



# 2020 TRIAL EXAMINATION BIOLOGY Form VI

## STRUCTURE OF PAPER

### SECTION I - 20 marks (pages 3-13)

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

### SECTION II – 80 marks (pages 15-35)

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

## EXAMINATION

DATE: Monday 10<sup>th</sup> August 8.39 AM  
DURATION: 3 hours + 5 minutes reading  
MARKS: 100

## CHECKLIST

Each boy should have the following:

- ☐ 1 Examination Paper
- ☐ 1 Multiple-Choice Answer Sheet

## GENERAL EXAM INSTRUCTIONS

- 5 minutes reading time and 3 hours working time.
- Write using black pen and draw diagrams using pencil.
- For questions in Section II, show all relevant working for questions involving calculations.
- NESA approved calculators may be used.
- Remove the centre staple and hand in all parts of the paper in a neat bundle.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which question you are answering.
- WRITE YOUR **CANDIDATE NUMBER** IN THE SPACE PROVIDED AT THE TOP OF EACH SEPARATE SECTION IN SECTION II.

| CLASS NUMBER    | 1      | 2      | 3      | 4      |
|-----------------|--------|--------|--------|--------|
| Class           | 6BL201 | 6BL202 | 6BL203 | 6BL204 |
| Master Initials | ZI     | DBD    | GPW    | ACR    |

Authors: ACR, DBD, GPW, ZI    Master in charge: ACR

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## SECTION I: MULTIPLE CHOICE (20 marks)

Attempt ALL Questions  
Use the Multiple-Choice Answer Sheet.

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- 1** Temperature regulation involves effectors.

Which of the following is an example of an effector?

- (A) Sweat
- (B) Motor neurones
- (C) Sensory neurones
- (D) Smooth muscle in blood vessel walls

- 2** Which one of the following lists is composed of both cellular and non-cellular pathogens?

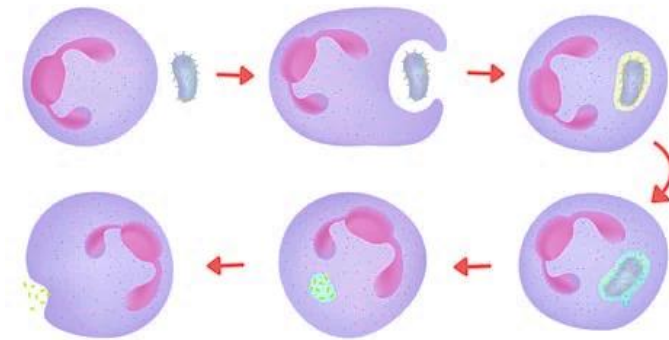
- (A) Fungi, Tick, Amoeba.
- (B) Tapeworm, Protozoa, Bacteria.
- (C) Yeast, Influenza Virus, Bacteria.
- (D) Influenza Virus, Prion, Human Papilloma Virus.

- 3** The human body has a certain amount of innate immunity to infection by pathogens. Which of the following is NOT classified as innate immunity?

- (A) The acidity of the stomach.
- (B) Cilia in the respiratory tract.
- (C) Lymphocytes in respiratory tract.
- (D) Macrophages in the bloodstream.

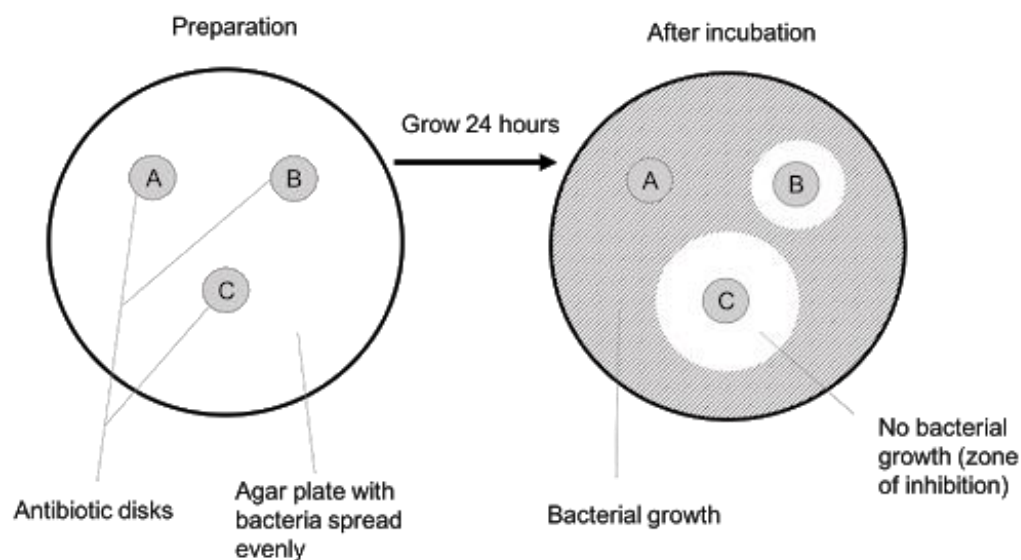
- 4** Throughout human history, epidemics have resulted in the deaths of many people. For example, the 'Black Death' in the 14<sup>th</sup> Century caused the death of one quarter of the population of Europe. Which of the following statements is always true of epidemics?
- (A) They are caused by virulent viruses.
  - (B) They will occur in populations that have been immunised.
  - (C) They involve an infectious disease that can be transmitted easily.
  - (D) They always occur in winter when a population has lowered resistance to infection.
- 5** Antigens are substances which:
- (A) act as a barrier to pathogens.
  - (B) stimulate the immune system.
  - (C) develop into T and B lymphocytes.
  - (D) are produced in response to infection by pathogens.

- 6 The diagram below illustrates one process that occurs as part of an immune response.



What process does this diagram illustrate?

- (A) Mitosis
  - (B) Exocytosis
  - (C) Inflammation
  - (D) Phagocytosis
- 7 A student set up the following agar plate to investigate how different antibiotics affect one species of bacteria.



Which of the following is the dependent variable?

- (A) Type of antibiotic.
- (B) Concentration of antibiotic.
- (C) Diameter of the zone of inhibition.
- (D) Period of time the plate was incubated.

- 8 The following pictures show different types of reproduction in organisms. They are not to scale.



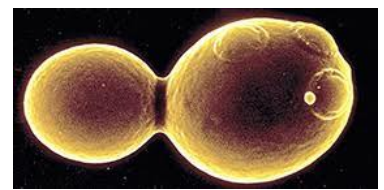
Hydra



Puffball mushroom



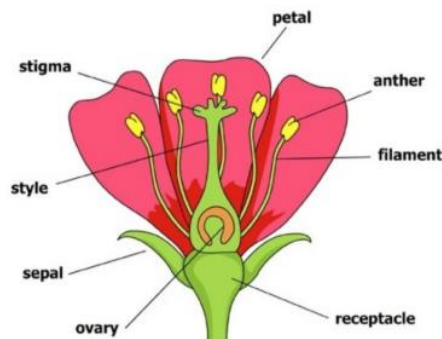
Strawberry plant with runners



Yeast

Which of the following statements is true about the reproductive process of these organisms?

- (A) They are all showing the release of eggs for fertilisation.
  - (B) All pictures show different forms of sexual reproduction.
  - (C) All pictures show different forms of asexual reproduction.
  - (D) Only the Hydra, puffball mushroom and the yeast show asexual reproduction.
- 9 The following diagram shows the reproductive organs of a flowering plant.

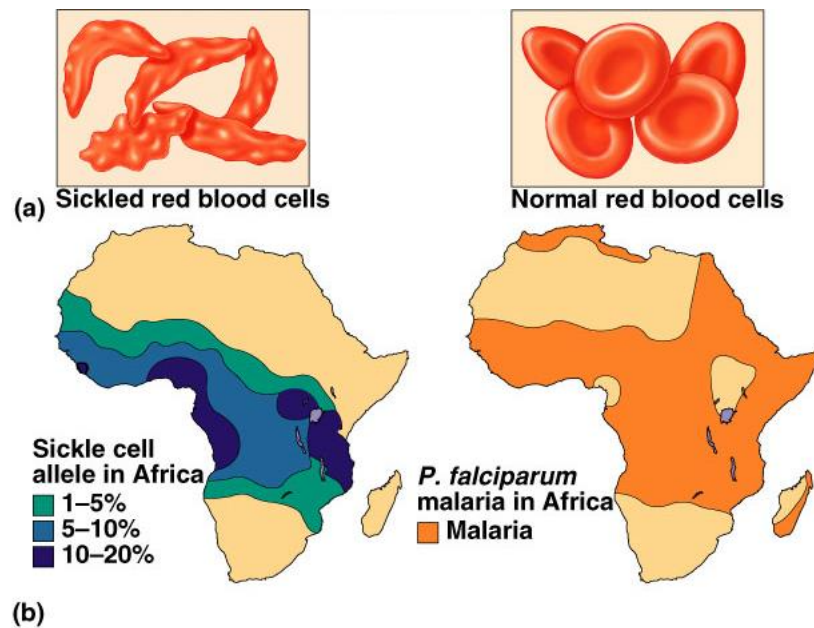


Which of the structures labelled above is the equivalent to the testes in animals?

- (A) Style
- (B) Anther
- (C) Stigma
- (D) Filament

- 10** Which of the following hormones is responsible for causing the corpus luteum to secrete oestrogen and progesterone during early pregnancy?
- (A) LH (Luteinising hormone)
  - (B) FSH (Follicle stimulating hormone)
  - (C) HCG (Human chorionic gonadotropin)
  - (D) GnRH (Gonadotropin-releasing hormone)
- 11** When pure breeding black Andalusian chickens are crossed with pure breeding white Andalusian chickens the first generation offspring are all grey in colour (known as 'blue' Andalusians). What is the expected phenotypic ratio when two of these 'blue' Andalusians are mated and produce offspring?
- (A) 50% black, 50% grey
  - (B) 50% black, 50% white
  - (C) 25% black, 50% grey, 25% white
  - (D) 25% white, 50% black, 25% grey

12 Analyse the following information.



Which statement would be the best conclusion about the relationship between sickle cell anaemia and malaria from the data?

- (A) Malaria causes sickle cell anaemia in regions of Africa.
- (B) The sickle cell allele is prevalent in areas where malaria is found.
- (C) People in Africa who have sickle cell anaemia don't contract malaria.
- (D) Malaria alleles and sickle cell anaemia alleles are found throughout Africa.

13 Which of the following cannot be mutagenic?

- (A) Viruses
- (B) UV light
- (C) Sodium metal
- (D) Toxins in mouldy food

- 14 The diagram below shows two examples of mutation events in messenger RNA.

Mutation A



Mutation B



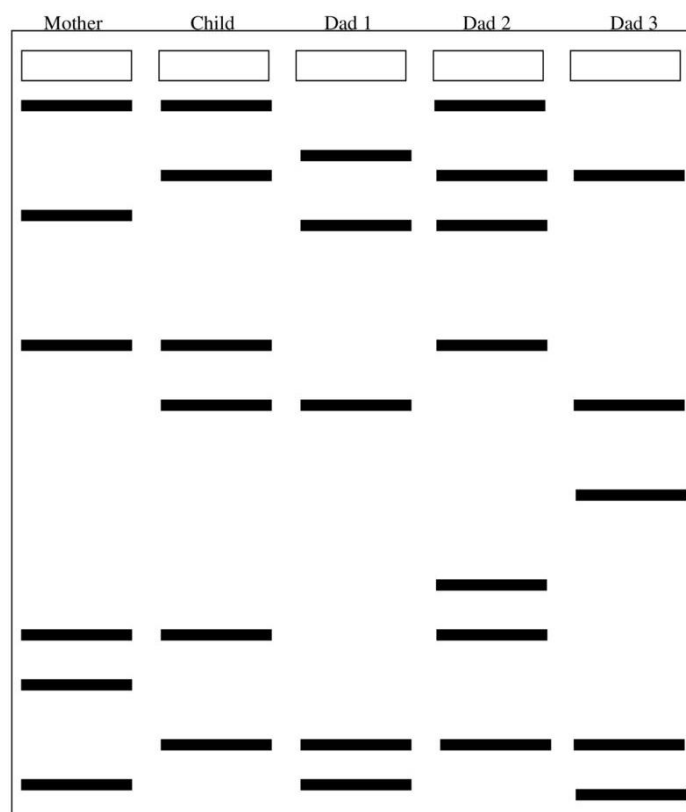
Using the information above, which of the following correctly identifies the mutations A and B?

|     | Mutation A  | Mutation B |
|-----|-------------|------------|
| (A) | Insertion   | Deletion   |
| (B) | Deletion    | Frameshift |
| (C) | Inversion   | Insertion  |
| (D) | Duplication | Inversion  |

- 15 In some people haemoglobin always contains the amino acid valine in place of glutamic acid at one position of the protein. What is the most likely cause of this?

- (A) Lack of glutamic acid in the diet.
- (B) An error in translation of the mRNA.
- (C) A base substitution in the haemoglobin gene.
- (D) An error in the transcription of the haemoglobin protein.

- Analyse the banding pattern shown below.



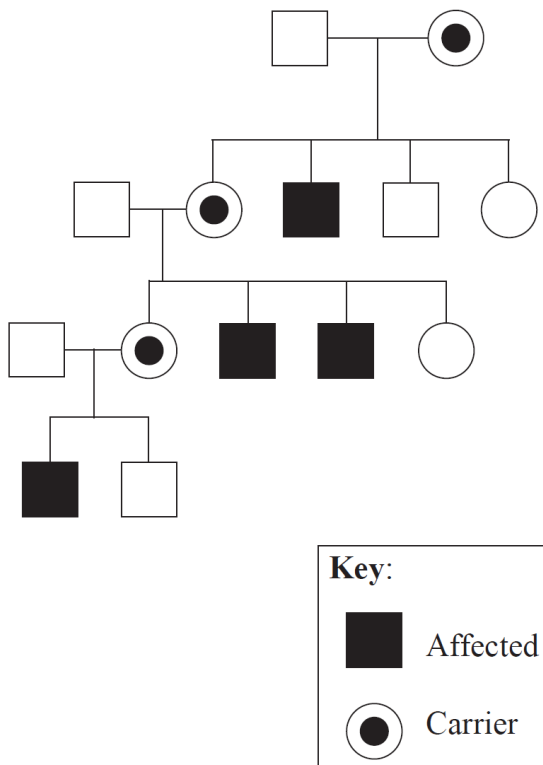
(A) Dad 1

(B) Dad 2

(C) Dad 3

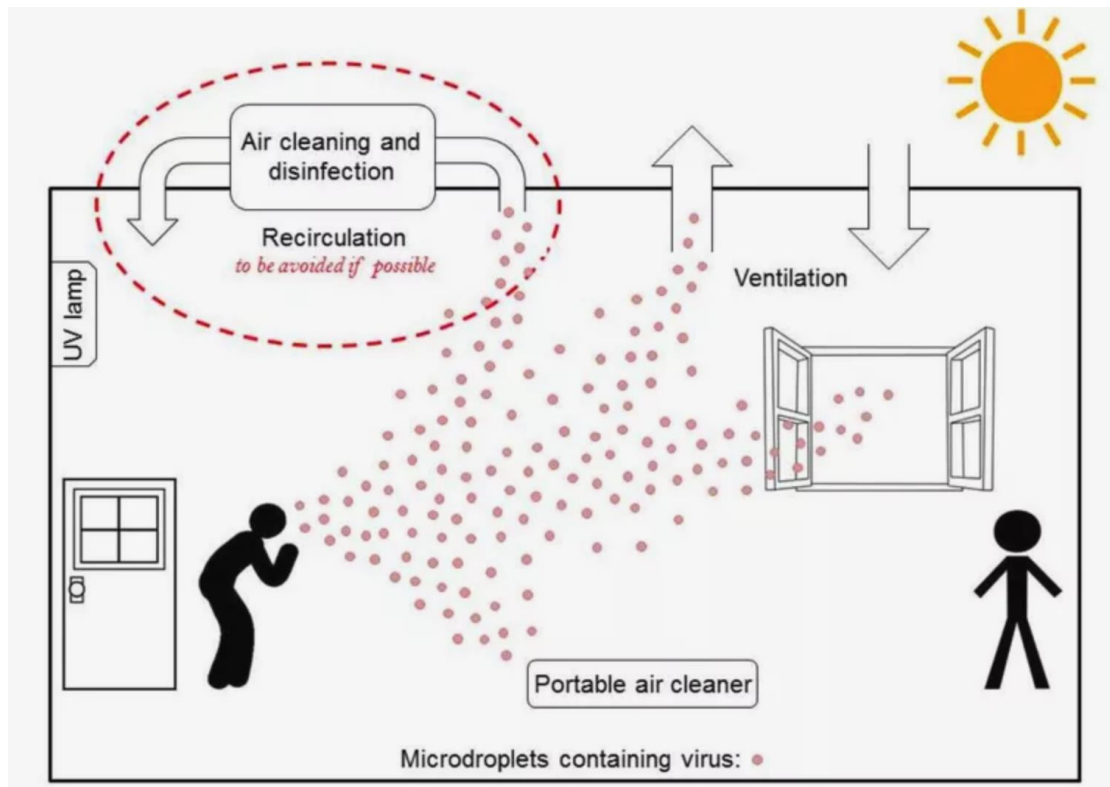
(D) Impossible to tell between Dad 1, 2 or 3

18 What type of inheritance is shown in this pedigree chart?



- (A) X-linked dominant
- (B) Y-linked dominant
- (C) X-linked recessive
- (D) Y-linked recessive

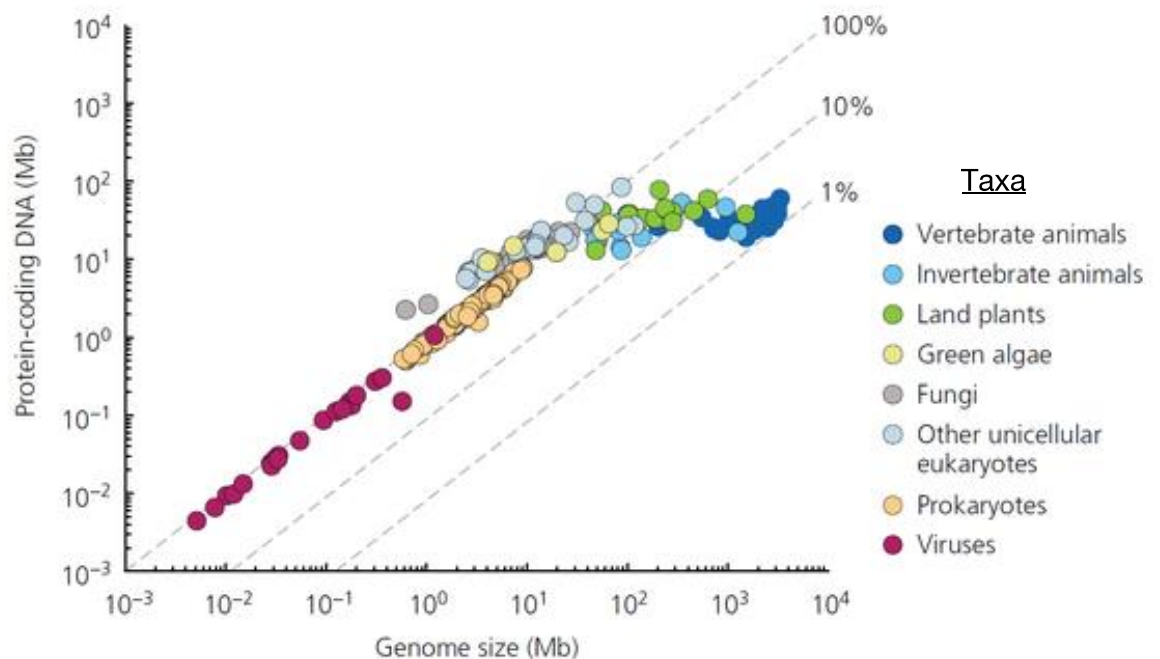
19 Look at the diagram below illustrating the transmission of a pathogen.



Which of the following procedures would NOT be effective in controlling the spread of this disease?

- (A) Washing your hands regularly.
- (B) Ventilation of an enclosed room.
- (C) Use of antibiotics for infected individuals.
- (D) TV advert informing this population on how this pathogen is transmitted.

- 20 The graph below compares the relative amounts of protein-coding DNA across different taxa (classification groups).



Which of the following statements is correct?

- (A) Every mutation in fungal DNA will affect its functionality.
- (B) On average, bacteria have less protein-coding DNA than viruses.
- (C) On average, vertebrate animals have the highest proportion of non-coding DNA.
- (D) Humans are more likely to be affected by mutations as they have relatively low amounts of protein-coding DNA.

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## SECTION II: SHORT AND LONG ANSWER

Answer the questions in the spaces provided.  
Show all relevant working in questions involving calculations.

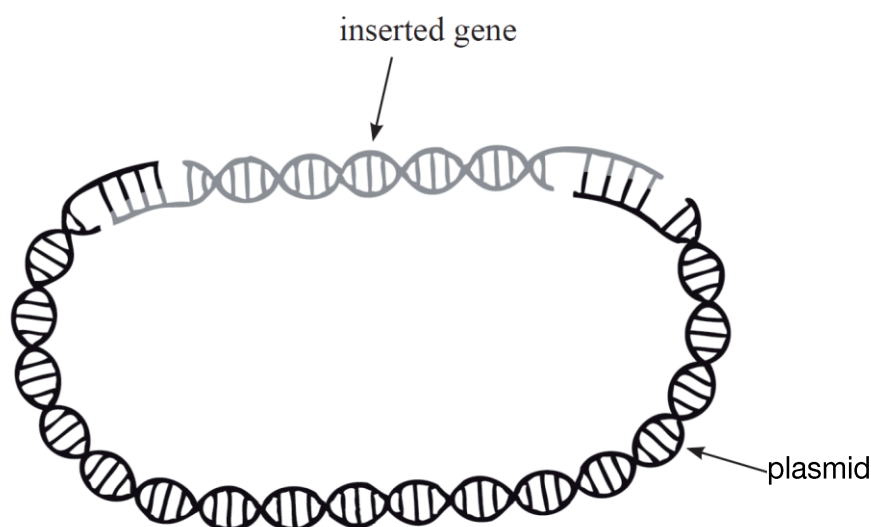
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### Question 21 (4 marks)

**Marks**

Gene transfer from other species into bacteria often involves small circles of DNA into which genes can be inserted. This circle of DNA is called a plasmid.

The diagram below shows a cut plasmid into which a gene can then be inserted.



- (a) Outline the techniques required to correctly insert the gene into the plasmid.

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- (b) Identify a potential advantage and disadvantage of gene transfer between species.

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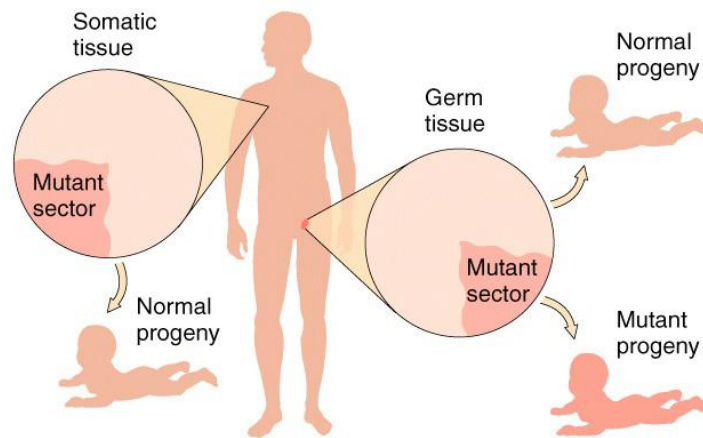
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**2**

**Question 22** (4 marks)

**Marks**

Look at the image below to help you answer the following question.



Distinguish between somatic and germ line mutations and discuss their effects on a population.

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**Question 23** (4 marks)

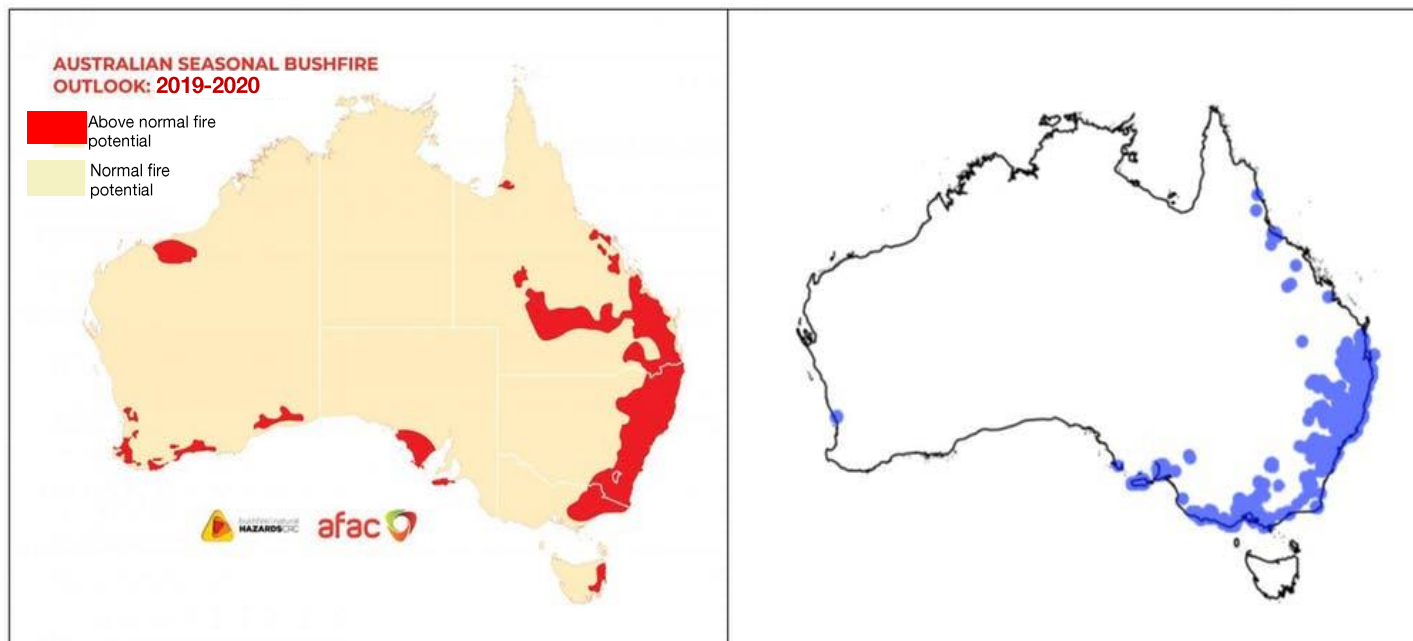
**Marks**

There is strong evidence to suggest that the Australian bushfire season is starting earlier, lasting longer and becoming more intense, possibly made worse by climate change. There is an above-average risk of serious fires across an extensive range of koala habitat on Australia's east coast.

"To protect Australia's iconic koalas we need to start freezing their genetic material. With more investment in the fast-developing field of cryogenics, koala hospitals could start taking samples from their patients, creating a vital lifeline for the species as a whole."

Source: The Conversation

The map below on the left shows the Australian seasonal bushfire outlook for the 2019-2020 bushfire season. The map below on the right shows the comparative koala distribution from January 2019 to January 2020.



- (a) Analyse the information above and assess the potential effect bushfires can have on koala genetic diversity.

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**Question 23 continued on next page.**

**Question 23 continued.**

**Marks**

- (b) Why is it suggested that freezing the genetic material of koalas could be a “lifeline” for the species?

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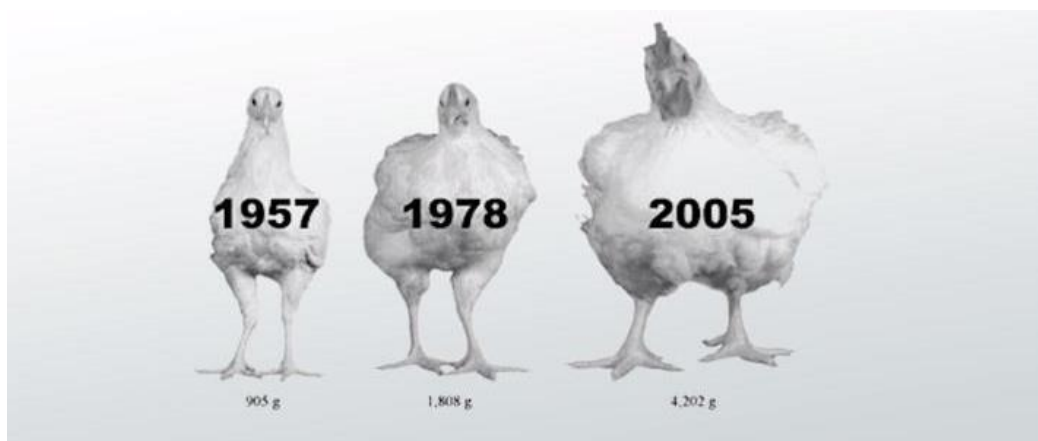
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**1**

**Question 24 (9 marks)**

Humans have been manipulating the genes of organisms for thousands of years.



Discuss the manipulation of plant and animal reproduction in agricultural practices throughout history. In your answer, evaluate the effects of genetic technologies in agriculture and assess the influence of social, economic and cultural factors.

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**Question 24 continued on next page.**

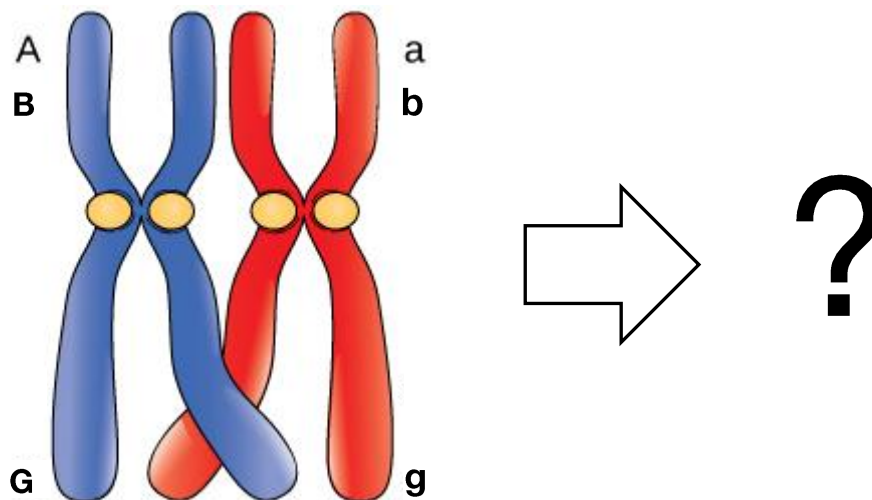
This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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**Question 25** (4 marks)

**Marks**

Analyse the diagram below showing a process from a stage of cell division.



- (a) Which type of cell division would this process be seen in?

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- (b) What is the genotype of the parent cell in this process?

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- (c) Identify the genotype of the daughter cells produced at the end of this cell division.

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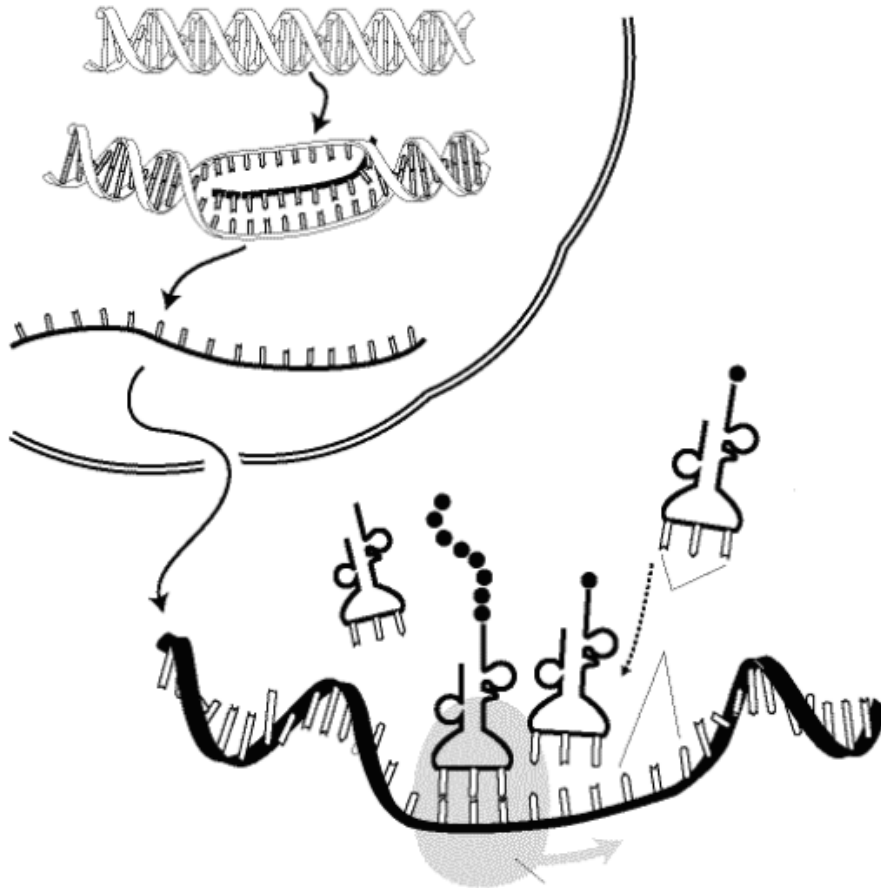
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**Question 26** (8 marks)

**Marks**

The diagram below represents polypeptide synthesis.



(a) Clearly label the following on the diagram above.

- i. tRNA
- ii. mRNA
- iii. polypeptide chain

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**Question 26 continued on next page.**

**Question 26 continued.**

**Marks**

- (b) Explain why tRNA is important in polypeptide synthesis.

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- (c) "Exposure to mutagenic chemicals can negatively impact polypeptide synthesis."  
Explain this statement.

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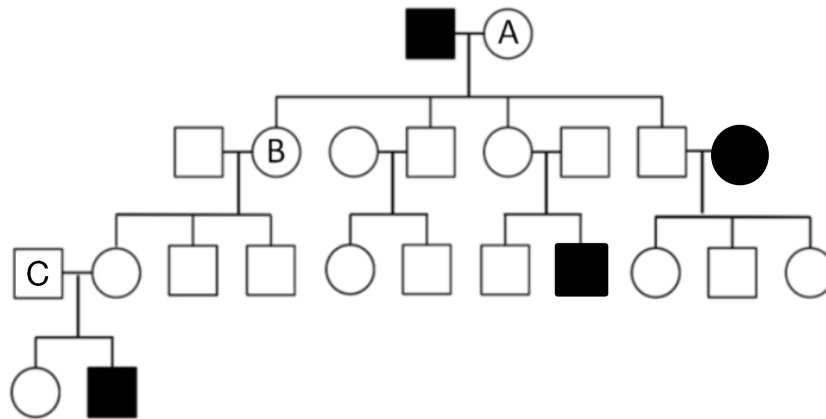
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**Question 27** (5 marks)

**Marks**

Analyse the pedigree below. All affected individuals are shaded. Individuals A, B and C are unaffected.



- (a) Identify the inheritance pattern shown in this pedigree.

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**1**

**Question 27 continued on next page.**

**Question 27 continued.**

**Marks**

- (b) Complete the table below to identify the possible genotype(s) of the individuals A-C and use appropriate evidence from the pedigree to support your choice. Use the letters 'N' or 'n' to represent the alleles.

| Individual | Genotype | Supporting evidence |
|------------|----------|---------------------|
| <b>A</b>   |          |                     |
| <b>B</b>   |          |                     |
| <b>C</b>   |          |                     |

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- (c) If individual C and their partner had a third child, what is the probability of this third child being a male with the trait?

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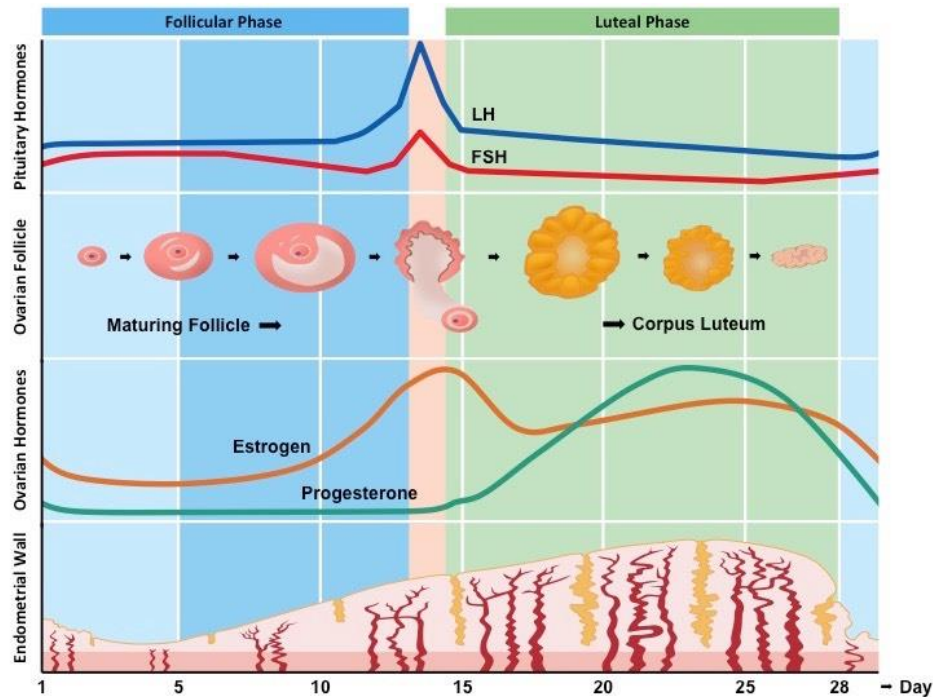
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**Question 28** (5 marks)

**Marks**

Use the diagram of the menstrual cycle below to help you answer the questions that follow.



- (a) Sometimes a treatment called *Clomiphene Citrate* is used to stimulate the release of FSH. With the help of the diagram above, explain why this treatment could improve the likelihood of pregnancy.

**2**

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- (b) Early miscarriage is sometimes due to the inability to retain the implanted blastocyst in the uterus. With reference to the hormones released during the menstrual cycle, explain how the chance of miscarriage might be reduced.

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Answer the questions in the spaces provided.  
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**Question 29** (5 marks)

**Marks**

- (a) Outline the meaning of the term homeostasis.

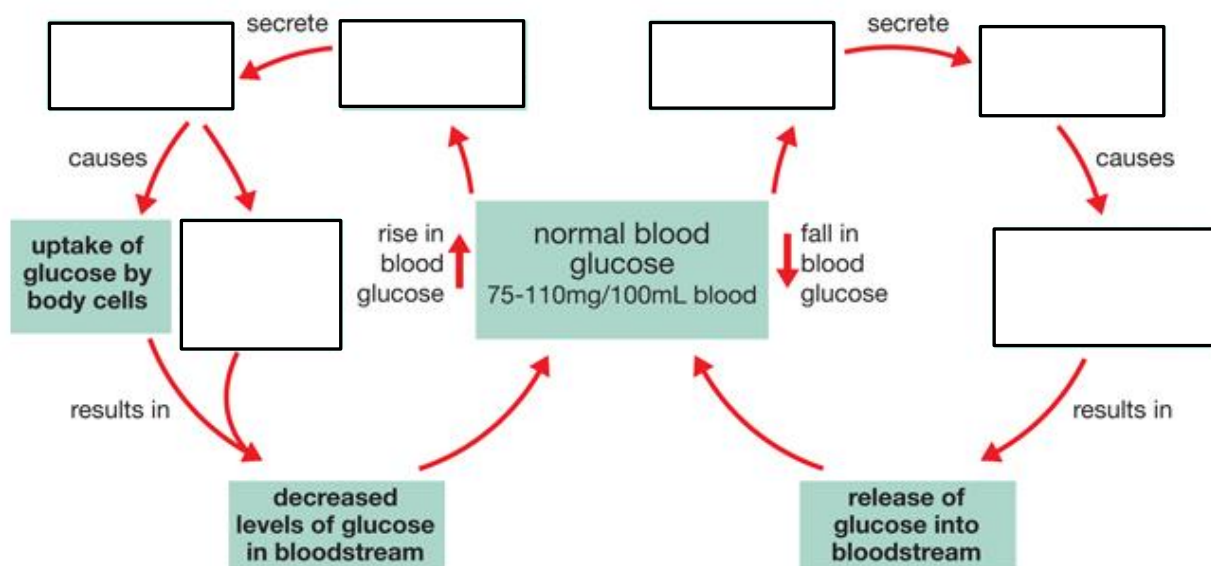
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- (b) The diagram below shows blood-glucose regulation through negative feedback.

Fill in the six blank boxes below.



**4**

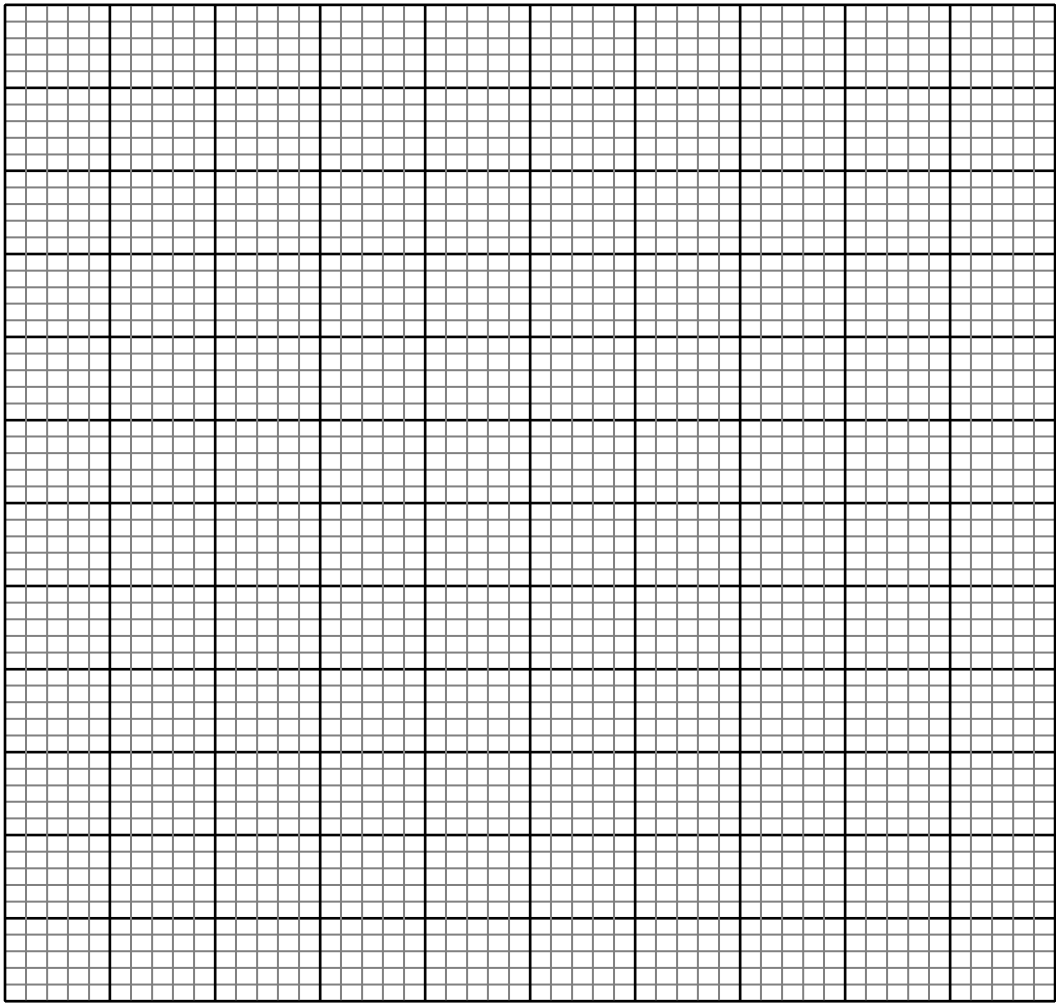
**Question 30** (7 marks)

**Marks**

The table below shows the membrane potential in millivolts (mV) of a functioning neurone over time in milliseconds (ms).

| Time (ms) | Membrane Potential(mV) |
|-----------|------------------------|
| 0         | -70                    |
| 0.5       | -55                    |
| 1.0       | +40                    |
| 1.5       | -65                    |
| 2.0       | -80                    |
| 3.0       | -75                    |
| 4.0       | -70                    |
| 5.0       | -70                    |

(a) Plot this data as a line graph on the grid below.



**Question 30 continued on next page.**

**Question 30 continued.**

**Marks**

(b) What is the name given to the response indicated by this neurone?

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(c) What is the greatest change in membrane potential during the time period shown?

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**1**

(d) At what time(s) is the membrane potential neutral?

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**Question 31** (3 marks)

**Marks**

All organisms are affected by temperature.

- (a) State an advantage to an organism of being endothermic.

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- (b) Describe two mechanisms that animals employ to ensure endothermy.

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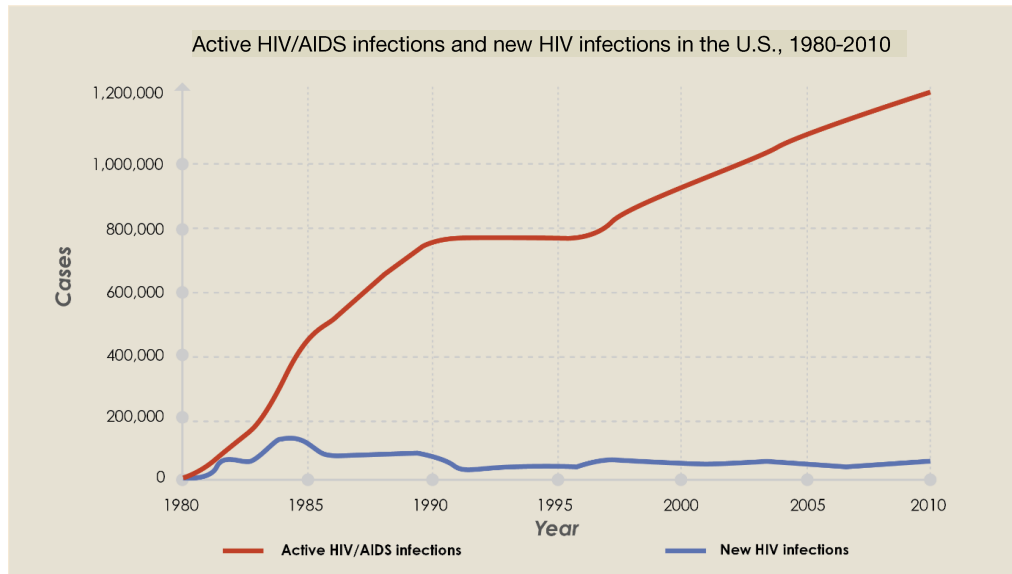
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Answer the questions in the spaces provided.  
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**Question 32** (10 marks)

**Marks**

The following graph shows the numbers of active HIV/AIDS infections and new HIV infections (which causes AIDS), over a thirty-year period in the United States (U.S.). The population of the U.S. in 2010 was 308 million. The last census in 2000 recorded a population of 281 million.



- (a) Describe the trend seen in the new HIV infections from 1980-2010.

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- (b) Calculate the incidence of HIV in 2010 as a percentage. Show all working.

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**Question 32 continued on next page.**

**Question 32 continued.**

**Marks**

- (c) Calculate the percentage change in prevalence of HIV from 2000-2010. Show all working.

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- (d) The graph shows a notable increase in the number of active HIV infections from 2000-2010. Does this data suggest a worsening of the AIDS epidemic? Justify your response by including reasons for the difference seen in incidence and prevalence of HIV infections.

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**Question 33 (12 marks)**

**Marks**

Panama disease is considered one of the most destructive diseases of banana plants worldwide.



Bananas affected by Panama Disease caused by the fungus *Fusarium oxysporum*.  
Source: ABC news

- (a) From the photo, identify an indicator of Panama disease in bananas.

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- (b) Describe an adaptation *Fusarium oxysporum* might use to facilitate its invasion of the host.

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**Question 33 continued on next page.**

**Question 33 continued.**

**Marks**

- (c) Plants do not have complex immune systems in the same way animals do, but they have developed physical and chemical barriers in response to pathogenic infections.

Identify ONE physical and ONE chemical barrier plants have to defend themselves against disease.

Physical:.....

**2**

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Chemical:.....

.....

- (d) Plant diseases are of great significance to the agricultural industry in Australia. Evaluate the contributions made by both Louis Pasteur and Robert Koch to our present understanding of the causes and prevention of infectious diseases and how this knowledge can be used to limit the spread of diseases in plants.

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**Question 33 continued on next page.**

**Question 33 continued.**

## Marks

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**END OF PAPER**

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| Master Initials | ZI     | DBD    | GPW    | ACR    |

Authors: ACR, DBD, GPW, ZI    Master in charge: ACR

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## SECTION I: MULTIPLE CHOICE (20 marks)

Attempt ALL Questions  
Use the Multiple-Choice Answer Sheet.

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Which of the following is an example of an effector?

- (A) Sweat
- (B) Motor neurones
- (C) Sensory neurones
- (D) Smooth muscle in blood vessel walls

- 2 Which one of the following lists is composed of both cellular and non-cellular pathogens?

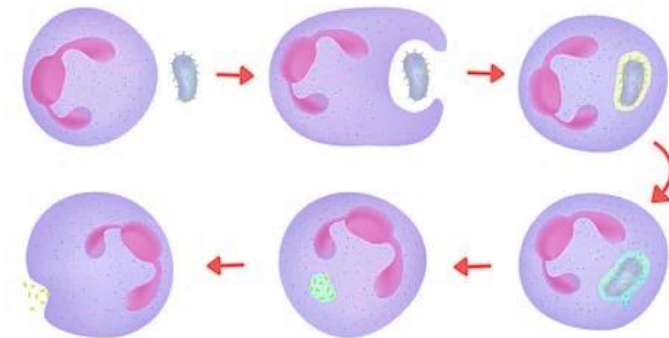
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- 3 The human body has a certain amount of innate immunity to infection by pathogens. Which of the following is NOT classified as innate immunity?

- (A) The acidity of the stomach.
- (B) Cilia in the respiratory tract.
- (C) Lymphocytes in respiratory tract.
- (D) Macrophages in the bloodstream.

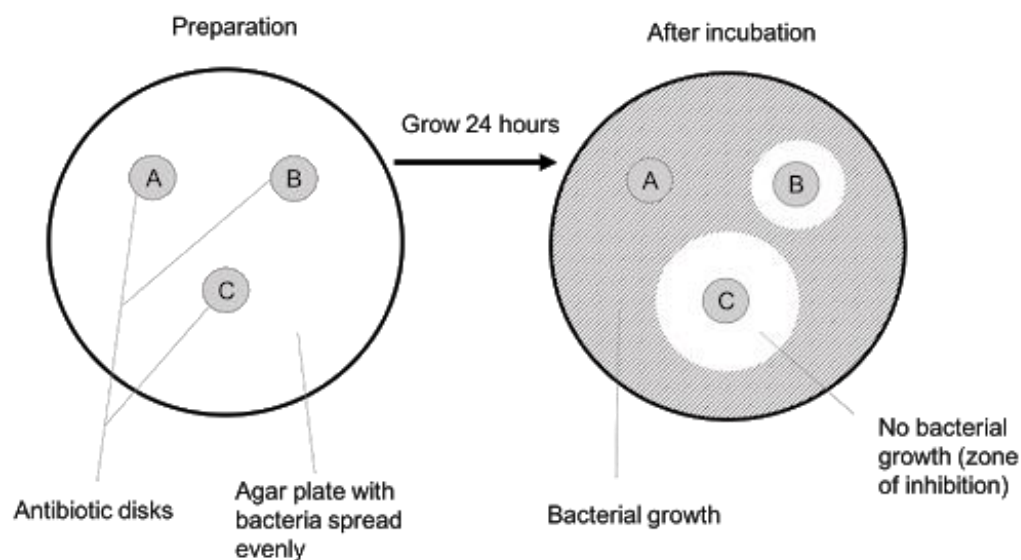
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  - (B) They will occur in populations that have been immunised.
  - (C) They involve an infectious disease that can be transmitted easily.
  - (D) They always occur in winter when a population has lowered resistance to infection.
- 5 Antigens are substances which:
- (A) act as a barrier to pathogens.
  - (B) stimulate the immune system.
  - (C) develop into T and B lymphocytes.
  - (D) are produced in response to infection by pathogens.

- 6 The diagram below illustrates one process that occurs as part of an immune response.



What process does this diagram illustrate?

- (A) Mitosis
  - (B) Exocytosis
  - (C) Inflammation
  - (D) Phagocytosis**
- 7 A student set up the following agar plate to investigate how different antibiotics affect one species of bacteria.



Which of the following is the dependent variable?

- (A) Type of antibiotic.
- (B) Concentration of antibiotic.
- (C) Diameter of the zone of inhibition.**
- (D) Period of time the plate was incubated.

- 8 The following pictures show different types of reproduction in organisms. They are not to scale.



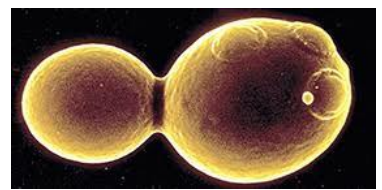
Hydra



Puffball mushroom



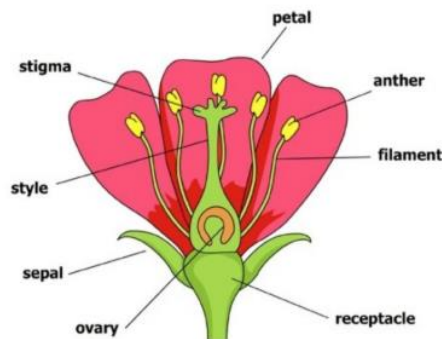
Strawberry plant with runners



Yeast

Which of the following statements is true about the reproductive process of these organisms?

- (A) They are all showing the release of eggs for fertilisation.
  - (B) All pictures show different forms of sexual reproduction.
  - (C) All pictures show different forms of asexual reproduction.
  - (D) Only the Hydra, puffball mushroom and the yeast show asexual reproduction.
- 9 The following diagram shows the reproductive organs of a flowering plant.

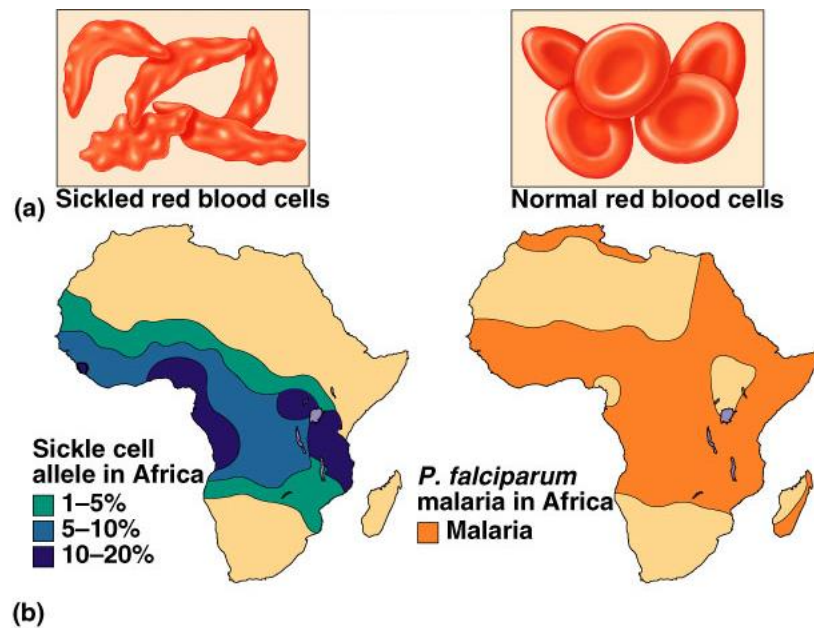


Which of the structures labelled above is the equivalent to the testes in animals?

- (A) Style
- (B) Anther
- (C) Stigma
- (D) Filament

- 10** Which of the following hormones is responsible for causing the corpus luteum to secrete oestrogen and progesterone during early pregnancy?
- (A) LH (Luteinising hormone)
  - (B) FSH (Follicle stimulating hormone)
  - (C) HCG (Human chorionic gonadotropin)**
  - (D) GnRH (Gonadotropin-releasing hormone)
- 11** When pure breeding black Andalusian chickens are crossed with pure breeding white Andalusian chickens the first generation offspring are all grey in colour (known as 'blue' Andalusians). What is the expected phenotypic ratio when two of these 'blue' Andalusians are mated and produce offspring?
- (A) 50% black, 50% grey
  - (B) 50% black, 50% white
  - (C) 25% black, 50% grey, 25% white**
  - (D) 25% white, 50% black, 25% grey

12 Analyse the following information.



Which statement would be the best conclusion about the relationship between sickle cell anaemia and malaria from the data?

- (A) Malaria causes sickle cell anaemia in regions of Africa.
- (B) The sickle cell allele is prevalent in areas where malaria is found.
- (C) People in Africa who have sickle cell anaemia don't contract malaria.
- (D) Malaria alleles and sickle cell anaemia alleles are found throughout Africa.

13 Which of the following cannot be mutagenic?

- (A) Viruses
- (B) UV light
- (C) Sodium metal
- (D) Toxins in mouldy food

- 14 The diagram below shows two examples of mutation events in messenger RNA.

Mutation A



Mutation B



Using the information above, which of the following correctly identifies the mutations A and B?

|     | Mutation A  | Mutation B |
|-----|-------------|------------|
| (A) | Insertion   | Deletion   |
| (B) | Deletion    | Frameshift |
| (C) | Inversion   | Insertion  |
| (D) | Duplication | Inversion  |

- 15 In some people haemoglobin always contains the amino acid valine in place of glutamic acid at one position of the protein. What is the most likely cause of this?

- (A) Lack of glutamic acid in the diet.
- (B) An error in translation of the mRNA.
- (C) A base substitution in the haemoglobin gene.
- (D) An error in the transcription of the haemoglobin protein.

- 16 If an allele was completely removed from a population, what would be the impact on this population's genetic diversity?

(A) Reduced

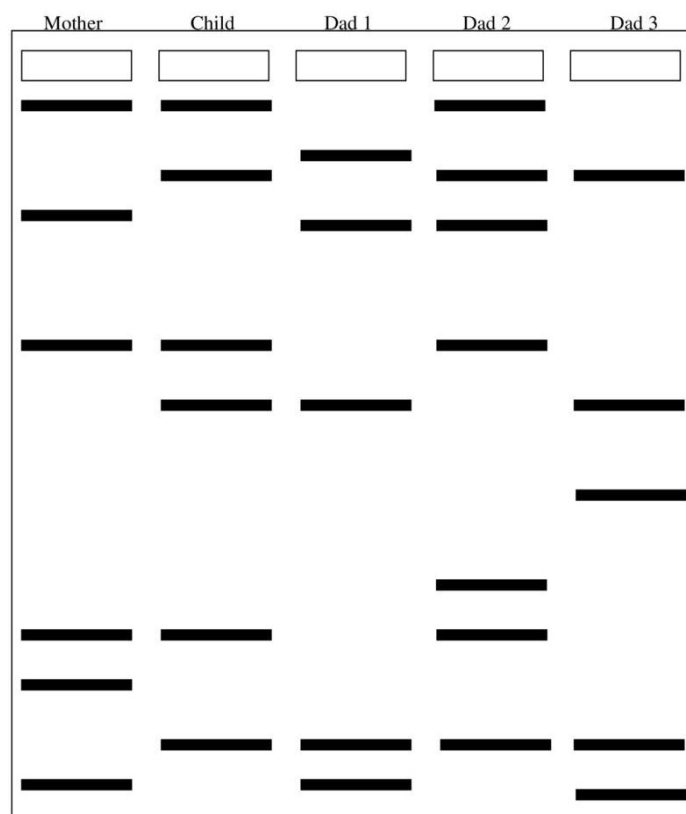
(B) Increased

(C) Stay the same

(D) Impossible to determine without additional information

- 17 DNA profiling is a forensic technique in criminal investigations, comparing criminal suspects' profiles to DNA evidence so as to assess the likelihood of their involvement in the crime. It is also used in paternity testing, to establish immigration eligibility, and in genealogical and medical research.

Analyse the banding pattern shown below.



Which Dad is the father of this child?

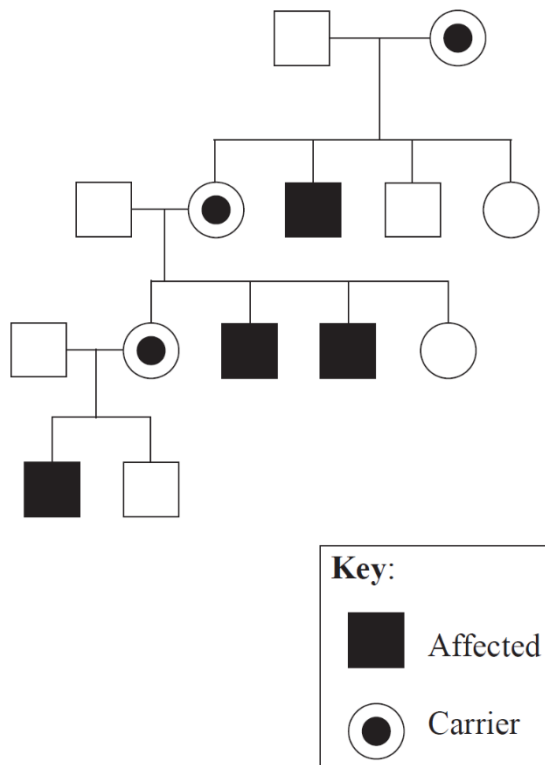
(A) Dad 1

(B) Dad 2

(C) Dad 3

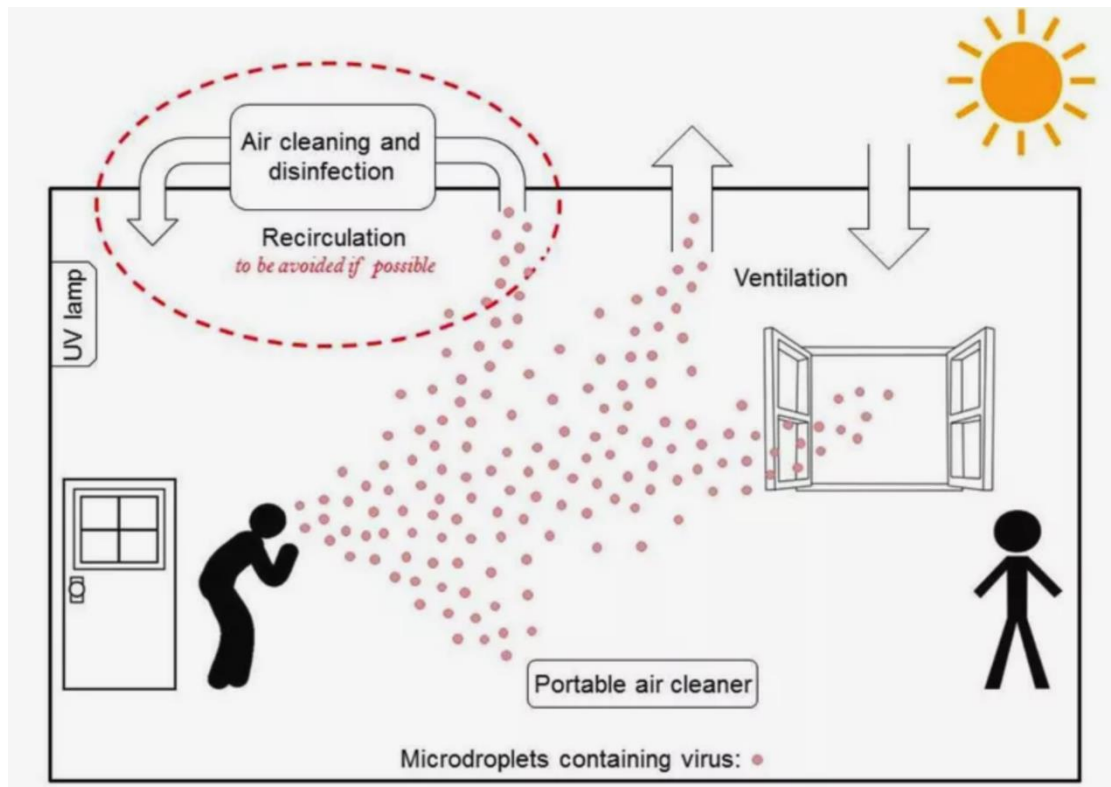
(D) Impossible to tell between Dad 1, 2 or 3

18 What type of inheritance is shown in this pedigree chart?



- (A) X-linked dominant
- (B) Y-linked dominant
- (C) X-linked recessive
- (D) Y-linked recessive

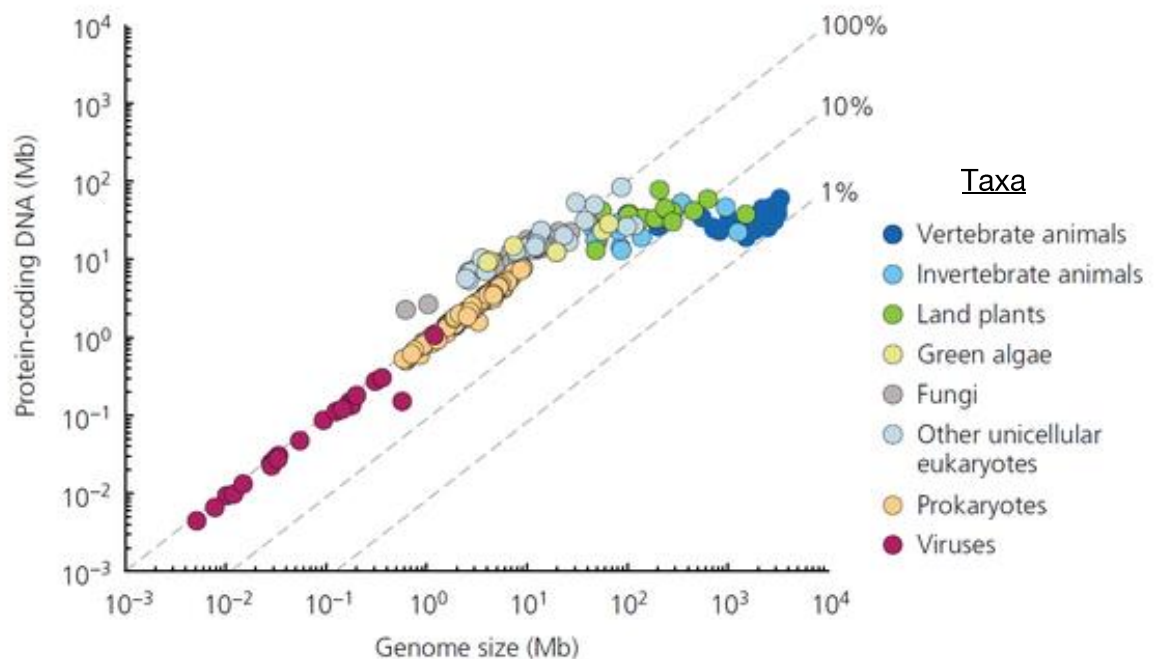
19 Look at the diagram below illustrating the transmission of a pathogen.



Which of the following procedures would NOT be effective in controlling the spread of this disease?

- (A) Washing your hands regularly.
- (B) Ventilation of an enclosed room.
- (C) Use of antibiotics for infected individuals.
- (D) TV advert informing this population on how this pathogen is transmitted.

- 20 The graph below compares the relative amounts of protein-coding DNA across different taxa (classification groups).



Which of the following statements is correct?

- (A) Every mutation in fungal DNA will affect its functionality.
- (B) On average, bacteria have less protein-coding DNA than viruses.
- (C) On average, vertebrate animals have the highest proportion of non-coding DNA.
- (D) Humans are more likely to be affected by mutations as they have relatively low amounts of protein-coding DNA.

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## SECTION II: SHORT AND LONG ANSWER

Answer the questions in the spaces provided.  
Show all relevant working in questions involving calculations.

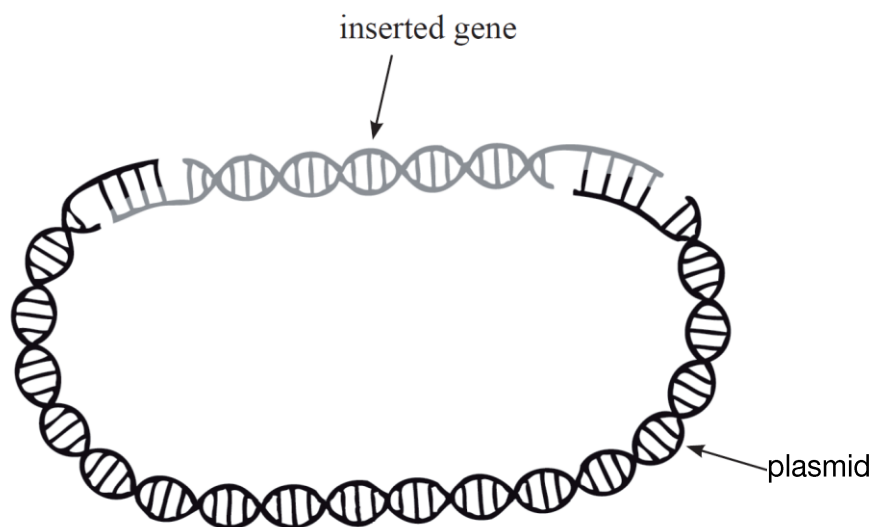
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### Question 21 (4 marks)

**Marks**

Gene transfer from other species into bacteria often involves small circles of DNA into which genes can be inserted. This circle of DNA is called a plasmid.

The diagram below shows a cut plasmid into which a gene can then be inserted.



- (a) Outline the techniques required to correctly insert the gene into the plasmid.

1 mark – use of (same) restriction enzymes to cut gene and plasmid (creating sticky ends)

1 mark – use of ligase enzyme to paste gene into plasmid

- (b) Identify a potential advantage and disadvantage of gene transfer between species.

1 mark – **Advantage to the organism or humans creating the transgenic organism**

Example: make organism disease resistant, increasing yield

1 mark – **Disadvantage to organism or the environment**

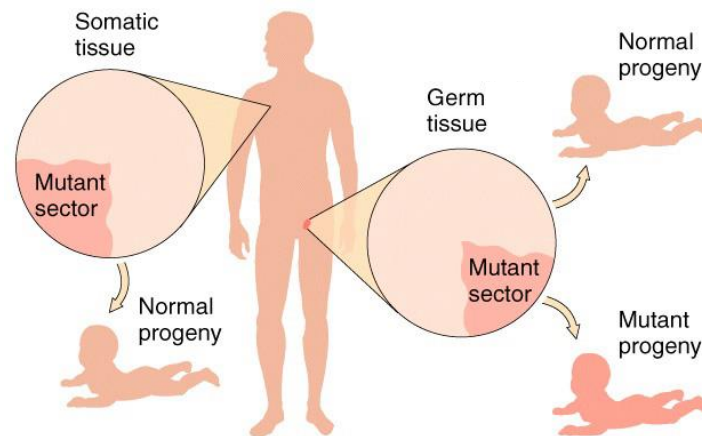
Example: reduces genetic diversity, susceptible to selective pressures

NOTE: Didn't accept comments to do with detrimental genes introduced, and causes mutations if done incorrectly.

**Question 22** (4 marks)

**Marks**

Look at the image below to help you answer the following question.



Distinguish between somatic and germ line mutations and discuss their effects on a population.

**2 marks – for distinguishing between somatic and germ line mutations.**

Somatic mutations occur in the body cells (during mitosis) and are confined to the individual organism, while germ line mutations occur in gametes (during meiosis).

**2 marks – for discussing the effects of these mutations on a population.**

Somatic mutations are not passed on to offspring, however, the individual may be adversely affected by way of cancers. This may cause the death of the individual organism.

In germline cells the mutation may be passed on to some offspring (can refer to normal/mutant progeny in diagram) and there is a possibility of genetic diseases (eg. haemophilia) passed on to future generations, spreading in the population / become prevalent in population.

**Question 23** (4 marks)

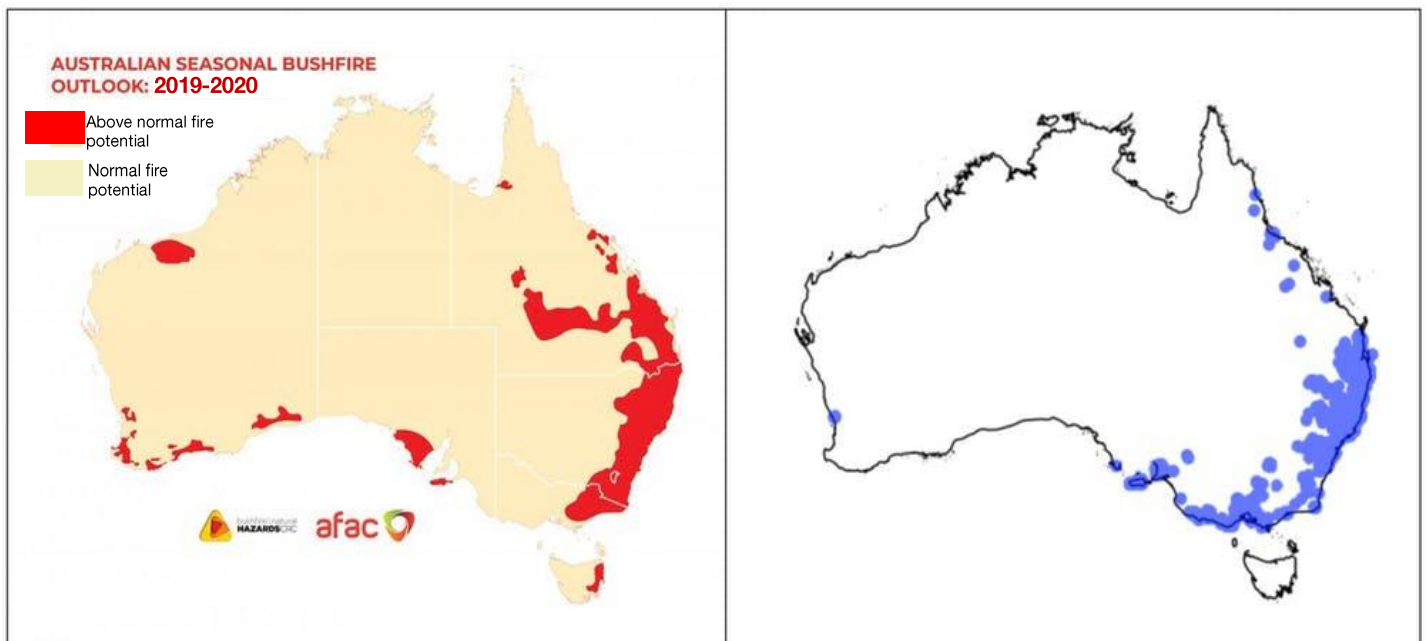
**Marks**

There is strong evidence to suggest that the Australian bushfire season is starting earlier, lasting longer and becoming more intense, possibly made worse by climate change. There is an above-average risk of serious fires across an extensive range of koala habitat on Australia's east coast.

"To protect Australia's iconic koalas we need to start freezing their genetic material. With more investment in the fast-developing field of cryogenics, koala hospitals could start taking samples from their patients, creating a vital lifeline for the species as a whole."

Source: The Conversation

The map below on the left shows the Australian seasonal bushfire outlook for the 2019-2020 bushfire season. The map below on the right shows the comparative koala distribution from January 2019 to January 2020.



- (a) Analyse the information above and assess the potential effect bushfires can have on koala genetic diversity.

1 mark – analysis of information – habitats destroyed by bushfires, reducing abundance/distribution of koalas

2 marks – this has the possibility of reducing koala genetic diversity (1 mark) making them more susceptible to diseases/becoming endangered, as the number of certain alleles present in the original population would be reduced (decreasing gene pool, bottlenecking)

**Question 23 continued on next page.**

**Question 23 continued.**

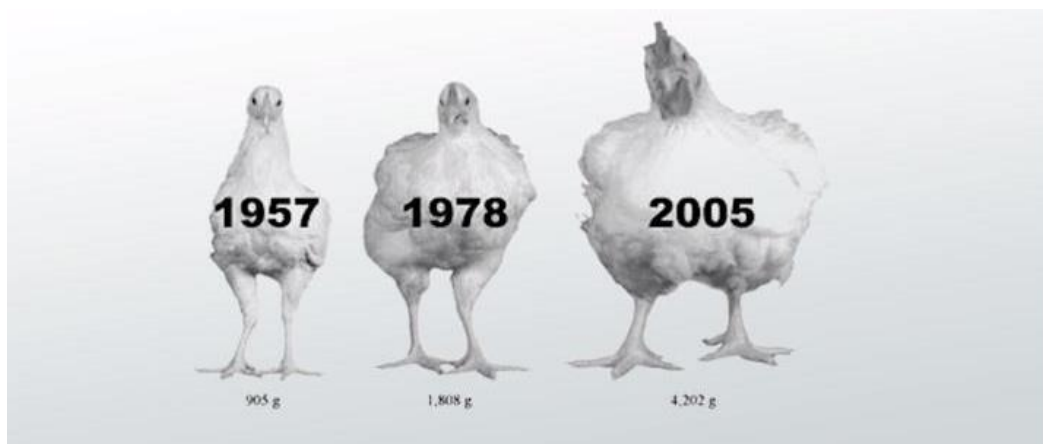
**Marks**

- (b) Why is it suggested that freezing the genetic material of koalas could be a “lifeline” for the species?

By collecting DNA from a large number of koalas, you will have a collection of various alleles. In the case of possible extinction, gene technology, such as cloning, could be used to save the species.

**Question 24 (9 marks)**

Humans have been manipulating the genes of organisms for thousands of years.



Discuss the manipulation of plant and animal reproduction in agricultural practices throughout history. In your answer, evaluate the effects of genetic technologies in agriculture and assess the influence of social, economic and cultural factors.

This question involved discussing the change in manipulation of plant/animal reproduction in agricultural practices over time.

Many answers did not take into account the progression/advancement in genetic techniques over time and just gave a general account of a few techniques (eg. artificial insemination, cloning, selective breeding) without any real context to why these techniques were useful / used during certain time periods in agriculture. Answers failed to relate how social, economic and cultural factors influence/d the use of these technologies.

**Question 24 continued on next page.**

**Question 24 continued.****Marks**

| <b>Criteria</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Marks</b> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <ul style="list-style-type: none"><li>- Describes the manipulation of plant and animal reproduction in agricultural practices</li><li>- Specifically states, using examples, how the techniques help improve agricultural practices</li><li>- Assesses the influence of social, economic and cultural factors and links to changing agricultural practices</li><li>- Describes clearly the progression of the various techniques throughout history</li><li>- Makes an evaluation of genetic technologies with supporting evidence</li><li>- Communicates logically and succinctly with precise biological terms</li></ul> | <b>8-9</b>   |
| <ul style="list-style-type: none"><li>- Describes the manipulation of plant and animal reproduction in agricultural practices</li><li>- Outlines the influence of social, economic and cultural factors</li><li>- Makes an evaluation of genetic technologies with supporting evidence</li></ul>                                                                                                                                                                                                                                                                                                                           | <b>6-7</b>   |
| <ul style="list-style-type: none"><li>- Outlines the manipulation of plant and animal reproduction in agricultural practices</li><li>- Evaluates the effects of genetic technologies</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>4-5</b>   |
| <ul style="list-style-type: none"><li>- Outlines the manipulation of either plant or animal reproduction</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>2-3</b>   |
| <ul style="list-style-type: none"><li>- Provides some relevant information</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>1</b>     |

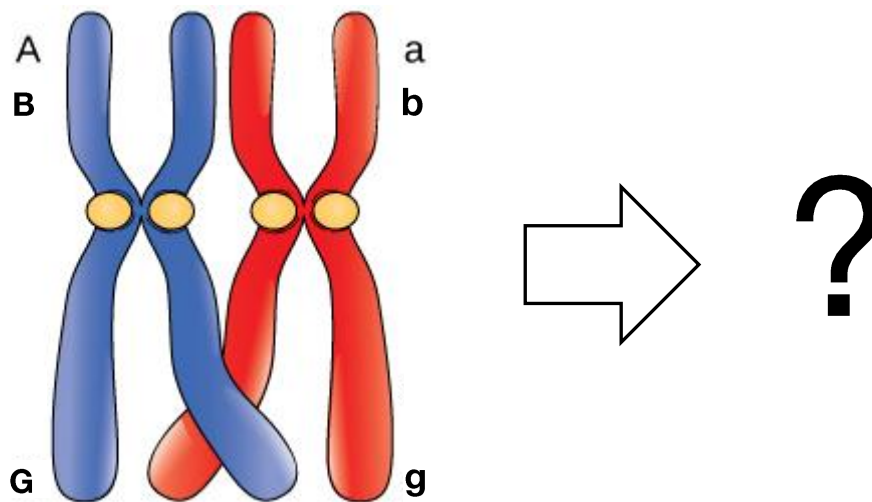
**Sample answer overleaf**

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**Question 25** (4 marks)

**Marks**

Analyse the diagram below showing a process from a stage of cell division.



- (a) Which type of cell division would this process be seen in?

Meiosis 1

Also accepted prophase I BUT this is not the type of cell division it is a 'stage' of the cell division named. Be careful of this in October!

- (b) What is the genotype of the parent cell in this process?

AaBbGg 1

Any combination of the above accepted EXCEPT if the word OR was included i.e. "ABG or abg"

Note the conventional representation of genotype.

Many boys missed that the chromosomes were homologous (i.e. had doubled up ready for stage I of meiosis) or forgot that parent genotype means two alleles for each gene (Aa, Bb etc)

- (c) Identify the genotype of the daughter cells produced at the end of this cell division.

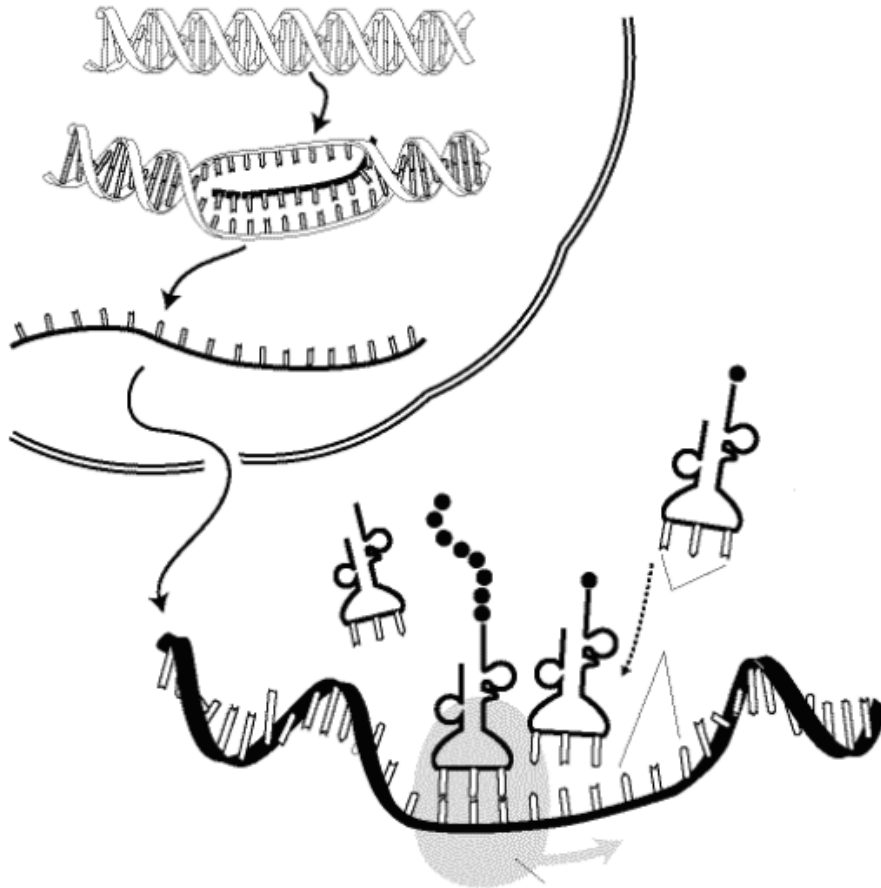
2 – ABG, ABg, abg, abG

1 – any combination that clearly shows crossing over of the Gg allele (ABG, ABg OR abg, abG)

**Question 26** (8 marks)

**Marks**

The diagram below represents polypeptide synthesis.



(a) Clearly label the following on the diagram above.

- i. tRNA
- ii. mRNA
- iii. polypeptide chain

**3**

3 – all correctly labelled

2 – most labelled

1 – some relevant label

**Question 26 continued on next page.**

**Question 26 continued.**

**Marks**

- (b) Explain why tRNA is important in polypeptide synthesis.

3 – clearly relates the structure of tRNA to codon/anti-codon binding and subsequent correctly ordered amino acids for the polypeptide chain.

2 – attempts to describe the function of tRNA or links the structure of tRNA to the codon/anti-codon binding

1 – some relevant information

- (c) “Exposure to mutagenic chemicals can negatively impact polypeptide synthesis.”

Explain this statement.

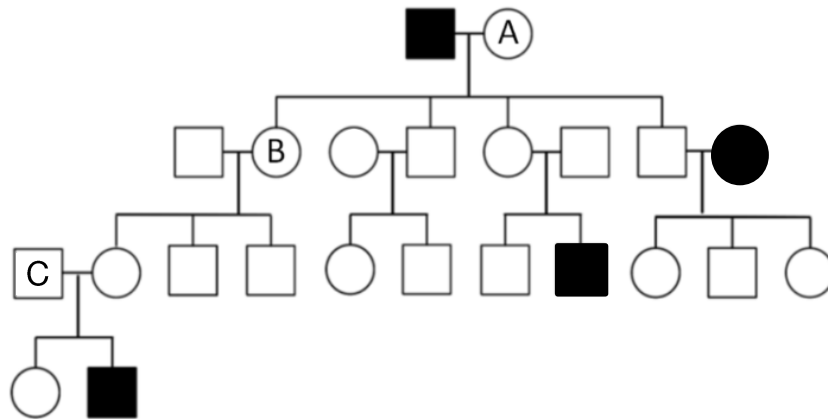
2 – Clearly relates the mutation of DNA by chemicals to the subsequent formation of a non-functional protein.

1 – some relevant information about mutations

**Question 27** (5 marks)

**Marks**

Analyse the pedigree below. All affected individuals are shaded. Individuals A, B and C are unaffected.



- (a) Identify the inheritance pattern shown in this pedigree.

Autosomal recessive

NB: must state autosomal and recessive

Many boys need to revise the analysis of pedigrees and learn how to reduce the amount of processing they do!

**Question 27 continued on next page.**

**Question 27 continued.****Marks**

- (b) Complete the table below to identify the possible genotype(s) of the individuals A-C and use appropriate evidence from the pedigree to support your choice. Use the letters 'N' or 'n' to represent the alleles.

| Individual | Genotype                          | Supporting evidence                                                                                                     |
|------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------|
| <b>A</b>   | Nn or NN<br><br>(must state both) | The partner is nn therefore a N allele must be present but there is not enough info to establish which of the two it is |
| <b>B</b>   | Nn                                | Father of B is nn but B is unaffected therefore must be Nn                                                              |
| <b>C</b>   | Nn                                | The son is nn so C must be Nn to provide a recessive allele (mother must also be Nn).                                   |

**3**

- (c) If individual C and their partner had a third child, what is the probability of this third child being a male with the trait?

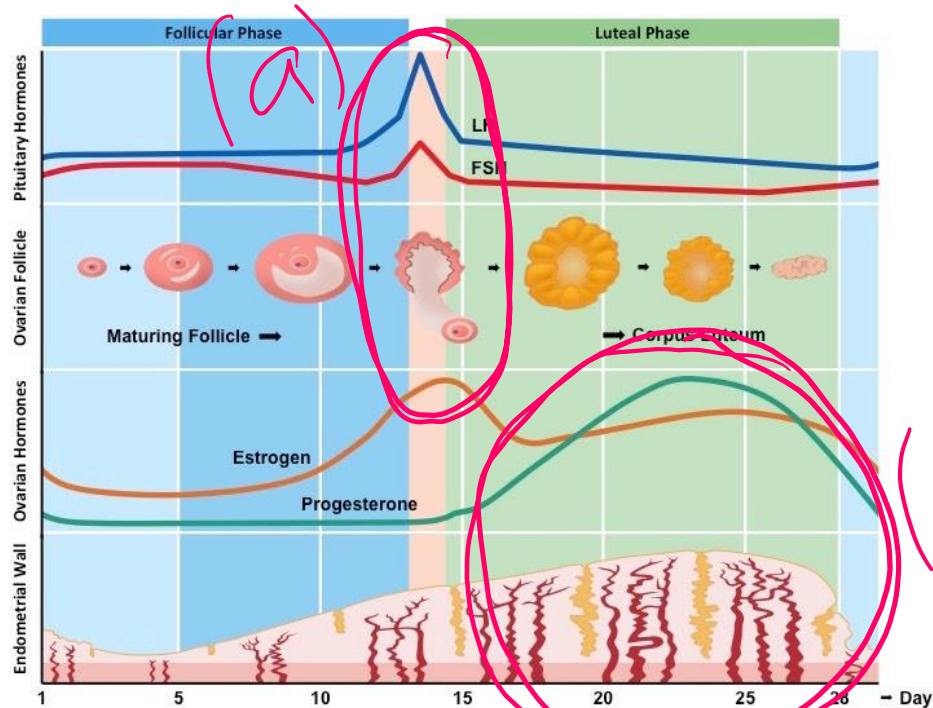
50% chance of being male and 25% chance of inheriting the recessive condition

$0.5 \times 0.25 = 0.125 = 12.5\%$  or  $1/8$

### Question 28 (5 marks)

Marks

Use the diagram of the menstrual cycle below to help you answer the questions that follow.



- (a) Sometimes a treatment called *Clomiphene Citrate* is used to stimulate the release of FSH. With the help of the diagram above, explain why this treatment could improve the likelihood of pregnancy.

2- clearly relates the function of FSH (stimulation of follicle maturation and release of ova) to falling pregnant (egg released so will contact with sperm and fertilisation occurs)

1 – some information about FSH

- (b) Early miscarriage is sometimes due to the inability to retain the implanted blastocyst in the uterus. With reference to the hormones released during the menstrual cycle, explain how the chance of miscarriage might be reduced.

3 – clearly links the role(s) of the relevant hormone(s) to maintaining pregnancy in the early stages (basically uterine lining maintenance)

2 – describes the role(s) of the relevant hormone(s)

1 – some relevant information

Some boys need to work on their graph analysis skills and learn how to read graphs like this one!

|                  |  |  |  |  |  |  |  |
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Answer the questions in the spaces provided.  
Show all relevant working in questions involving calculations.

### Question 29 (5 marks)

Marks

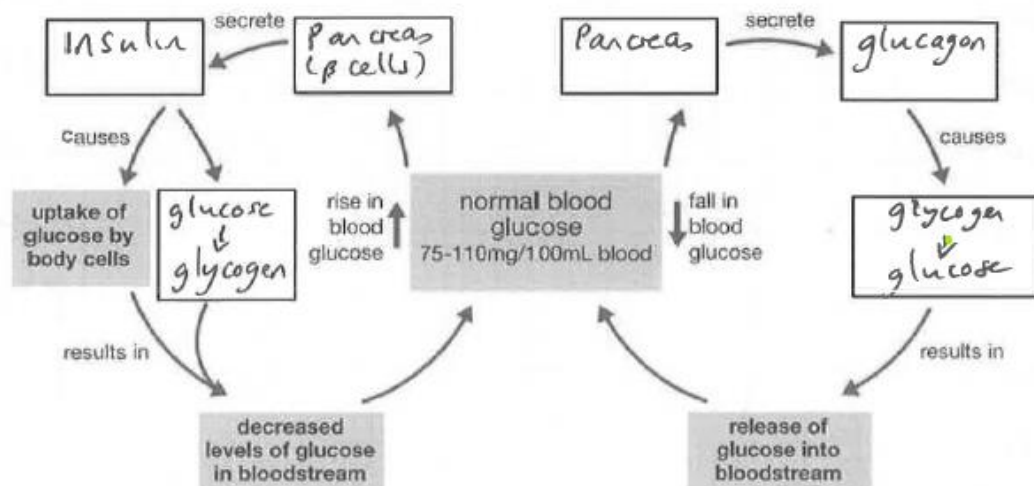
- (a) Outline the meaning of the term homeostasis.

**Maintaining a constant internal environment.**.....

1

- (b) The diagram below shows blood-glucose regulation through negative feedback.

Fill in the six blank boxes below.



All 6 Boxes correct : 4

4-5

3

2-3

2

1-2

1

4

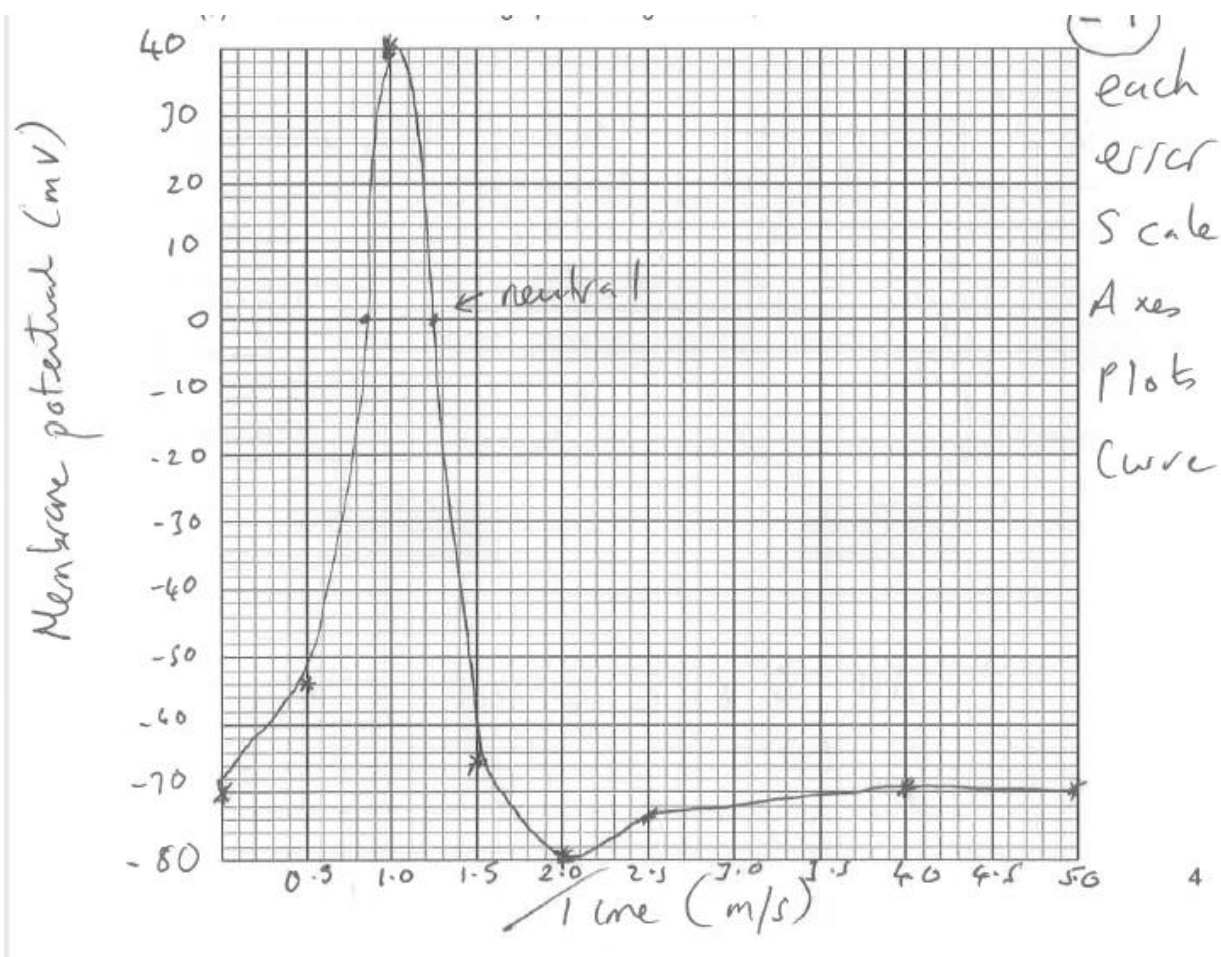
4

**Question 30** (7 marks)**Marks**

The table below shows the membrane potential in millivolts (mV) of a functioning neurone over time in milliseconds (ms).

| Time (ms) | Membrane Potential(mV) |
|-----------|------------------------|
| 0         | -70                    |
| 0.5       | -55                    |
| 1.0       | +40                    |
| 1.5       | -65                    |
| 2.0       | -80                    |
| 3.0       | -75                    |
| 4.0       | -70                    |
| 5.0       | -70                    |

(a) Plot this data as a line graph on the grid below.

**4**

Question 30 continued on next page.

**Question 30 continued.**

**Marks**

- (b) What is the name given to the response indicated by this neurone?

**Action Potential**.....

**1**

- (c) What is the greatest change in membrane potential during the time period shown?

**-120mV (1.0 m/s – 2.0 m/s)**

.....

**/**

- (d) At what time(s) is the membrane potential neutral?

**From the graph they have constructed: range 0.7-0.8 m/s and 1.10-1.12 m/s**

.....

**1**

**Question 31 (3 marks)**

**Marks**

All organisms are affected by temperature.

- (a) State an advantage to an organism of being endothermic.

**Can have much greater geographical distribution/internal temp. is independent of external temp/ greater specialisation of organism.....** **1**

.....

- (b) Describe two mechanisms that animals employ to ensure endothermy.

..... **2**

**Any 2 descriptions** e.g. vasodilation: expanding of superficial blood vessels – greater heat loss

Vasoconstriction: constriction of superficial blood vessels: reduces heat loss

Sweating: evaporation of sweat : cooling effect

Piloerection: raising hairs on skin traps insulating layer of air: conserves heat

.....

.....

.....

.....

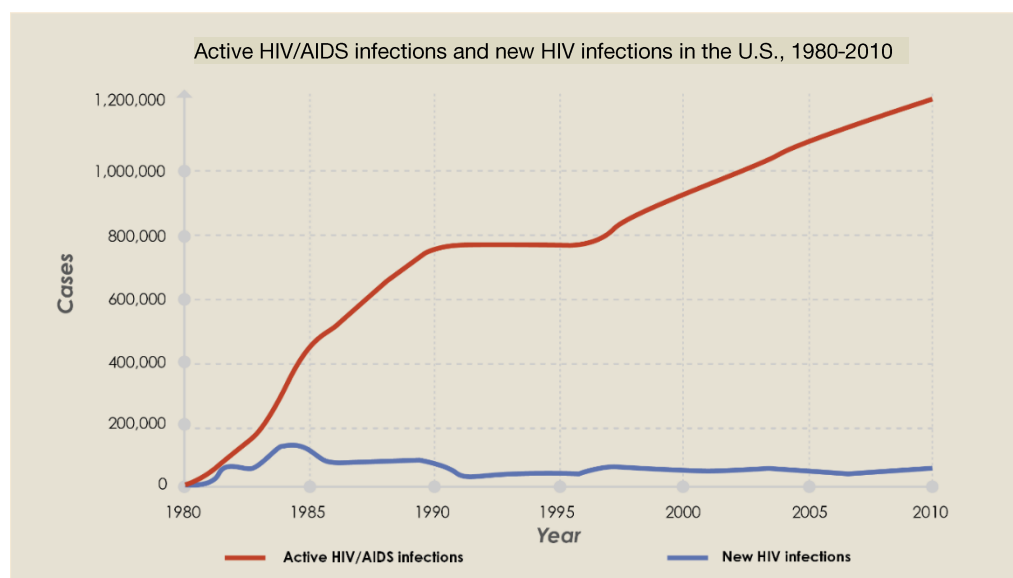
Answer the questions in the spaces provided.  
Show all relevant working in questions involving calculations.

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### Question 32 (10 marks)

**Marks**

The following graph shows the numbers of active HIV/AIDS infections and new HIV infections (which causes AIDS), over a thirty-year period in the United States (U.S.). The population of the U.S. in 2010 was 308 million. The last census in 2000 recorded a population of 281 million.



- (a) Describe the trend seen in the new HIV infections from 1980-2010.

Must provide details of full line for new HIV infections from 1980-2010.....

**1**

e.g new infections increase up to a peak ~150,000 in ~1984 and then start to decline over the next few years up until ~1991 when it starts to level off/become more stable ~70,000 cases per year.

- (b) Calculate the incidence of HIV in 2010 as a percentage. Show all working.

$$\text{Incidence} = \frac{\text{Number of new cases during a period of time}}{\text{Number in population at risk during period}} \times 100$$

**1**

$$\begin{aligned} \text{Thus: Incidence} &= \frac{\sim 70,000 \text{ (reasonable range accepted)}}{308,000,000} \times 100 \\ &= 0.02\% \end{aligned}$$

**Question 32 continued on next page.**

**Question 32 continued.**

**Marks**

- (c) Calculate the percentage change in prevalence of HIV from 2000-2010. Show all working.

Prevalence had to include All active + New infections calculated for 2000 (1) and 2010 (1)  
Any calculation of percent change that made sense (1)

$$\text{e.g Prevalence} = \frac{\text{All Active} + \text{New Infections}}{\text{Total population in that period}} \times 100 \dots\dots\dots \mathbf{3}$$

$$\text{Thus: In 2000, prevalence} = \frac{(\sim 920,000 + \sim 70,000)}{281,000,000} \times 100 = 0.352\%$$

$$\text{Thus: In 2010, prevalence} = \frac{(\sim 1,200,000 + \sim 70,000)}{308,000,000} \times 100 = 0.412\%$$

Therefore change =  $0.412 - 0.352 = + 0.06\%$  / An increase of 0.06%

OR

$$\% \text{ change} = \frac{\text{Prevalence in 2010} - \text{prevalence in 2000}}{\text{Prevalence in 2000}} \times 100 = 17\%$$

**(NB:** Numbers may vary slightly due to reading off graph, reasonable approximations accepted)

- (d) The graph shows a notable increase in the number of active HIV infections from 2000-2010. Does this data suggest a worsening of the AIDS epidemic? Justify your response by including reasons for the difference seen in incidence and prevalence of HIV infections. **5**

- 1- There has been no change/worsening of the epidemic, even though more people have the disease (or other conclusion + justification to follow)
  - 2 Marks - Explanation of ideas why prevalence may have increased eg this is a sign that death rate has decreased which explains why the number of active cases has increased/more people seem to have the disease/ there is no cure so numbers continue to rise/ people are surviving longer with the disease / improvement in treatment/medication / understanding of disease.
- 1 – Some data interpretation to justify their conclusion.
- 1 – Reasons for incidence staying stable – eg even though stable numbers, actually less new cases per population (due to increase in population of ~10%) thus incidence levels dropping so epidemic improving due to more education regarding transmission and prevention of HIV.

**Question 33 (12 marks)**

**Marks**

Panama disease is considered one of the most destructive diseases of banana plants worldwide.



Bananas affected by Panama Disease caused by the fungus *Fusarium oxysporum*.  
Source: ABC news

- (a) From the photo, identify an indicator of Panama disease in bananas.

e.g discolouration of conducting tissue/black lesions/spots on skins/fruit peel

**1**

.....

- (b) Describe an adaptation *Fusarium oxysporum* might use to facilitate its invasion of the host.

Adhesion assisted by cell wall to adhere to host cells to invade/ .....

**1**

Spores penetrating plant's root tips/wounds/ enters from soil so infects host since roots uptake water+minerals from soil

**Question 33 continued on next page.**

**Question 33 continued.**

**Marks**

- (c) Plants do not have complex immune systems in the same way animals do, but they have developed physical and chemical barriers in response to pathogenic infections.

Identify ONE physical and ONE chemical barrier plants have to defend themselves against disease.

Physical: cell wall/wax cuticle/wound barriers/lignification .....

**2**

Chemical: release of enzymes/breakdown toxins/pH changes/release toxic compounds/hydrogen peroxide

- (d) Plant diseases are of great significance to the agricultural industry in Australia. Evaluate the contributions made by both Louis Pasteur and Robert Koch to our present understanding of the causes and prevention of infectious diseases and how this knowledge can be used to limit the spread of diseases in plants.

**8**

| Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Marks      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <ul style="list-style-type: none"> <li>- Describes the work of Koch and Pasteur</li> <li>- Relates work to cause and prevention of plant diseases</li> <li>- Multiple links between work of Pasteur and Koch and how related to plant diseases</li> <li>- Specifically states how the techniques prevent further spread of the disease in plants</li> <li>- Evaluation of contributions supported with evidence</li> <li>- Communicates logically and succinctly with precise biological terms</li> </ul> | <b>7-8</b> |
| <ul style="list-style-type: none"> <li>- Outlines the work of Koch and Pasteur</li> <li>- Relates a contributions to cause and prevention of plant diseases in general terms</li> <li>- Makes an evaluation with supporting evidence</li> </ul>                                                                                                                                                                                                                                                           | <b>5-6</b> |
| <ul style="list-style-type: none"> <li>- Outlines/describes the work of Koch and Pasteur</li> <li>- Relates work to a cause and/or prevention of plant diseases</li> </ul>                                                                                                                                                                                                                                                                                                                                | <b>3-4</b> |
| <ul style="list-style-type: none"> <li>- Outlines the work of Koch and Pasteur</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>2</b>   |
| <ul style="list-style-type: none"> <li>- Provides some relevant information</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>1</b>   |

**Question 33 continued on next page.**

### Question 33 continued.

Marks

Eg of information to include

Evaluation – Significant contribution....

Pasteur – Germ Theory of disease/ disproved spontaneous generation  
lead to idea of hygiene + sterilisation eg links directly to border control methods / agricultural methods including cleaning of footwear / informed our border declaration laws / sterilisation of agricultural equipment to prevent transmission of pathogens and thus spreading of disease

Koch's 4 postulates:

- The pathogen must be present in every case of the disease.
- The pathogen must be isolated from the host with the disease and grown in pure culture.
- The specific disease must be reproduced when a pure culture of the pathogen is inoculated into a healthy susceptible host.
- The pathogen must be recoverable from the experimentally infected host.

Why it's important to identify the type of microbe – link this to transmission and adaptations of microbes to invade plants.

Links to: Quarantine/ Mobility of plants / introduced species /

Links to prevention treatments, eg genetic engineering / Bt Cotton, pesticides, insecticides, border security

E.g of Panama Disease can be used – identified infectious agent was a fungus. Led to preventative measures such as reduction in plant movement/destruction of infectious plants/reduction in plant/animal movements

The best answers used an example and specifically addressed how the treatments/methods work to help limit the spread, rather than just saying 'use pesticides'

**Sample Answers overleaf**