



National  
Qualifications  
2023

**X840/76/12**

**Human Biology  
Paper 1 — Multiple choice**

THURSDAY, 27 APRIL

9:00 AM – 9:40 AM

**Total marks — 25**

Attempt ALL questions.

**You may use a calculator.**

Instructions for the completion of Paper 1 are given on *page 02* of your answer booklet X840/76/02.

Record your answers on the answer grid on *page 03* of your answer booklet.

Space for rough work is provided at the end of this booklet.

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



\* X 8 4 0 7 6 1 2 \*

Total marks — 25 marks

Attempt ALL questions

1. Which row in the table matches the type of cell division that occurs in germline cells with a description of the gametes produced?

	Type of division	Gametes produced
A	mitosis	diploid
B	mitosis	haploid
C	meiosis	diploid
D	meiosis	haploid

2. Which of the following statements about DNA replication is correct?

Fragments are formed on the

- A leading strand and are joined by DNA polymerase
  - B lagging strand and are joined by ligase
  - C lagging strand and are joined by DNA polymerase
  - D leading strand and are joined by ligase.
3. PCR was used to amplify a region of DNA. After 5 cycles 32 copies were present. Calculate the number of **additional copies** present after 4 further cycles.
- A 224
  - B 256
  - C 480
  - D 512
4. The list shows the nucleic acid molecules involved in gene expression within a cell.
1. rRNA
  2. mRNA
  3. DNA
  4. tRNA

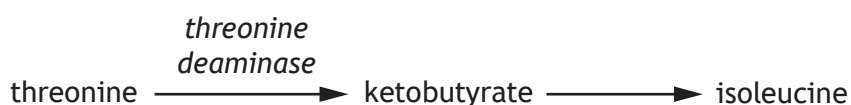
Which of these molecules are required for translation?

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

5. A student set up a test tube containing 5 cm<sup>3</sup> of milk and 1 cm<sup>3</sup> of the enzyme trypsin. The milk became clear and the student concluded that the white milk protein had been broken down by trypsin.

To show that trypsin caused the milk to become clear, a control tube should contain

- A 5 cm<sup>3</sup> of milk and 1 cm<sup>3</sup> of distilled water
  - B 5 cm<sup>3</sup> of distilled water and 1 cm<sup>3</sup> of trypsin
  - C 5 cm<sup>3</sup> of boiled and cooled milk and 1 cm<sup>3</sup> of trypsin
  - D 5 cm<sup>3</sup> of boiled and cooled milk and 1 cm<sup>3</sup> of distilled water.
6. Part of a metabolic pathway used to produce the amino acid isoleucine is shown.



Isoleucine is a feedback inhibitor of the enzyme threonine deaminase.

The statements refer to substances in the metabolic pathway.

1. Isoleucine binds to threonine deaminase.
2. Threonine deaminase lowers the activation energy required to convert threonine into ketobutyrate.
3. Ketobutyrate is the substrate of isoleucine.

Which of these statements are correct?

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

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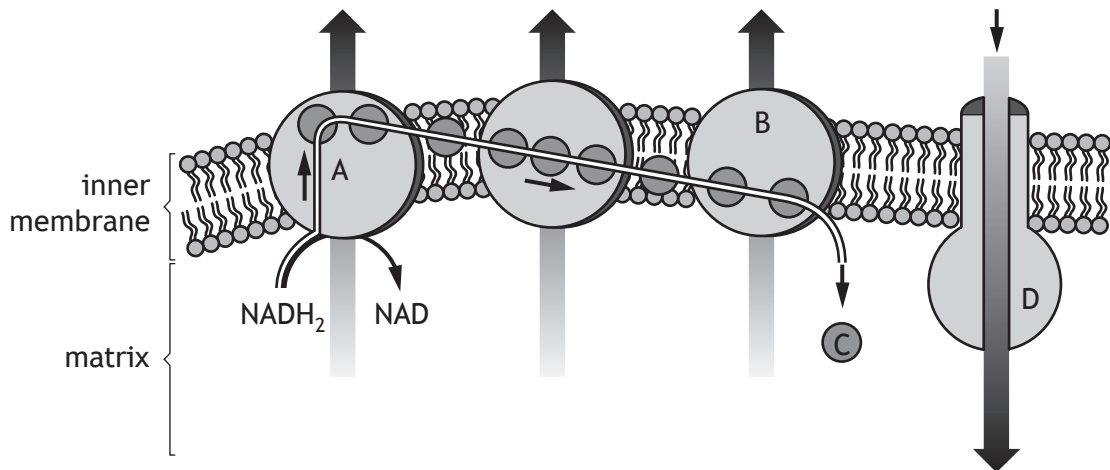
7. The table shows the effect of a competitive inhibitor on an enzyme's activity.

Concentration of inhibitor (mM)	Enzyme activity (%)
0.00	100
0.10	60
0.20	40
0.30	20
0.40	0
0.50	0

Predict the concentration of inhibitor when half of the active sites of the enzyme are occupied by inhibitor.

- A 0.15 mM  
B 0.25 mM  
C 0.40 mM  
D 0.50 mM
8. An investigation was carried out into the effect of substrate concentration on the rate of a reaction in the presence of a competitive inhibitor.  
Which of the following would ensure the results were valid?
- A Repeating the investigation using a non-competitive inhibitor.  
B Keeping the inhibitor concentration constant.  
C Repeating the investigation with each concentration of substrate.  
D Keeping the substrate concentration constant.
9. During aerobic respiration in a cell, one molecule of glucose yielded 38 molecules of ATP.  
During respiration without oxygen in the same cell, one molecule of glucose yielded 2 molecules of ATP.  
Calculate the percentage decrease in ATP yield per glucose molecule when this cell carries out respiration without oxygen compared to when it respire aerobically.
- A 5%  
B 6%  
C 95%  
D 1800%

10. The diagram represents some of the processes that occur in a mitochondrion.



Which letter represents ATP synthase?

11. Which of the following applies to the skeletal muscle fibres that are most useful during a cross-country ski race?

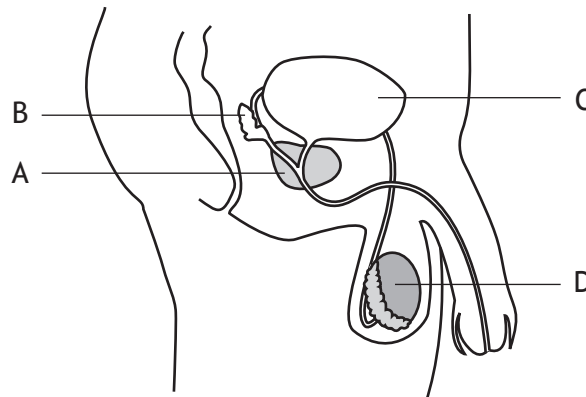
	Number of mitochondria	Blood supply	Generation of ATP
A	low	low	glycolysis only
B	high	large	glycolysis only
C	low	low	aerobic respiration
D	high	large	aerobic respiration

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12. Which hormone, found in contraceptive pills, causes thickening of the cervical mucus?

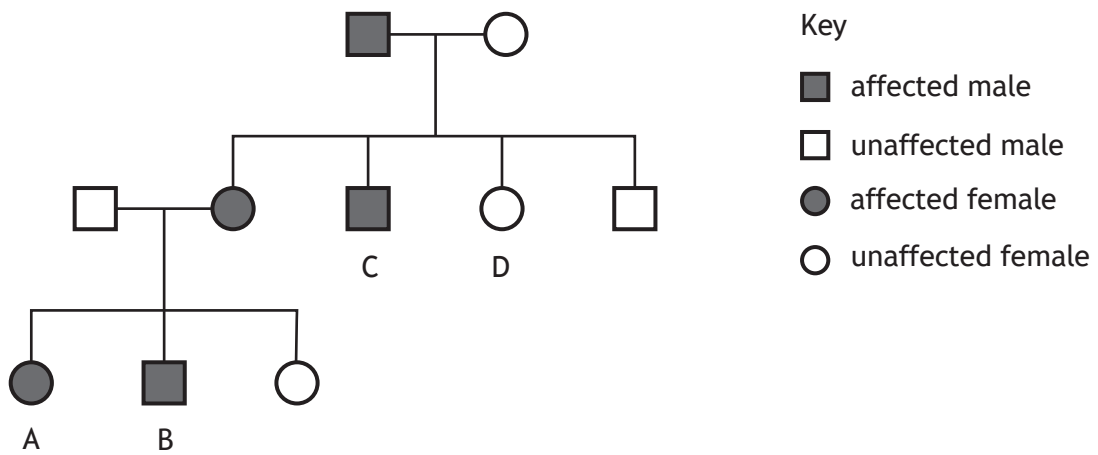
- A Oestrogen
- B Progesterone
- C Luteinising Hormone (LH)
- D Follicle Stimulating Hormone (FSH)

13. Which letter in the diagram indicates the site of testosterone production?



14. Cystic fibrosis is caused by a recessive allele.

The diagram shows the inheritance of cystic fibrosis in three generations of a family.



Which individual confirms that cystic fibrosis is **not** a sex-linked condition?

15. The following steps are involved in the process of in vitro fertilisation (IVF):

1. Zygotes are incubated.
2. Woman is given drugs to stimulate ovulation.
3. Eggs are mixed with sperm in a culture dish.
4. Eggs are surgically removed.
5. Embryos are implanted.
6. Fertilisation occurs.

Which of the following sequences shows the order in which these events take place?

- A 4, 3, 6, 1, 2, 5
- B 2, 4, 3, 6, 1, 5
- C 4, 3, 1, 6, 5, 2
- D 2, 4, 3, 6, 5, 1

16. Measurement of a child's cardiac cycle showed that systole lasted for 0.2 seconds while diastole lasted for 0.4 seconds.

What was the heart rate of this child?

- A 60 beats per minute
- B 75 beats per minute
- C 100 beats per minute
- D 150 beats per minute

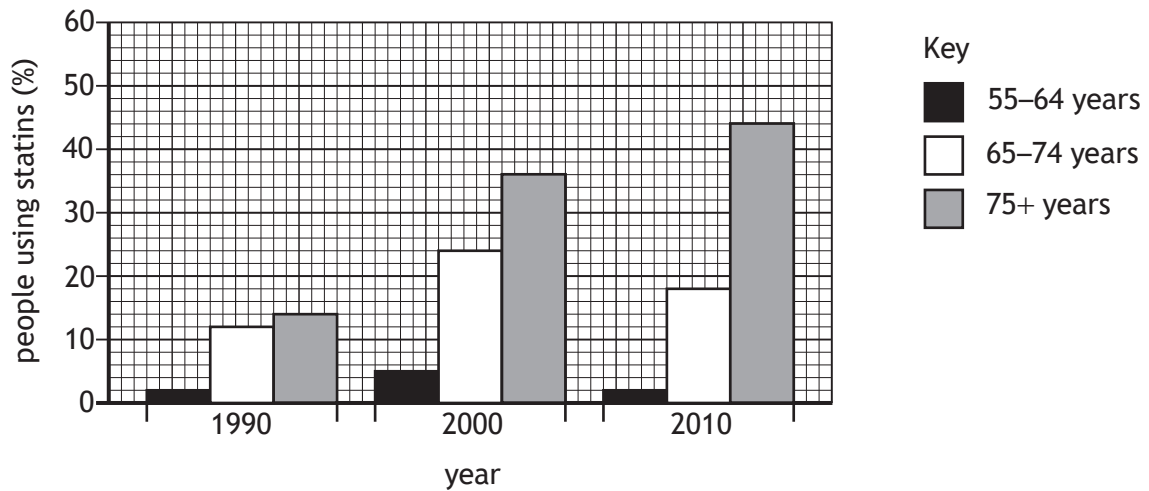
17. Peripheral vascular disease most commonly occurs in the arteries to the

- A leg
- B lung
- C brain
- D heart.

[Turn over

18. In a study, the percentage of people aged 55 years and older who use statins was recorded in 1990, 2000 and 2010.

The results are shown in the bar graph.



Which of the following statements is correct?

- A Between 2000 and 2010, statin use increased in all age groups.  
 B Between 1990 and 2010, statin use in the 75+ age group tripled.  
 C Between 1990 and 2000, statin use in the 65–74 age group doubled.  
 D Between 1990 and 2010, statin use in the 55–64 age group decreased.
19. Which row in the table matches the branch of the autonomic nervous system (ANS) with its effect?

	Branch	Effect
A	sympathetic	increases intestinal secretions
B	sympathetic	decreases breathing rate
C	parasympathetic	decreases intestinal secretions
D	parasympathetic	increases peristalsis

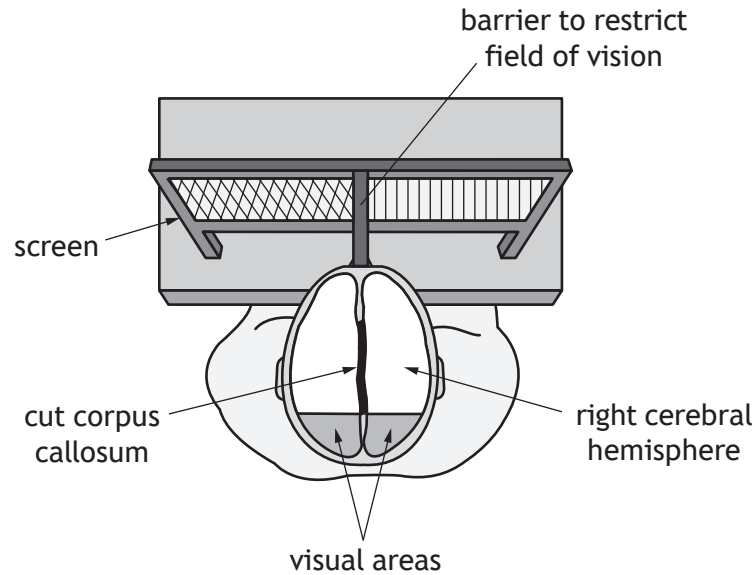
20. Which of the following is **not** a method of encoding information into long term memory?

- A Chunking  
 B Rehearsal  
 C Elaboration  
 D Organisation

21. Split-brain patients cannot transfer information between the right and left hemispheres of the cerebral cortex because the corpus callosum has been cut during surgery.

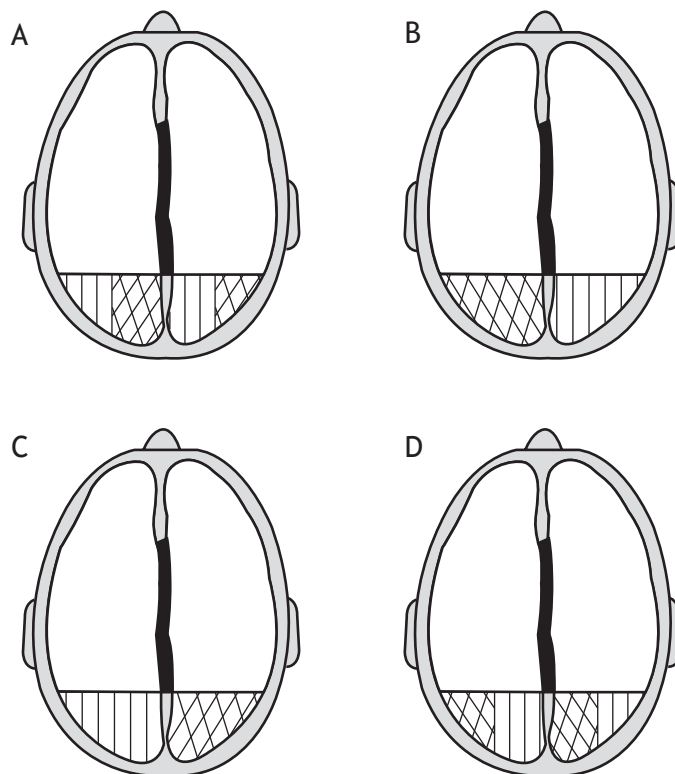
In a study a split-brain patient was asked to press their forehead against a barrier so that their left eye could only see to the left of the barrier and their right eye to the right of the barrier.

The diagram shows the setup of the study.



The patient was asked to look straight ahead and then two patterns were flashed briefly on the screen as shown.

Which of the following diagrams represents where the patterns are interpreted in the visual areas of this patient's cortex?



22. An individual displayed a hypersensitive response to a foreign substance.

Which row in the table identifies the cause of this response and the type of lymphocyte involved?

	Cause of response	Type of lymphocyte involved
A	autoimmune disease	B
B	allergy	B
C	autoimmune disease	T
D	allergy	T

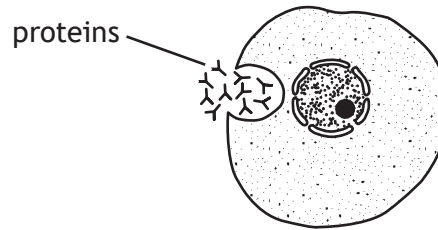
23. During an epidemic, the R number refers to the number of cases of a disease that are directly caused by contact with one infected individual.

During an epidemic, an individual becomes infected when the R number is 2. This means that during the first level of transmission, two further people will be infected who will each infect two more people during the second level of transmission.

Predict the **total** number of people infected after four levels of transmission.

- A 8
- B 15
- C 16
- D 31

24. The diagram shows a lymphocyte releasing proteins it has produced.



Which row in the table identifies the type of lymphocyte and the proteins produced?

	Lymphocyte	Protein
A	B	antibody
B	T	antigen
C	T	antibody
D	B	antigen

25. The list contains statements about factors considered during the vaccination of a population.

1. The type of disease
2. The population density
3. The effectiveness of the vaccine
4. The percentage of non-immune individuals

Which of the statements refer to factors that can affect the herd immunity threshold?

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

[END OF QUESTION PAPER]

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