

Student number: \_\_\_\_\_



# PENRITH SELECTIVE HIGH SCHOOL

## 2020

**PART  
A -**

### **General Instructions**

- Reading time – 10 minutes
- Exam time – 3 hrs
- Board-approved calculators may be used
- Write using **blue or black** pen
- Answers written in pencil may be disqualified from review

### ***Multiple Choice (20)***

- Attempt Questions 1 – 20
- Allow about 30 minutes for this part
- Use the multiple choice answer sheet found at the end of this paper
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### **PART B - *Free Response Questions (80)***

- Attempt Questions 16 – 34

**TOTAL MARKS**

**/100**

# **TRIAL EXAMINATION HSC BIOLOGY**

**THIS EXAM PAPER MUST BE SUBMITTED AT THE END OF THE EXAMINATION**

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## PART A – MULTIPLE CHOICE QUESTIONS

Attempt Questions 1-20

Allow about 30 minutes for this part

Use the multiple-choice answer sheet for questions 1-20

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### Question 1

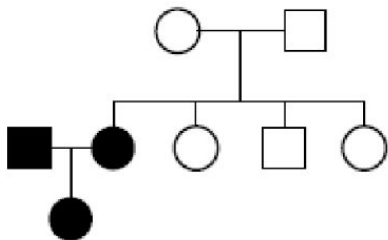
Which of the following options does not correctly match the term with the definition?

- (A) Birth            The emergence of the new individual from the body of its parent
- (B) Pregnancy      Carrying a developing embryo or foetus within the body
- (C) Fertilisation    Fusion of male and female gametes
- (D) Implantation   Release of the egg from the ovary

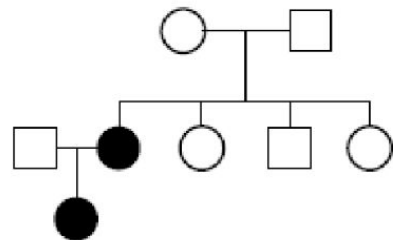
### Question 2

Which pedigree represents an X-linked dominant trait?

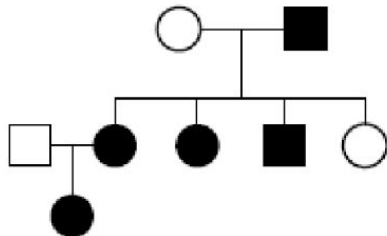
A.



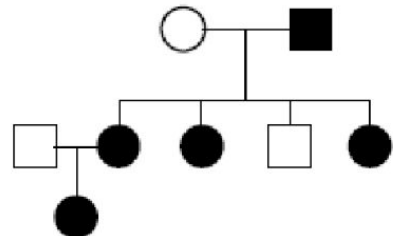
B.



C.



D.



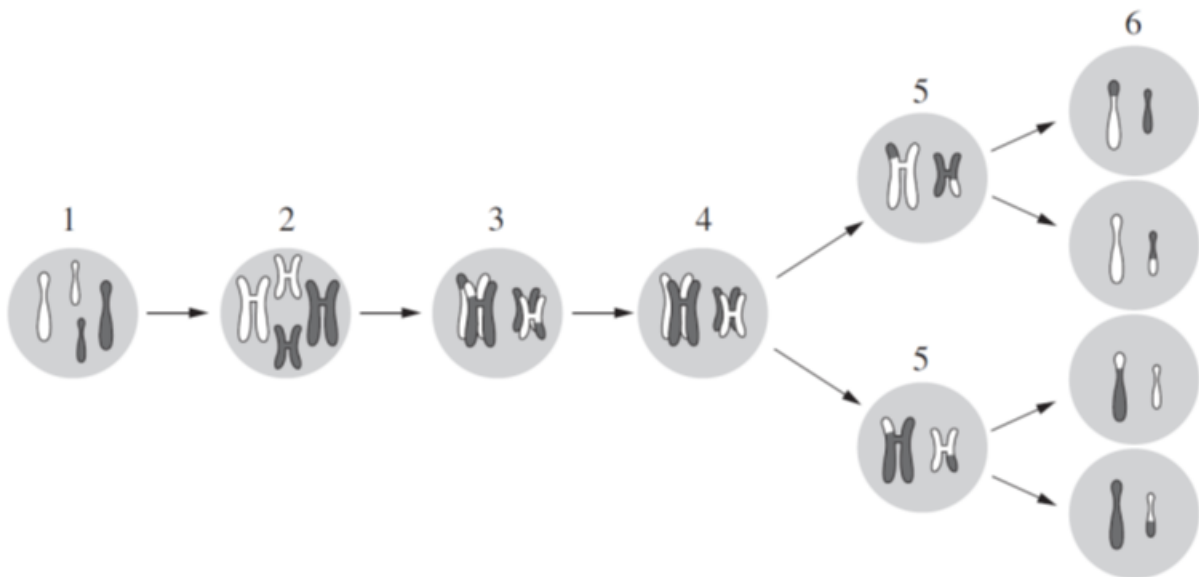
### Question 3

Like mammals, the fruit fly *Drosophila* has an XY systems of sex determination. *Drosophila* usually have large, round eyes, but a dominant allele at the Bar gene on the X chromosome causes small, narrow eyes, called “Bar eyes”. If a male with Bar eyes is crossed with a female with normal eyes, then

- (A) Half of the female offspring will have Bar eyes but none of the males
- (B) Half of the male offspring will have Bar eyes but none of the females
- (C) All of the male and female offspring will have Bar eyes
- (D) All of the female offspring will have Bar eyes but none of the males

### Question 4

A student constructed a model of meiosis as shown. However, there is an error in the model.



Which aspect of this model does NOT fit with observations of meiosis?

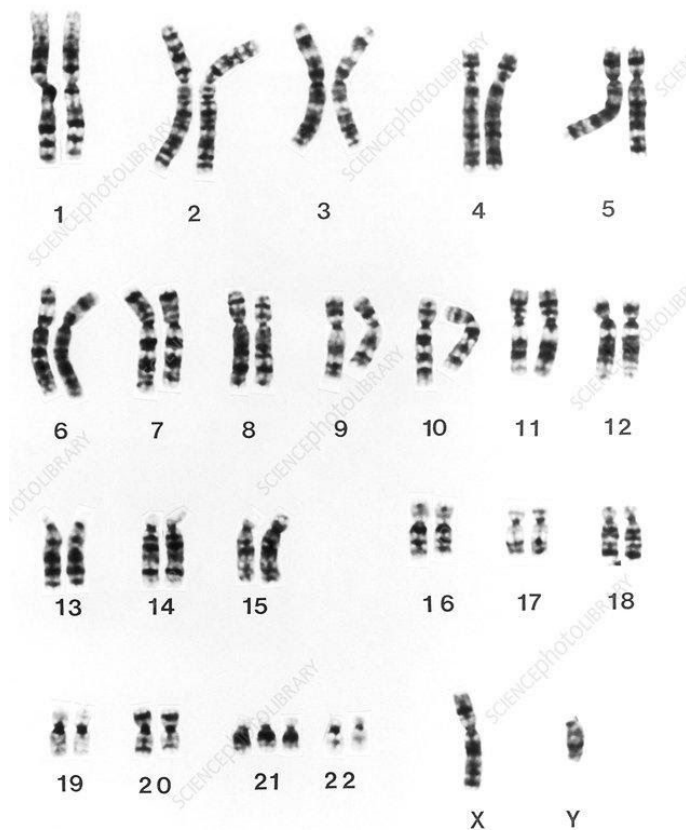
- (A) Separation of chromatids has not been shown in the model
- (B) The chromosomes have not independently assorted in stage 2
- (C) The chromosomes in stage 4 should have been duplicated before stage 5
- (D) The chromosomes have undergone crossing over before sister chromosome alignment in stage 3

**Question 5**

In a developing embryo, tissues such as muscle and nerve are produced by

- (A) Somatic cells dividing by meiosis
- (B) Germline cells dividing by meiosis
- (C) Somatic cells dividing by mitosis
- (D) Germline cells dividing by mitosis

**Question 6**



What type of mutation is shown in the karyotype above?

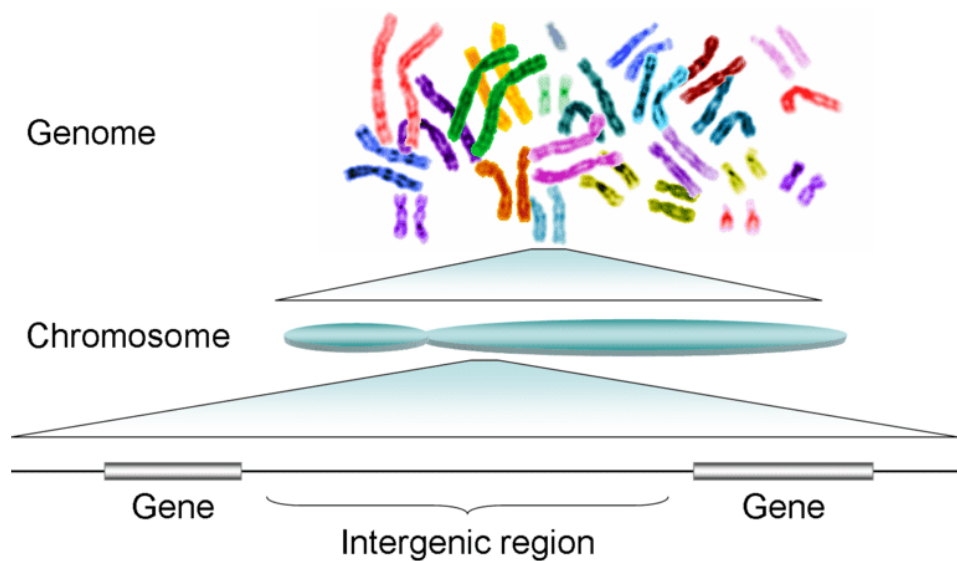
- (A) Point mutation
- (B) Block mutation
- (C) Chromosomal mutation
- (D) Germinal mutation

**Question 7**

The following definition - “*The deliberate introduction of sperm into a female's cervix or uterine cavity for the purpose of achieving a pregnancy through in vivo fertilization by means other than sexual intercourse*”, refers to

- (A) Artificial pollination
- (B) Cloning
- (C) Biotechnology
- (D) Artificial insemination

**Question 8**



The intergenic region shown contains

- (A) RNA
- (B) Alleles
- (C) Non-coding DNA
- (D) Introns

**Question 9**

Mutagens can be defined as

- (A) Any agent capable of altering the genetic constitution of a cell by changing the structure of the hereditary material, deoxyribonucleic acid (DNA).
- (B) Permanent alteration in the DNA sequence that makes up a gene
- (C) A section of DNA that codes for a specific polypeptide
- (D) Codons for which no normal tRNA molecule exists.

**Question 10**

The section of the electromagnetic variation most likely to cause mutation is

- (A) Radio
- (B) Infrared
- (C) Ultra Violet
- (D) Blue light

**Question 11**

What is an antigen?

- (A) Any foreign substances that causes an immune response
- (B) An invading microorganism
- (C) A membrane bound receptor
- (D) A modified bound receptor

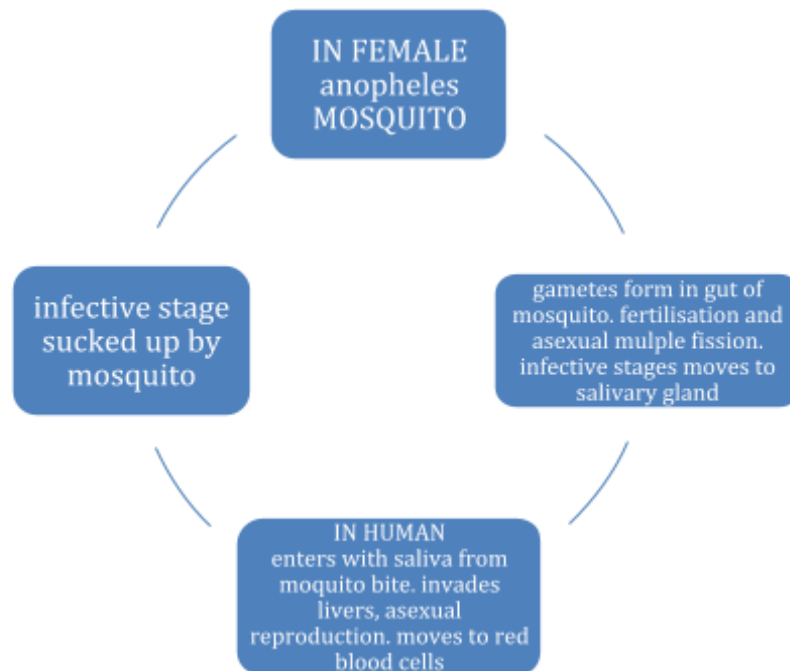
**Question 12**

Which of the following gives the best description of innate immunity?

- (A) Non-specific barriers to prevent entry of a pathogen
- (B) Specific barriers to prevent entry of a macro organism
- (C) Non-specific responses that produce antibodies to fight infection
- (D) Individual factors that fight pathogens

The diagram below is to be used for questions 13 -15

This is a simplified flow chart for the life cycle of the protozoan *plasmodium vivax* that causes malaria in humans



### Question 13

In this disease, what is the vector?

- (A) Mosquito
- (B) *Plasmodium*
- (C) Human
- (D) Both the mosquito and *plasmodium*

### Question 14

Identify the intermediate host

- (A) Mosquito
- (B) *Plasmodium*
- (C) Human
- (D) Both the mosquito and *plasmodium*



**Question 15**

An analysis of the life cycle of the pathogen shows prevention measures for a disease. Which of the following would NOT be a preventative measure for this disease?

- (A) Destroying adult mosquitoes by spraying insecticides
- (B) Draining standing water
- (C) Humans wearing protective clothing and sleeping under mosquito nets
- (D) Removing game animals from infected areas

**Question 16**

Homeostasis of the body is maintained by the

- (A) Positive feedback system
- (B) Negative feedback system
- (C) Enantiostasis
- (A) Stimulus-response pathway

**Question 17**

Non infectious diseases CANNOT be caused by

- (A) Bacteria
- (B) Viruses
- (C) A poor nutrition
- (D) Radiation

**Question 18**

Elephant are predominantly found living in areas categorised by a hot sunny climate. They need to have specific adaptations to successfully regulate their body temperature.

Which of the following IS NOT an example of a behavioural adaptation observed in elephants for thermoregulation?

- (A) Minimising movement and remaining under tall trees for shade

- (B) Swimming to wet the skin
- (C) Flapping the ears to cool down blood
- (D) Vasodilation or vasoconstriction of blood vessels

**Question 19**

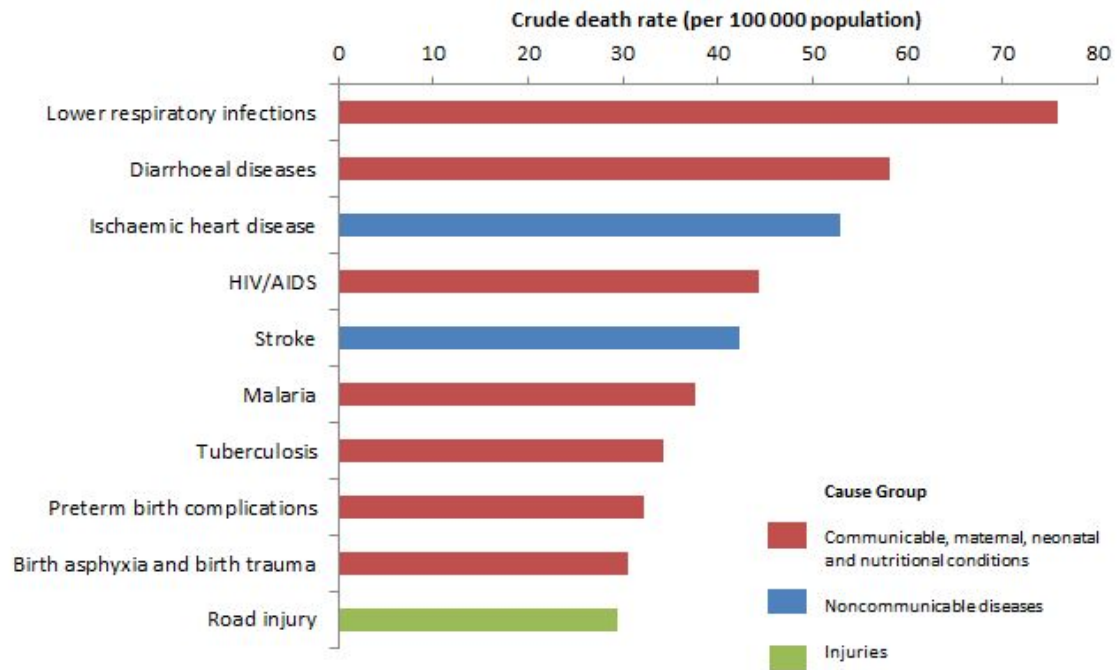
Which statement best explains the mechanism responsible for maintaining water balance in plants?

- (A) Water enters the roots by diffusion and is transported up through the phloem vessel until it reaches the leaves
- (B) Water enters the roots by osmosis and is transported up through the xylem vessel until it reaches the leaves
- (C) Water vapour is exchanged between the leaves and the atmosphere via stomates found on the topside of leaves
- (D) Water vapour is exchanged between the leaves and the atmosphere via stomates found on the underside of leaves

**Question 20**

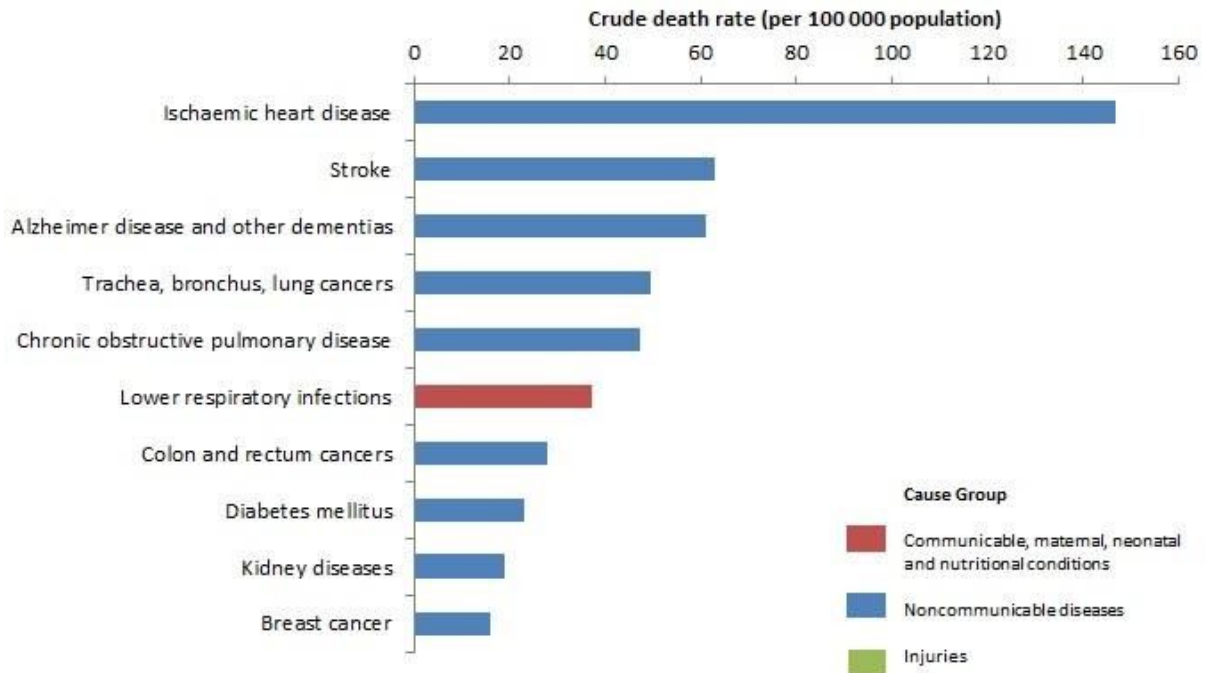
Closely observe the 2 graphs provided by the World Health Organisation to answer question 20.

## Top 10 causes of deaths in low-income countries in 2016



Source: Global Health Estimates 2016: Deaths by Cause, Age, Sex, by Country and by Region, 2000-2016. Geneva, World Health Organization; 2018.  
World Bank list of economies (June 2017), Washington, DC: The World Bank Group; 2017 (<https://datahelpdesk.worldbank.org/knowledgebase/articles/906319-world-bank-country-and-lending-groups>).

## Top 10 causes of deaths in high-income countries in 2016



What can be inferred from the TWO graphs provided? Choose the BEST statement

- (A) Infectious diseases are the leading causes of deaths worldwide
- (B) Deaths in low income countries are caused by infectious diseases due to poor hygiene and healthcare
- (C) Deaths caused by ischemia and strokes are strictly a result of a poor diet
- (D) High income countries experience more deaths caused by infectious diseases

**PART B – FREE RESPONSE QUESTIONS**

Attempt Questions 21 – 34

Allow 2.5 hours for Part B

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**Question 21**

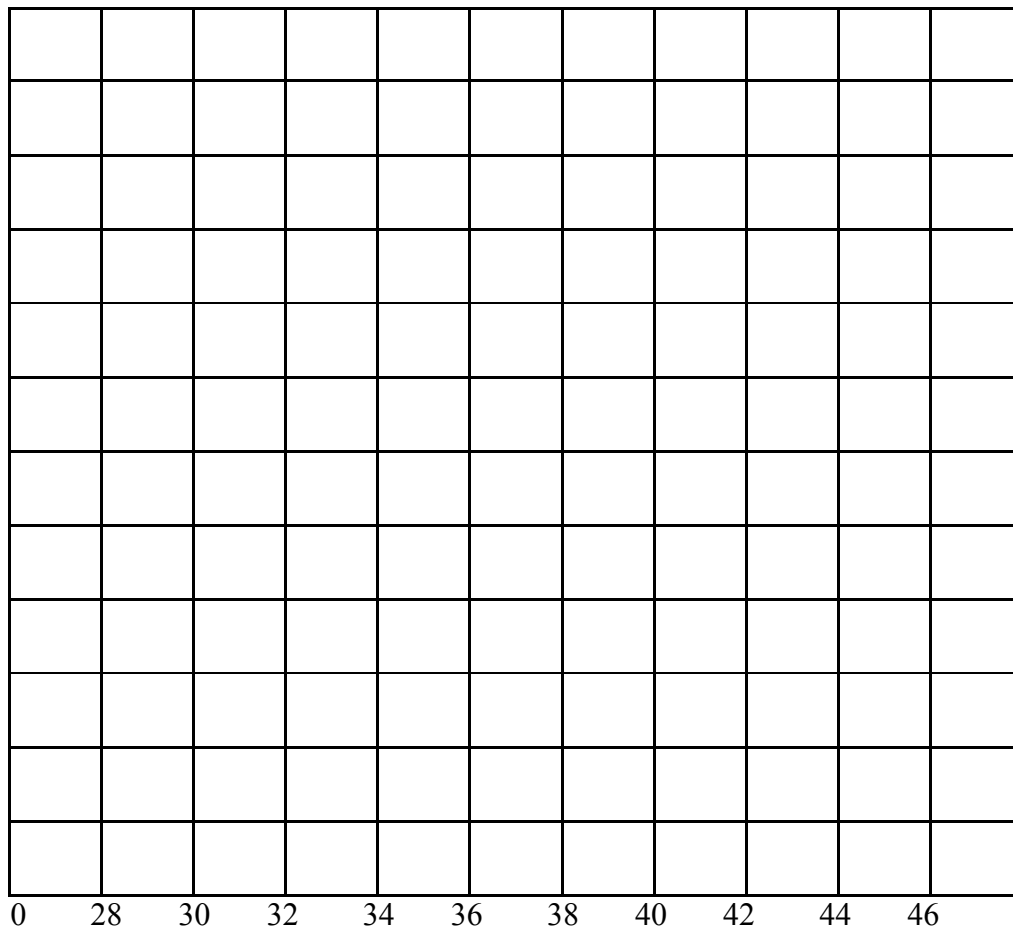
**7 marks**

Data from reproductive clinics can be used to indicate how the age of the women can affect the success rate of IVF.

<b>Age</b>	<b>Birth Rate (own egg) (%)</b>	<b>Birth Rate (donor egg) (%)</b>
28	35	59
30	34	60
32	32	59
34	30	58
36	25	56
38	18	54
40	12	51
42	8	48
44	3	44
46	0	40

- a) For the given data, construct a graph to show how the age of the mother affects the pregnancy rate and birth rate.

3m



Age (in years)

b) Identify the trend in the data. 1m

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c) Explain why older women undergoing IVF are more likely to give birth to a child if donor eggs are utilised. 3m

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**Question 22**

**3 marks**

The ABO blood group of humans is an autosomal trait that has 3 alleles as follows:

- $I^A$  protein A on red blood cells
- $I^B$  protein B on red blood cells
- $i$  no protein on the red blood cells

In this system there are 4 different blood types A, B, AB and O.

In a family of four children, each child has a different blood type with regard to this gene.

Use punnett squares to determine the phenotype and genotype of each parent. 3m

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**Question 23**

**3 marks**

Devil Facial Tumour Disease (DFTD) occurs in Tasmanian devils. A devil that contracts the disease will die within three months of being afflicted.

Samples taken from the tumours of infected devils have shown there are several genes on the second and third chromosome that may be responsible for protein coding associated with cancer risk or immune system function.

Sequencing of the genomes of several devils has shown a number of SNP's that illustrate a low level of genetic diversity in devils from different areas in Tasmania.

There is some evidence that the devils are evolving to become resistant to DFTD, as the number of devils has now stabilised.

Explain the success of modern genetic technologies in assisting scientists in gathering this current information about Tasmanian Devils. 3m

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**Question 24**

**7 marks**

The table below shows the percentage of bases in each of the strands of a DNA molecule

DNA strand	Percentage of each base			
	A	C	G	T
Strand 1	16		21	
Strand 2		21	34	

- a) Complete the table above 2m
- b) Complete the boxes to show the sequence of bases found along the corresponding section of the mRNA and DNA strands 2m

<b>tRNA</b>	<b>AGC</b>	<b>UUC</b>
<b>mRNA</b>		
<b>DNA</b>		

- c) Describe the role of tRNA in the process of translation. 3m

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**Question 25**

**3 marks**

Identical twins, Brian and Steve, were exposed to gamma radiation after an accident in a nuclear reactor.

The radiation caused a mutation in a cell in Brian's skin which led to uncontrolled cell growth. Steve's skin was not affected but a mutation did occur in his testes in a cell which was involved in producing sperm cells.

Compare the outcomes of the mutations for Steve and Brian.

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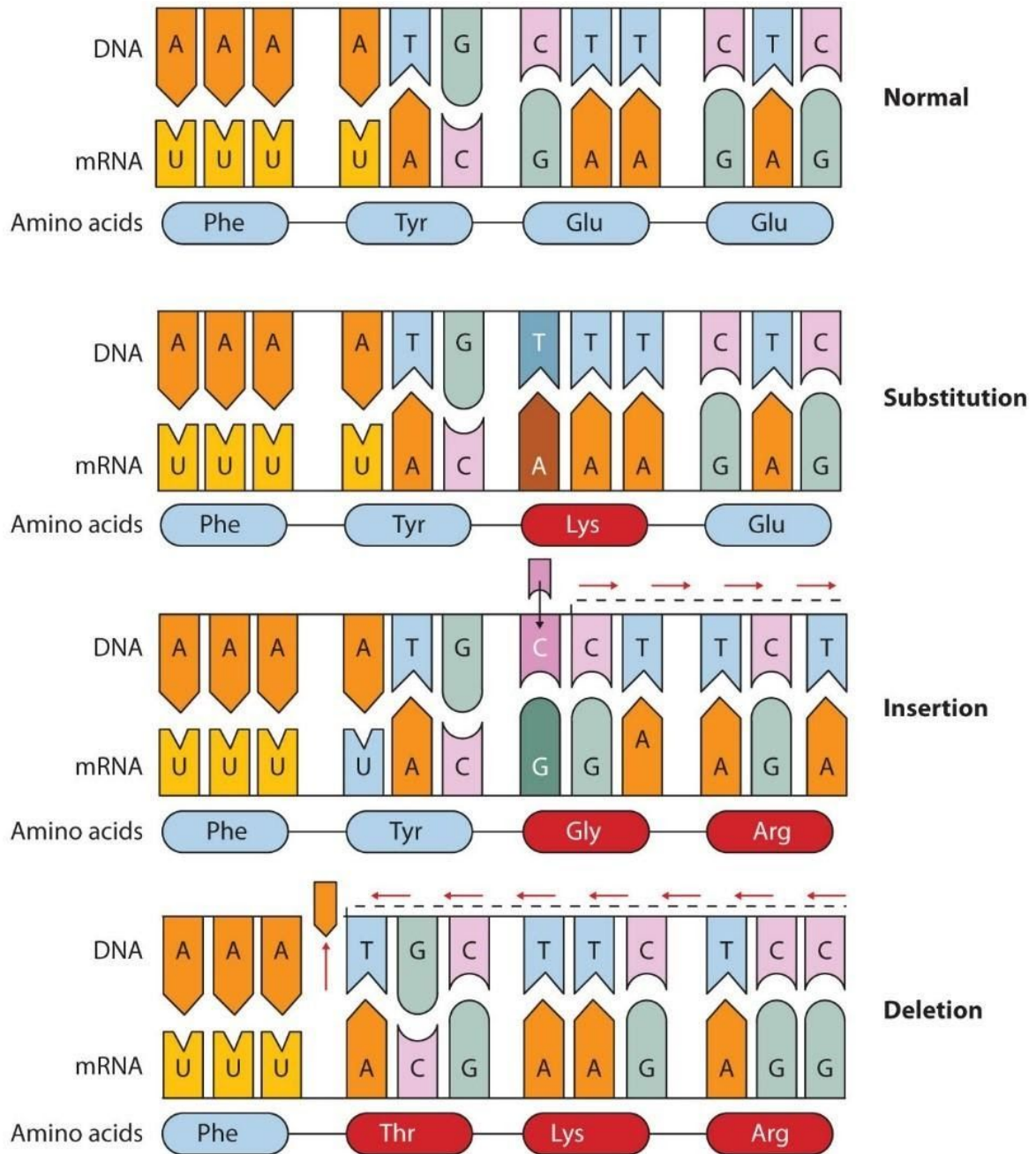
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**Question 26**

**4 marks**

The diagram below shows three types of point mutation.



*Question 26 continued...*

a) Identify which type of mutation does NOT cause a frame shift. 1m

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b) Explain why frame shift mutations are usually more harmful than mutations which do not cause a frame shift. 3m

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Question 28

5 marks

Refer to the figure below to answer the questions that follow. The following information refers to wild bird species that occur on farms

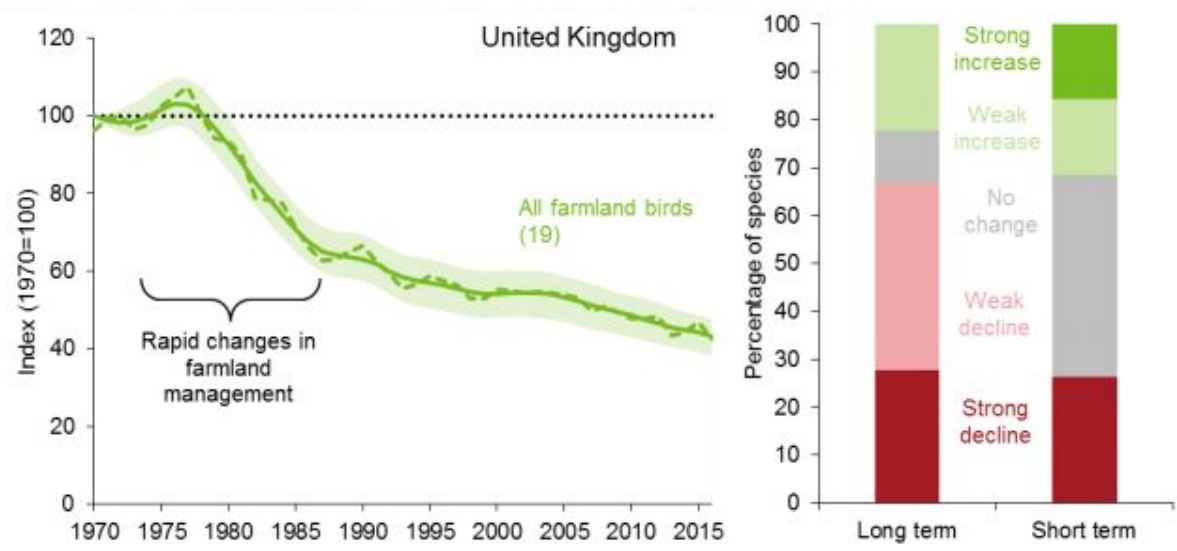


Figure 1. Breeding farmland birds in the UK, 1970 to 2016

Notes:

1. The figure in brackets shows the number of species.
2. The line graph shows the unsmoothed trend (dashed line) and smoothed trend (solid line) with its 95% confidence intervals.
3. The bar chart shows the percentage of species within the indicator that have increased, decreased, or shown no change, based on set thresholds of annual change.

Source: British Trust for Ornithology, Defra, Joint Nature Conservation Committee, Royal Society for the Protection of Birds.

a) Describe the trends and patterns in the data shown. 2m

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b) Explain how the introduction of one named biotechnology in agriculture could have an impact on the biodiversity of farmland birds. 3m

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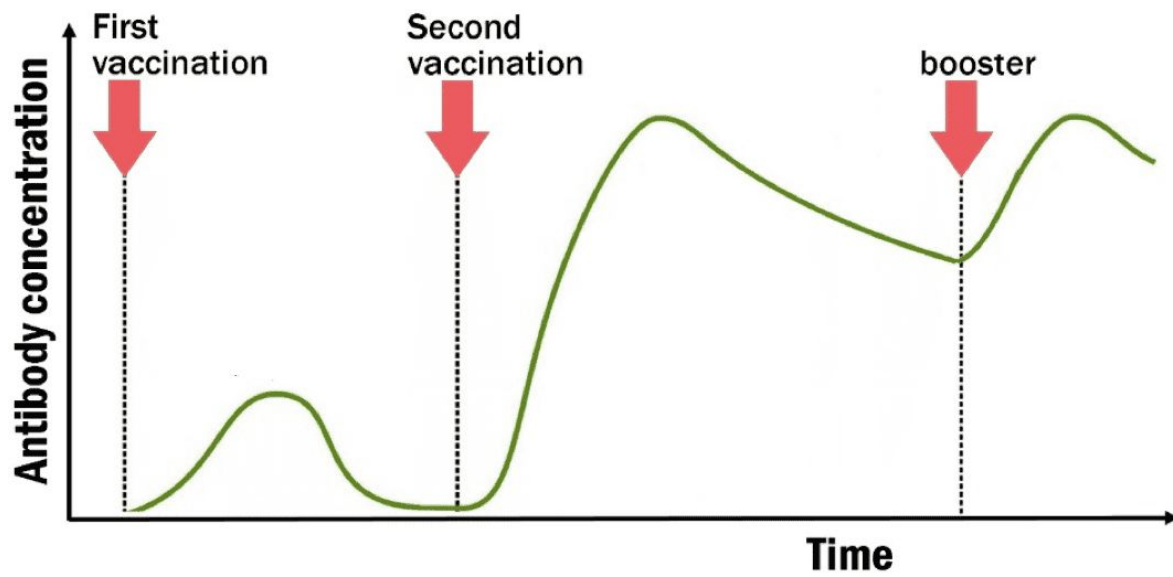
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Question 29

10 marks

The graph below shows the antibody concentration after a vaccination course.



a) Explain how vaccines work against infectious diseases.

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b) There are different types of vaccines developed for different infectious diseases:

- 1 dose vaccinations in an individual's lifetime e.g. chickenpox
- 3 or more doses / booster shots e.g. poliomyelitis at 2, 4 and 6 months and later at age 4.
- Annual vaccinations e.g. influenza

Account for the need for different types of vaccines. 3m

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c) Discuss the implications of low vaccinations rates on the occurrence of preventable diseases. 4m

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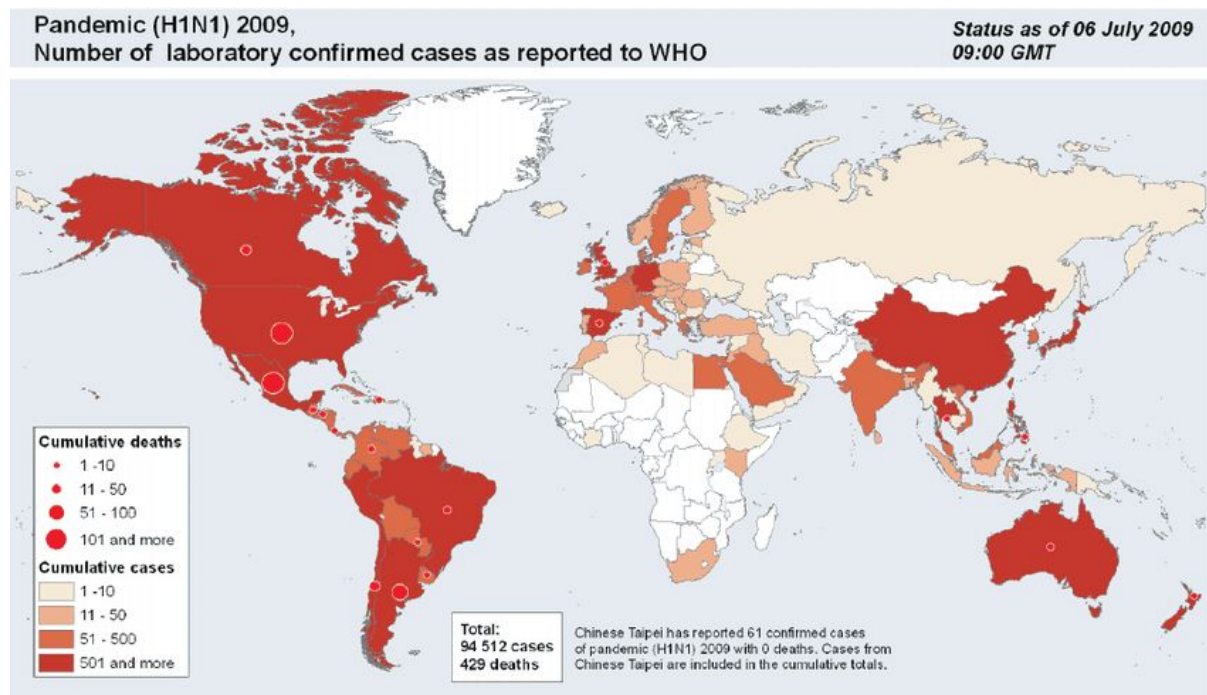
### Question 30

Use the stimulus AND the graph below to answer question 30

Swine flu, also known as the H1N1 virus, is a relatively new strain of an influenza virus that causes symptoms similar to the regular flu. It originated in pigs but is spread primarily from person to person. The World Health Organization (WHO) declared the H1N1 pandemic over in August 2010. Since then, the H1N1 virus has been known as a regular human flu virus. It continues to spread during flu season like other strains of the flu. Swine flu is caused by a strain of influenza virus that usually only infects pigs. Transmission usually occurs from person to person, not animal to person. Swine flu is very contagious. The disease is spread through saliva and mucus particles. The symptoms of swine flu are very much like those of regular influenza.

Below is the global distribution of the H1N1 virus during the 2009 pandemic.

Source: <https://www.healthline.com/health/swine-flu#causes>



a) Identify TWO trends shown in Figure 1. 2m

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b) Explain how ONE procedure could be used to prevent the spread of the disease 3m

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c) Explain how the mode of transmission effects the rate of which an infectious disease spreads throughout a community. Use specific examples, one of which is Swine Flu. 4m

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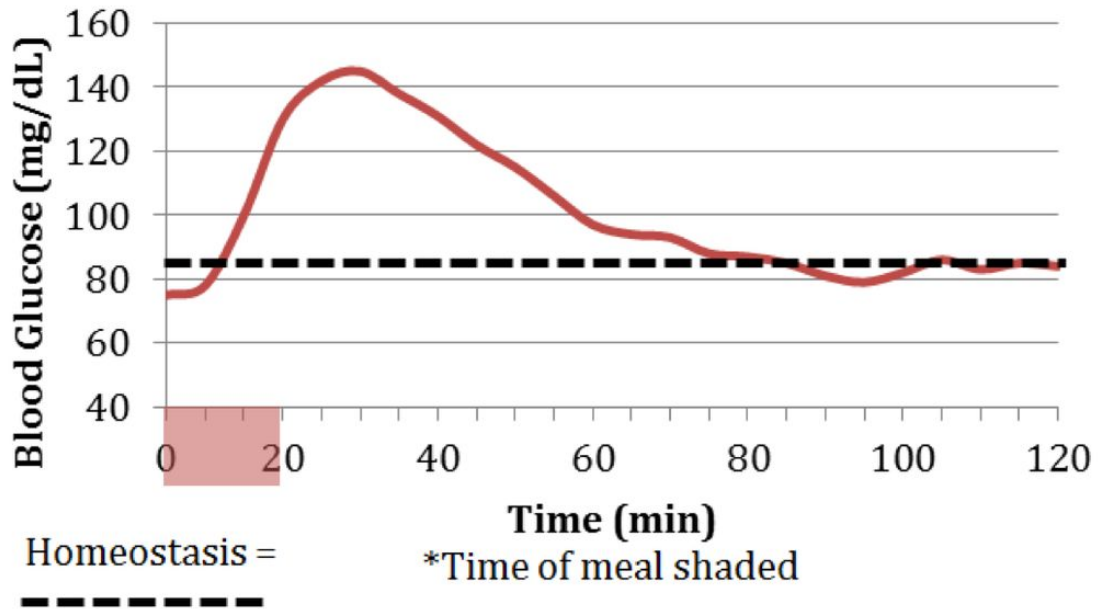
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**Question 31**

**7 marks**

The consumption of food introduces sugar into the body. This can increase the blood sugar level of an individual as shown in the graph below.



a) Define homeostasis. 1m

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b) Outline the role of TWO hormones involved in controlling blood sugar levels. 2m

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c) How many minutes after the meal does it take for the blood sugar level to return to normal? 1m

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- d) Construct a flow diagram to illustrate the negative feedback loop carried out by the body in response to an increase in blood sugar level. 3m

**Question 32**

**3 marks**

Name a plant and outline the mechanisms used to conserve water.

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**Question 33**

**7 marks**

Breast cancer is one of the most common causes of death in women in Australia. It is the abnormal growth of the cells lining the breast lobules or ducts. These cells grow uncontrollably and have the potential to spread to other parts of the body. Both men and women can develop breast cancer, although it is less common in men.

An experimental breast cancer vaccine has been developed by Dr Leisha Emens at the John Hopkins Kimmel Cancer Centre and is currently being tested in clinical trials. Dr Emens understood that breast cancer cells “flew under the radar” of an individual’s immune system. This knowledge is crucial behind the design of the vaccine.

The vaccine has been in clinical trials for patients with advanced disease and initial results have been promising, with tumours decreasing in size. Further research and trials are still underway before the vaccine is available to the public.

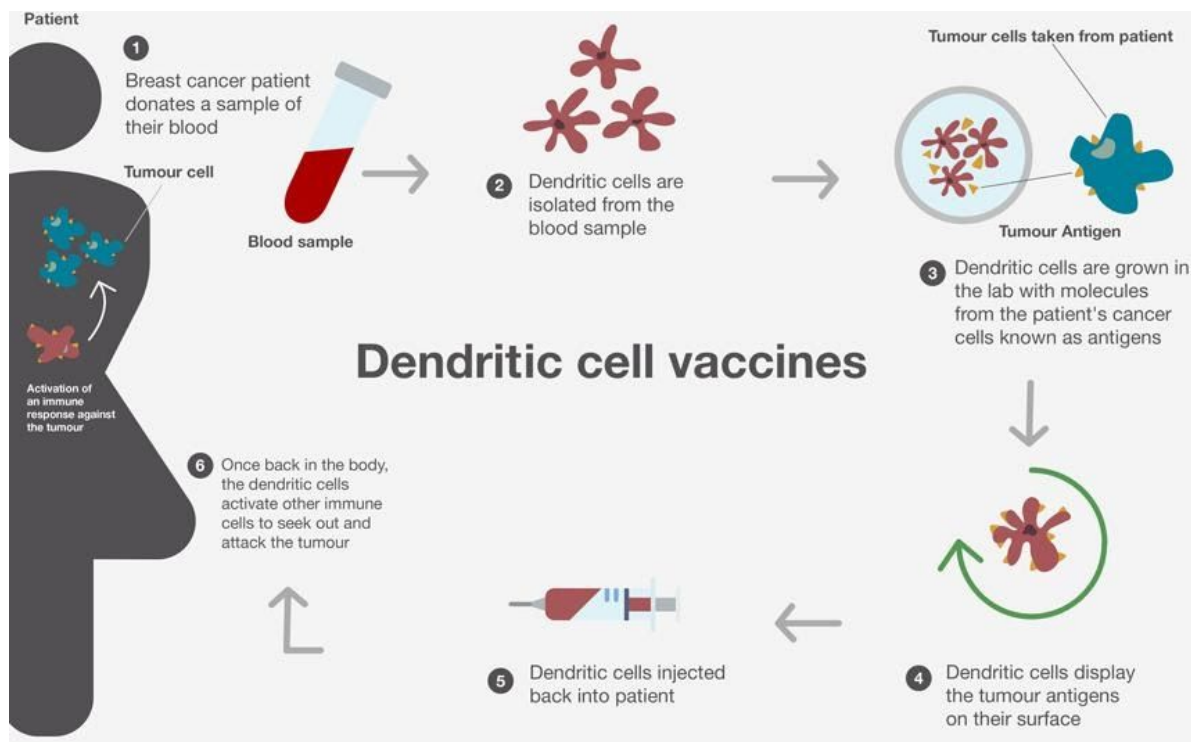


Figure 1. Production of breast cancer vaccines

a) The information above states that breast cancer cells “flew under the radar” of an individual’s immune system. Justify this statement. 2m

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b) Using your own knowledge of the body's immune system and the information provided in figure 1, explain scientifically how the vaccine is designed to trigger an immune response against breast cancer cells in patients. 3m

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c) A number of vaccines have been developed to combat against infectious diseases such as influenza, poliomyelitis, whooping cough etcetera.

Outline TWO differences between vaccines for infectious diseases and vaccines against a non-infectious disease like breast cancer. 2m

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**Question 34**

**4 marks**

Compare the effects that non-infectious and infectious diseases have on society. Provide specific examples to support your response.

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**-END OF EXAMINATION -**

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## PART A – INSTRUCTIONS FOR MULTIPLE CHOICE QUESTIONS

Use the multiple-choice answer sheet provided to answer PART A.

Select the alternative A, B, C or D that best answers the question.

Fill in the response oval completely.

Example  $2 + 4 = ?$

2	6	8	9
<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

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

<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>
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If you change your mind and have crossed out what you consider to be the correct answer, then indicate this by writing the word 'correct' and drawing an arrow as follows:

	correct		
<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>

Student Number: \_\_\_\_\_

### PART A – MCQ ANSWER SHEET

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|-----|-------------------------|-------------------------|-------------------------|-------------------------|
| 1.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 2.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 3.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 4.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 5.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 6.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
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| 8.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 9.  | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 10. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 11. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
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| 13. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 14. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 15. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 16. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 17. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 18. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 19. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |
| 20. | A <input type="radio"/> | B <input type="radio"/> | C <input type="radio"/> | D <input type="radio"/> |