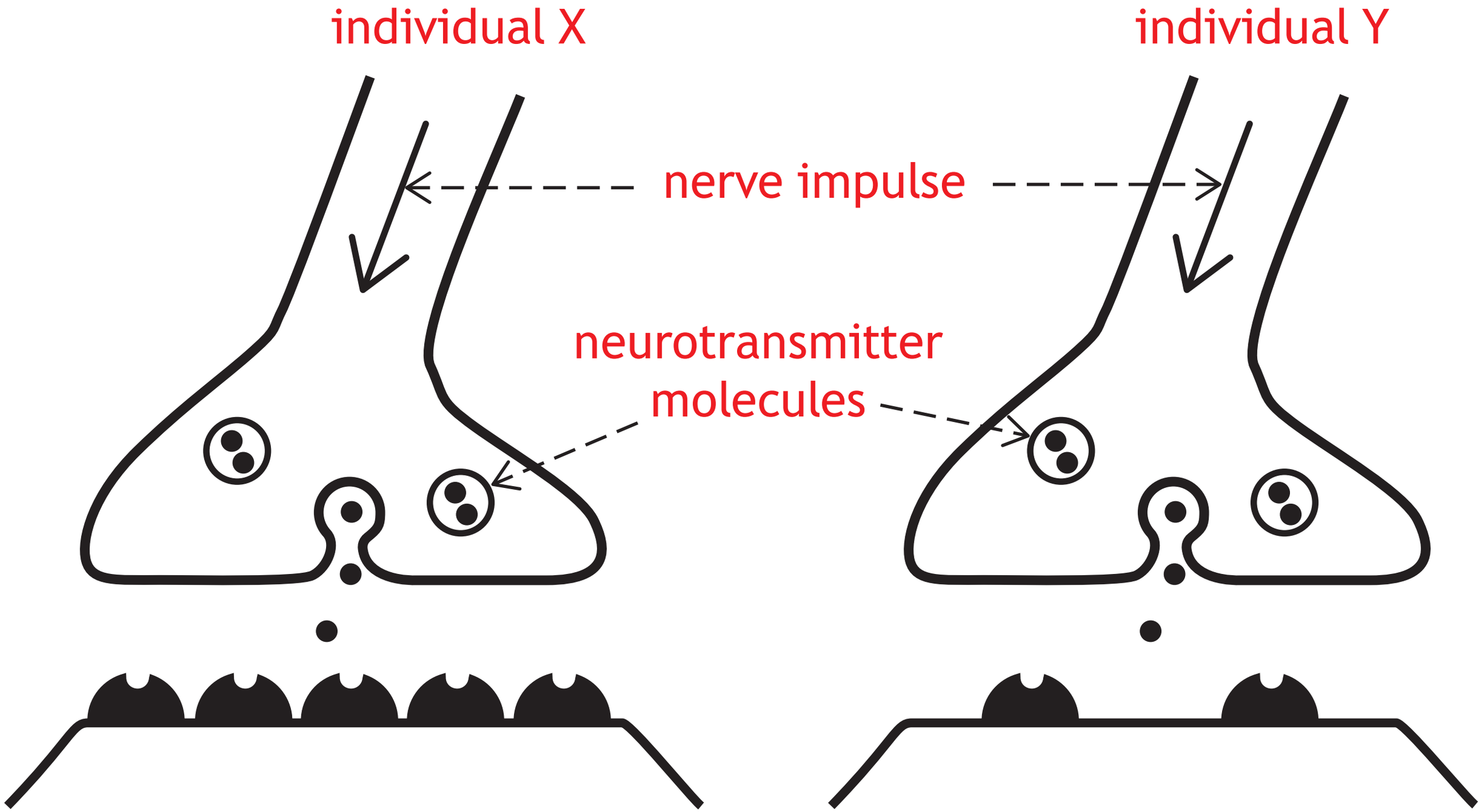
family 2



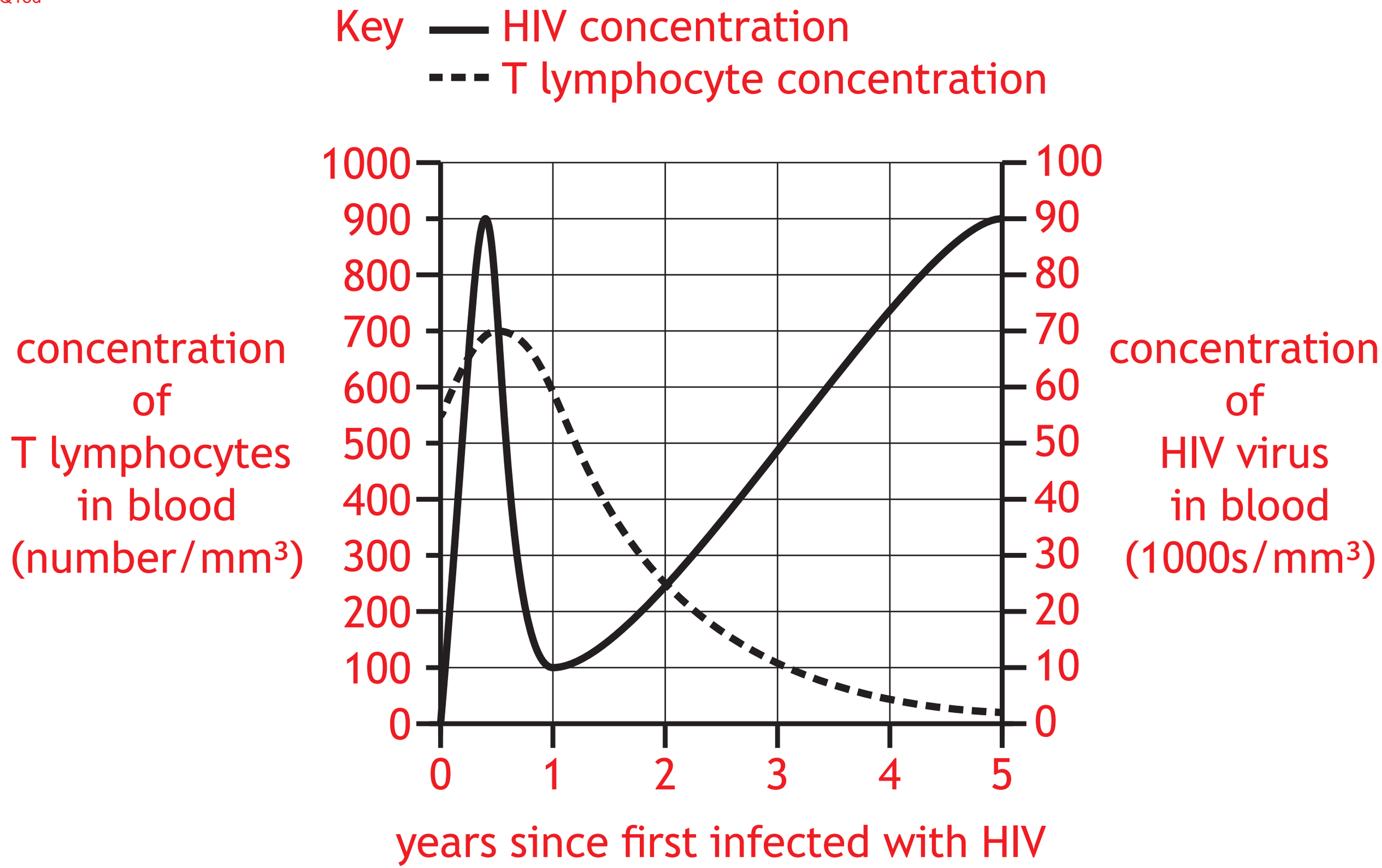
Q9


Key
blood glucose concentration
blood insulin concentration
blood glucose concentration (mg/100 cm³)
250
200
150
100
50
0
blood insulin concentration (units/litre)
500
400
300
200
100
0
0
30
60
90
120
150
time (minutes)

Q12c


individual X
individual Y
nerve impulse
neurotransmitter
molecules

Q13d


Key
HIV concentration
T lymphocyte concentration
concentration of T lymphocytes in blood (number/mm³)
concentration of HIV virus in blood (1000s/mm³)
1000
900
800
700
600
500
400
300
200
100
0
100
90
80
70
60
50
40
30
20
10
0
0
1
2
3
4
5
years since first infected with HIV