Student Number _____

Saint Ignatius' College
RIVERVIEW

St Ignatius College Riverview - Faculty of Science

2022 | TRIAL EXAMINATION

Biology

General Instructions

- Reading time – 5 minutes.
- Working time – 3 hours.
- Write using black pen.
- Draw diagrams using pencil.
- For questions in Section II, show all relevant working in questions involving calculations.
- NESA approved calculators may be used.

Total marks: 100

Section I – 20 marks (pages 2 – 11)

- Attempt questions 1 – 20.
- Allow about 35 minutes for this section.

Section II – 80 marks (pages 12 – 38)

- Attempt questions 21 – 33
- Allow about 2 hours and 25 minutes for this section.

Student Number _____

Section I – 20 marks

Attempt Questions 1-20

Allow about 35 minutes for this section

Use the multiple-choice answer sheet.

Select the alternative A, B, C or D that best answers the question. Fill in the response oval completely.

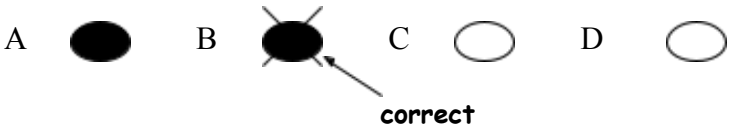
Sample: 2 + 4 = (A) 2 (B) 6 (C) 8 (D) 9



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



If you change your mind and have crossed out what you consider to be the correct answer, then indicate the correct answer by writing the word **correct** and drawing an arrow as follows.



Student Number _____

1. Identify which of the following are non-cellular pathogens.

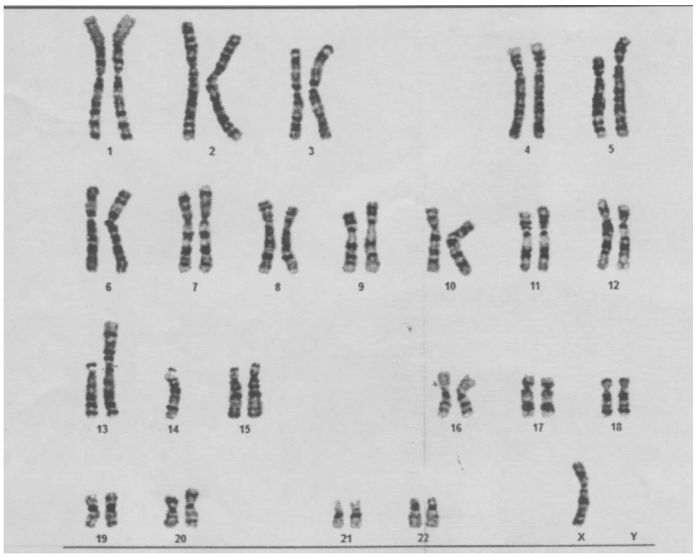
(A) Bacteria and protozoa

(B) Bacteria and fungi

(C) Protozoa and Prion

(D) Virus and Prion

The image below shows a human karyotype.



2. What type of mutation could create this karyotype?

(A) Point mutation

(B) Frame shift mutation

(C) Chromosome mutation

(D) Recombinant DNA

3. Which one of the following is the source of FSH in the menstrual cycle?

(A) placenta

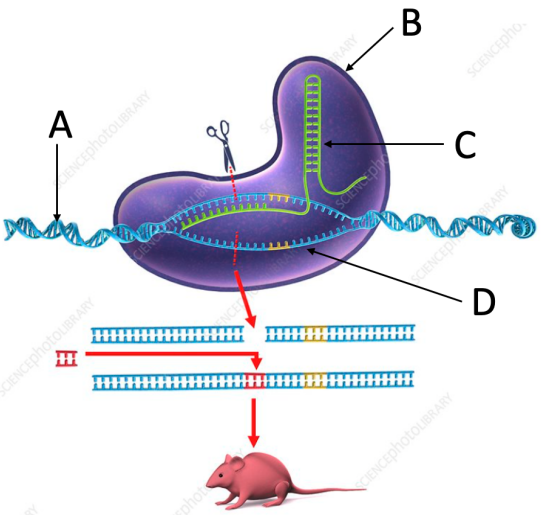
(B) pituitary

(C) corpus luteum

(D) hypothalamus

Student Number _____

4. The diagram below represents the action of the CRISPR-Cas9 gene editing tool.



What is the purpose of CRISPR in this diagram?

(A) To remove C from A

(B) To untwist A to initiate protein synthesis

(C) To use C to remove a section of DNA

(D) To insert C into A

5. A germ-line mutation is one which:

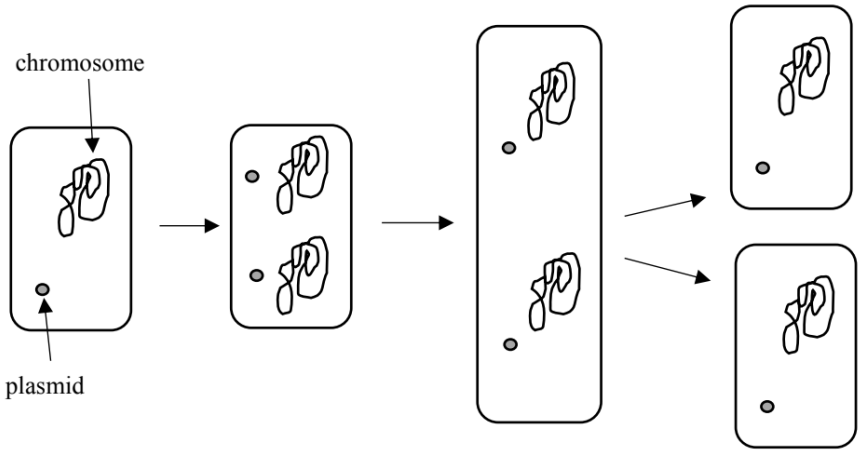
(A) is acquired from a virus.

(B) affects somatic cells

(C) affects sex cells

(D) changes the virulence of a pathogen.

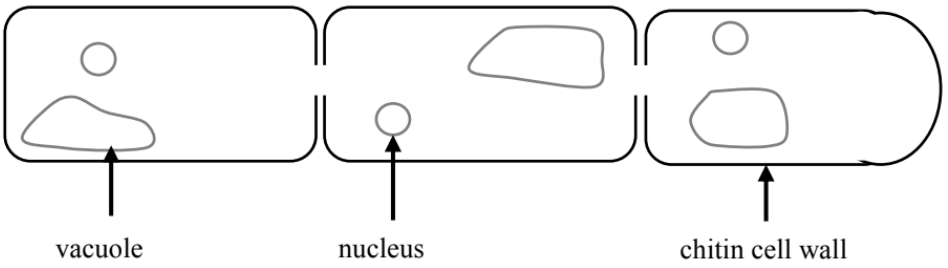
6. The diagram below represents a type of asexual reproduction.



Which one of the following correctly names this process?

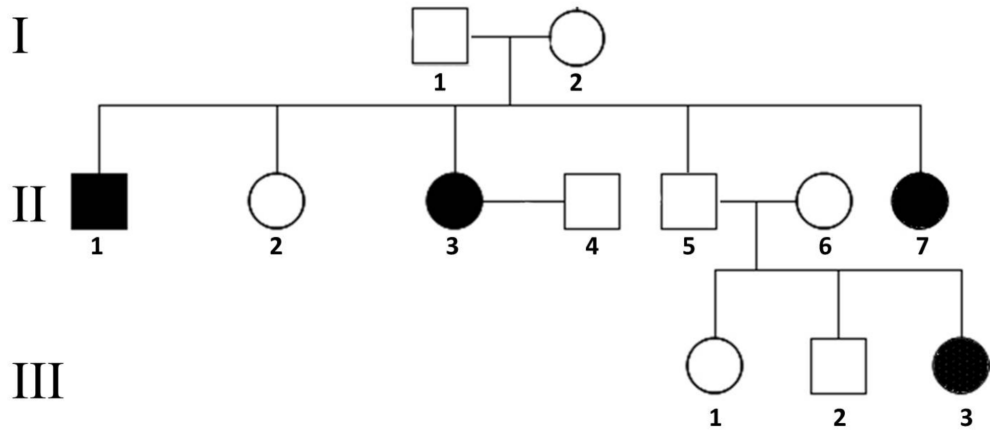
(A) binary fission in bacteria
(B) budding in bacteria
(C) binary fission in protists
(D) budding in protists

7. Identify the type of pathogen shown below:



(A) bacterium
(B) virus
(C) fungus
(D) prion

Questions 8 and 9 refer to the pedigree below, which shows the inheritance of a genetic condition (represented by shading) through four generations of a family.



8. Which statement below best classifies this condition?

(A) sex-linked, recessive.

(B) autosomal, recessive.

(C) sex-linked, dominant.

(D) autosomal, dominant.

9. If individuals III 3 has a child with a heterozygous partner, what is the chance that their child would have the genetic condition?

(A) 0%

(B) 25%

(C) 50%

(D) 100%

10. The table below compares the prevalence of Dementia in men and women by age group.

Age group	Prevalence of Dementia (%)	
	Males	Females
65-69	1.5	1.0
70-74	3.1	2.4
75-79	5.1	6.5
80-84	10.2	13.3
85-89	16.7	22.2
90-94	27.5	29.6
95+	30.0	34.4

Source: *Dementia UK - The Full Report; Alzheimers Society, 2007*

If a very large group of men and women, without Dementia, in the 70 -74 age group were to be followed until the age of 89 (assuming all survived to that age) which one of the following would you expect from these data?

(A) More men than women would have developed Dementia.

(B) More women than men would have developed Dementia.

(C) Dementia rates for each gender would be the same.

(D) Impossible to predict from these data.

11. An antigen is:

(A) something which stimulates an immune response.

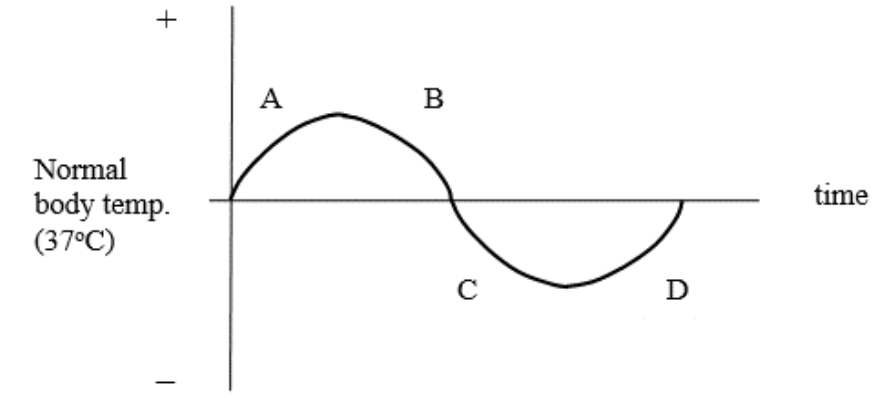
(B) a protein which combats a specific pathogen.

(C) a mechanism which detects whether a foreign body is ‘self or non-self’.

(D) a chemical which targets foreign cells within the body.

Student Number _____

Questions 12 and 13 refer to the graph below, which shows how body temperature varies in humans.



12. Which letter represents a time at which a human would most likely be shivering?

(A) A

(B) B

(C) C

(D) D

13. Which letter(s) represent a time at which a negative feedback response would be underway?

(A) A

(B) B

(C) B & C

(D) B & D

14. Which of the following techniques would produce the least genetic diversity?

(A) whole organism cloning

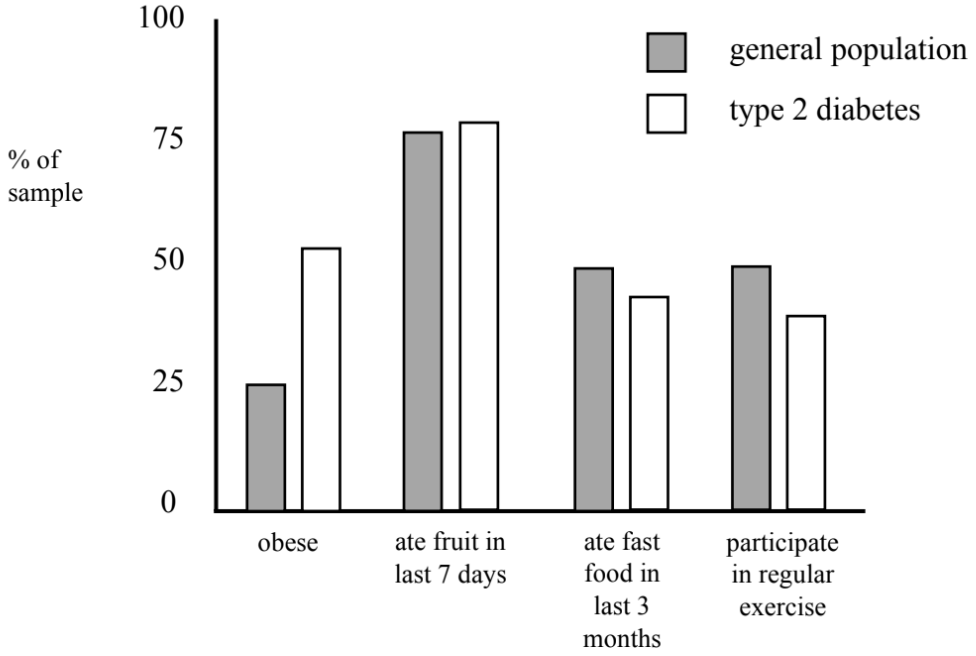
(B) hybridisation

(C) selective breeding

(D) artificial insemination

Student Number _____

Questions 15 and 16 refer to the graph below, which compares some lifestyle factors for Australian adults with Type 2 diabetes and the general adult population.



Source: *Roy Morgan Single Source (Australia), July 2014 – June 2015 (n=51,371).* ***Base:*** *Australians 18+*

15. From the data above, which factor has the greatest influence on development of Type 2 diabetes?

(A) obesity

(B) consumption of fruit

(C) consumption of fast food

(D) exercise

16. Type 2 diabetes develops as the cells of the body become insensitive to insulin.

Which substance would build up in the blood as a result?

(A) fat

(B) urea

(C) glycogen

(D) glucose

17. Which one of the following cells is part of the innate immune response?

(A) B lymphocyte

(B) Helper T lymphocyte

(C) Killer T lymphocyte

(D) Phagocyte

18. Tetanus is a disease caused by the *Clostridium* bacterium.

The bacteria infect a wound and produce a toxin which targets the nervous system, causing severe muscle spasms.

The best way to treat someone who has tetanus would be to target the pathogen through:

(A) vaccination

(B) antitoxin

(C) antivirals

(D) antibiotics

Student Number _____

19. The sequence of bases below is from the coding strand of a molecule of DNA.

CATCGTAGTAGTAGTAGTACCAGC

How many amino acids could this section of DNA potentially code for?

(A) 24

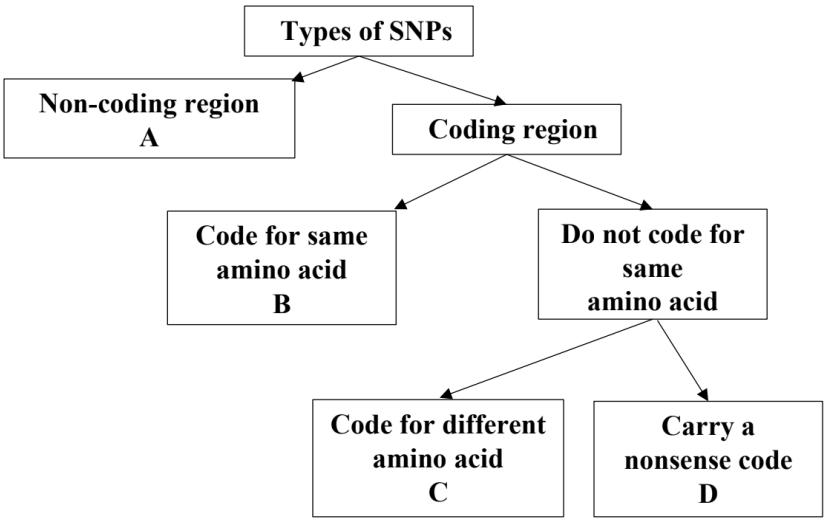
(B) 12

(C) 8

(D) 4

20. Single Nucleotide Polymorphisms are very common within the Human Genome.

They can occur in many different locations.



Which type of SNP would be most likely to affect the phenotype?

(A) A

(B) B

(C) C

(D) D

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Student Number _____

Saint Ignatius' College
RIVERVIEW

St Ignatius College Riverview - Faculty of Science

2022 | TRIAL EXAMINATION

Biology

Section II
Answer Booklet

80 marks

Attempt Questions 21 – 33

Allow about 2 hours and 25 minutes for this part

Instructions

- Answer the questions in the spaces provided. These spaces provide guidance for the expected length of response.
- Show all relevant working in questions involving calculations.
- Extra writing space is provided at the back of this booklet. If you use this space, clearly indicate which questions you are answering.

Student Number _____

Question 21 (5 marks)

(a) Identify a function of the kidney **1**

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(b) Describe a technology that is used to artificially perform the role of the kidney and identify a disadvantage of this process. **4**

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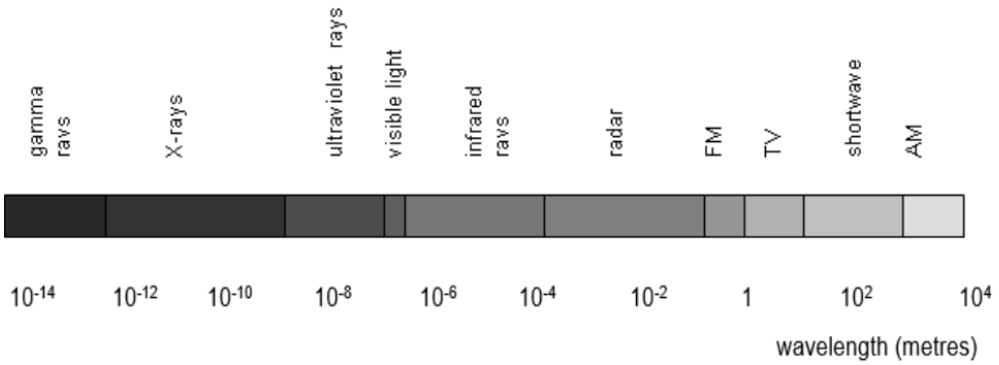
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Question 22 (6 marks)

The diagram below shows the electromagnetic spectrum.



(a) Describe how ONE of the types of electromagnetic radiation shown above is able to cause mutation. **3**

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(b) Explain the role of mutation in evolution. **3**

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Student Number _____

Question 23 (10 marks)

Read the information below about snake venom and snake bite.

Venomous snakes attack their prey and defend themselves by injecting a protein-based toxin into their victim.



Eastern Brown snake

Kingdom:	Animalia
Phylum:	Chordata
Class:	Reptilia
Order:	Squamata
Suborder:	Serpentes
Family:	Elapidae
Genus:	*Pseudonaja*
Species:	***P. textilis***



King Brown snake

Kingdom:	Animalia
Phylum:	Chordata
Class:	Reptilia
Order:	Squamata
Suborder:	Serpentes
Family:	Elapidae
Genus:	*Pseudechis*
Species:	***P. australis***



Red Bellied Black snake

Kingdom:	Animalia
Phylum:	Chordata
Class:	Reptilia
Order:	Squamata
Suborder:	Serpentes
Family:	Elapidae
Genus:	*Pseudechis*
Species:	***P. porphyriacus***

Most venomous Australian snakes belong to the family Elapidae, and while some are more toxic than others, their toxins are chemically very similar.

Question 23 continued

(a) Why would immunity generally extend to the venom of snakes of the same family, but not to those of other families? **3**

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Question 23 (continued)

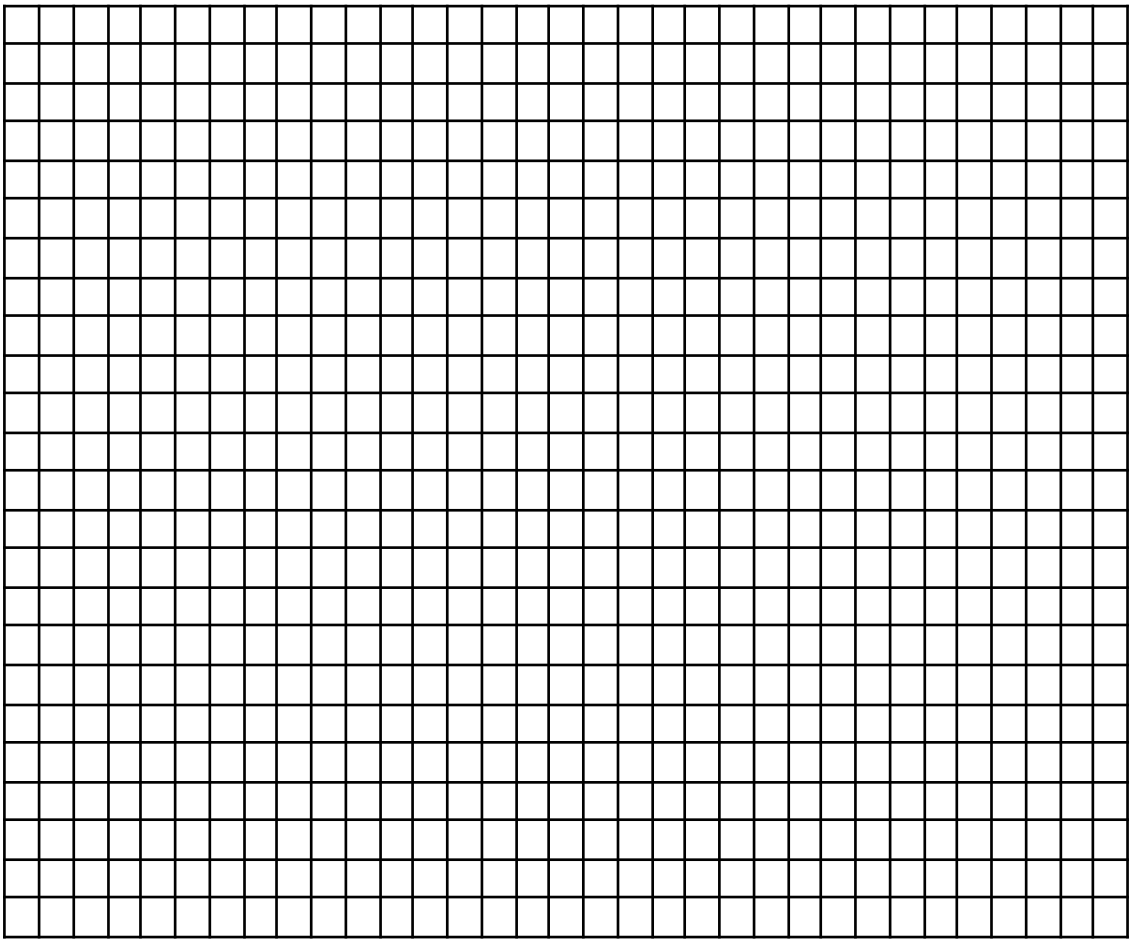
Snake bite is a major cause of death and disease in many parts of the world.

The data below have been extracted and simplified from *Kasturiratne et al. 2008. The Global Burden of Snakebite.*

Region	Estimated snake bite deaths in 2007	
	Total deaths	Deaths per 100,000
Central Asia	29	0.037
South Asia	33,666	2.175
South-East Asia	19,094	3.245
Australasia	4	0.016
North America	7	0.002
Caribbean	1,161	2.983
Sub-Saharan West Africa	18,654	5.909
Western Europe	45	0.011

Question 23 (continued)

(b) Use the table on p18 to draw a graph of Deaths per 100,000 from snakebite by region. **3**



Question 23 (continued)

(c) Explain why it is more useful to report deaths / 100,000 of population, rather than total deaths in a study like this. **2**

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(d) Justify TWO reasons for some of the differences shown in your graph. **2**

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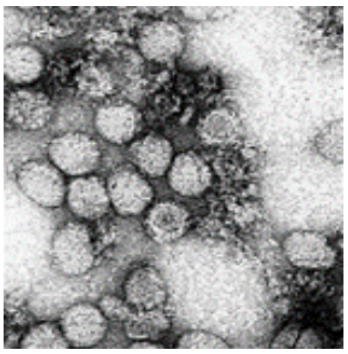
Student Number _____

Question 24 (7 marks)

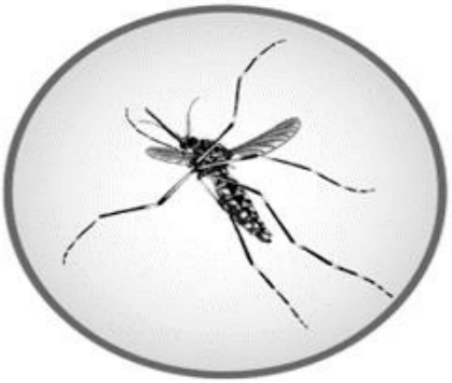
Yellow fever is a disease which is endemic to parts of Africa and South America. It is caused by a virus of the genus *Flavivirus*.

The virus is transmitted by mosquitoes of the genus *Aedes*.

Yellow fever can infect both humans and non-human primates (monkeys and apes).



Flavivirus



Aedes mosquito

The World Health Organisation estimates that there are about 200,000 cases of Yellow fever worldwide each year. About 30,000 of these cases develop into a severe version of the disease and about 15,000 people die.

A very effective vaccine is available for yellow fever.

(a) Identify the pathogen and vector of this disease **1**

Pathogen ……. Vector ……

(b) Explain how the vaccinated will protect those that can't be vaccinated **3**

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Question 24 (continued)

(c) Justify TWO public health measures (other than vaccination) which could be used to reduce transmission of the virus in countries where the disease is endemic. **3**

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Question 25 (6 marks)

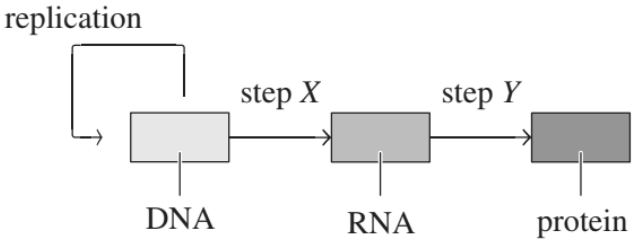
Construct a table to compare both the process and products of meiosis and mitosis. **6**

Student Number _____

Question 26 (9 marks)

(a) Draw a labelled drawing of a single nucleotide below. **2**

The diagram shows a simplified overview of polypeptide synthesis.



(b) Identify steps X and Y and describe what occurs during these stages. **7**

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Question 26 (continued)

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Student Number _____

Question 27 (4 marks)

Explain the need for a named example of a biotechnology and how it can affect genetic diversity and biodiversity. **4**

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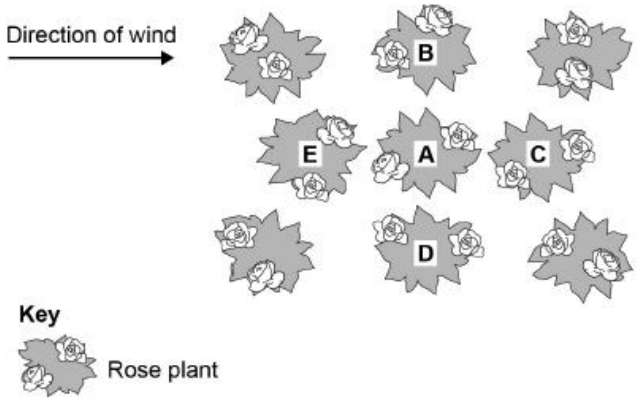
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Question 28 (4 marks)
The image below shows a plan of a garden containing rose plants.



Plant A has the fungal disease rose black spot.

a) Identify which plant you would expect to catch the disease first and describe why (2 marks) **2**

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Question 28 (continued)

b) Suggest TWO ways the gardener could reduce the spread of rose black spot to the other plants in the garden. (2 marks) **2**

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Question 29 (5 marks)

Complete the table below to compare internal and external fertilisation in named examples of animals. **5**

	Internal fertilisation	External fertilisation
Example of animal		
Way in which meeting of gametes is ensured.		
Site of fertilisation		
Relative number of offspring.		
Site of development of embryo		

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Question 30 (8 marks)

A link between high levels of cholesterol in the blood and coronary heart disease has long been recognised by doctors.

The Scandinavian Simvastatin Survival Study (4S) followed a group of 4444 people with high levels of blood cholesterol who were all on cholesterol lowering diets.

The patients were randomly divided into two equal sized groups. One group was treated with a medication containing the cholesterol lowering drug Simvastatin, while the other received a placebo – an identical treatment, but without Simvastatin. Patients were not aware of which group they were in.

The health of the patients was then closely monitored, and the table below shows some of the data obtained after six years.

	Simvastatin Group (2222 patients)	Placebo Group (2222 patients)
Patients who had 1 or more major cardiac events	431 (19%)	622 (28%)
Patients who died from cardiac arrest	111 (5%)	189 (8.5%)
Patients who died from non-cardio-vascular causes.	46 (…….)	49 (…….)

Information taken from: Randomised trial of cholesterol lowering in 4444 patients with coronary heart disease: the Scandinavian Simvastatin Survival Study (4S). Lancet. 1994 Nov 19;344(8934):1383-9. PMID: 7968073.

(a) i. Calculate the missing percentages in the table above. **1**

ii. Explain why a placebo group is necessary in this study. **2**

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Question 30 (a) (continued)

iii. Analyse the results shown in the table. **5**

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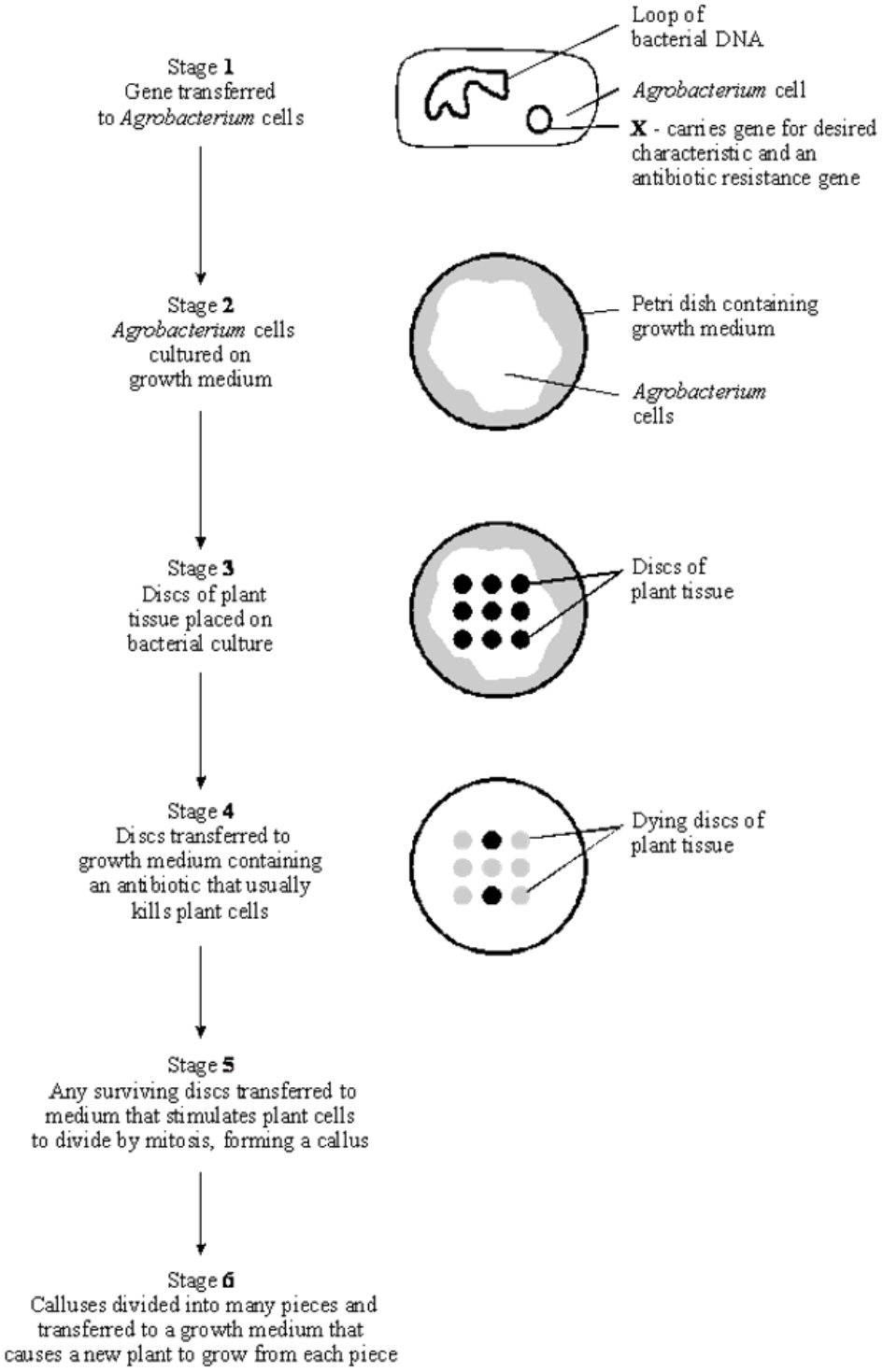
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Question 31 (7 marks)

Agrobacterium is a bacterium used in genetic engineering of plants.
The diagram shows stages in the transfer of a gene into a plant.



a.) Name structure X in stage 1 (1 mark) **1**

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Question 31 (continued)

b) In stage 2, suggest why the bacteria are cultured before the plant tissue is added. (2 marks) **2**

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c) In stage 4, explain why the growth medium contains an antibiotic. (2 marks) **2**

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d) Suggest reasons why stage 6 is necessary for the commercial production of genetically engineered plants. (2 marks) **2**

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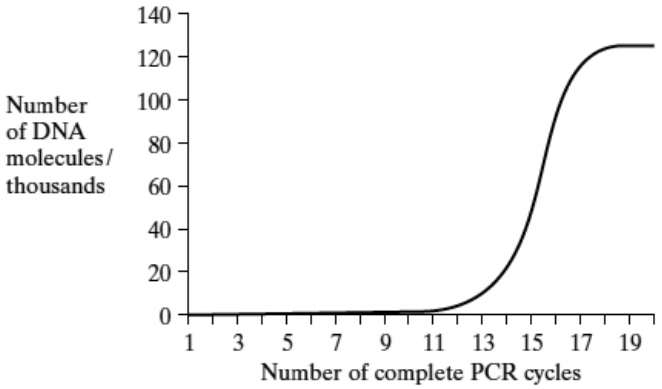
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Student Number _____

Question 32 (3 marks)

The graph shows the number of DNA molecules made using PCR, starting with one molecule.



Explain the shape of the curve from cycles 1- 20 (3 marks) **3**

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Question 33 (6 marks)

Assess the contributions of Louis Pasteur and Robert Koch to the development of our knowledge about the causes and transmission of COVID-19. **6**

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Student Number _____

Section II extra writing space.

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Student Number _____

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Student Number _____

2022

TRIAL EXAMINATION

Biology

Multiple Choice Answer Sheet

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