H

National Qualifications 2024

X840/76/12

Human Biology
Paper 1 — Multiple choice

WEDNESDAY, 15 MAY

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.

Total marks — 25

Attempt ALL questions

1. Red blood cells are produced in the bone marrow by differentiation of

   A   multipotent tissue stem cells

   B   pluripotent tissue stem cells

   C   multipotent embryonic stem cells
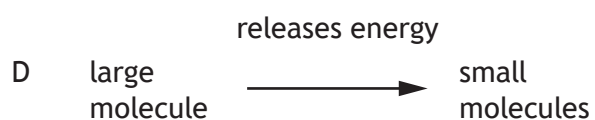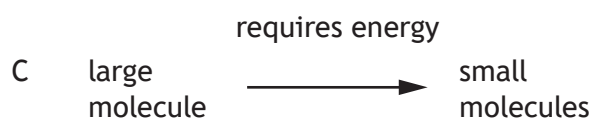
   D   pluripotent embryonic stem cells.
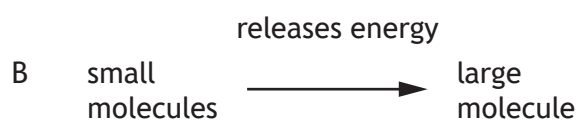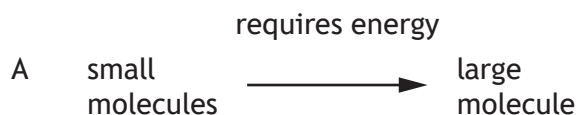
2. A molecule of DNA has a thymine to guanine ratio of 3:2.

   The molecule contains 1245 adenine bases.

   The number of guanine bases in the molecule is

   A   415

   B   498

   C   830

   D   1660

3. Identify the catabolic reaction.

   A   small   requires energy   large
       molecules   ───────────►   molecule

   B   small   releases energy   large
       molecules   ───────────►   molecule

   C   large   requires energy   small
       molecule   ───────────►   molecules

   D   large   releases energy   small
       molecule   ───────────►   molecules

4. An investigation was carried out to compare the rate of respiration of an organism at different temperatures. The apparatus was set up as shown.
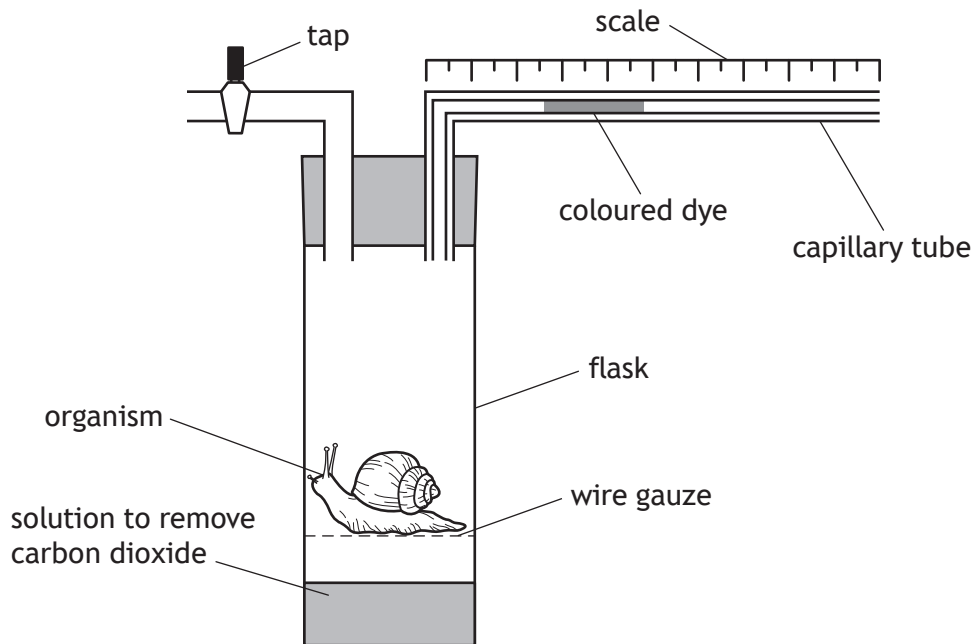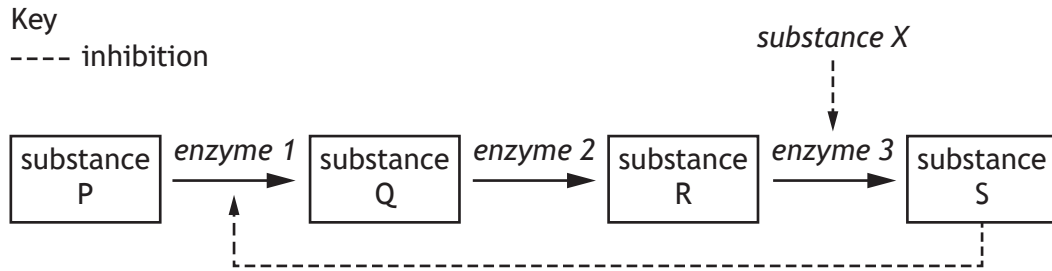

The investigation was repeated at four different temperatures. The organism was left in the apparatus for 30 minutes at each temperature.

A suitable control for this investigation would be to use the same set up with

A   more organisms

B   a wider range of temperatures

C   glass beads in place of organism

D   no solution to remove carbon dioxide.

5. What term describes the use of genome information in the choice of drugs that may be prescribed to a patient?

A   Bioinformatics

B   Human genomics

C   Pharmacogenetics

D   Genomic sequencing

[Turn over

6. The diagram shows a metabolic pathway and two ways that it can be inhibited.

Key
---- inhibition

substance X

| substance P | *enzyme 1* | substance Q | *enzyme 2* | substance R | *enzyme 3* | substance S |

The effect of both inhibitors is reduced by increasing substrate concentration.

Which row in the table identifies the two types of inhibition?

	Inhibition due to substance S	Inhibition due to substance X
A	feedback	competitive
B	competitive	non-competitive
C	feedback	non-competitive
D	non-competitive	competitive

7. Which of the following mutations results in a premature stop codon causing a shorter protein to be produced?

A   Missense

B   Nonsense

C   Splice-site

D   Frameshift

8. The diagrams show three pairs of homologous chromosomes before and after chromosome mutations occur.

before mutation   after mutation
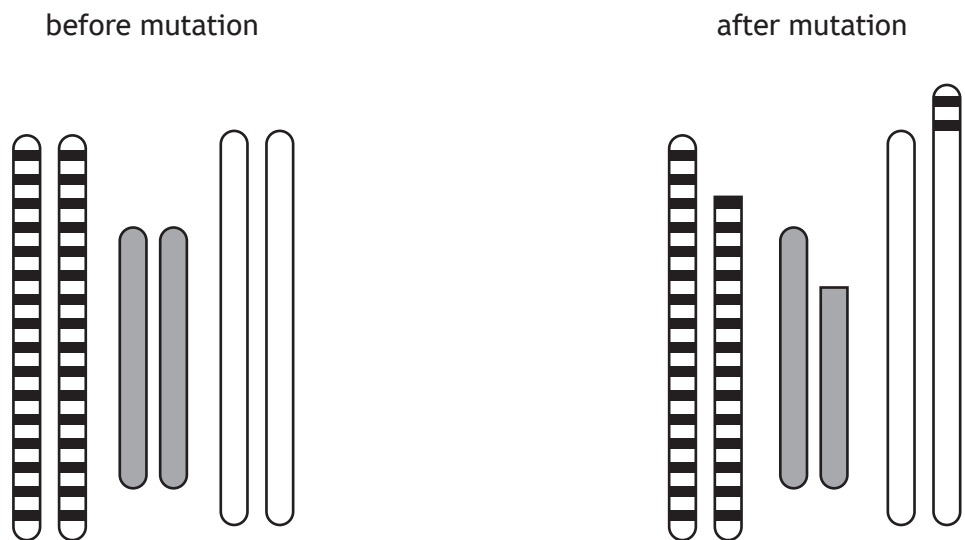
Which of the following types of chromosome mutation have occurred?

A   Inversion and translocation

B   Deletion and duplication

C   Duplication and inversion

D   Deletion and translocation

9. During exercise, an oxygen debt can build up.

When the oxygen debt is repaid, lactate is converted in the liver to

A   pyruvate and glucose

B   carbon dioxide and water

C   pyruvate and water

D   carbon dioxide and glucose.

10. PCR is a reaction that amplifies a section of DNA and involves three temperature changes per cycle.

Calculate how many temperature changes the reaction would undergo if there were 256 copies of the DNA section produced.
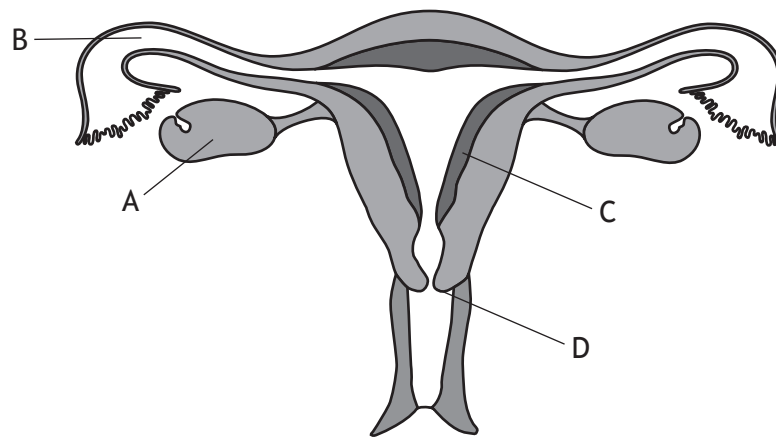
A   3

B   8

C   21

D   24

11. In the testes, sperm are produced by

A   mitosis in the seminal vesicles

B   meiosis in the seminal vesicles

C   mitosis in the seminiferous tubules

D   meiosis in the seminiferous tubules.

12. The diagram represents the female reproductive system.

Identify the structure affected by the progesterone-only (mini) pill as a means of contraception.

13. Thalassaemia is a recessive inherited blood condition in which individuals produce abnormal haemoglobin.

The diagram shows the children and grandchildren of a male with thalassaemia and a female who is homozygous.

Key

☐ unaffected male

■ affected male

○ unaffected female

● affected female
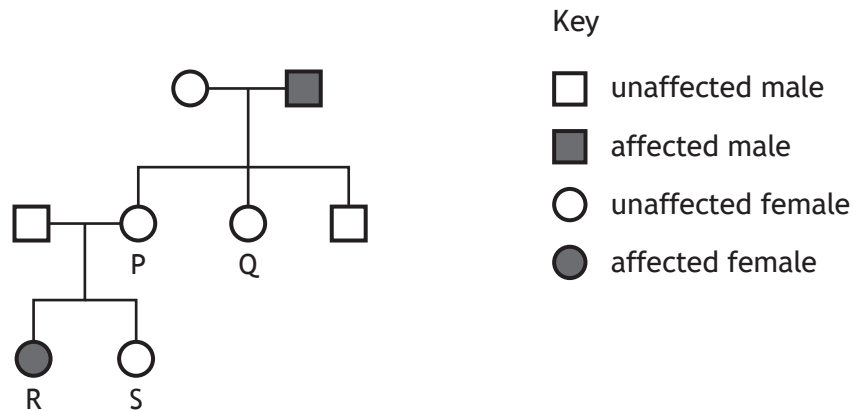
Which of the labelled individuals confirms that thalassaemia is **not** a sex-linked condition?

A   P

B   Q

C   R

D   S

14. Artificial insemination requires

A   PGD to identify single gene disorders

B   several samples of semen to be collected

C   surgical removal of eggs from the ovaries

D   the head of a sperm to be drawn into a needle.

[Turn over

15. Phenylketonuria (PKU) is an inherited disorder caused by a mutation that affects a reaction in a metabolic pathway.

Which row in the table identifies the type of mutation and reaction affected?

	Type of mutation	Reaction affected
A	deletion	phenylalanine → tyrosine
B	deletion	tyrosine → phenylalanine
C	substitution	phenylalanine → tyrosine
D	substitution	tyrosine → phenylalanine

16. The table shows some measurements taken from an athlete before and after a 3-month training camp.

	Resting heart rate (bpm)	Stroke volume (l)
Before training	60	0.07
After training	51	0.09

Calculate the increase in cardiac output after training.

A 0.02

B 0.39

C 4.59

D 9.29

17. An atheroma may rupture, damaging the endothelium. This triggers the release of clotting factors, which activates a cascade of reactions.

Which of the following reactions comes first in the cascade?

A Fibrinogen → fibrin

B Fibrin → fibrinogen

C Prothrombin → thrombin

D Thrombin → prothrombin

18. Which of the following would be used to calculate the BMI of an individual?

    A   Body mass divided by height squared

    B   Body mass squared divided by height

    C   Height squared divided by body mass

    D   Height divided by body mass squared

19. The corpus callosum

    A   allows the transfer of information between cerebral hemispheres

    B   allows the localisation of brain functions in the cerebral cortex

    C   processes information from the opposite side of the cerebrum

    D   transfers information between short-term memory and long-term memory.

20. Which of the following is **not** a function of the association areas in the cerebral cortex?

    A   Imagination

    B   Language processing

    C   Coordinating balance

    D   Determining personality and intelligence

21. A recreational drug can stimulate the reward pathway in the brain by

    A   blocking the dopamine reuptake protein

    B   blocking the endorphin reuptake protein

    C   acting as an antagonist at dopamine receptors

    D   acting as an antagonist at endorphin receptors.

22. The graph contains information about serotonin and dopamine levels in an individual, following injections of a drug at 0 and 60 minutes.

Key
— serotonin
····· dopamine
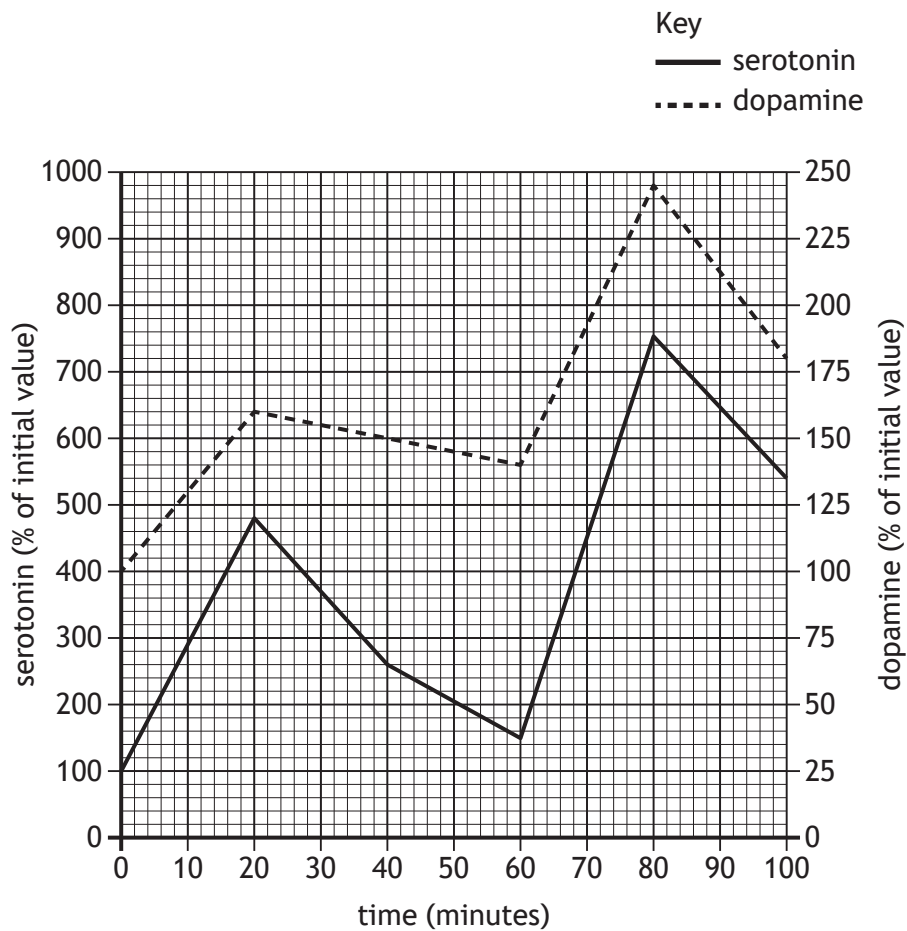
Predict what the individual's dopamine levels will be at 120 minutes.

A   80%

B   115%

C   320%

D   460%

23. The list shows cell types found in the immune system.

1.   Mast cell

2.   Phagocyte

3.   Lymphocyte

Which of these cell types are involved in non-specific body defences against disease?

A   2 only

B   1 and 2 only

C   2 and 3 only

D   1, 2 and 3

24. An investigation was carried out into the use of different types of adjuvants on the effectiveness of a vaccine.

Four vaccines were prepared, each containing a different type of adjuvant and antigens against the pathogen.

The effectiveness of each vaccine was measured at 7 days and 14 days after immunisation.

Identify the independent variable in this investigation.

A   Volume of the vaccine

B   Type of adjuvant used

C   Effectiveness of the vaccine

D   Length of time left after immunisation

25. To establish herd immunity against measles 90% of a population must be successfully vaccinated.

The measles vaccine is not successful in some individuals who have a weakened immune system.

Which of the following populations is most at risk of a measles outbreak?

	Number of vaccinated individuals in the population	Number of vaccinated individuals where vaccine was not successful	Population
A	600 000	10 000	630 000
B	202 000	2000	220 000
C	410 000	5000	450 000
D	300 000	5000	340 000

[END OF QUESTION PAPER]

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