



--	--	--	--	--	--	--	--

Student Number

Sydney Girls High School

2022

TRIAL HSC EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- NESA approved calculators may be used

Total Marks: 100

Section I – 20 marks (pages 2 – 10)

- Attempt Questions 1 - 20
- Allow about 35 minutes for this section

Section II – 80 marks (pages 11 - 30)

- Attempt Questions 21 - 33
- Allow about 2 hours and 25 minutes for this section

Section I

20 marks

Attempt Questions 1 - 20

Allow about 35 minutes for this part.

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

- 1** Which feature of DNA promotes easy replication?
- (A) Complementary base pairing
 - (B) Use of deoxyribose, not ribose
 - (C) The sugar-phosphate backbone
 - (D) The presence of nitrogen in the bases
- 2** Which of the following processes increases the genetic variation between offspring of the same parents?
- (A) Mitosis
 - (B) Cloning
 - (C) Mutation
 - (D) Crossing over
- 3** What is a behavioural adaptation in kangaroos that helps them cope with heat?
- (A) They rest during the middle of the day.
 - (B) They spend a lot of time wading in lakes.
 - (C) They shelter in caverns to avoid direct sunlight.
 - (D) Their feet and tail enable them to travel long distances very efficiently.
- 4** There are four different nitrogenous bases in DNA. A sequence of fifty base pairs of nucleotides contains 17 adenine bases. How many cytosine bases are there in the sequence?
- (A) 17
 - (B) 22
 - (C) 33
 - (D) 50

- 5 The text shows the causes of three diseases.

Mercury poisoning is caused by a build-up of ingested mercury in the body.

Beriberi is caused by insufficient amounts of thiamine in the body.

Glucose-6-phosphate dehydrogenase deficiency is caused by an inability to make a particular functional enzyme.

What is the correct classification of these diseases?

	<i>Genetic</i>	<i>Nutritional</i>	<i>Environmental</i>
(A)	Mercury poisoning	Beriberi	Glucose-6-phosphate dehydrogenase deficiency
(B)	Beriberi	Mercury poisoning	Mercury poisoning
(C)	Glucose-6-phosphate dehydrogenase deficiency	Beriberi	Mercury poisoning
(D)	Mercury poisoning	Glucose-6-phosphate dehydrogenase deficiency	Beriberi

- 6 If a red flowered snap dragon plant is crossed with a white flowered one, the progeny will all be pink flowered. When pink is crossed with pink, the progeny are in the ratio 1 red : 2 pink : 1 white.

Which of the following is the most correct prediction of the ratios of offspring when a pink snapdragon is crossed with a white snapdragon?

- (A) 1 pink : 1 white
- (B) 1 pink : 3 white
- (C) 1 pink : 2 white : 1 red
- (D) 1 red : 2 pink : 1 white

- 7 After being exposed to a virus responsible for influenza (the “flu”), the antibody levels of two individuals were measured over the course of several days. This was done via blood sampling through a vein on the left arm. The counts of both individuals are presented below:

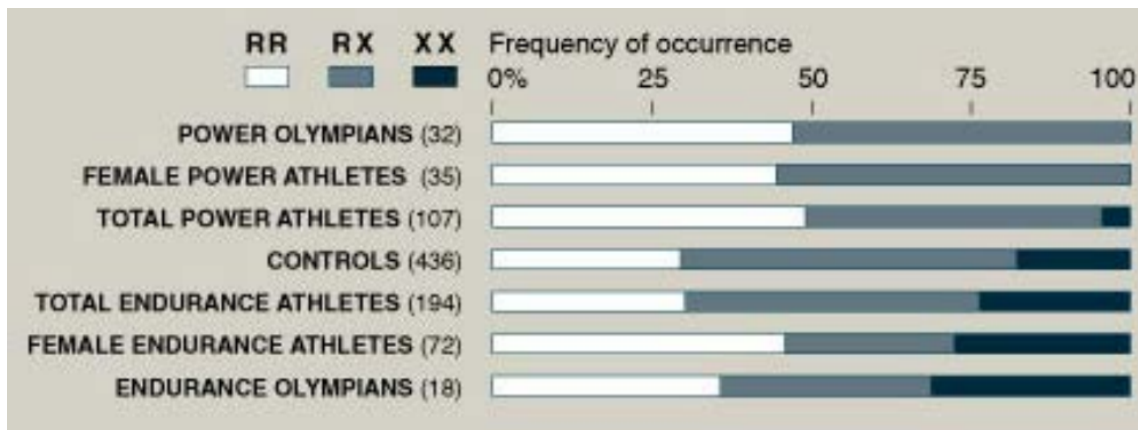
Day	Individual A	Individual B
1	2	5
2	5	100
3	50	3500
4	1000	10000<
5	10000<	10000<

Which individual(s) is more likely to have received the influenza vaccine?

- (A) Individual A, as their antibody counts increased more rapidly.
 - (B) Individual B, as their antibody counts increased more rapidly.
 - (C) Neither individual as their antibody levels both peak at 10000<.
 - (D) Both individuals as their antibody level both peak at 10000.
- 8 If the template strand of a DNA molecule has the sequence 3' CTTGGATCGA 5', which of the following mRNA strands would be produced?

- (A) 5' CUUGGAUCGA 3'
- (B) 5' GUUCCATCGA 3'
- (C) 5' GAACCTAGCT 3'
- (D) 5' GAACCUAGCU 3'

- 9 A single nucleotide polymorphism (SNP) is a DNA sequence variation occurring within a group of the same species in which a single nucleotide differs between individual members. SNP's can be in coding or non-coding regions of DNA. There are many studies that look at how SNP's correlate with a person's phenotype. ACTN3 is a gene coding for muscle specific protein alpha-actinin-3. Three genotypes exist for this gene: RR, RX and XX. Lack of this protein (XX) is not associated with disease.

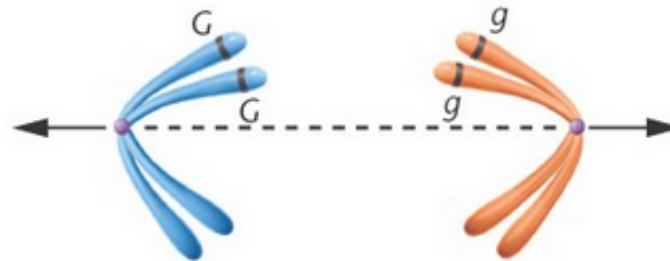


What is the role of alpha-actinin-3 protein?

- (A) Gives an advantage in becoming an endurance athlete.
 (B) Does not give an advantage in becoming an endurance athlete.
 (C) Gives an advantage in becoming a power athlete.
 (D) Does not give an advantage in becoming a power athlete.
- 10 Choose the description below which correctly identifies the characteristics of the genetic material found in some types of infective agents.

	Contains no DNA or RNA – protein only	DNA or RNA in a protein coat	DNA in the cell cytoplasm	DNA in membrane bound nucleus
(A)	Virus	prion	bacterium	protozoan
(B)	Prion	virus	protozoan	bacterium
(C)	virus	prion	protozoan	Bacterium
(D)	Prion	virus	bacterium	protozoan

- 11 The picture below shows a pair of homologous chromosomes in a cell at the beginning of anaphase I of meiosis.



The reason this process results in increased variability of offspring in sexual reproduction is because

- (A) Gametes produced have half the number of chromosomes.
 - (B) This homologous pair moves independently of other pairs.
 - (C) Sexual reproduction combines chromosomes from two individuals.
 - (D) Mutations in homologous chromosomes occur readily at this stage.
- 12 Which of the following is a correct role of the lymph system in the immune response?
- (A) Initiating a fever response.
 - (B) Triggering cell death around the pathogen.
 - (C) Preventing entry of pathogen into the body.
 - (D) Holding a record of past invasion by pathogens.
- 13 Which of the following is an example of natural passive immunity to the measles virus?
- (A) Being injected with antibodies to the measles virus.
 - (B) A baby receiving measles antibodies in breast milk.
 - (C) Being injected with weakened strain of measles virus.
 - (D) Being naturally exposed to the measles virus.

- 14 Albinism is an inherited disorder characterised by the complete or partial absence of pigment in the skin, hair and eyes due to absence of an enzyme involved in the production of melanin. This disease affects both genders equally and can be found in the children of parents who do not show the disease.

Which of the following best describes the mechanism of inheritance for albinism?

- (A) Recessive
 - (B) Dominant
 - (C) Sex- linked
 - (D) Co-dominant
- 15 In 2002, the first cloned cat (CC) was produced using a somatic cell from a calico cat (Rainbow).



CC



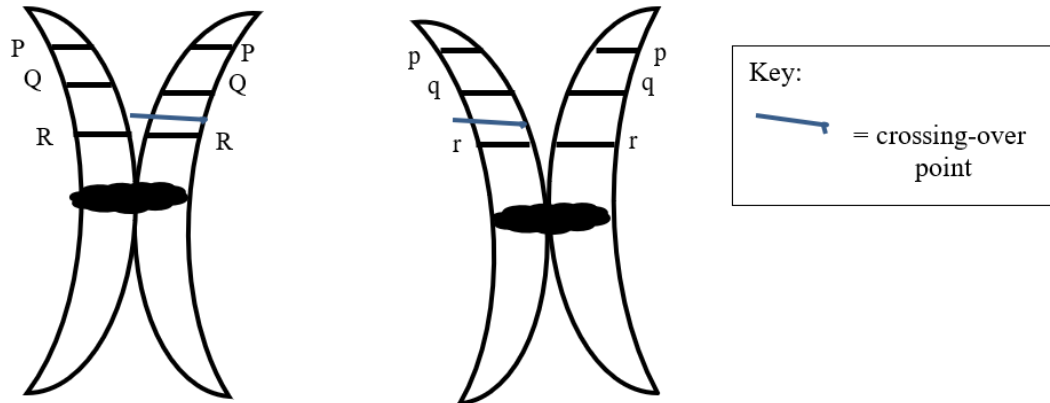
Rainbow

CC is not identical to Rainbow. Rainbow's coloured fur patches are not of the same size and shape as her clone.

What is the most probable explanation for this phenomenon?

- (A) Crossing over during meiosis.
- (B) The influence of environment on phenotype.
- (C) Independent assortment of chromosomes in meiosis.
- (D) Expression of recessive genes from previous generations.

- 16 The diagram represents one pair of homologous chromosomes during meiosis. Crossing over occurs, at the points shown, and random segregation takes place.



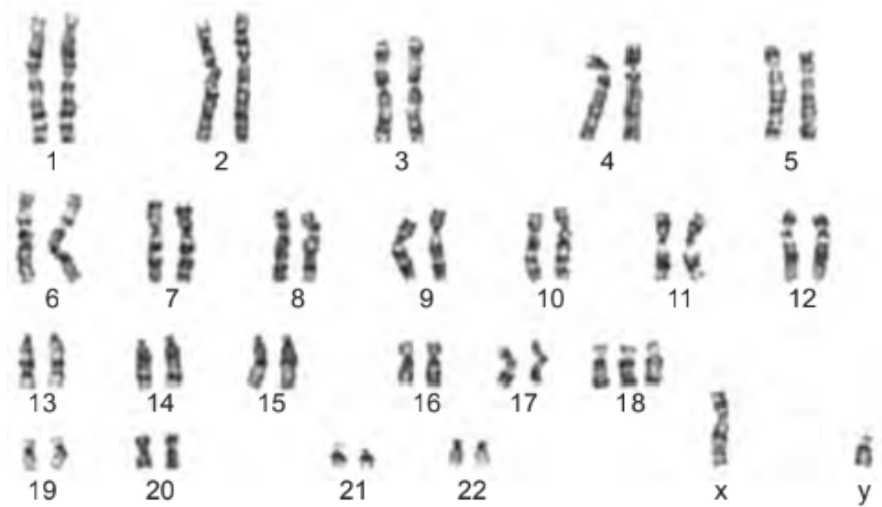
What are the genotypes of the resulting chromosomes?

- (A) PQR, pQR, Pqr, pqr
 - (B) PQR, PQr, pqR, pqr
 - (C) PQR, PQR, pqr, pqr
 - (D) PQR, pQr, PqR, pqr
- 17 In the search for a malaria vaccine, scientists have focused on a protein called circumsporozoite protein (CSP). CSP is secreted by the malaria parasite and is present on its surface.

For the vaccination to work, the scientists want CSP to act as

- (A) An antigen.
- (B) An allergen.
- (C) An antibody.
- (D) A complement protein.

- 18 Consider the following karyotype.



Source: MA Hill

The cell from which these chromosomes were taken

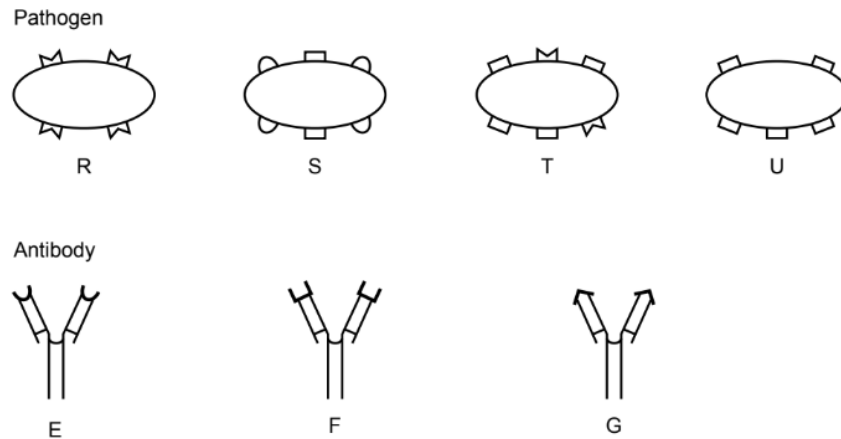
- (A) Has a diploid number of 44.
 - (B) Comes from a human female.
 - (C) Has two copies of each of the genes found on chromosome 18.
 - (D) Has inherited one chromosome number 4 from the mother and inherited one chromosome number 4 from the father.
- 19 Advances in DNA technology have made it possible to carry out genetic screening for particular genetic diseases. Some people may decide not to have children based on the result of their genetic screening.

This decision will

- (A) Alter the frequency of an allele and will, therefore, have an impact on future human evolution.
- (B) Have no impact on future human evolution since the genes or DNA are not altered in the testing.
- (C) Increase genetic variation in the human population and will, therefore, have an impact on future human evolution.

- (D) Result in complete loss of an allele from a population and will, therefore, have an impact on future human evolution.

20 Consider the following diagram of four pathogens and three antibodies.



Which one of the following statements is correct?

- (A) Antibody E would be effective against both pathogen S and pathogen R.
- (B) Antibody F is effective against three of the pathogens.
- (C) There are no antibodies effective against pathogen U.
- (D) Antibody G is only effective against pathogen R.

2022

TRIAL
HSC
EXAMINATION

--	--	--	--	--	--	--	--

Student Number

Biology

Section II

Answer Booklet

80 marks

Attempt Questions 21 - 33

Allow about 2 hours and 25 minutes for this section

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of the response.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.
- If you require more space than is available in the extra writing space provided, please ask a supervising teacher for extra paper. Clearly indicate which question you are answering on the extra paper.

Question 21 (8 marks)

Hydrangeas are plants whose flowers change colour according to the pH of the soil.

Four cuttings were made from a single hydrangea plant and cultivated into established plants. These plants were then planted in four separate locations around a backyard.

(Propagating plants from cuttings is an ancient form of cloning).



<https://commons.wikimedia.org>

- (a) Using your knowledge of genotypic and phenotypic expression, explain why these clones had different coloured flowers. 2K

- (b) One of the plants became infected with a disease and died.

Hypothesise how this disease might affect the other plants.

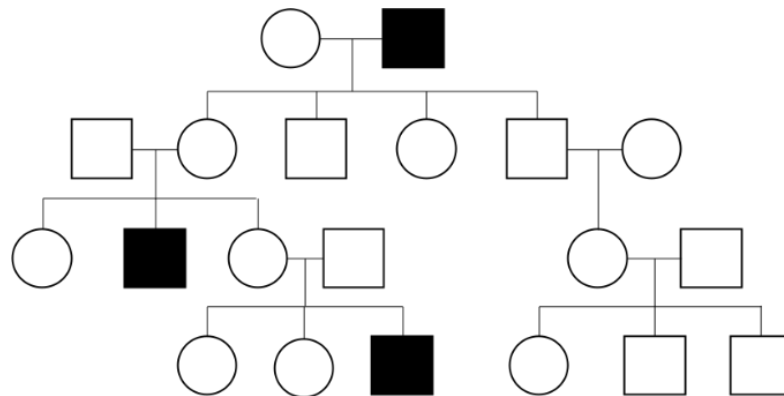
2K

- (c) Hydrangeas are produced commercially using cuttings, which is a common asexual (vegetative) propagation method.

Discuss the advantages and disadvantages of this method of agricultural production.

Question 22 (9 marks)

Colour blindness is a disorder caused by mutant genes in the red and green cones in cone cells. People with these genes cannot differentiate between the colours red and green.



- (a) Use the diagram above to infer the inheritance pattern of colour blindness. Provide evidence from the pedigree tree to support your answer. 3A

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

- (b) On the diagram above, indicate all potential carriers of colour blindness by shading half the shape. 2A

(c) A carrier for colour-blindness married a colour-blind male.

4A

Use a punnet square to determine the likelihood of them having a colour-blind daughter.
Include genotypes and phenotypes of the offspring as percentages.

Question 23 (11 marks)

The red kangaroo is an endotherm that will lie in the shade as a behavioural adaption to assist in cooling down body temperature during the heat of the day.



<https://commons.wikimedia.org>

- (a) Explain how **ONE** structural and **ONE** physiological adaption that the kangaroo above may be exhibiting, helps it to cool itself.
3K

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

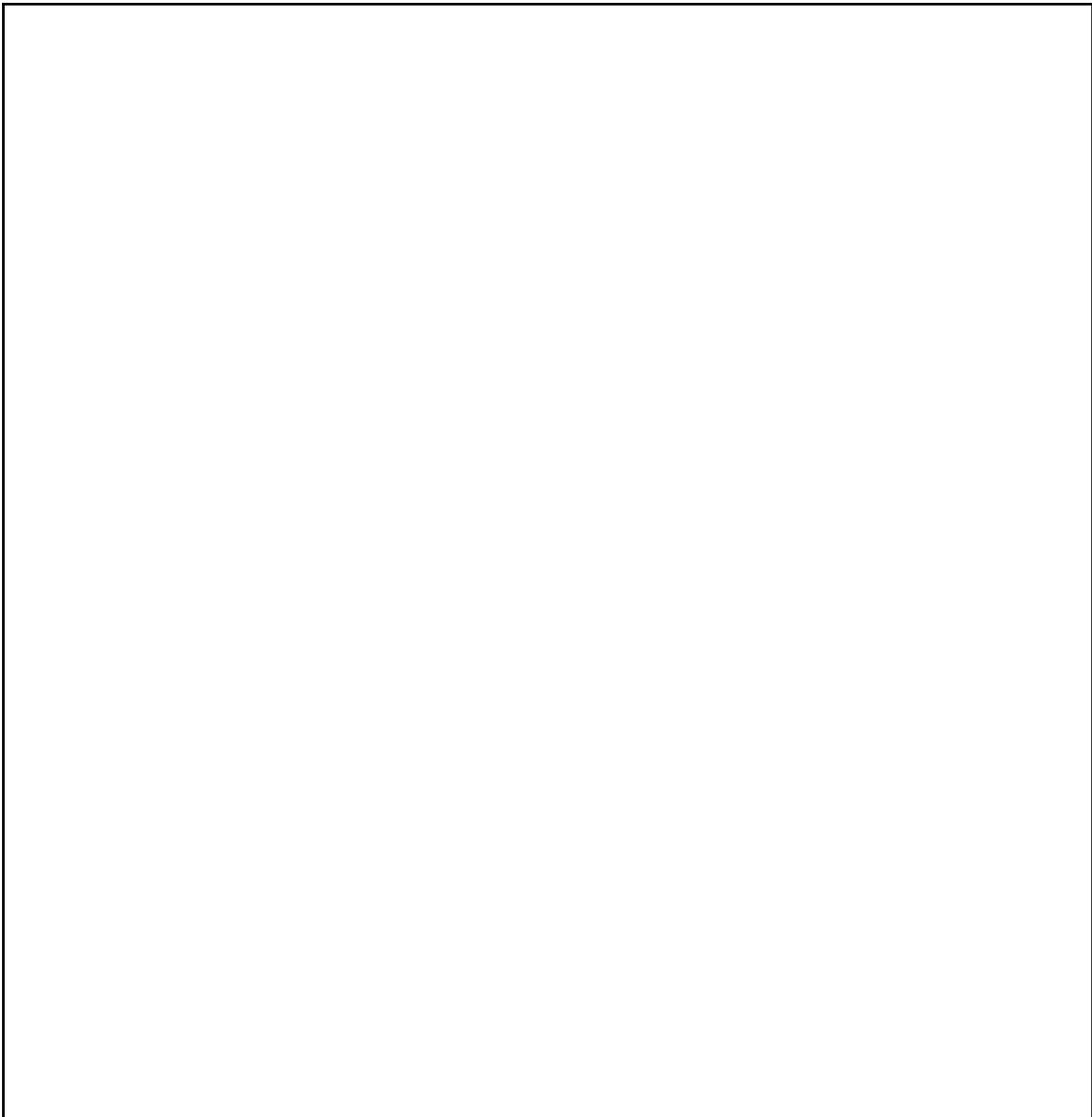
.....

.....

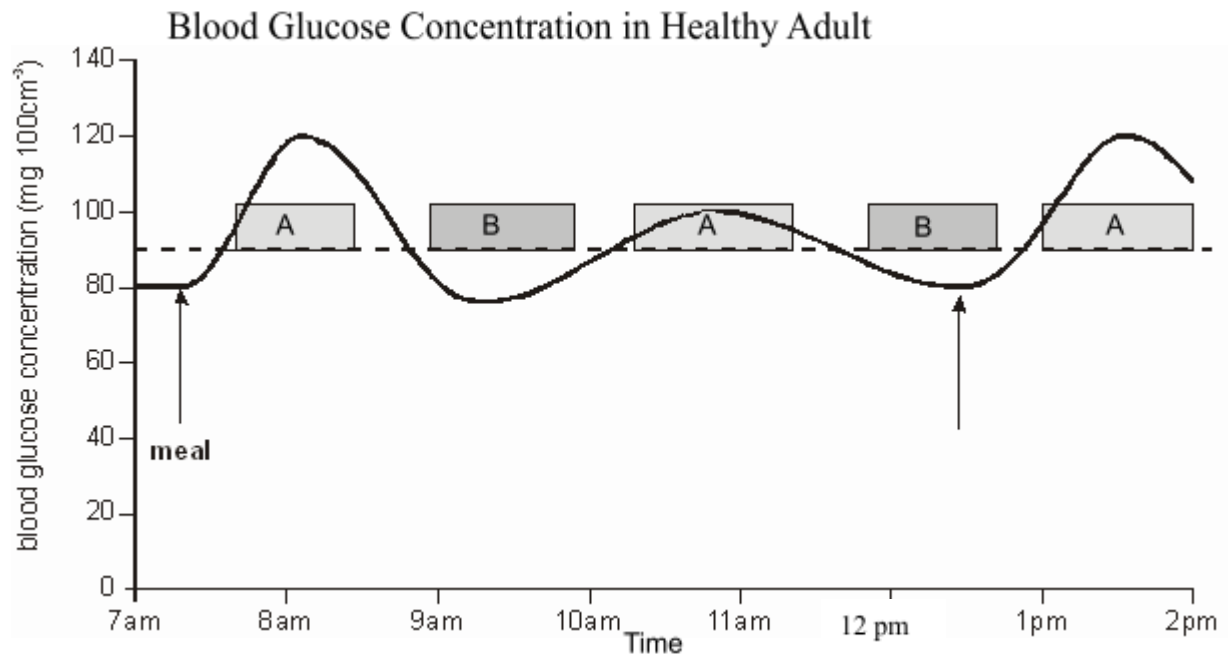
-
- (b) The internal and external environments of organisms are constantly changing. Our bodies, along with all other organisms on Earth, have evolved systems to maintain homeostasis. This enables us to function at an optimal level.

Construct a diagram of a negative feedback loop to show how the human body regulates temperature when there is a change to its internal environment.

4K



(c) The figure below illustrates the changes in blood glucose concentration of a person from the morning to the afternoon.



- i. The grey boxes on the graph represent the times during which hormones are released into the blood from the pancreas. What are the hormones represented by the boxes labelled A and B? 1K

- ii. Suggest what event occurred at approximately 12.30pm, as indicated by the arrow? 1A

- iii. Explain the significance of the dotted line on the graph at a blood glucose concentration of 90/100 cm³. 2K

Question 24 (4 marks)

Indigenous bush foods have become a more significant part of Australian cuisine, not only for their unique flavours, but also for their nutritional and medicinal properties.

Identify a bush food you have studied and describe its Aboriginal and contemporary applications. 4K

[illegible]

Question 25 (4 marks)

This graph shows the obesity rates in a range of countries across the globe.



(a) Describe the trend seen in the graph.

3A

.....

.....

.....

.....

.....

.....

(b) Identify the approximate prevalence of obesity in Australia.

1A

.....

.....

Question 26 (8 marks)

The World Health Organisation declared COVID19 a pandemic in March 2020. In that same month, Australia implemented its hotel quarantine program requiring all returning travellers to undertake 14 days of quarantine. However, the United Kingdom (UK) implemented a similar quarantine program much later, in February 2021.

Up to March 2021, Australia had 29 000 cases of COVID 19, while the UK had over 4.21 million.

Select TWO disease preventive procedures from the following list and evaluate how these procedures can work together to minimise and control COVID 19 pandemic.

- quarantine
- hygiene practices
- public health campaigns
- vaccination

[illegible]

Question 27 (6 marks)

(a) What is the difference between *meiosis* and *mitosis*?

2K

(b) How does cell replication contribute to the survival of a species?

4K

Question 28 (4 marks)

A mysterious disease outbreak occurs in a colony of koalas around the Lucas Heights nuclear reactor. Ten sick animals are found to be suffering from the same symptoms: weight loss, skin lesions and foul breath. Radioactive contamination of the local environment is suspected, however blood tests of the sick animals reveal that they have a type of bacterium in their blood.

Describe the steps that you would have to undertake to prove that this particular bacterium is the cause of the disease.

4K

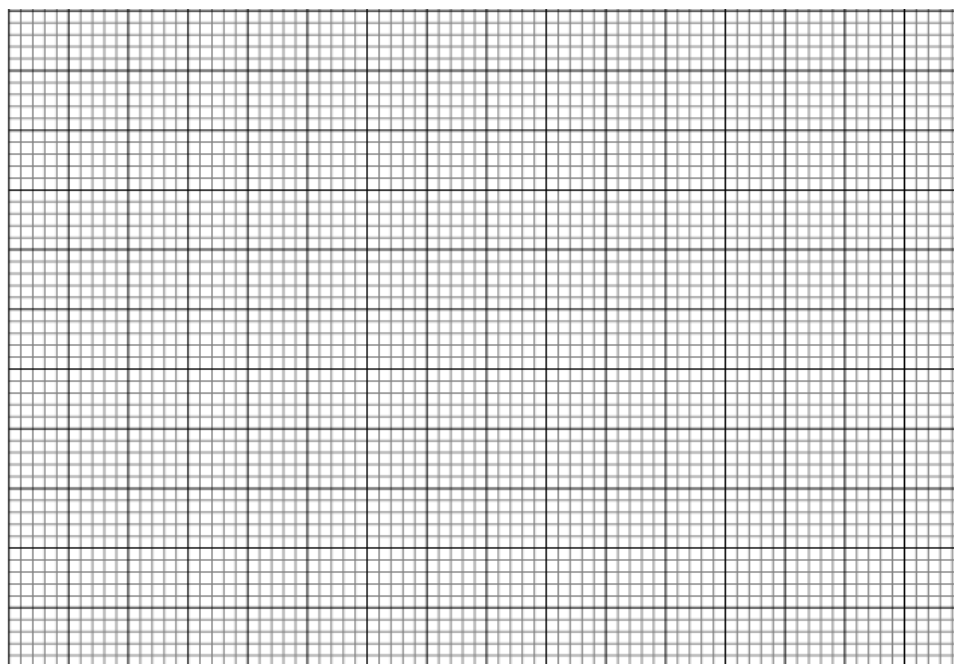
[illegible]

Question 29 (7 marks)

Malaria is a disease caused by the protozoan *Plasmodium*. The following data were recorded about the declining effectiveness of two drugs which are taken to treat or prevent malaria by interfering with the lifecycle of the pathogen.

Year	Effectiveness of Drug (%)	
	Mefloquinone	Quinine
1976	100	90
1978	100	85
1980	100	80
1984	100	72
1988	90	64
1990	70	58

- (a) Graph the data on the grid below to compare the effectiveness of the two drugs over time. 4A



(b) Use the data to explain the impact of human processes on genetic diversity.

3A

.....

.....

.....

.....

.....

.....

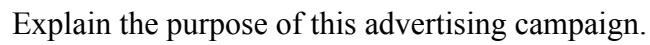
.....

.....

.....

.....

The advertisement shown in the picture was on a bus stop outside a school. It was generated by a not-for-profit company funded by the Australian government.

[illegible]

Question 31 (5 marks)

A child's mother has a blood type of A– and her father's blood type is AB+.

- (a) Identify which phenotypes are NOT possible for the child.

2A

.....

.....

.....

.....

.....

- (b) Describe TWO differences in inheritance patterns of the ABO blood group system and the Rhesus blood group system.

3K

.....

.....

.....

.....

.....

.....

.....

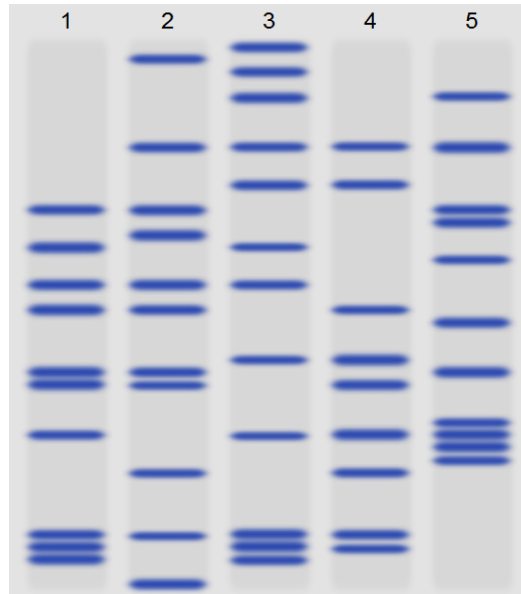
.....

.....

.....

Question 32 (5 marks)

The diagram shows the DNA fingerprints of two parents (2 and 3), their two biological children and their adopted child.



(a) Which of individuals 1, 4 or 5 is the adopted child? Justify with reference to the picture. 2A

.....

.....

.....

.....

(b)

.....

Explain why DNA fingerprinting uses sections of repeating sets of bases, rather than functional genes, for identification.

3K

.....

.....

.....

.....

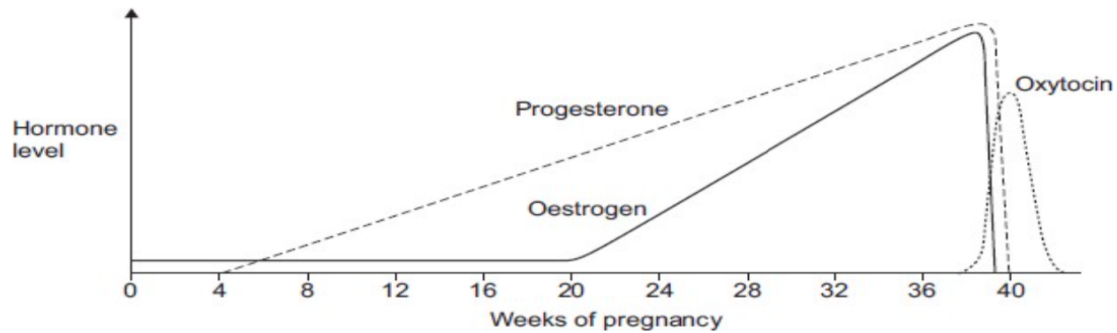
.....

.....

.....

Question 33 (5 marks)

The following graph shows changes in female hormones in blood during the forty weeks of pregnancy.



- (a) Explain why progesterone levels in blood increase dramatically from week 4 of the pregnancy. 2K

.....

.....

.....

.....

- (b) For ONE other hormone from the graph, describe its function with specific reference to the graph. 3A

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

END OF PAPER

Section II extra writing space

If you use this space, clearly indicate which question you are answering.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.



--	--	--	--	--	--	--	--

Student Number

Sydney Girls High School

2022

TRIAL HSC EXAMINATION

Biology

[Answers](#)

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black pen
- Draw diagrams using pencil
- NESA approved calculators may be used

Total Marks: 100

Section I – 20 marks (pages 2 – 10)

- Attempt Questions 1 - 20
- Allow about 35 minutes for this section

Section II – 80 marks (pages 11 - 30)

- Attempt Questions 21 - 33
- Allow about 2 hours and 25 minutes for this section

Section I

20 marks

Attempt Questions 1 - 20

Allow about 35 minutes for this part.

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

- 1** Which feature of DNA promotes easy replication?
- (A) Complementary base pairing
 - (B) Use of deoxyribose, not ribose
 - (C) The sugar-phosphate backbone
 - (D) The presence of nitrogen in the bases
- 2** Which of the following processes increases the genetic variation between offspring of the same parents?
- (A) Mitosis
 - (B) Cloning
 - (C) Mutation
 - (D) Crossing over
- 3** What is a behavioural adaptation in kangaroos that helps them cope with heat?
- (A) They rest during the middle of the day.
 - (B) They spend a lot of time wading in lakes.
 - (C) They shelter in caverns to avoid direct sunlight.
 - (D) Their feet and tail enable them to travel long distances very efficiently.
- 4** There are four different nitrogenous bases in DNA. A sequence of fifty base pairs of nucleotides contains 17 adenine bases. How many cytosine bases are there in the sequence?
- (A) 17
 - (B) 22
 - (C) 33
 - (D) 50

- 5 The text shows the causes of three diseases.

Mercury poisoning is caused by a build-up of ingested mercury in the body.

Beriberi is caused by insufficient amounts of thiamine in the body.

Glucose-6-phosphate dehydrogenase deficiency is caused by an inability to make a particular functional enzyme.

What is the correct classification of these diseases?

	<i>Genetic</i>	<i>Nutritional</i>	<i>Environmental</i>
(A)	Mercury poisoning	Beriberi	Glucose-6-phosphate dehydrogenase deficiency
(B)	Beriberi	Mercury poisoning	Mercury poisoning
(C)	Glucose-6-phosphate dehydrogenase deficiency	Beriberi	Mercury poisoning
(D)	Mercury poisoning	Glucose-6-phosphate dehydrogenase deficiency	Beriberi

- 6 If a red flowered snap dragon plant is crossed with a white flowered one, the progeny will all be pink flowered. When pink is crossed with pink, the progeny are in the ratio 1 red : 2 pink : 1 white.

Which of the following is the most correct prediction of the ratios of offspring when a pink snapdragon is crossed with a white snapdragon?

- (A) 1 pink : 1 white
 (B) 1 pink : 3 white
 (C) 1 pink : 2 white : 1 red
 (D) 1 red : 2 pink : 1 white

- 7 After being exposed to a virus responsible for influenza (the “flu”), the antibody levels of two individuals were measured over the course of several days. This was done via blood sampling through a vein on the left arm. The counts of both individuals are presented below:

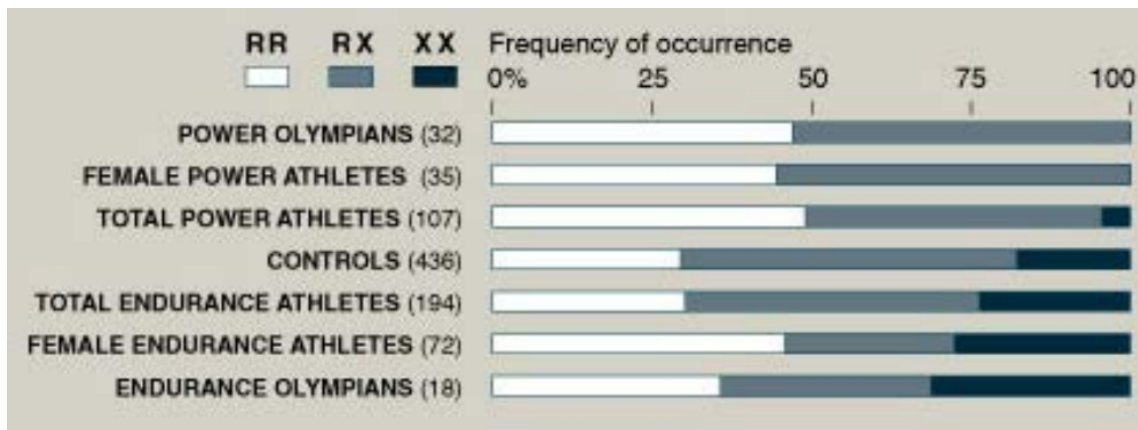
Day	Individual A	Individual B
1	2	5
2	5	100
3	50	3500
4	1000	10000<
5	10000<	10000<

Which individual(s) is more likely to have received the influenza vaccine?

- (A) Individual A, as their antibody counts increased more rapidly.
 - (B) Individual B, as their antibody counts increased more rapidly.
 - (C) Neither individual as their antibody levels both peak at 10000<.
 - (D) Both individuals as their antibody level both peak at 10000.
- 8 If the template strand of a DNA molecule has the sequence 3' CTTGGATCGA 5', which of the following mRNA strands would be produced?

- (A) 5' CUUGGAUCGA 3'
- (B) 5' GUUCCATCGA 3'
- (C) 5' GAACCTAGCT 3'
- (D) 5' GAACCUAGCU 3'

- 9 A single nucleotide polymorphism (SNP) is a DNA sequence variation occurring within a group of the same species in which a single nucleotide differs between individual members. SNP's can be in coding or non-coding regions of DNA. There are many studies that look at how SNP's correlate with a person's phenotype. ACTN3 is a gene coding for muscle specific protein alpha-actinin-3. Three genotypes exist for this gene: RR, RX and XX. Lack of this protein (XX) is not associated with disease.

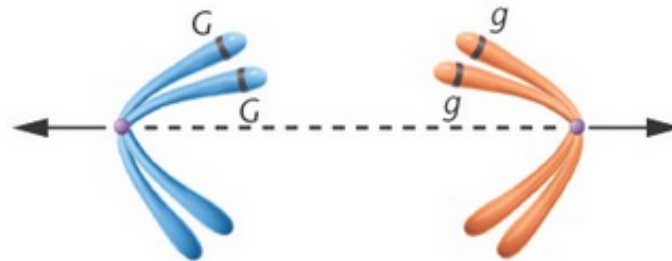


What is the role of alpha-actinin-3 protein?

- (A) Gives an advantage in becoming an endurance athlete.
 (B) Does not give an advantage in becoming an endurance athlete.
 (C) Gives an advantage in becoming a power athlete.
 (D) Does not give an advantage in becoming a power athlete.
- 10 Choose the description below which correctly identifies the characteristics of the genetic material found in some types of infective agents.

	Contains no DNA or RNA – protein only	DNA or RNA in a protein coat	DNA in the cell cytoplasm	DNA in membrane bound nucleus
(A)	Virus	prion	bacterium	protozoan
(B)	Prion	virus	protozoan	bacterium
(C)	virus	prion	protozoan	Bacterium
(D)	Prion	virus	bacterium	protozoan

- 11 The picture below shows a pair of homologous chromosomes in a cell at the beginning of anaphase I of meiosis.



The reason this process results in increased variability of offspring in sexual reproduction is because

- (A) Gametes produced have half the number of chromosomes.
 - (B) This homologous pair moves independently of other pairs.
 - (C) Sexual reproduction combines chromosomes from two individuals.
 - (D) Mutations in homologous chromosomes occur readily at this stage.
- 12 Which of the following is a correct role of the lymph system in the immune response?
- (A) Initiating a fever response.
 - (B) Triggering cell death around the pathogen.
 - (C) Preventing entry of pathogen into the body.
 - (D) Holding a record of past invasion by pathogens.
- 13 Which of the following is an example of natural passive immunity to the measles virus?
- (A) Being injected with antibodies to the measles virus.
 - (B) A baby receiving measles antibodies in breast milk.
 - (C) Being injected with weakened strain of measles virus.
 - (D) Being naturally exposed to the measles virus.

- 14 Albinism is an inherited disorder characterised by the complete or partial absence of pigment in the skin, hair and eyes due to absence of an enzyme involved in the production of melanin. This disease affects both genders equally and can be found in the children of parents who do not show the disease.

Which of the following best describes the mechanism of inheritance for albinism?

- (A) Recessive
(B) Dominant
(C) Sex- linked
(D) Co-dominant
- 15 In 2002, the first cloned cat (CC) was produced using a somatic cell from a calico cat (Rainbow).



CC



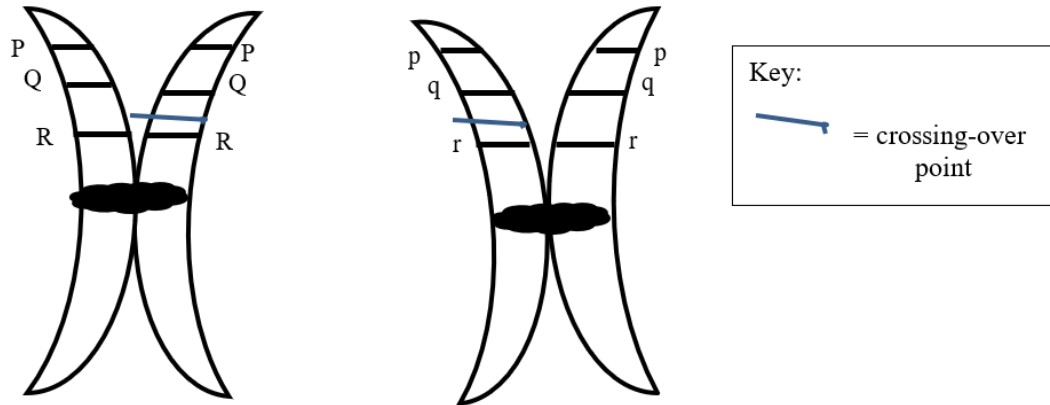
Rainbow

CC is not identical to Rainbow. Rainbow's coloured fur patches are not of the same size and shape as her clone.

What is the most probable explanation for this phenomenon?

- (A) Crossing over during meiosis.
(B) The influence of environment on phenotype.
(C) Independent assortment of chromosomes in meiosis.
(D) Expression of recessive genes from previous generations.

- 16 The diagram represents one pair of homologous chromosomes during meiosis. Crossing over occurs, at the points shown, and random segregation takes place.



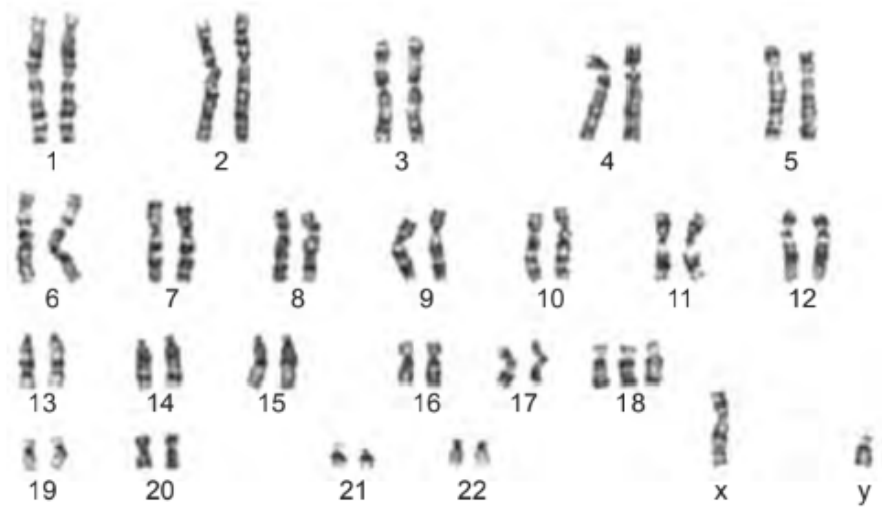
What are the genotypes of the resulting chromosomes?

- (A) PQR, pQR, Pqr, pqr
 - (B) PQR, PQr, pqR, pqr
 - (C) PQR, PQR, pqr, pqr
 - (D) PQR, pQr, PqR, pqr
- 17 In the search for a malaria vaccine, scientists have focused on a protein called circumsporozoite protein (CSP). CSP is secreted by the malaria parasite and is present on its surface.

For the vaccination to work, the scientists want CSP to act as

- (A) An antigen.
- (B) An allergen.
- (C) An antibody.
- (D) A complement protein.

- 18 Consider the following karyotype.



Source: MA Hill

The cell from which these chromosomes were taken

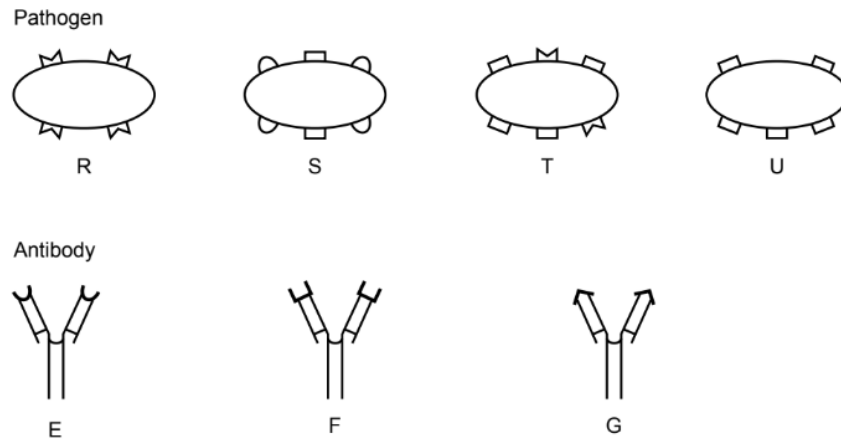
- (A) Has a diploid number of 44.
 - (B) Comes from a human female.
 - (C) Has two copies of each of the genes found on chromosome 18.
 - (D) Has inherited one chromosome number 4 from the mother and inherited one chromosome number 4 from the father.
- 19 Advances in DNA technology have made it possible to carry out genetic screening for particular genetic diseases. Some people may decide not to have children based on the result of their genetic screening.

This decision will

- (A) Alter the frequency of an allele and will, therefore, have an impact on future human evolution.
- (B) Have no impact on future human evolution since the genes or DNA are not altered in the testing.
- (C) Increase genetic variation in the human population and will, therefore, have an impact on future human evolution.

- (D) Result in complete loss of an allele from a population and will, therefore, have an impact on future human evolution.

20 Consider the following diagram of four pathogens and three antibodies.



Which one of the following statements is correct?

- (A) Antibody E would be effective against both pathogen S and pathogen R.
- (B) Antibody F is effective against three of the pathogens.
- (C) There are no antibodies effective against pathogen U.
- (D) Antibody G is only effective against pathogen R.

Section II

Question 21 (8 marks)

(a) 2 marks

Criteria	Marks
- Identifies the effect of the environment on phenotype - State the specific conditions for different phenotypic hydrangeas	2K
Identifies the effect of the environment on phenotype	1K

Majority of students done this question very well, only a few students didn't identify the effect of the environment on phenotype.

Sample answer:

Although each individual hydrangea plant is genetically the same (clones), they are all planted in different environments which can affect phenotype. The soil in each part of the garden must be a different pH for the flowers to be different colours.

(b) 2 marks

Criteria	Marks
Identifies that the plants are genetically identical so all susceptible	2K
Some relevant information	1K

Most of the students answered correctly. A few students didn't identify that the plants are genetically identical so all susceptible.

Sample answer:

If all plants were to be infected with the disease, then they would die as they are genetically identical.

(c) 4 marks

Criteria	Marks
- Discusses advantages - Discusses disadvantages	4K
- Discusses advantages and a disadvantage OR - Discusses disadvantages and an advantage	3K
Discusses an advantage and a disadvantage	2K
Provides some relevant information	1K

Except a few students, all the students done this question very well. All the students discussed the advantages well, but a few students only discussed one disadvantage rather than discussing two disadvantages. If the question asks to discuss advantages or disadvantages, you need to use at least two advantages and two disadvantages.

Sample answer:

Advantages of propagating hydrangeas from cuttings ensures that each cutting will produce a plant with the same features as initial plant, such as flower shape and density. Another advantage is that plants from cutting mature faster than those from seeds, allowing them to be sold in a smaller time frame.

However, as all individuals are clones, they will all be susceptible to the same diseases and pest, meaning the stock of hydrangeas could be wiped out from one incidence of disease. Another disadvantage is that although genetically identical, due to the environment affecting the hydrangea flower phenotype, unless planted and kept in the same pH soil, the flower colour of the hydrangeas will not be identical.

Some other advantages:

- efficient form of reproduction
- amount of time and energy to produce offspring is minimal
- population sizes can increase rapidly in optimal environments
- there is no need to find a sexual partner
- offspring are genetically identical to the parent cell, so they are well suited to a stable environment

Some other disadvantages:

- rapid population growth can lead to overcrowding and increased competition for resources
- the lack of genetic variation in a population can cause death of the entire population if conditions change (e.g. a disease pathogen arrives or a severe drought) because they are not adaptable to new environmental conditions

Question 22 (9 marks)

(a) 3 marks

Criteria	Marks
• Identifies inheritance as sex-linked and recessive • Supports answer with evidence from pedigree tree	3A
• Identifies inheritance as either sex-linked or recessive • Supports answer with evidence from pedigree tree OR • Identifies inheritance as sex-linked and recessive	2A
• Identifies inheritance as either sex-linked or recessive	1A

Majority of students identified the inheritance as sex-linked and recessive and provided evidence correctly.

Some students identified the inheritance as sex-linked and recessive but did not provide the evidence correctly.

Some students identified the inheritance as either sex-linked or recessive and provided evidence for one side.

Sample answer:

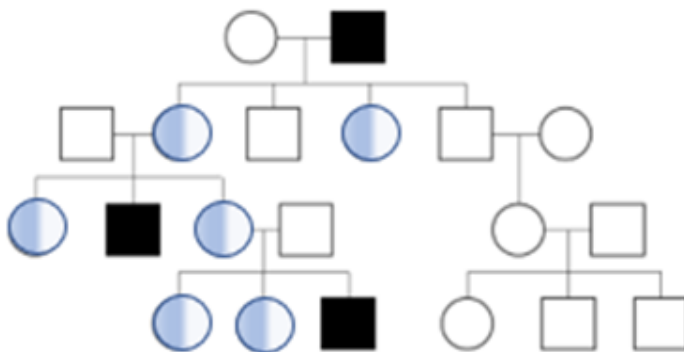
The inheritance pattern in the pedigree tree is sex-linked. This is because only males are affected as seen in the pedigree tree as only squares are coloured. It is also recessive as it is present in every second generation as seen in the pedigree tree.

(b) 2 marks

Criteria	Marks
Indicates all potential carriers (6)	2A
Indicates some potential carriers (4-5, without shading any squares)	1A

Many students didn't indicate all the potential carriers.

Sample answer:



(c) 4 marks

Criteria	Marks
- Includes all the genotypes and phenotypes of the parents and offspring correctly and include the correct percentage of having a colour-blind daughter) - Uses a correct format for punnet square	4A
- Includes most of the genotypes and phenotypes of the parents and offspring correctly and includes the correct percentage of having a colour-blind daughter. - Uses a correct format for punnet square	3A
Includes most of the genotypes and phenotypes correctly and uses a correct format of punnet square	2A
Provides some relevant information	1A

Most of the students didn't identify the genotypes and phenotypes of parents and off-springs correctly, so the percentage of having a colour-blind daughter is incorrect. Most of the students didn't consider that it was a sex-linked disease.

Sample answer:

Carrier female

x	X ^c	Y
X ^c	X ^c X ^c	X ^c Y
X	X X ^c	XY

Colour-blind male

X^c – affected
X – unaffected

One disease carrier daughter

One colour-blind daughter

One colour-blind son

One normal son.

Ratio: 1:1:1:1 25%: 25%: 25%: 25%

There is a 25% chance they will have a colour-blind daughter.

Question 23 (11 marks)

(a) 4 marks

Criteria	Marks
- explains a structural and a physiological adaptation - Adaptations are all appropriate to kangaroo	3K
- Explains a structural or a physiological adaptation - Adaptations are all appropriate to kangaroo	2K
Provides some relevant information	1K

Most of the students didn't do this question well. They didn't identify the correct structural and behavioural adaptations. Most of them mentioned structural adaptations which were not relevant to Kangaroo (Ex. Fur, short hair, tail, etc)

Many students confused behavioural adaptations with physiological adaptations.

Ex. They identified lying down/resting as physiological adaptations.

Sample answer:

Kangaroos' tall ears allow for blood to cool down through capillary networks which is a structural adaptation. A physiological adaptation is that blood vessels under the skin will dilate to allow for blood to move the skin's surface to cool down.

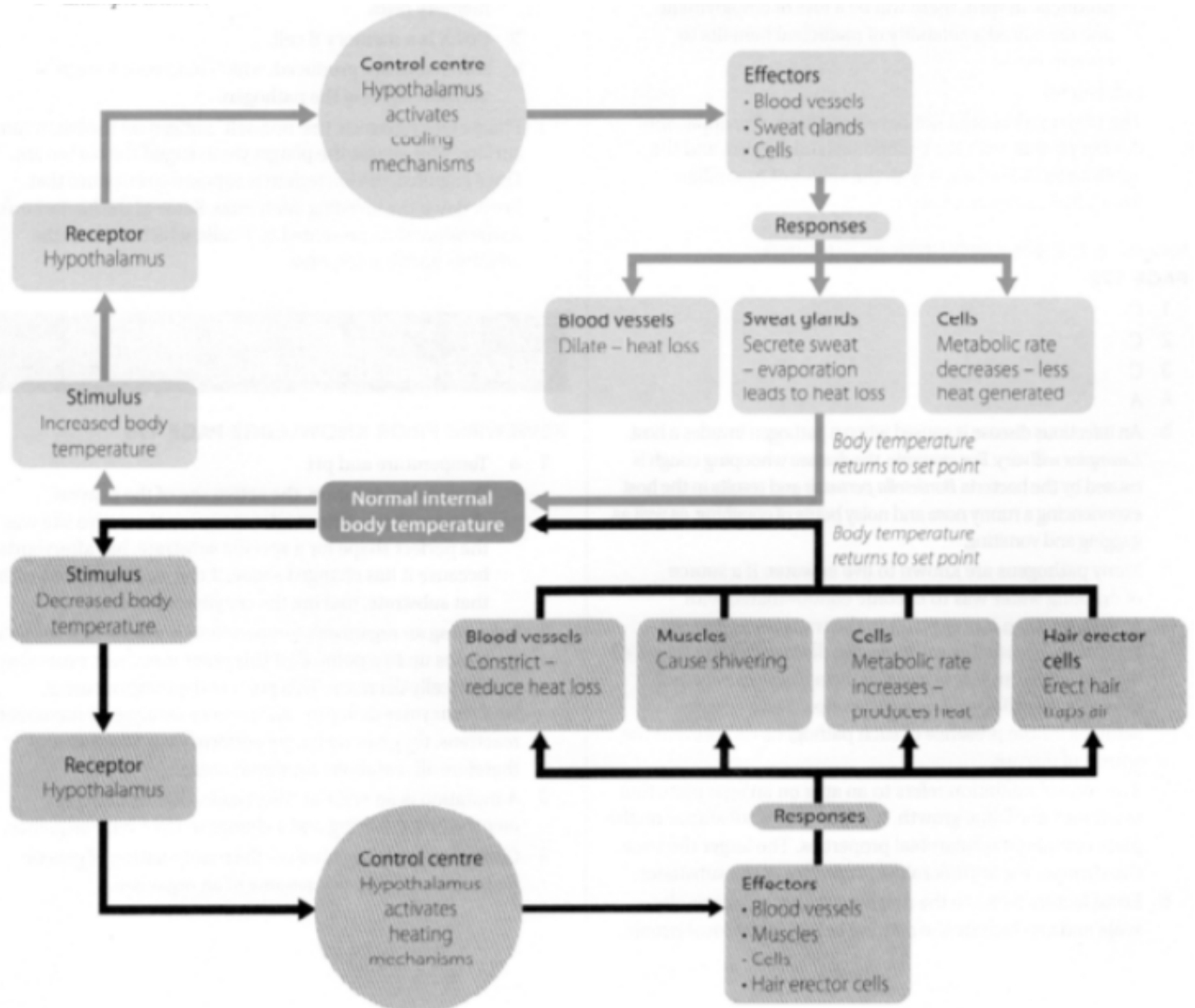
(b) 3 marks

Criteria	Marks
Identifies all the parts of the negative feedback loop correctly.	4K
One missing or incorrect part of the negative feedback loop.	3K
Two missing or incorrect parts of the negative feedback loop.	2K
Provides some relevant information	1K

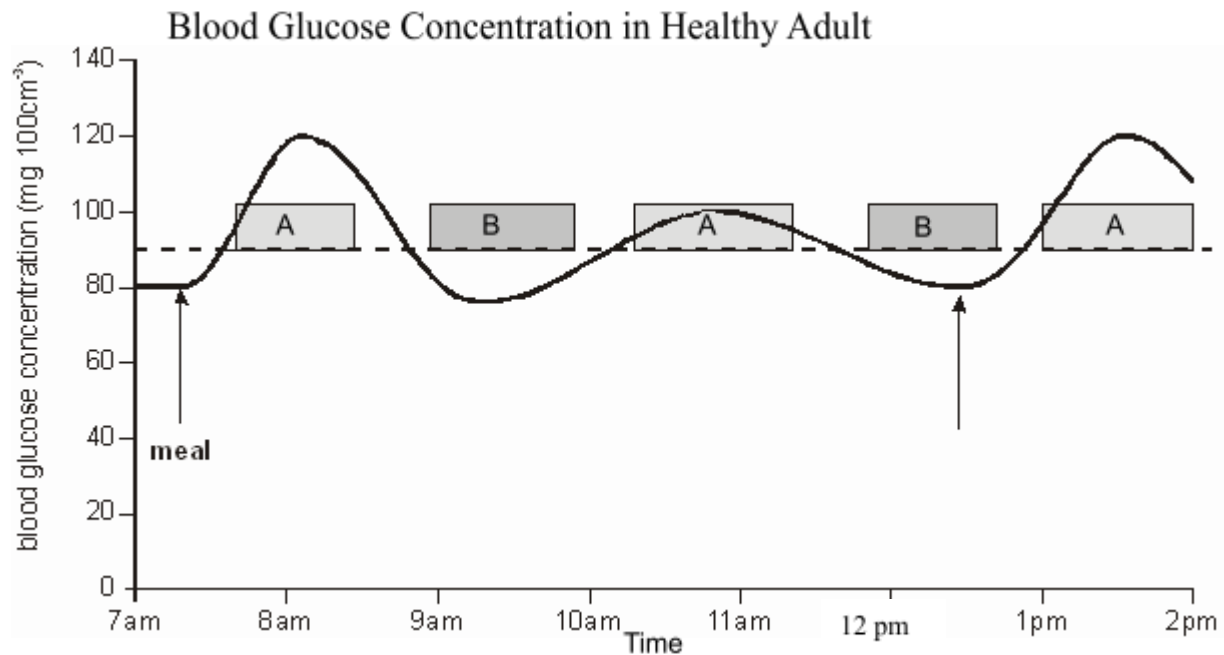
Majority of students construct the negative feedback loop correctly by identifying all the parts (stimulus, receptor, control centre, effector and response). However, some students missed some parts.

Ex. After **control centre**, some students mentioned the **response** without stating the effector organs.

Sample answer:



(23c) The figure below illustrates the changes in blood glucose concentration of a person from the morning to the afternoon.



- i. The grey boxes on the graph represent the times during which hormones are released into the blood from the pancreas. What are the hormones represented by the boxes labelled A and B? 1K

Poorly answered some incorrect responses included:

- incorrect hormones stated eg oxytocin which is a pregnancy hormone
- confused glycogen for hormone glucagon
- did not identify which hormone was A and B

- ii. Suggest what event occurred at approximately 12.30pm, as indicated by the arrow? 1A
Answered well

- iii. Explain the significance of the dotted line on the graph at a blood glucose concentration of 90/100 cm³. 2K

Poorly answered :

- Incorrect terminology used eg average, instead of normal/set point
- Did not EXPLAIN significance just stated homeostasis BUT NOT HOW/WHY part of homeostasis

Question 24 (4 marks)

(a) 4 marks

Criteria	Marks
- Identifies a bush food - Shows thorough understanding of Aboriginal applications - Shows thorough understanding of modern applications	4K
- Identifies a bush food - Shows sound understanding of Aboriginal applications - Shows sound understanding of modern applications	3K
AND - Identifies a bush food OR - Shows sound understanding of Aboriginal applications - Shows sound understanding of modern applications	2K
Provides some relevant information	1K

Majority of students didn't answer the question correctly. Some students even didn't attempt to answer it.

Ex.

One student used Kakadu plum, some students used Tea tree, Eucalyptus, Smock bush or cycads (very good).

Some students used animal food ex. Eel, Kangaroo meat, etc (I gave marks this time)

Some students didn't identify a specific food and they describe the applications of bush food generally (didn't give marks).

Need to do:

If the question asks to identify a bush food/bush medicine and describe the aboriginal and contemporary applications, it is better to use either **Kakadu plum, Tea tree or Eucalyptus** as they have several aboriginal and contemporary applications.

Sample answer:

Kakadu plum is a small purple fruit which contains substantially more Vitamin C than an orange. It has been used by Aboriginal and Torres Strait Islander people boost the body's nutrient levels. It has also been used to combat or prevent diseases such as scurvy. Similarly, the Kakadu plum is incorporated into modern natural medicines as a Vitamin C source. It is also used in skin treatments for its antioxidant properties which help restore the skin membrane and elasticity.

Question 25 (4 marks)

(a) 3 marks

Criteria	Marks
----------	-------

Describes the relationship between x and y-axis extracting data from the graph	3A
Identify the relationship between x and y-axis	2A
Provides some relevant information	1A

Majority of the students identified the relationship between x and y axis however, some students didn't describe the trend by extracting data from the graph.

Sample answer:

As income inequality increases, so does the obesity percentage of the population.

Countries with a low-income inequality such as Japan, Sweden and Norway have a low percentage of obesity, but countries with a high-income inequality such as USA and UK have a high percentage of obesity.

(b) 1 mark

Criteria	Marks
Gives the approximate prevalence of obesity in Australia	1A

Sample answer:

17-19%

Majority of the students got the correct answer.

Question 26 (8 marks)

Criteria	Marks
- Shows comprehensive understanding of procedures that can be employed to slow and prevent the spread of disease - Shows comprehensive analysis of using the named strategies collectively (by considering pros and cons of each method when they work alone) - Relates answer to pandemic scenario - Makes a judgement	8K
- Shows thorough understanding of procedures that can be employed to slow and prevent the spread of disease - Shows thorough analysis of using the named strategies collectively (by considering pros and cons of each method when they work alone) - Relates answer to pandemic scenario - Makes a judgement	6-7K
- Shows sound understanding of procedures that can be employed to slow and prevent the spread of disease - Shows sound analysis of using the named strategies collectively	4-5K
- Shows some understanding of procedures that can be employed to slow and prevent the spread of disease - Shows some analysis of using the named strategies collectively	2-3K
Provides some relevant information	1K

Majority of the students got 5-6 marks, a few students got 8 marks

Need to

- Describe the procedure (Majority of the students did well)

- Analyse the pros and cons of each procedure in regards to effectiveness of controlling and minimising COVID-19 when they work alone and show how these procedures minimise and control the disease when they work together (some students done well)
- Make your judgement based on the above criteria.

Sample answer:

Australia had been able to successfully minimise the impact of the COVID 19 pandemic due to both its nature as an island continent, but also comprehensive hotel quarantine and public health strategies. To work towards suppression/elimination of COVID 19, a multifaceted approach has been essential.

Australia's first line of defence against COVID 19 has been its **quarantine program**. This program (for the majority) has prevented the virus from entering the country by, like all quarantine, requiring a period of isolation prior to entering the Australian community. Further to the hotel program, all lockdowns in the country have also acted as periods of quarantine. Quarantine has prevented Australia from feeling the full effects of the pandemic experiences by majority of the rest of the world.

In addition to quarantine, **public health campaigns and hygiene practices** have helped to limit the spread of COVID 19 when present in the community. These two strategies work together. Hygiene practices, such as washing hands regularly and thoroughly, sneezing/coughing into your elbow and wearing a mask, slow the spread of disease by reducing the risk of person-to-person transmission. Public health campaigns disseminate the knowledge of these hygiene practices and persuade the public to engage in the behaviours.

From the very beginning of the COVID 19 pandemic, the world has been working towards producing an effective **vaccination**. As vaccinations work by triggering an immune response without inducing symptoms, individuals can develop immunity for a disease which prevents them from potentially spreading the disease in the future. When majority of the population is vaccinated, herd immunity can be established and the disease cannot spread as effectively because of lack of susceptible hosts.

During the COVID 19 pandemic Australia has used quarantine, hygiene practices and public health campaigns collectively to successfully manage outbreaks. Even now, with the addition of vaccination to its arsenal, none of these strategies alone would have had the same effect as the collective use. Quarantine, while largely keeping out the disease, does not manage community transmission without stopping society functioning e.g. lockdowns. Though vaccination will be a game changer in the trajectory of the pandemic globally, it still will need to be used in combination with the other strategies as vaccine efficacies are not 100%.

To prevent the spread of disease during a pandemic, a multifaceted approach of employing strategies is required, as Australia has shown in its successful handling of the COVID 19 outbreak.

Question 27 (6 marks)

(a) 2 marks

Criteria	Marks
• Correctly defines <i>meiosis</i> and <i>mitosis</i> • Identifies difference(s) between them	2K
• Correctly defines <i>meiosis</i> or <i>mitosis</i>	1K

Majority of the students define the meiosis and mitosis correctly, but some students missed some parts

Ex: Didn't mention that meiosis produces germ cells; mitosis produces somatic cells and whether those cells were diploid or haploid.

Sample answer

Mitosis is the process by which two identical (diploid) cells, containing 46 chromosomes in humans are produced. Cells produced via mitosis are used for repair and growth. Whereas meiosis is the process by which four unique (haploid) cells containing 23 chromosomes are produced and is required for sexual reproduction.

(b) 4 marks

Criteria	Marks
• explain the effect of both mitosis and meiosis can have on the continuity of species including how mutations happen during these processes contribute on the continuity of species.	4K
• Provides some explanation of mitosis and meiosis can have on the continuity of species including how mutations happen during these processes contribute on the continuity of species.	3K
• Provides generalised comment on cell replication and the continuity of species or explain either mitosis or meiosis can contribute on the continuity of species.	2K
• Provides some relevant information	1K

Majority of students explained how mitosis and meiosis contribute on the continuity of species. Only some students mentioned how mutations happen during these processes contribute on the continuity of species.

Sample answer

The effect of mitosis can have on the continuity of species

Mitosis basically produces genetically identical cells (clones), thus ensuring that favourable characteristics are inherited by offsprings throughout the population. With the offspring inheriting favourable adaptations, they would have a higher chance of survival in its environment than without. This is seen in plants' runners leading to new plants that are **clones** (genetically identical) of their parents. In humans, our muscle cells, hair cells and so many other cells reproduce via mitosis. Mitosis is important for cell development and growth!

Mutations

The daughter cell has mutated (either through mistakes during **mitosis/meiosis** or due to mutagens in the environment such as UV radiation etc). The mutation leads to variation that may be beneficial or detrimental to the organism. If the characteristic is favourable, it will continue to be passed on through reproduction and the species will evolve.

While both processes are completely different, they both ensure that the species continues. It may stay the same and survive efficiently in its environment, or it will mutate, causing new more favourable characteristics to appear.

The effect of meiosis can have on the continuity of species

Crossing over occurs during Prophase I of meiosis where, non-sister chromatids in homologous pairs exchange genetic materials, creating new allele combinations. In addition to crossing over in meiosis, the processes of independent assortment and random segregation during meiosis also help increase variation in the resulting offspring. In general, both lead to increased genetic variation of the resulting gametes. As these processes increase the genetic variation in the resulting offspring and, thus the species population, it reduces the probability that a sudden change in environment will lead to an extinction event. This will therefore 'ensure' the continuity of a species through meiosis.

Question 28 (4 marks)

A mysterious disease outbreak occurs in a colony of koalas around the Lucas Heights nuclear reactor. Ten sick animals are found to be suffering from the same symptoms: weight loss, skin lesions and foul breath. Radioactive contamination of the local environment is suspected, however blood tests of the sick animals reveal that they have a type of bacterium in their blood.

Describe the steps that you would have to undertake to prove that this particular bacterium is the cause of the disease.

4K

Many student received 2/4

Did not clearly state that the isolated sample is cultured to obtain a pure colony of bacteria which is then injected into a healthy koala

AND

Did not state that once the healthy koala has symptoms ANOTHER sample needs to be taken and cultured to determine if the same bacteria is present as in Step 1 (ten sick animals)

Question 29 (7 marks)

Malaria is a disease caused by the protozoan *Plasmodium*. The following data were recorded about the declining effectiveness of two drugs which are taken to treat or prevent malaria by interfering with the lifecycle of the pathogen.

Year	Effectiveness of Drug (%)	
	Mefloquinone	Quinine
1976	100	90
1978	100	85
1980	100	80
1984	100	72
1988	90	64
1990	70	58

Majority of students scored 3/4

Need to improve:

- **Interval scale on x axis not consistent, followed the table of data AND NOT a set scale**
- **Y axis- need to use more than 50% of y axis when plotting data**
- **Use pencil when plotting and drawing LOBF**
- **Some plotted column graph but year is continuous data**
- **Use different symbols NOT different coloured lines**
- **LOBF- smooth line for quinine don't join dots with ruler**
- **LOBF for Mefloquinone is a straight line so use a ruler**

- (a) Graph the data on the grid below to compare the effectiveness of the two drugs over time.

(b) Use the data to explain the impact of human processes on genetic diversity.

3A

Not answered well, many received 1/3 marks

- **Did not explain impact on genetic diversity well (selection pressures were drugs, acting on genetic variation within plasmodium population, natural selection leads to increase in pop of resistant plasmodium)**
- **Did not refer to data**
- **Some students answered the question in the context of adaptive immunity**

Question 30 (4 marks)

The advertisement shown in the picture was on a bus stop outside a school. It was generated by a not-for-profit company funded by the Australian government.



Explain the purpose of this advertising campaign.

4K

Not answered well many students scored 1/4

Misunderstanding of how antibiotics work- some students state it introduces antibodies/helps immune system fight the infection, that the human body or cells builds up resistance to antibiotics and NOT the bacteria

Did not address that antibiotics not effective for colds and flus as they don't kill viruses ONLY bacteria (thereby term waste used)

Many students answered the question in relation to effectiveness of public health campaign ONLY and not addressing the message of the campaign (which is antibiotics only kill bacteria not viruses)

TERMINOLOGY- small diseases, antibiotics/antibodies, human body implements measures of resistance, power of antibiotics

Question 31 (5 marks)

A child's mother has a blood type of A– and her father's blood type is AB+.

- (a) Identify which phenotypes are NOT possible for the child.

2A

Poorly answered

Mum IAI- or IAIi

Dad IAIB-OR IAIB

Child can be blood type A or AB not O+/- as needs to inherit ii from each parent

- (b) Describe TWO differences in inheritance patterns of the ABO blood group system and the Rhesus blood group system.

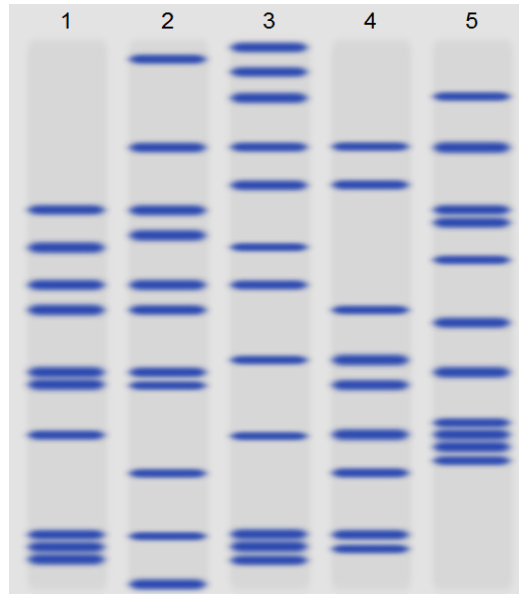
3K

Poorly answered

- **Many students answered the question in the context of blood transfusions**
- **Needed to include genotypes with the blood type**

Question 32 (5 marks)

The diagram shows the DNA fingerprints of two parents (2 and 3), their two biological children and their adopted child.



- (a) Which of individuals 1, 4 or 5 is the adopted child? Justify with reference to the picture. 2A

Majority answered this question well

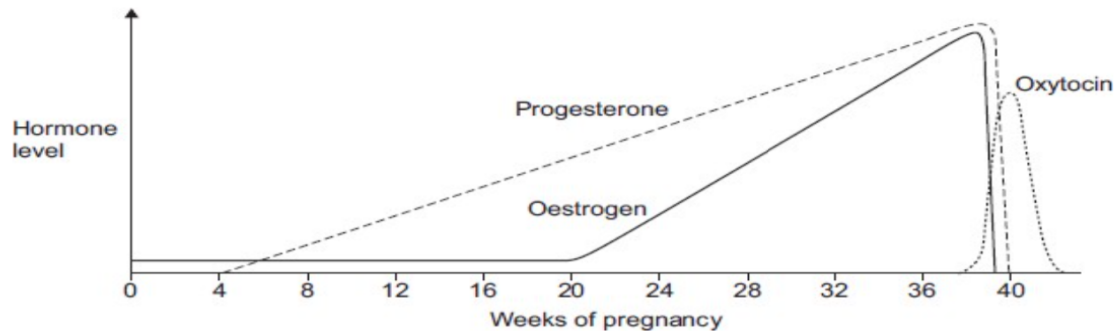
- (b) Explain why DNA fingerprinting uses sections of repeating sets of bases, rather than functional genes, for identification. 3K

Not answered well

Did not identify that DNA fingerprinting is highly variable between unrelated individuals WHEREAS functional genes which code for proteins will be identical within individuals as they code for essential proteins

Question 33 (5 marks)

The following graph shows changes in female hormones in blood during the forty weeks of pregnancy.



- (a) Explain why progesterone levels in blood increase dramatically from week 4 of the pregnancy. 2K

Not answered well as did not address CAUSE of increase (placental production) only EFFECT of progesterone

- (b) For ONE other hormone from the graph, describe its function with specific reference to the graph. 3A

- Did not refer to data in the graph when describing hormone (when it increased and decreased).**
- Students did not know correct function of stated hormone (confused oestrogen role with oxytocin)**