Centre Number

Student Number

2026 SPlICE EDUCATION
MOCK TRIAL EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write your Centre Number and Student Number at the top of this page and on the multiple-choice answer sheet
- Write using black pen
- NESA-approved calculators may be used
- A reference sheet is provided at the back of this paper
- For questions in Section II, show all relevant working where a calculation is required
- Extra writing booklets are available if you need more space

Total marks: 100

Section I – 20 marks
Attempt Questions 1–20
Allow about 35 minutes for this section

Section II – 80 marks
Attempt Questions 21–30
Allow about 2 hour and 25 minutes for this section

1. Below is the sequence of bases that can be found on the Sonic hedgehog gene (*SHH*)

TTTCGAGG

Which of the following will be the mRNA seqeunce?

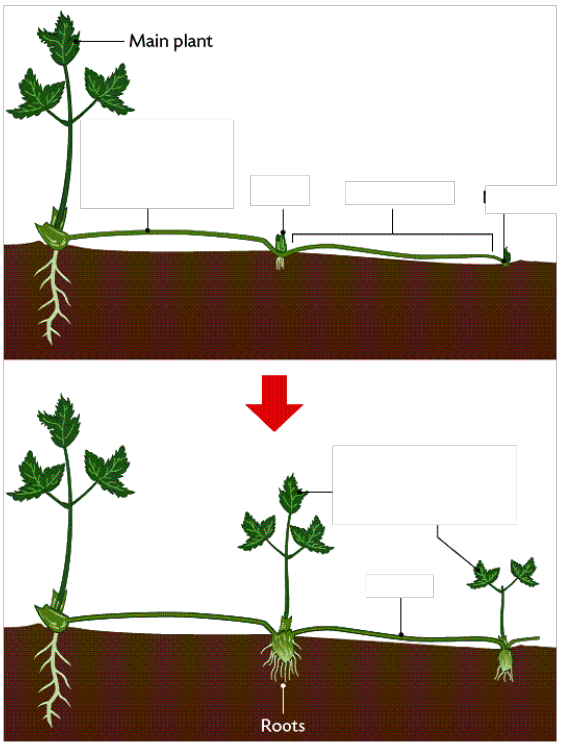
A. AAAGCTCC

B. UUTCGAGG

C. UUUCGAGG

D. AAACGUGG

2. The following diagram shows the method mint reproduces.



This method is known as.

A. Spores

B. Binary Fission

C. Vegetative Propagation

D. Budding

3. Clotrimazole is a medication to treat disease. It works by damaging the cell membrane of a certain pathogen which does not have a flagellum. This pathogen usually replicates via spores. Clotrimazole is usually applied topically. Clotrimazole can be considered to be

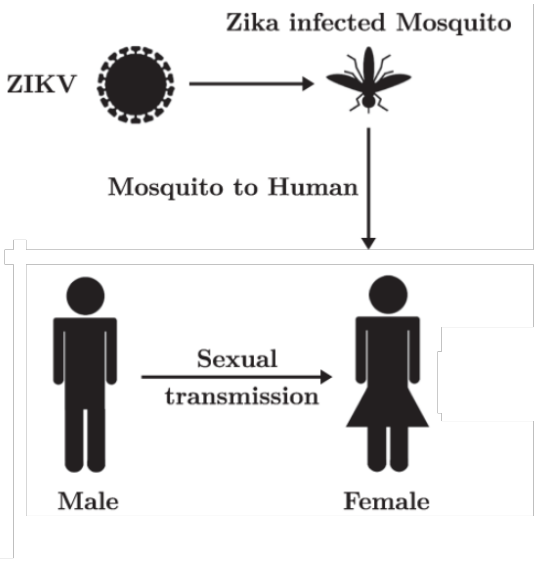
A. Antiviral medication

B. Antibiotic

C. Anti-fungal

D. Anti-parasite

4. Zika virus is a mosquito-borne virus that was first identified in Uganda in 1947 in a Rhesus macaque monkey, followed by evidence of infection and disease in humans in other African countries in the 1950s.



What are the type/s of transmission in this case study?

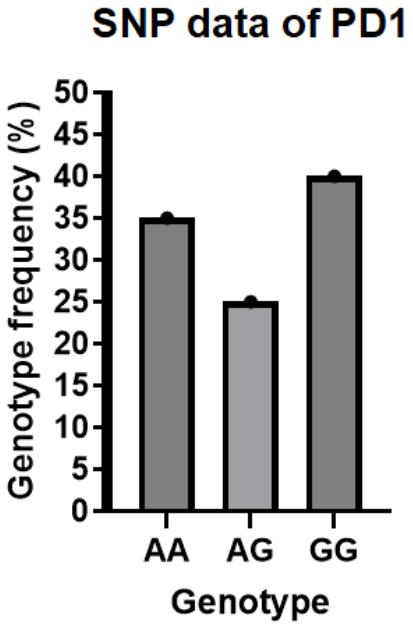
A. Sexually transmitted infection

B. Indirect transmission and vector transmission

C. Direct transmission and vector transmission

D. Indirect transmission and reservoir based transmission

5. *PD1* is a gene used for immune checkpoint therapies however there are SNP variations.



The graph shows genotype frequencies for a SNP locus in a population. Which statement is best supported by the data?

A. The allelle frequency of G is 40%

B. The allele frequency of A is 35%

C. The allele frequncy of G is 52.5%

D. The alle frequcny of A is 45.5%

6. DNA replication is a complex process requiring many enzymes. Which of the following list have enzymes ONLY relating to DNA replication

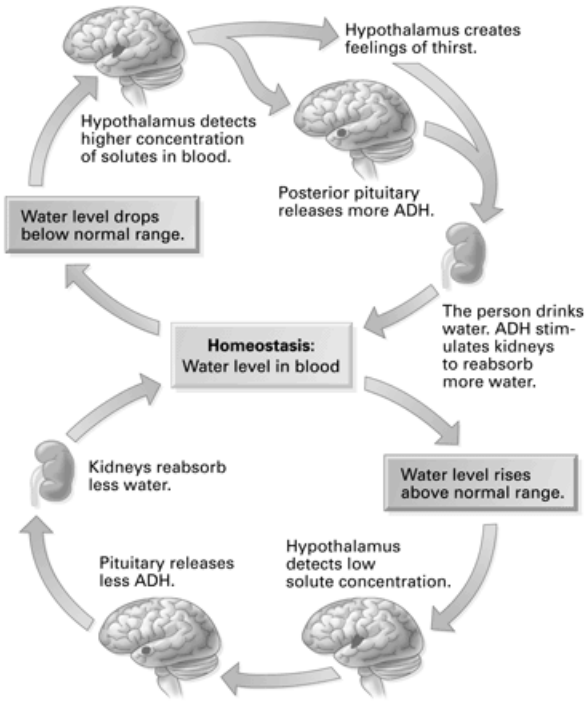
A. Helicase, DNA polyermase, ribosomes

B. DNA polymerase, retrotransposons, DNA methylation

C. DNA polymerase, ligase, helicase

D. Helicase, adenine, DNA polyermase

7. A negative feedback loop involved in osmoregulation is shown below



Which statment below best describes the relationship between ADH and the kidneys

A. Decrease in ADH leads to less reabsorption of water

B. Decrease in water leads to decrease in ADH

C. Decrease in ADH leads to less pituitary stimulation

D. Decrease in ADH leads to overall less brain activity

8. Louis Pasteur was a French chemist, pharmacist, and microbiologist renowned for his discoveries of the principles of vaccination, microbial fermentation, and pasteurization. His swan neck flask experiment was one of the most famous experiments in microbiology.

Which of the following is the independent variable in the swan neck flask experiment?

A. Temperature

B. Flask Shape

C. Room Air

D. Growth of microbes

9. Somatic mutations can occur at different stages of pregnancy which is most likely to result in a permanent somatic mutation

A. Fertilization

B. Implantation

C. Spermatogenesis

D. Embryo formation

10. Which of the following describes one method naturally occurring mutagens cause mutations?

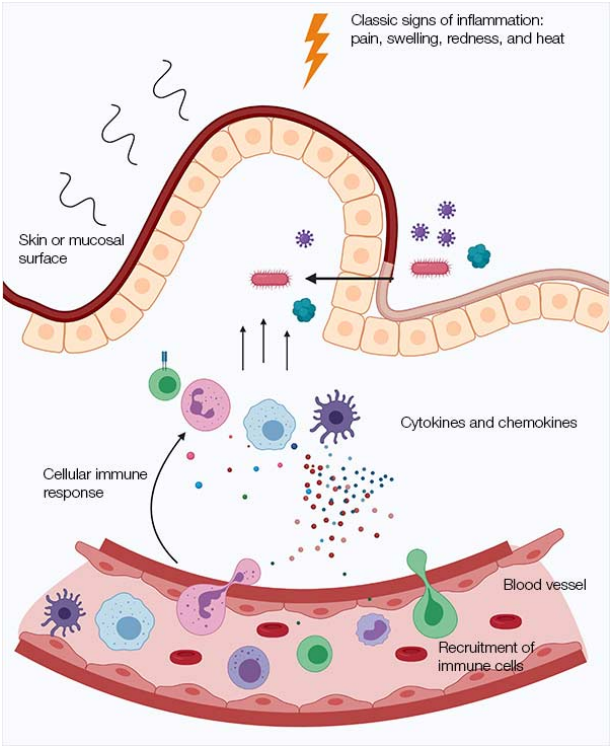
A. Ionizing radiation causes thymine dimers

B. Retroviruses causing DNA damage

C. Consistent exposure to Bromodeoxyuridine

D. Eating burnt food

Using the following diagram for questions 11-12.



11. The diagram above shows the inflammation response

What chemical do the leukocytes produce to initiate this response?

A. Lysozyme

B. Endocrine

C. Macrophage

D. Histamines

12. Classic signs of inflammation is pain swelling redness and heat

Why would the body present with these signs?

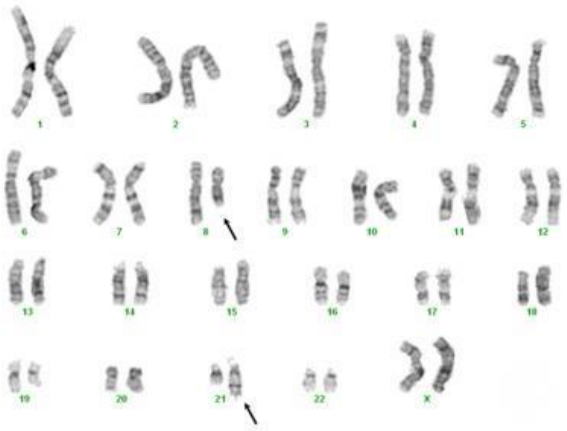
A. Vasodilation to result in heat dissipation

B. Vasoconstriction to result to decrease vascular permeability

C. Vasodilation to result in increase vascular permeability

D. Vasodilation to result increase oxygen recruitment

13. The diagram shows a mutation in a patient with Acute Myeloid Leukaemia



What is the most likely reason this mutation has led to the disease?

A. Loss of chromosome

B. Changes in phenotype in the blood cells

C. Meiosis is disrupted

D. Protein structure is changed

14. A sciencist is trying to test the effectivness of this new antibiotic

Here is the list of steps they are using:

1. Culture 2 plates of *E.Coli*

2. Pour the antibiotic into both plates

3. Incubate at 37° C for 24 hours

4. Compare bacterial growth

Which of the following is true about what is wrong with the experiment

A. The plates should be non sterile

B. There is no dependent variable

C. There is no independent variable

D. Bacteria do not grow at 37° C

15. What is the function of the glomerulus? (MOD 8*)

A. Reabsorption of minerals

B. To filter large molecules from entering the kidney

C. To allow waste to enter the liver

D. Supply the kidney with deoxygenate blood

16. Glycogen is a glucose storage molecule. (MOD 8*)

Which of the following is true?

A. Insulin stimulates the breakdown of glycogen

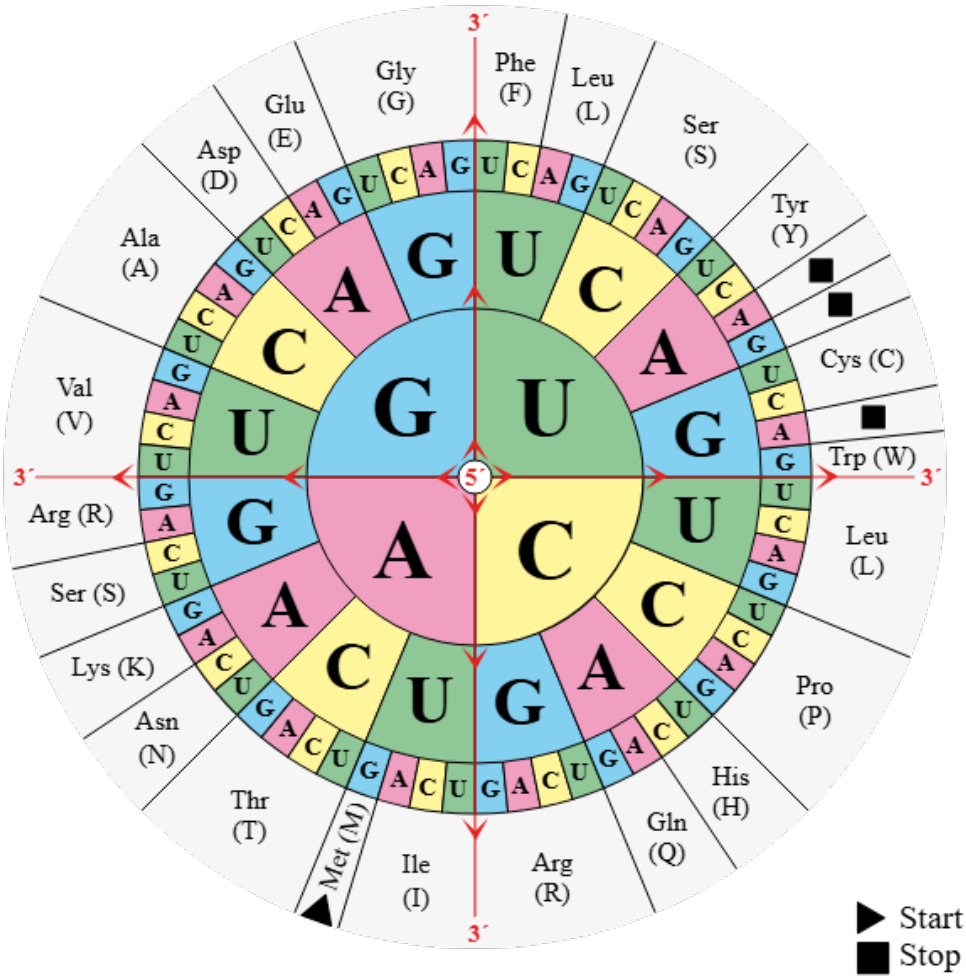
B. Insulin stimulates the uptake of glycogen into cells

C. Glucagon makes glycogen

D. Glycogen is made in the liver

17. The template strand of a gene is

3' TAC GAC CCG ACT 5'



Using the diagram above transcribe the DNA strand to mRNA and use the codon chart to translate the genetic code into a sequence of amino acids

The correct sequence of amino acids is

A. Arg-Thr-Asp

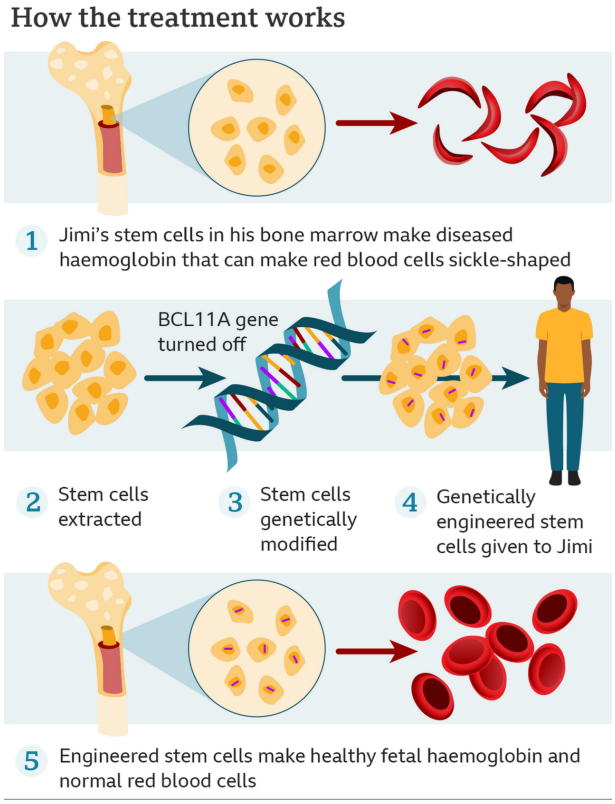
B. Start-Leu-Gly-Stop

C. Start-Gly-Leu-Cys

D. Start-Leu-Gly-Cys

Use the following information for questions 18-20.

Sickle cell anaemia is a genetic disorder caused by a mutation in the gene responsible for producing adult haemoglobin, the protein that carries oxygen in the blood. This mutation results in misshapen red blood cells. Traditional management of the condition often involves monthly blood transfusions to reduce symptoms. Casgevy, a newly approved gene therapy, works by editing a patient's own blood stem cells to restore the production of functional foetal haemoglobin. Foetal haemoglobin is naturally produced early in life but is later switched off by the BCL11A gene. Foetal haemoglobin has a different polypeptide composition than the adult haemoglobin, allowing it to bind oxygen more effectively. A summary of the process is illustrated below.



18. Casgevy "edits" in a non-coding region. Why would sciencist choose to edit in non-coding region?

A. Introns are more easy to edit

B. Non coding regions regulate gene expression

C. Exon are very small

D. Foetal haemglobin has too many exons to edit

19. One benefit of Casgevy is that is a one time treatment where patients do not run the risk of immune rejection. Typical treatment include blood transfusion for people with sickle cell. Immune rejection is when the tissue from a human is given to another human such as a blood transfusion. (Blood is a type of tissue)

Which of the follow statements is true?

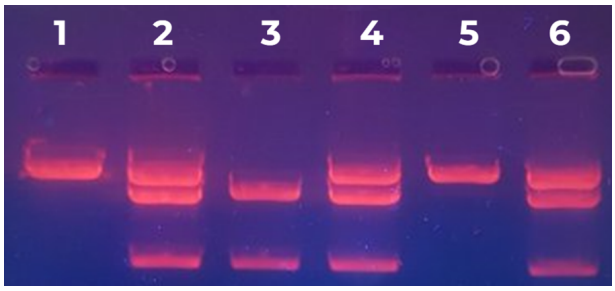
A. Patients with sickle cell anaemia will have MHCII so it will then immune rejection will occur

B. Macrophages will have MHCII and can recognise if antigens are self or non self this will lead to immune rejection

C. Cytokines will communicate with T cells to release antibodies these antibodies will lead to immune rejection

D. Patients with sickle cell anaemia will have higher immunity to blood transfusions.

20. DNA profiliing is one of the way to tell if someone has sickle cell anameia. Sickle cell anaemia is an autosomal recessive disease.



From the graphic Person 3 is homozygous and does not have the disease.

Determine which person/s have the disease?

A. 1

B. 2

C. 2, 4 and 6

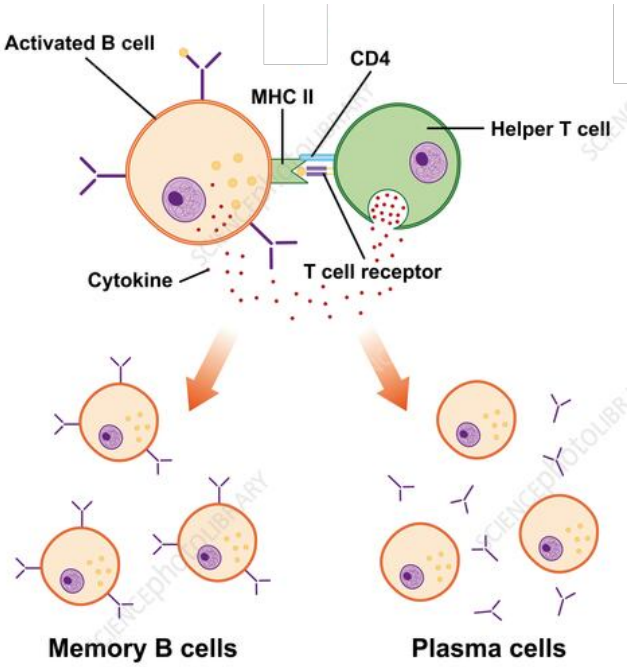
D. 1 and 5

Section II

55 marks
Attempt Questions 21–27
Allow about 1 hour and 40 minutes for this section

Answer the questions in the spaces provided. These spaces show the expected length of response.

Question 21 **(4)**



Using your own knowledge and the diagram above, describe the process above.

Question 22 **(6)**

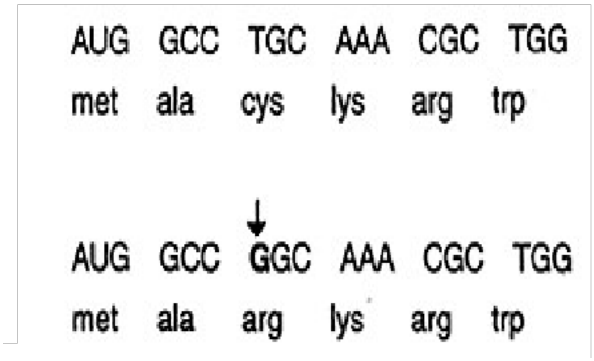
(a) Draw a diagram of a chosen visual disorder. (MOD8*) **(3)**

(b) Describe a technology to assist with your chosen visual disorder. (MOD8*) **(3)**

Question 23 **(7)**

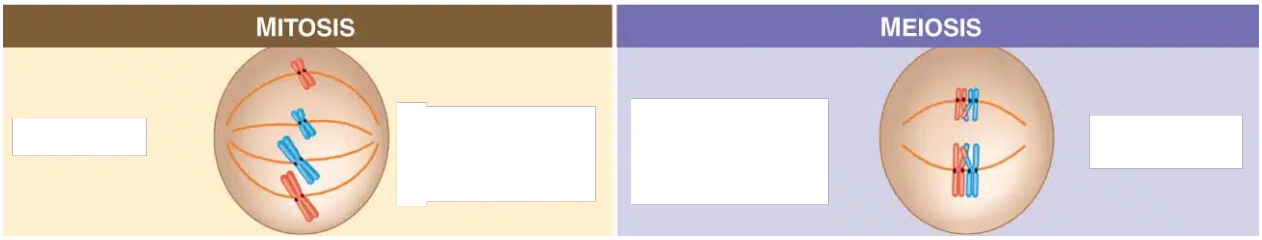
(a) Compare point mutations and chromosomal mutations. **(3)**

(b) Using the diagram below, identify what type of mutation this is and explain its effect. **(4)**



End of question 23

Question 24 **(4)**



Identify what stage of mitosis and meiosis is this and compare the differences of this **STAGE.**

Question 25 **(6)**

Gordon conducted a large-scale study to investigate the relationship between the timing of vaccinations after birth and the risk of fatal infection. The study collected data from thousands of infants who received vaccinations at different times after birth.

Table 1: Effect of vaccination timing on fatal infection cases

Age vaccination given after birth (days)	**Fatal infection cases**
0	5
7	10
14	20
21	35
28	60
35	95
40	150
50	220
60	320

Gordon surveyed 5000 different babies from different races, ethnic and social backgrounds.

Question 25 continues on next page

(a) Using the table, graph the data. **(3)**

Question 25 continues on next page

(b) Provide an explanation of the trend seen in the graph. **(3)**

End of question 25

Question 26 **(7)**

Duchenne muscular dystrophy (DMD) is a severe genetic disorder causing progressive muscle degeneration and weakness.

Jeslyn the doctor wants to determine how it is inherited using a pedigree. Her patient Eugene has DMD.

The following are clues Jeslyn has to use:

1. Eugene is male

2. Eugene has two brothers with DMD and a sister without

3. Eugene's father and mother do not have DMD

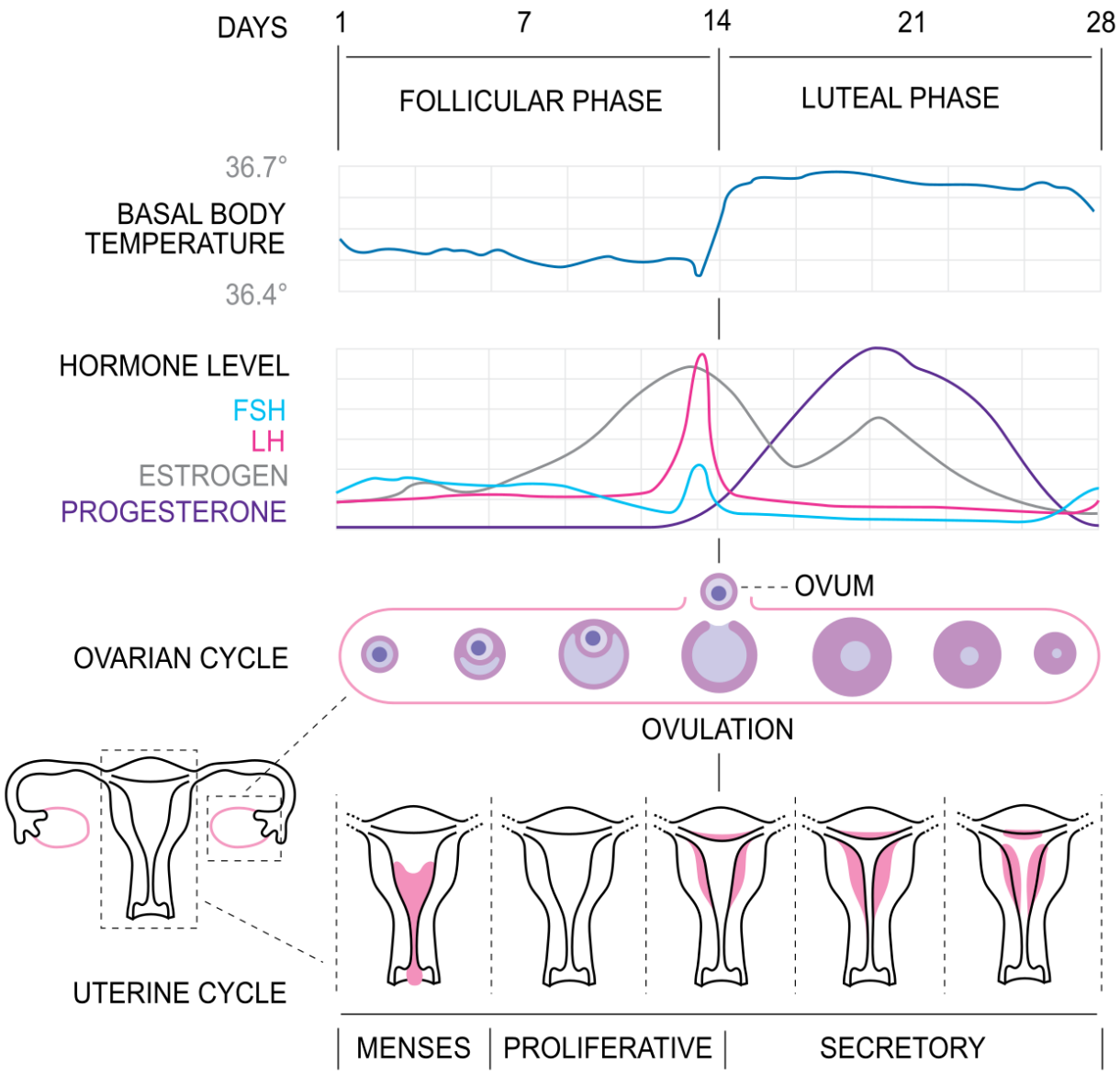
4. Eugene's mother does not have DMD but his mother's father does

(a) Construct a pedigree in the area below using the information above. **(3)**

(b) With reference to your pedigree and the information above, explain the inheritance of Duchenne muscular dystrophy. You may draw a punnett square in your answer **(4)**

End of question 25

Question 27 **(14)**



The menstrual cycle is a monthly biological process that prepares the body for pregnancy. Averaging 28 days, it is regulated by hormones and governed by the ovarian cycle (maturing an egg) and the uterine cycle (thickening the womb lining)

(a) With reference to the image above, compare the hormonal responses following successful implantation and unsuccessful implantation. **(6)**

(b) Identify a hormone not on the graph and describe its function **(4)**

(c) Describe the hormonal pathway responsible for maintaining pregnancy, identifying the organs involved. **(4)**

End of question 27

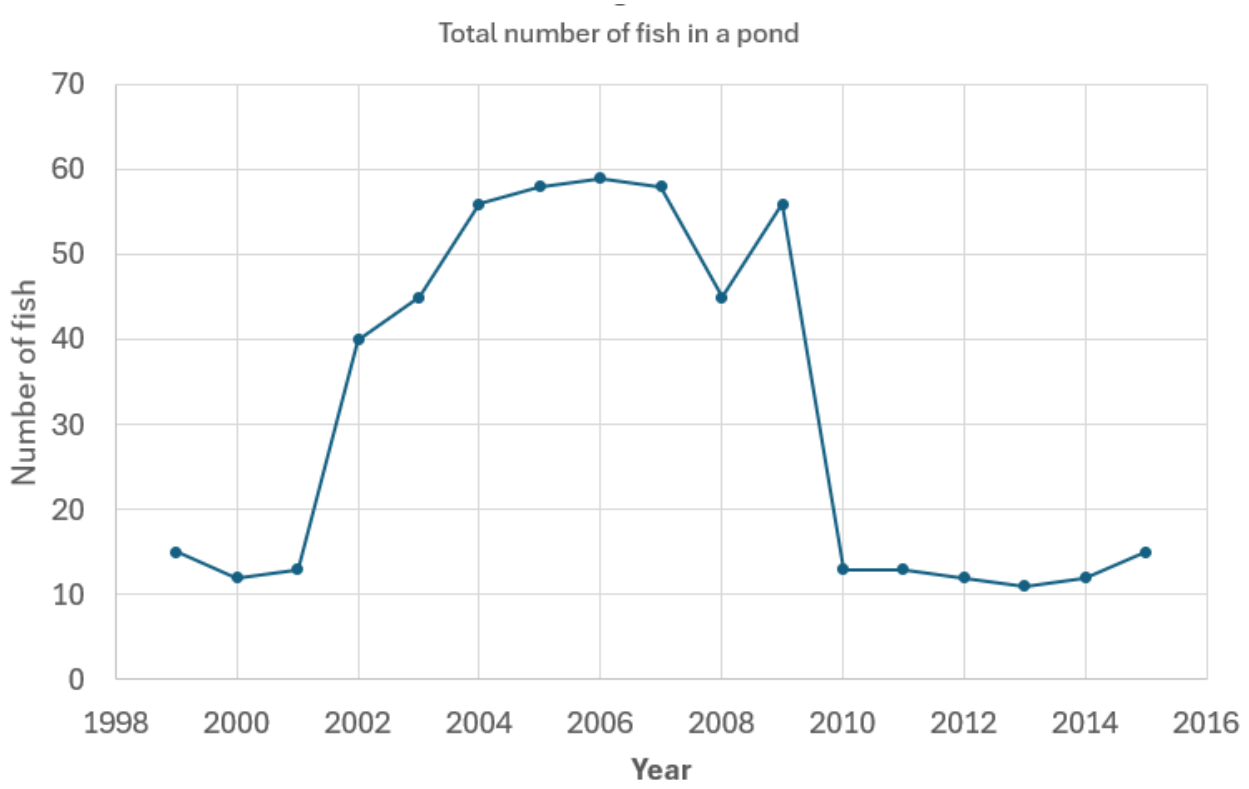
Question 28 **(3)**

More than 25,000 plant species are found across Australia's diverse ecosystems, with many containing naturally occurring bioactive compounds. For thousands of years, Aboriginal and Torres Strait Islander Peoples have used native plants such as tea tree (Melaleuca alternifolia) and eucalyptus (Eucalyptus globulus) to help treat wounds, infections, and respiratory conditions. Today, antibiotics and anti-inflammatory medicines are widely used to manage bacterial infections and inflammation. However, the overuse of antibiotics has contributed to the emergence of antibiotic-resistant bacteria, while some anti-inflammatory medications may cause adverse effects such as stomach irritation, increased blood pressure, or kidney damage. As a result, scientists continue to investigate plant-derived compounds as potential sources of new medicines that may be both effective and have fewer unwanted side effects.

With reference to the information above, explain the importance of recognising and protecting Indigenous cultural and intellectual property.

End of question 28

Question 29 **(7)**



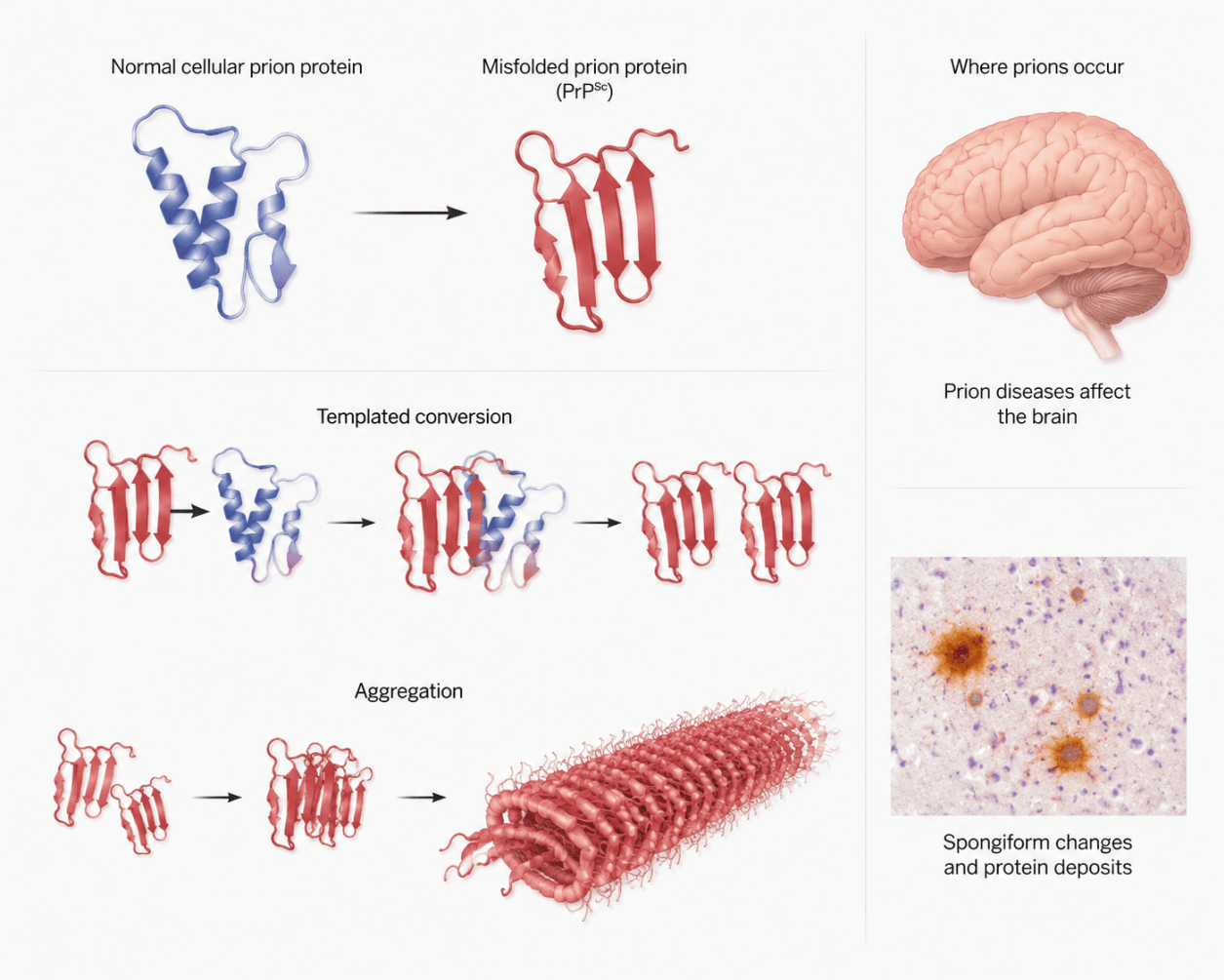
A population of fish was monitored in a freshwater pond over a 15-year period. In 2001, a number of fish from a different pond located several kilometres away were introduced into the population. Following this introduction, the fish population increased steadily as the new individuals reproduced and adapted to the pond environment. In 2011, a major flood event affected the pond ecosystem. As a result, the fish population declined over the following years. The graph above shows changes in the fish population size from 2000 to 2015.

Evaluate how the introduction of fish and the flooded had on population size and genetic diversity.

End of question 29

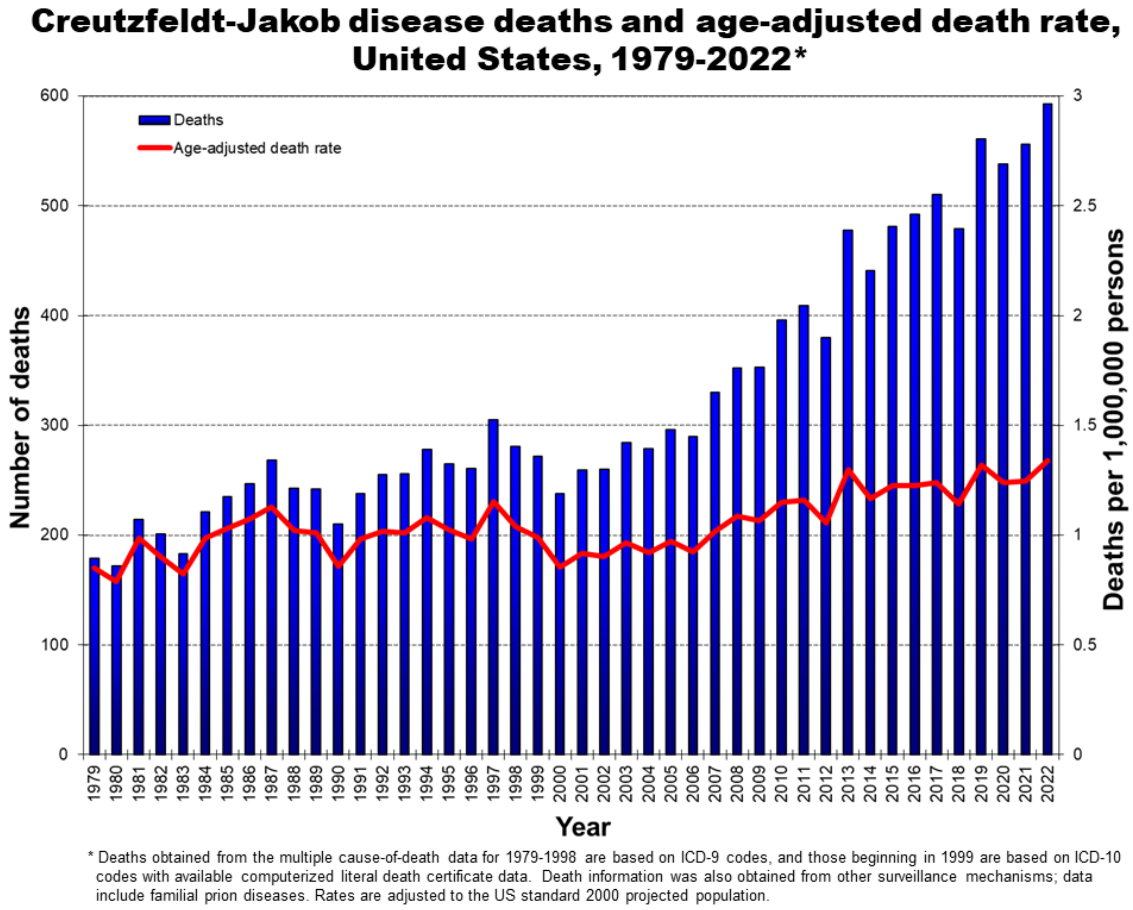
Question 30 **(15)**

Prion diseases are devastating neurodegenerative disorders in humans and many animals, including sheep, cows, deer, cats, and camels.



(a) Describe the main steps that brain cells use to make proteins link prion proteins **(4)**

(b) Identify the structure of the prion protein and describe the other different levels of protein structure **(4)**



Prion diseases are rare but pose significant public health challenges. Creutzfeldt-Jakob disease (CJD) is a type of prion disease. Prions disease can be caused by transmission or by spontaneous mutations in the brain.

(c) Discuss the reason behind the trend of the data **(8)**

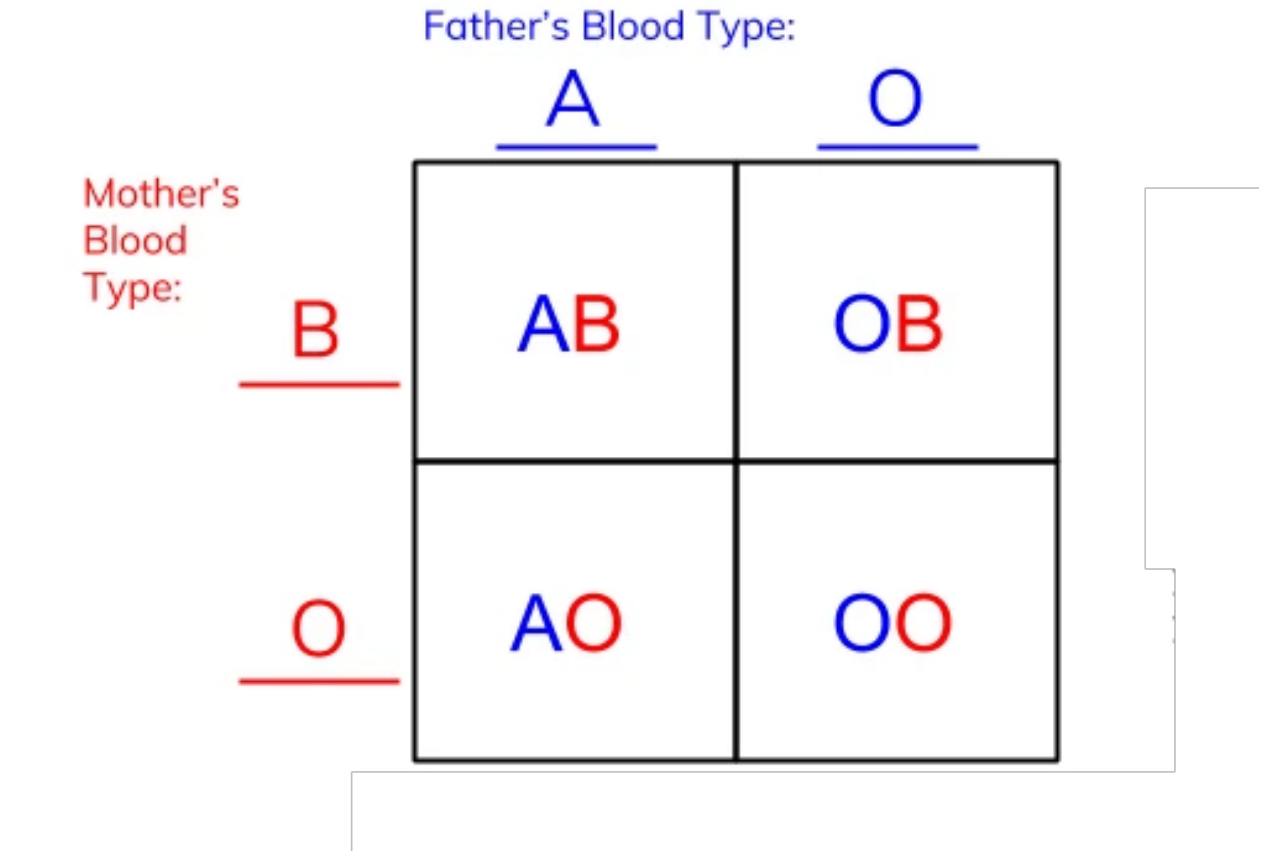
Health authorities identified several cases of a rare human prion disease. Epidemiological investigations found that all affected individuals had been exposed to the infectious prion several years before symptoms developed. During this incubation period, infected individuals showed no signs of illness and could not be identified through routine screening.

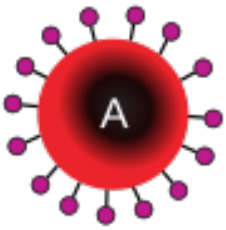
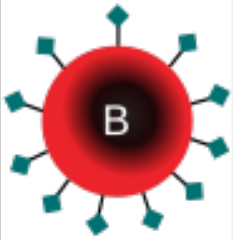
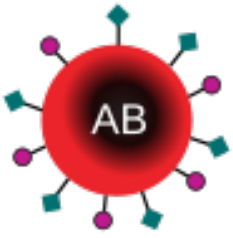
Health authorities considered quarantining people who were thought to have been exposed. However, evidence indicated that prion diseases are not transmitted through everyday person-to-person contact, such as coughing, touching, or sharing food. Instead, the rare documented cases of transmission have occurred through contaminated surgical instruments, tissue or organ transplants, and, in very rare cases, contaminated blood products.

(d) Evaluate the use of quarantine as a prevention method for prion disease **(4)**

Question 31 **(2)**

Aveny requires an emergency blood transfusion after an accident. His mother has blood type A and his father has blood type B. Doctors determine that blood from either parent cannot be safely transfused into the boy.



	Group A	Group B	Group AB	Group O
Red blood cell type				
Antibodies in plasma	 Anti-B	 Anti-A	None	 Anti-A and Anti-B
Antigens in red blood cell	 A antigen	 B antigen	 A and B antigens	None

Explain why the boy cannot safely receive blood from either parent.

End of paper

Section I

20 marks
Attempt Questions 1–20
Allow about 35 minutes for this section

Use the multiple-choice answer sheet for Questions 1–20.

Multiple-Choice Answer Sheet

1.	A ◯	B ◯	C ◯	D ◯	**11.**	A ◯	B ◯	C ◯	D ◯
2.	A ◯	B ◯	C ◯	D ◯	**12.**	A ◯	B ◯	C ◯	D ◯
3.	A ◯	B ◯	C ◯	D ◯	**13.**	A ◯	B ◯	C ◯	D ◯
4.	A ◯	B ◯	C ◯	D ◯	**14.**	A ◯	B ◯	C ◯	D ◯
5.	A ◯	B ◯	C ◯	D ◯	**15.**	A ◯	B ◯	C ◯	D ◯
6.	A ◯	B ◯	C ◯	D ◯	**16.**	A ◯	B ◯	C ◯	D ◯
7.	A ◯	B ◯	C ◯	D ◯	**17.**	A ◯	B ◯	C ◯	D ◯
8.	A ◯	B ◯	C ◯	D ◯	**18.**	A ◯	B ◯	C ◯	D ◯
9.	A ◯	B ◯	C ◯	D ◯	**19.**	A ◯	B ◯	C ◯	D ◯
10.	A ◯	B ◯	C ◯	D ◯	**20.**	A ◯	B ◯	C ◯	D ◯

If you think you have made a mistake, neatly cross out the incorrect answer and fill in the new answer.