



Student number:

PENRITH SELECTIVE HIGH SCHOOL HSC BIOLOGY TRIAL 2021

General Instructions

- Reading time – 5 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

PART A - *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
-

PART B - *Free Response Questions* (80)

- Attempt Questions 21 – 32

TOTAL MARKS

/100

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

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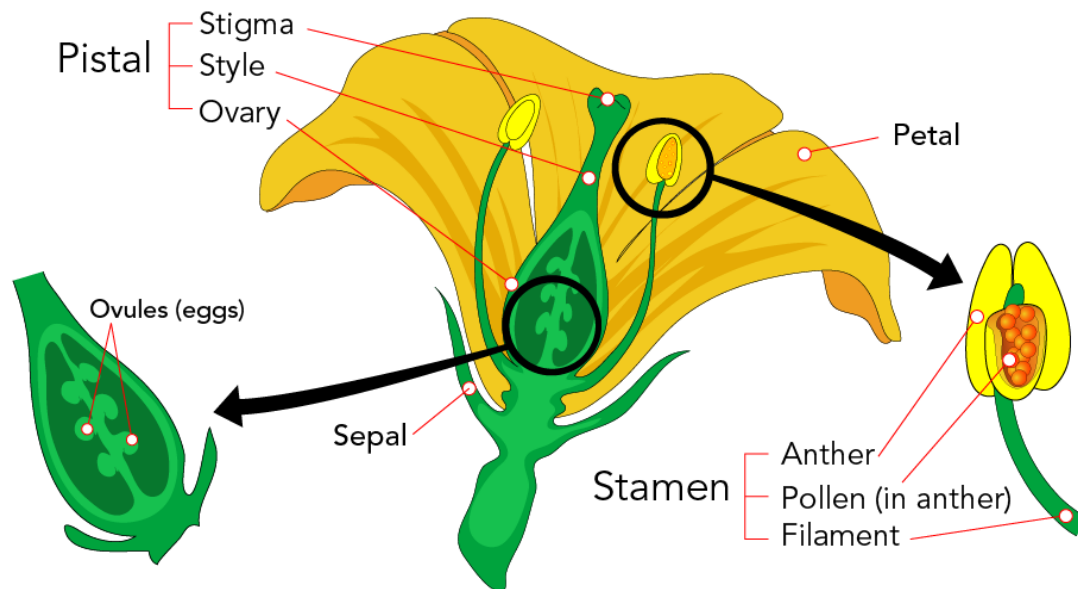
PART A – MULTIPLE CHOICE QUESTIONS

Attempt Questions 1-20

Allow about 30 minutes for this part

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

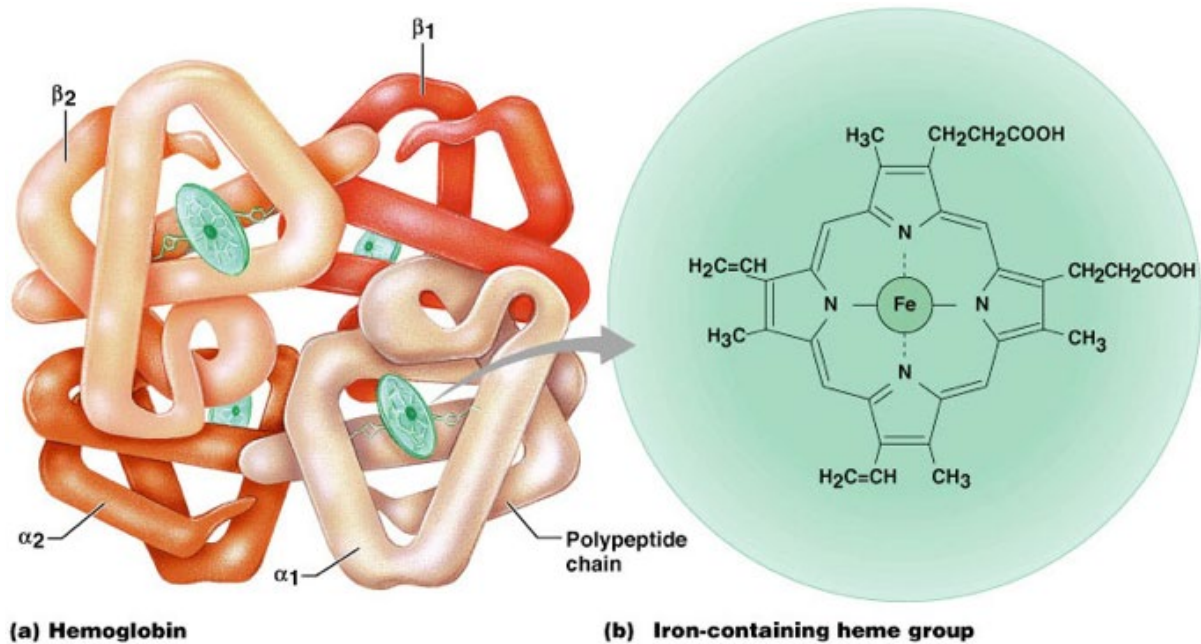
Question 1



Which structure in a flower receives pollen?

- (A) Sepal
- (B) Stigma
- (C) Ovule
- (D) Anther

Question 2

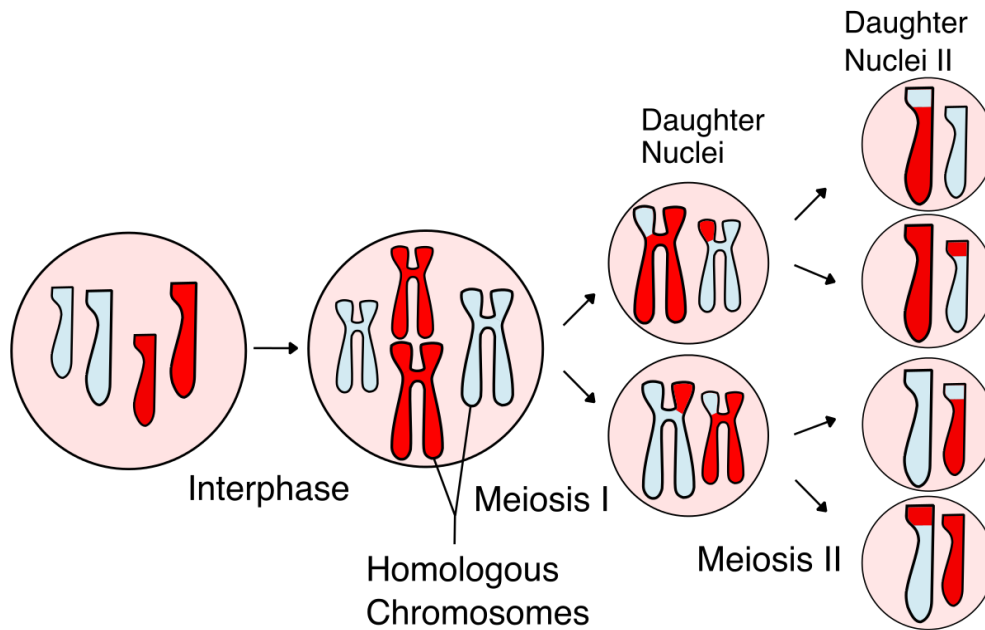


Hemoglobin is a vital protein which transports oxygen attached to heme groups. It has a quaternary structure made up of four polypeptides. The structure of the polypeptide groups is essential to the function of the molecule.

The process of polypeptide synthesis is important because

- (A) It leads to the correct sequence of amino acids in polypeptides and proteins
- (B) Peptide bonds contain a lot of energy
- (C) Hemoglobin is an enzyme
- (D) Structure is always linked to function in Biology

Question 3



In this diagram the process of crossing-over has occurred

- (A) During interphase
- (B) After Meiosis II
- (C) During Meiosis I
- (D) After cytokinesis

Question 4

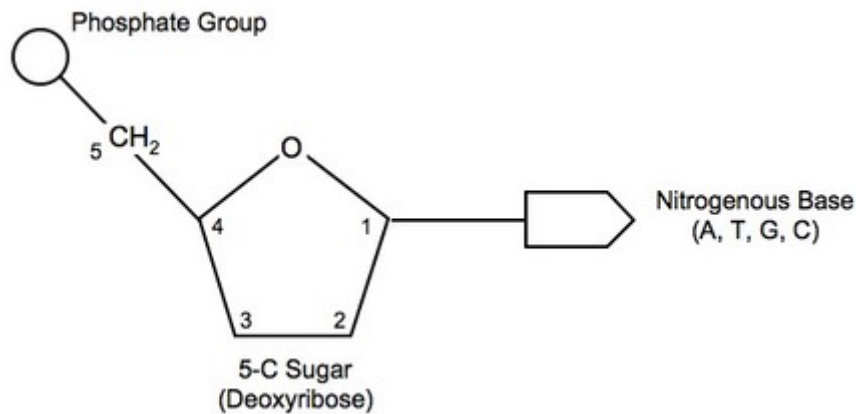
Two alleles P and Q are the only alleles in a gene pool for a particular characteristic, their frequencies in the population are p and q respectively. This means that the frequency of alleles can be given as $p+q=1$. The genotypes in the population are given by $PP=p^2$, $QQ=q^2$, $PQ=2pq$. For the whole population $p^2+2pq+q^2=1$.

If the frequency of the allele p in the population is 0.1, what is the frequency of the genotype PQ?

- (A) 1
- (B) 0.5
- (C) 0.18
- (D) 0.81

Question 5

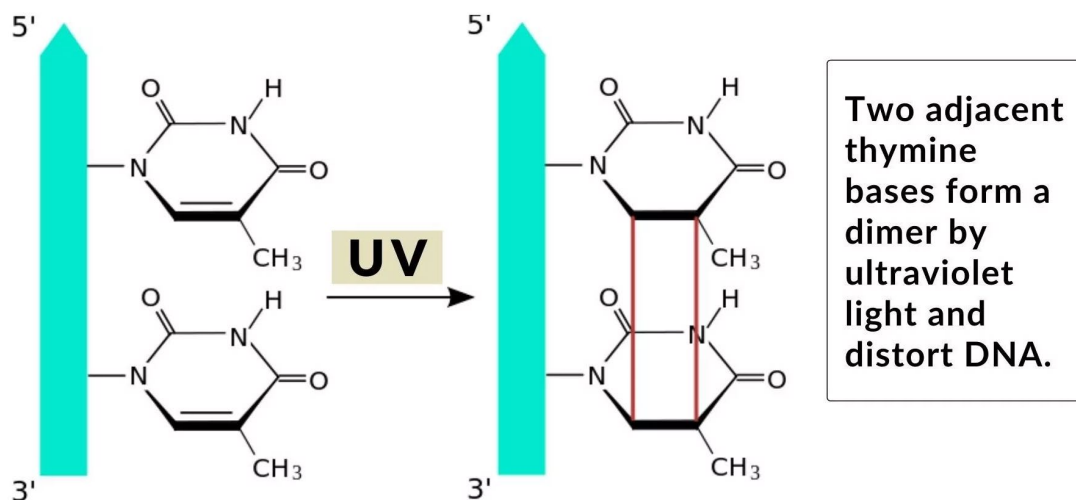
The diagram shows a nucleotide.



To which carbon on deoxyribose will the next nucleotide's phosphate group join to start to build a strand of DNA?

- (A) 2
- (B) 3
- (C) 5
- (D) G

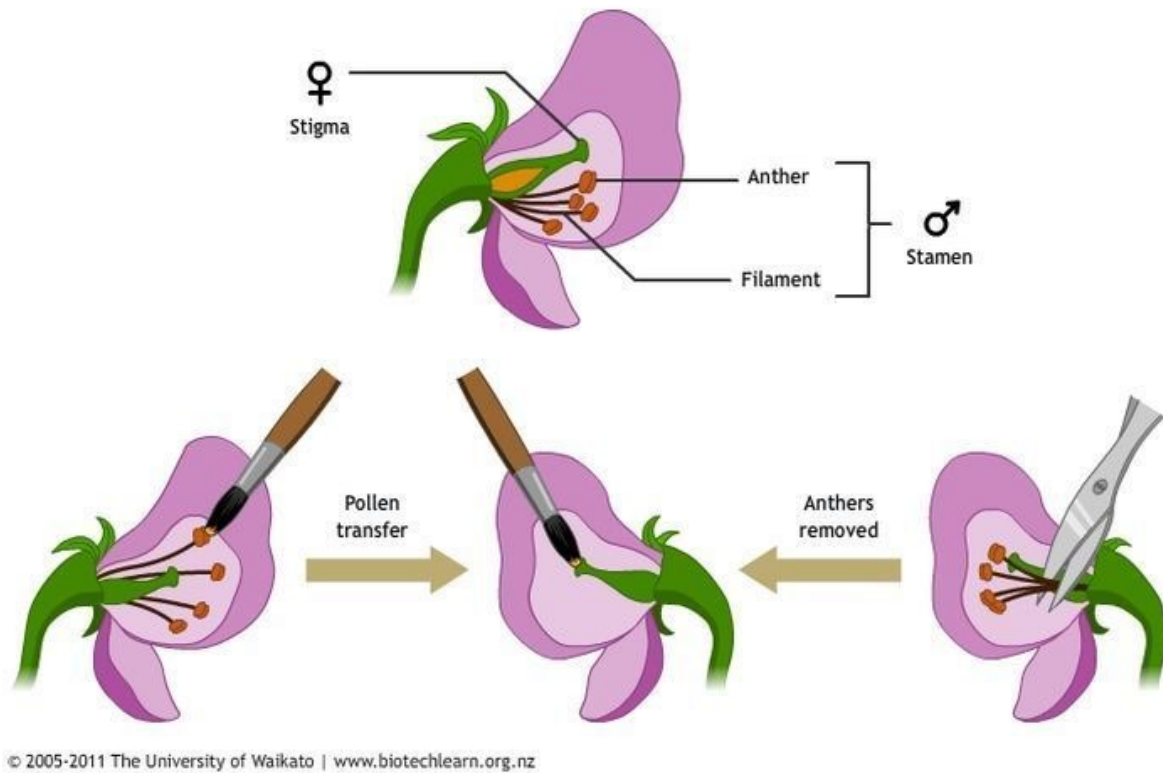
Question 6



Ultraviolet light in the diagram above is an example of

- (A) A chemical mutagen
- (B) An electromagnetic mutagen
- (C) A point mutation
- (D) A chromosomal mutagen

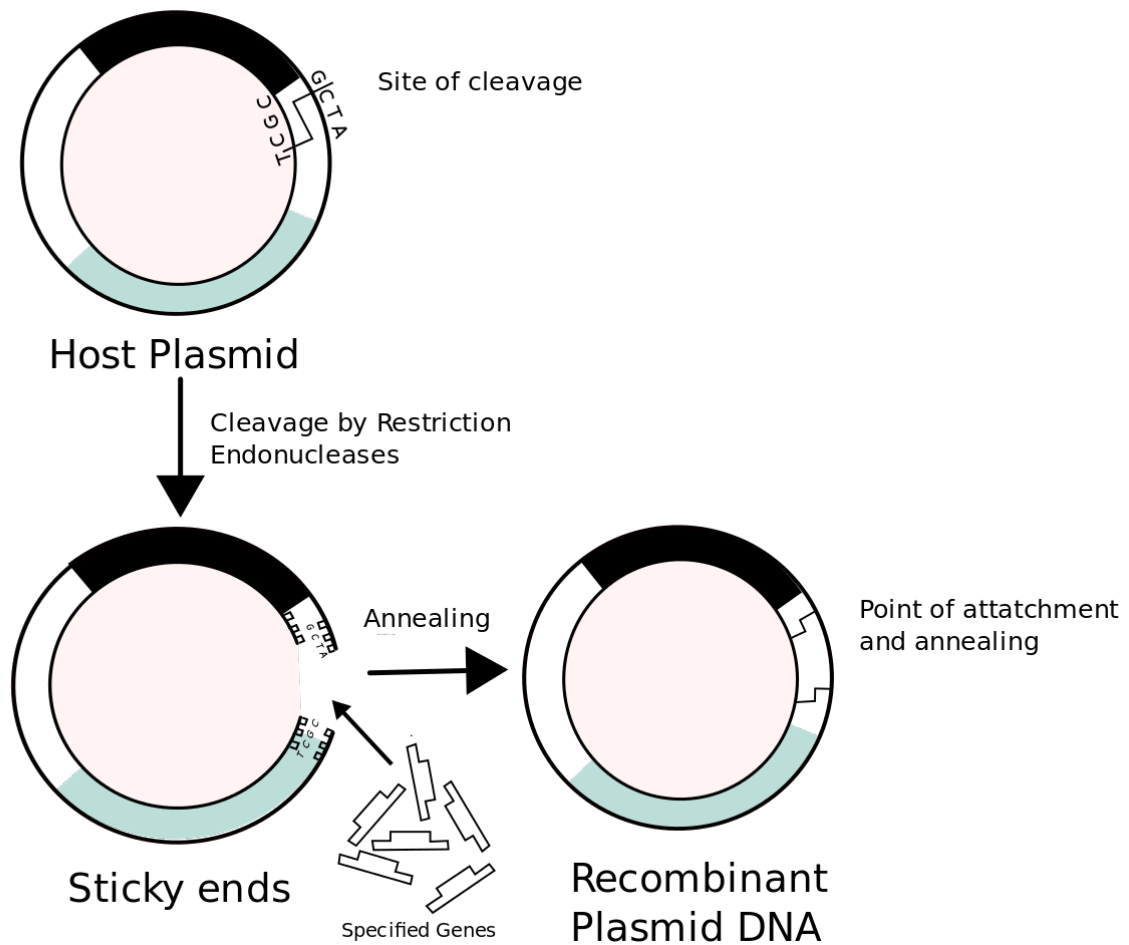
Question 7



The removal of anthers during artificial pollination is important in the development of new crosses because

- (A) It prevents ovulation
- (B) It aids in pollen transfer
- (C) It prevents self-pollination
- (D) It increases variation

Question 8



The diagram above shows essential elements of;

- (A) Gene cloning
- (B) Whole organism cloning
- (C) Translocation
- (D) Metaphase II

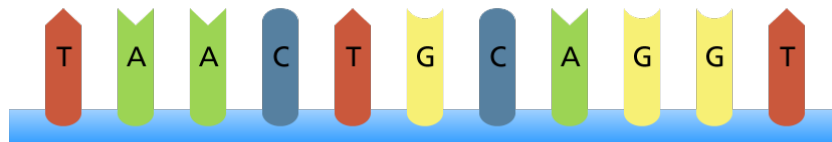
Question 9

Biodiversity is best defined as

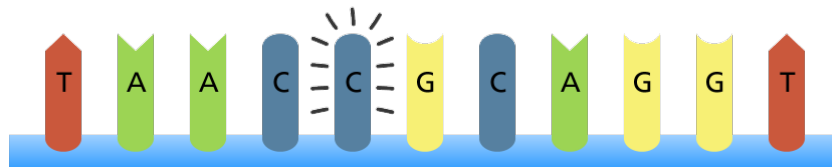
- (A) The systematic study of living organisms
- (B) A measure of nutrient flow in ecosystems and its impacts on human society
- (C) The variation among living organisms and the ecological complexes of which they are a part.
- (D) The variety of animals and plants on Earth

Question 10

Original sequence



Point mutation

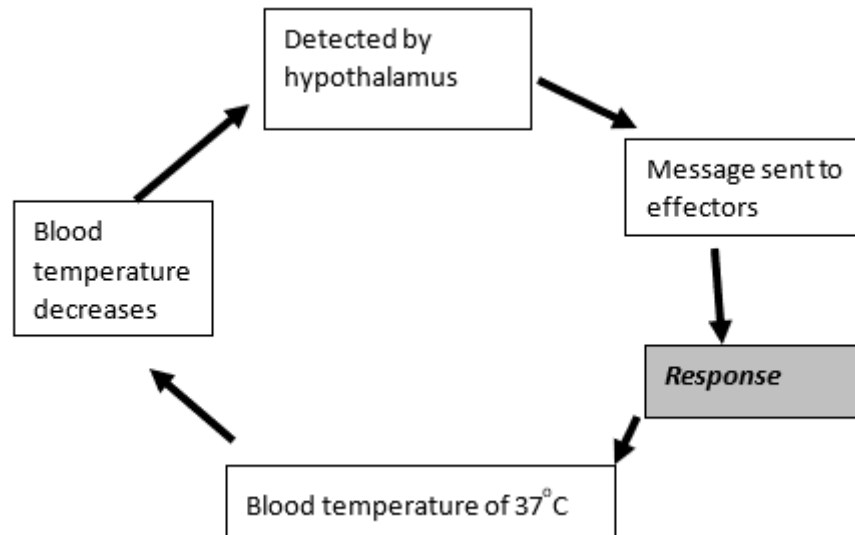


The type of point mutation shown is a

- (A) Substitution
- (B) Deletion
- (C) Inversion
- (D) Trisomy

Question 11

The diagram below summarises a negative feedback mechanism which operates in the control of human body temperature.



Which one of the following best describes the *Response* in this diagram?

- (A) Vasodilation
- (B) Reduced metabolic rate
- (C) Vasoconstriction
- (D) Sweating

Question 12

Which factor affects homeostasis?

- (A) Internal environment
- (B) External environment
- (C) Social environment
- (D) All of the above

Question 13

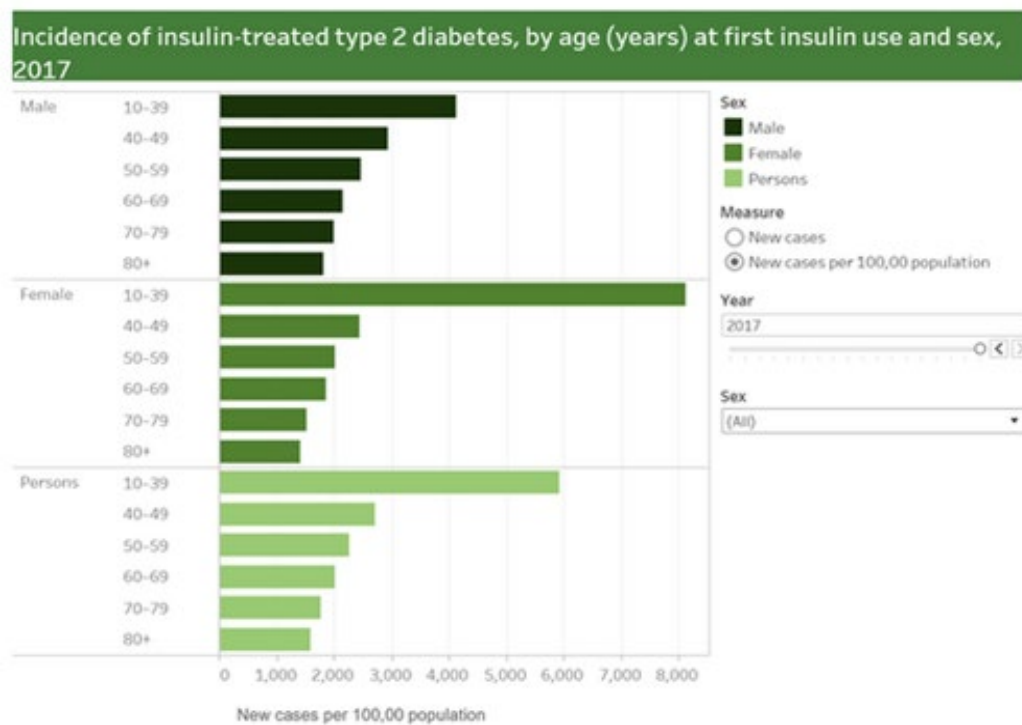
The maintenance of a relatively constant internal environment is:

- (A) Metabolism
- (B) Positive feedback loop
- (C) Inflammation
- (D) Homeostasis

Question 14

Look at the information presented below about the incidence of type 2 diabetes in Australia in 2017:

Source: Australian Institute of Health and Welfare



Which statement is correct based on the graph?

- (A) As populations age the incidence rates are higher
- (B) Diabetes is a communicable disease
- (C) Females in the 10-39 age group have the highest incidence rate
- (D) Males under the age of 40 are more at risk of contracting type 2 diabetes

Question 15

Kangaroos lick their forearms to maintain a constant temperature when they are hot, the saliva evaporates to help cool them. Kangaroo forearms are thin, with dense networks of surface capillaries that aid heat loss to the environment.



This is an example of which type of adaptation to maintain homeostasis

- (A) Physiological and structural
- (B) Behavioural
- (C) Structural
- (D) Behavioural and structural

Question16

Which answer shows the correct size order from largest pathogen to smallest?

- (A) Virus, bacterium, prion, macroparasite.
- (B) Prion, virus, bacterium, fungi
- (C) Protozoan, bacterium, virus, fungi
- (D) Macroparasite, fungi, protozoan, prion.

Question 17

Which of the following is an example of direct transfer of a pathogen?

- (A) Typhoid through the consumption of contaminated food
- (B) Ross river fever transferred through a mosquito bite
- (C) Influenza through the transfer of droplets when an infected person sneezes
- (D) Lyssa virus through close contact with a bat

Question 18

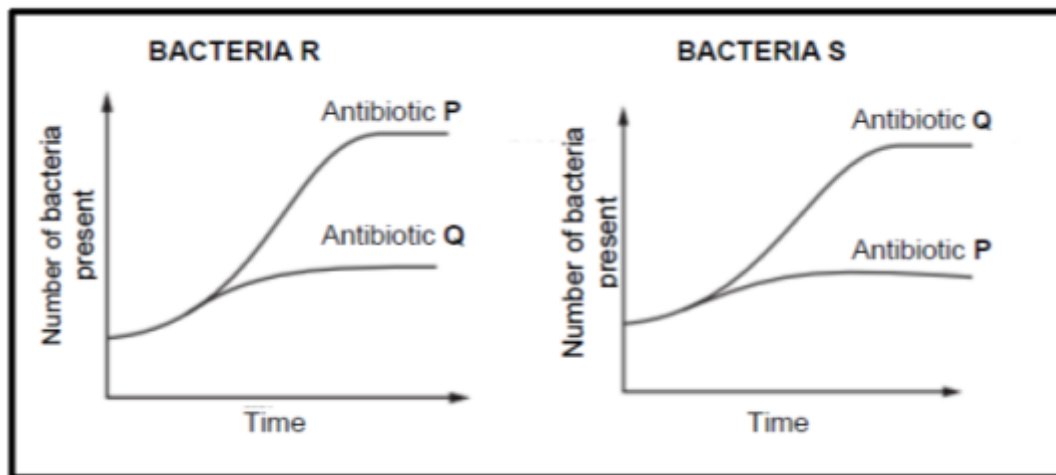
In Australia cases of influenza are always present but occasionally they rise to unusually high levels.

In this case, the disease is said to have changed from being

- (A) epidemic to endemic
- (B) endemic to epidemic
- (C) sporadic to epidemic
- (D) endemic to sporadic

Question 19

The graphs below show the effect of two antibiotics, **P** and **Q**, on two different species of bacteria, **R** and **S**.

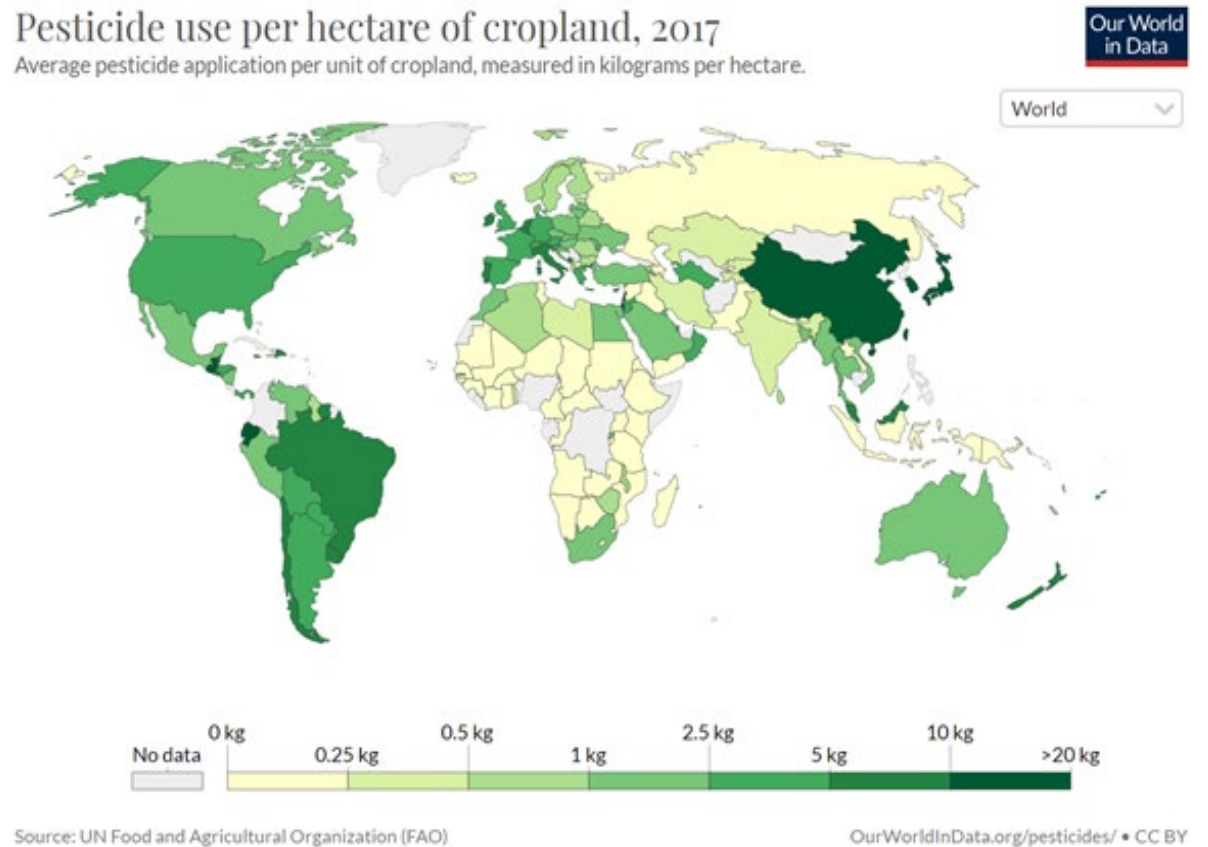


The conclusion that can be drawn from the graphs is:

- (A) Bacteria **R** is less resistant to antibiotic **P** than antibiotic **Q**
- (B) Bacteria **R** is more resistant to antibiotic **P** than antibiotic **Q**
- (C) Antibiotic **Q** is equally effective on bacteria **R** and **S**
- (D) Antibiotic **P** is equally effective on bacteria **R** and **S**

Question 20

Pesticides are used worldwide to minimise the impact of pests on the production of food crops. The level of pesticide used in each country varies as shown in the graph below.



The most significant issue associated with the use of pesticides is:

- (A) The pesticide DDT is not used in Australia as is associated with the development of cancers.
- (B) They are expensive to purchase and are not available to farmers in different countries.
- (C) They kill non target species.
- (D) Insects and pathogens become resistant to pathogens.

PART B – FREE RESPONSE QUESTIONS

Attempt Questions 21 – 32

Allow 2.5 hours for Part B

Question 21

5 marks

“The development of internal fertilization was essential for complex animals to move onto land.” *Roach 2021*

Justify this statement with reference to named examples of internal and external fertilisers.

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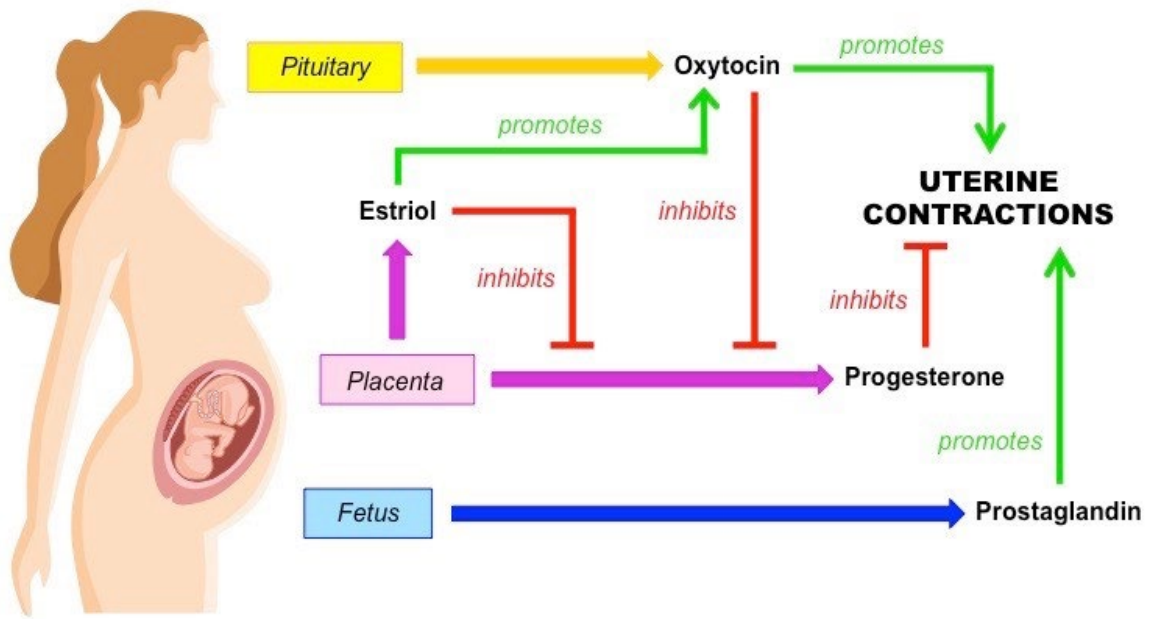
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Question 22

7 marks



- a) Which organ produces progesterone and estradiol (oestrogen) before implantation? 1m

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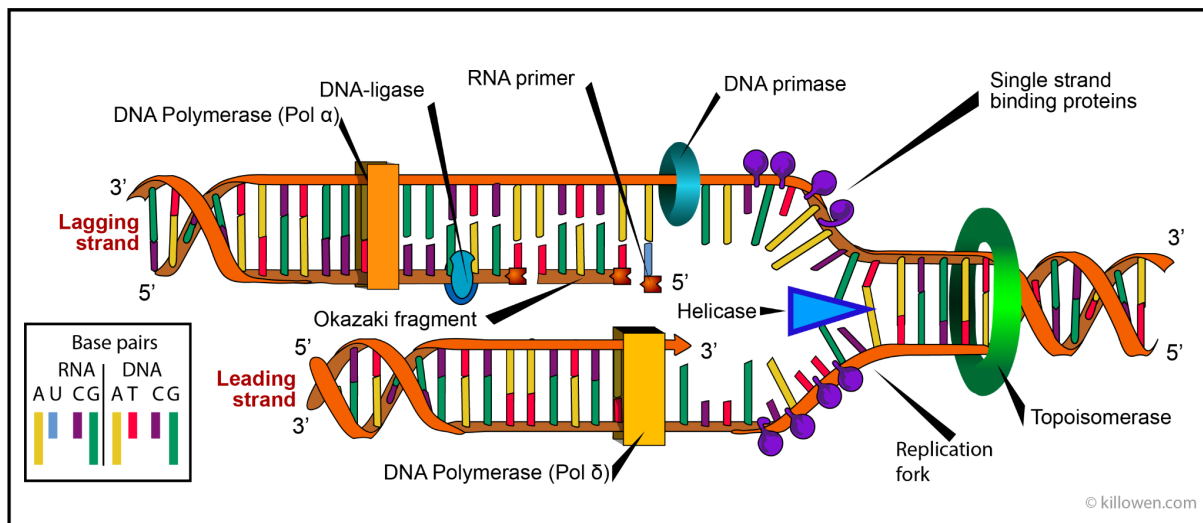
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- b) Explain the role of progesterone in fertilization, pregnancy and birth. 6m

[illegible]

Question 23

4 marks



a) Identify the process shown in the diagram.

1m

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b) Explain the role of DNA-ligase in this process.

3m

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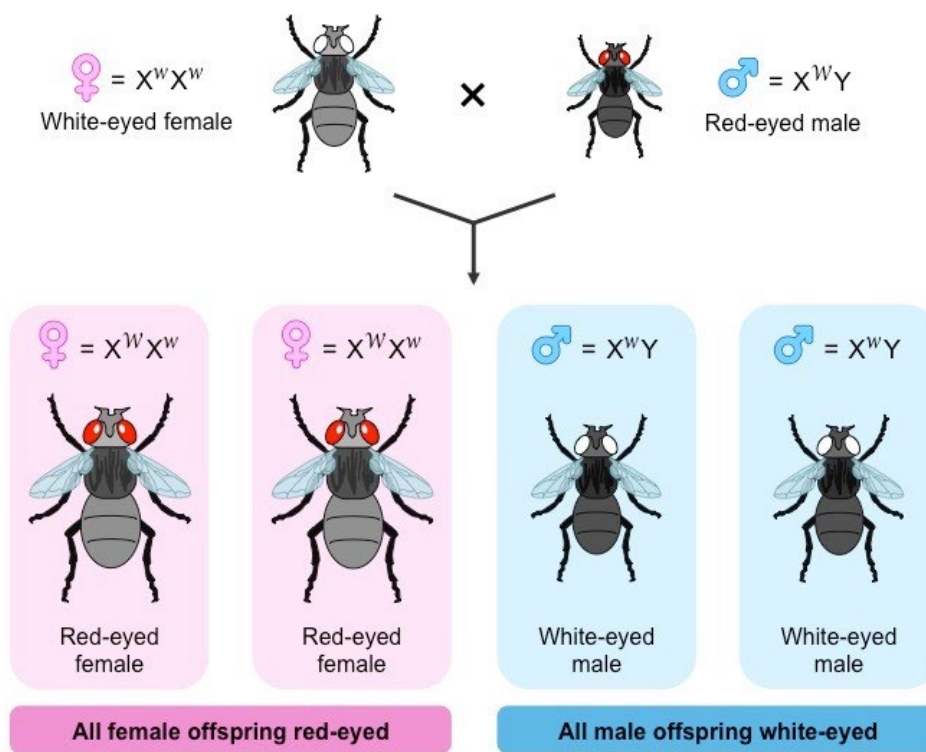
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Question 24

4 marks

The genetic cross below involved a pure breeding white-eyed female fruit fly mating with a pure breeding red-eyed male.



- a) Identify the type of inheritance shown in the diagram.

1m

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- b) Use Punnett squares to show the genotypic and phenotypic ratios of a cross between the male and female offspring.

3m

Question 25

4 marks

Compare the effects of germline and somatic mutations on an organism and its offspring. 4m

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Question 26

3 marks

Clarify the difference between the terms “gene flow” and “genetic drift”. 3m

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Question 27

8 marks

Evaluate the effect of genetically engineered organisms on the biodiversity of Earth. 8m

This image shows a full page of primary-ruled paper. It features approximately 20 horizontal rows, each defined by two parallel dotted lines. The paper is otherwise blank, with no margins, text, or other markings.

Question 28

6marks

Read the following passage.

“Talk about a Pandora’s box. Protecting patient privacy is a growing concern, thanks to technology that is making it possible to decode the human genome. But as scientists become adept at deciphering a person’s genetic composition, it is increasingly likely that compromising information about a person’s future health is going to become available.

This creates enormous problems. For instance, it may become possible to know that a 5-year-old is going to develop serious heart disease later in life, but does a prospective employer have the right to know that? How will this knowledge affect the individual’s ability to obtain a job, insurance, or a mortgage? Should such information be available to insurers and others? This is a thorny problem destined to become only thornier.”

Ed Silverman 2004 <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3570985/>

Discuss the benefits and limitations for patients of biotechnologies which can provide information about the genetic health of individuals.

6m

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Question 29**7 marks**

Read the following passage and study the graphs provided on page 23 to answer Question 29

In Australia, the percentage of daily smokers has been steadily declining, from 22.4% of adults in 2001 to 16.1% in 2011–12. This equates to 2.8 million adults who were daily smokers in 2011–12.

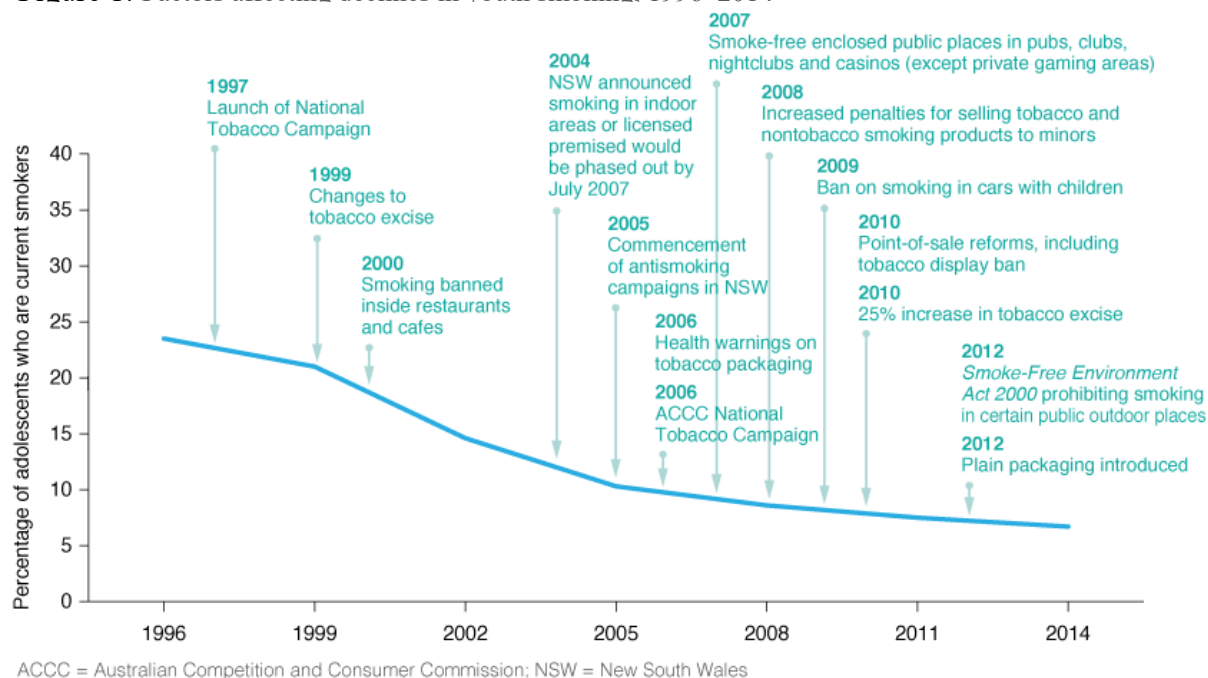
Tobacco smoking has been estimated to be the greatest contributor to the health burden of Indigenous people, at 12% of the total Indigenous health burden. While the proportion of current smokers amongst Indigenous people has decreased from 51% in 2002 to 47% in 2008, Indigenous Australians were 2.2 times as likely to smoke tobacco compared to non-Indigenous Australians.

The Australian government and public health organisations have undertaken several steps to prevent adolescents from taking up smoking and reduce the smoking rates in Australia. These include increase in tobacco tax, changes to tobacco packaging (no logos and explicit warnings on packaging), smoke-free environments, public education campaigns and restrictions on adolescents access to tobacco. Smoke-free environments include no smoking inside public building, restrictions on where people can smoke on university/school campuses and proximity to entrances into building and designated smoking areas in pubs/clubs.

Source: <https://www.canceraustralia.gov.au/publications-and-resources/position-statements/lifestyle-risk-factors-and-primary-prevention-cancer/lifestyle-risk-factors/tobacco>

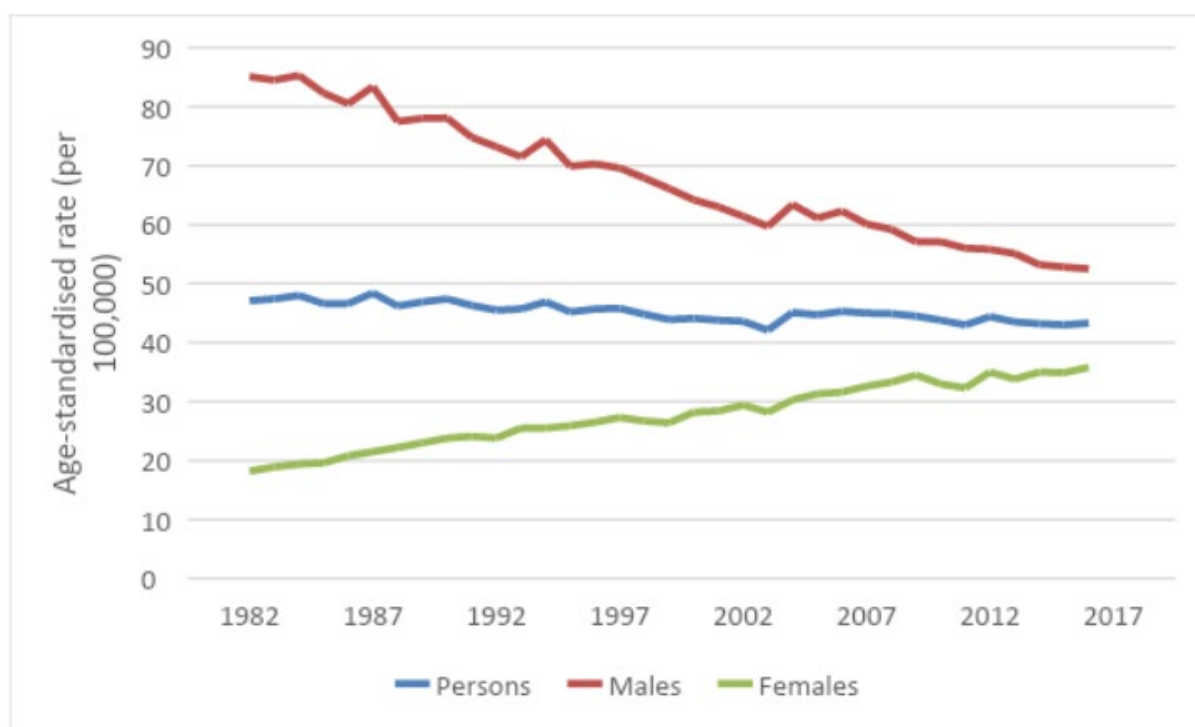
Stimulus continued on page 23

Figure 1: Factors affecting declines in youth smoking, 1996–2014



source: <https://www.phrp.com.au/issues/january-2016-volume-26-issue-1/factors-influencing-reductions-in-smoking-among-australian-youth/>

Figure 2: Age-standardised incidence rates for lung cancer, 1982 to 2016, by sex



source: <https://www.canceraustralia.gov.au/affected-cancer/cancer-types/lung-cancer/lung-cancer-australia-statistics>

a) Identify TWO trends in the data shown. 2m

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b) With reference to the data provided, assess TWO strategies implemented to prevent lung cancer due to smoking in Australia in relation to the indigenous population. 5m

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Question 30**12 marks**

Matt ate a snickers bar and measured his blood glucose for 120 minutes after his meal. Blood glucose is measure in mg/dL and the optimal level for most humans is 80 mg/dL.

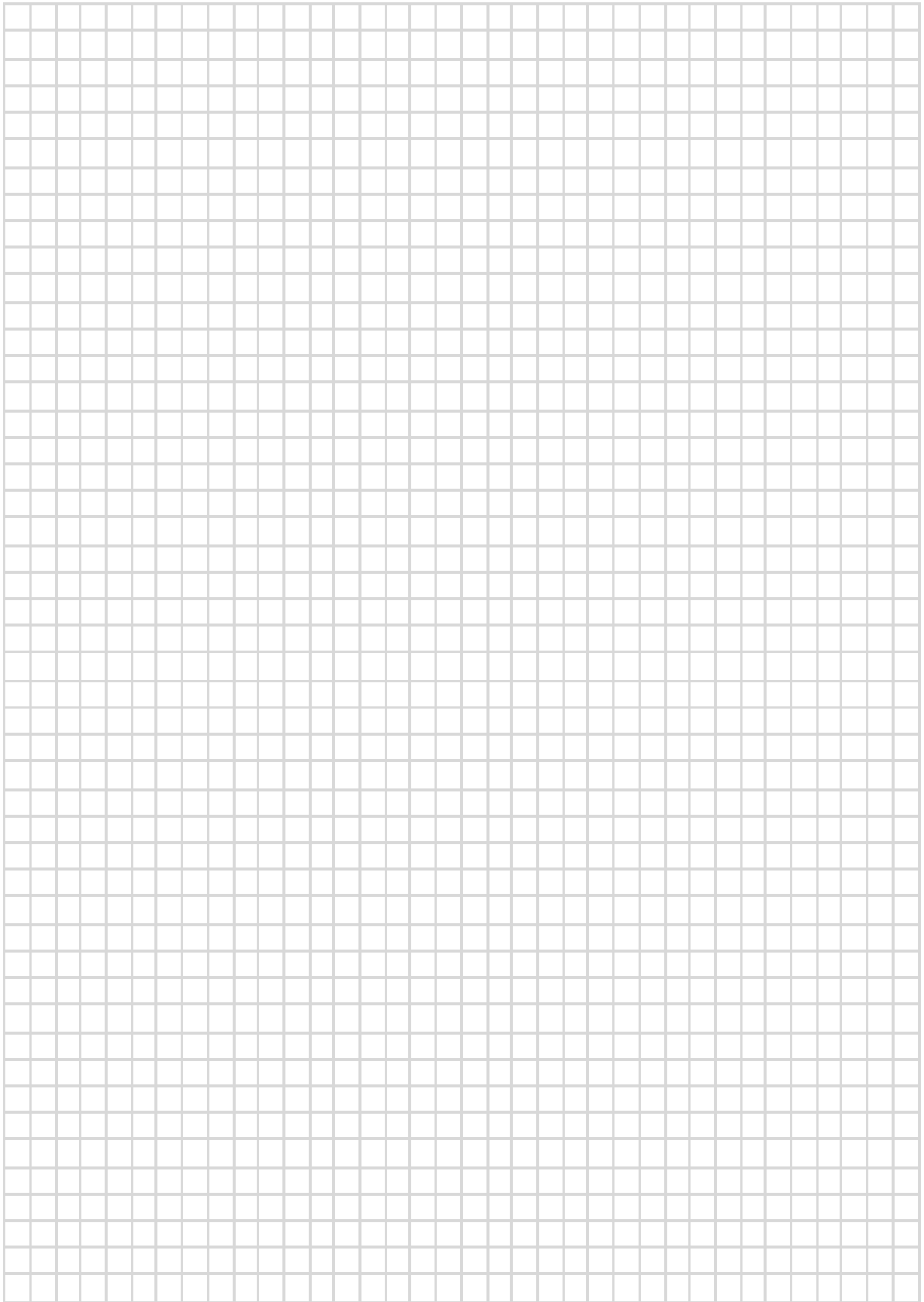
Below is the data he obtained.

Time (minutes)	Blood glucose (mg/dL)
0	75
10	90
20	100
30	145
40	125
50	110
60	95
70	85
80	85
90	75
100	78
110	80
120	80

- a) Construct a suitable graph, on page 26, to present the data obtained.

5m

Question 30 continued on page 26



b) Describe the shape of the graph.

2m

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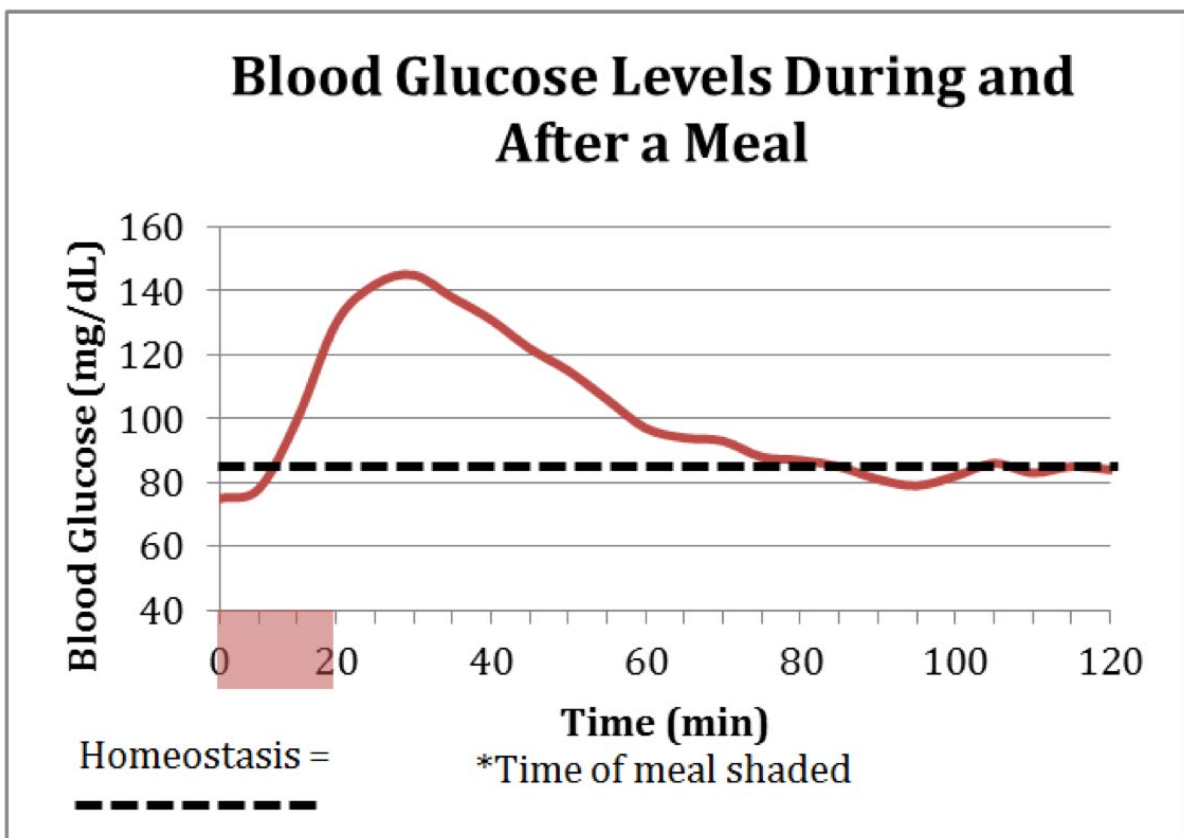
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c) The maintenance of blood glucose levels is indicative of a negative feedback loop.

Annotate the graph to indicate the body's response to maintain the glucose levels. 5m



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Question 31

2marks

Identify a pathogen of a named Australian plant and state how the plant responds to this pathogen.

2m

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Question 32

18 marks

Two days after receiving a scratch to the skin from a rusty nail, a scab has formed. The area around the scab is red, swollen and feels hot. The immune system has initiated a response.

a) Account for the symptoms that have been observed.

3m

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b) Clostridium tetani is the bacteria that is responsible for the development of tetanus. Children are first vaccinated against this disease using INFANRIX HEXA. The active ingredients of INFANRIX HEXA are non-infectious substances from tetanus, diphtheria bacteria, purified proteins of pertussis bacteria, the surface protein of the hepatitis B virus (HBsAg, derived from genetically engineered yeast cells) and inactivated poliovirus. The vaccine cannot cause these diseases.

NSW IMMUNISATION SCHEDULE with dose numbers from 1 July 2018

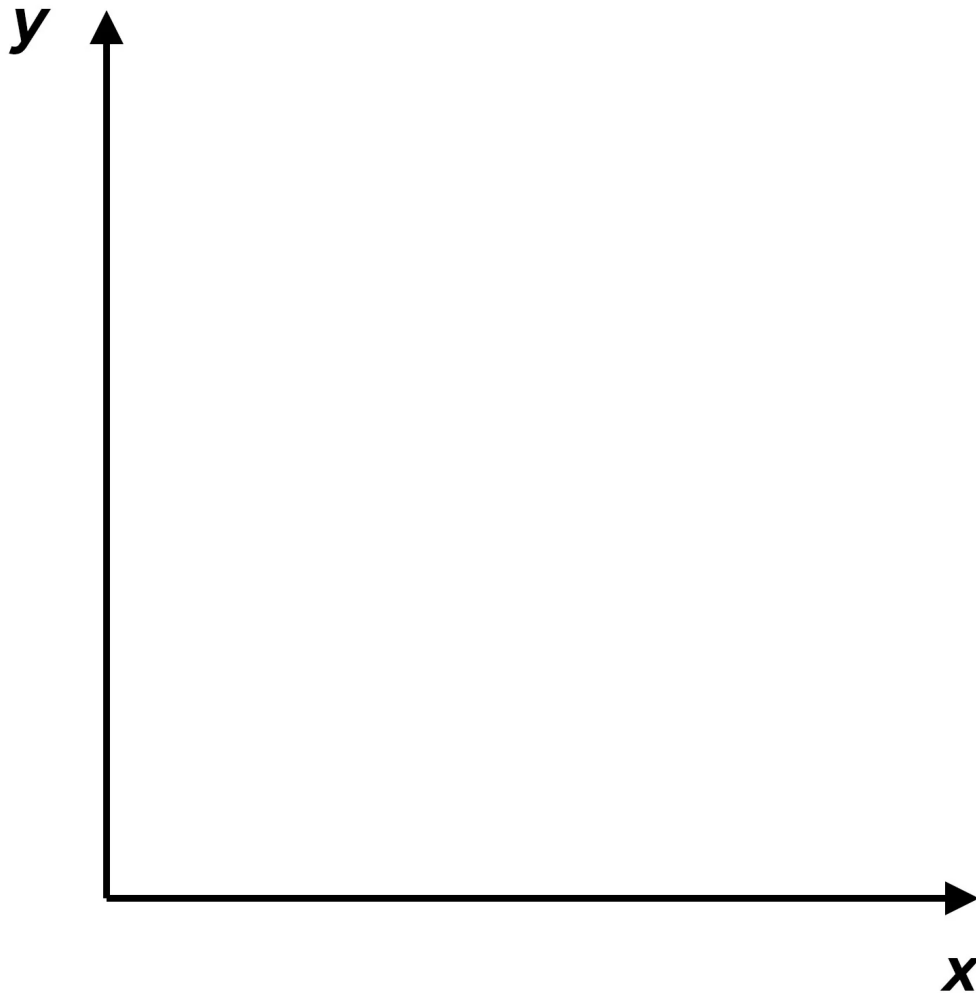


Important: The dose numbers on this resource should be used with caution. Do not presume previous doses are given if the evidence has not been cited (e.g. Blue Book, immunisation history statement).

Age	Disease	Vaccine	Dose
Childhood Vaccines			
Birth	Hepatitis B	H-B-Vax II or ENGERIX B	0
6 weeks	Diphtheria, Tetanus, Pertussis, Haemophilus influenzae type b, Hepatitis B, Polio	INFANRIX HEXA	1
	Pneumococcal	PREVENAR 13	1
	Rotavirus	ROTARIX	1
4 months	Diphtheria, Tetanus, Pertussis, Haemophilus influenzae type b, Hepatitis B, Polio	INFANRIX HEXA	2
	Pneumococcal	PREVENAR 13	2
	Rotavirus	ROTARIX	2
6 months	Diphtheria, Tetanus, Pertussis, Haemophilus influenzae type b, Hepatitis B, Polio	INFANRIX HEXA	3
12 months	Meningococcal ACWY	NIMENRIX	1
	Pneumococcal*	PREVENAR 13	3
	Measles, Mumps, Rubella	MMR II or PRIORIX	1
18 months	Diphtheria, Tetanus, Pertussis	INFANRIX or TRIPACEL	4
	Measles, Mumps, Rubella, Varicella	PRIORIX TETRA or PROQUAD	2
	Haemophilus influenzae type b	ACT-HIB	4
4 years	Diphtheria, Tetanus, Pertussis, Polio	INFANRIX-IPV or QUADRACEL	5

*children with medical conditions associated with an increased risk of invasive pneumococcal disease require an additional dose of Pneumococcal vaccine (Prevenar 13) at 6 months

Construct an appropriately labelled curve to illustrate the level of tetanus antibodies that will occur in the blood of a child from birth until the age of 4 years if they are vaccinated in accordance with the schedule given above. 4m



Question 32 continued on page 31

- c) Explain why the concentration of antibodies changes between birth and 4 years of age. 3m

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- d) Under the age of 6 weeks, babies are highly susceptible to diseases that they are going to be vaccinated against.

Outline TWO methods that are used by the community to minimise the chances of babies contracting these diseases. 3m

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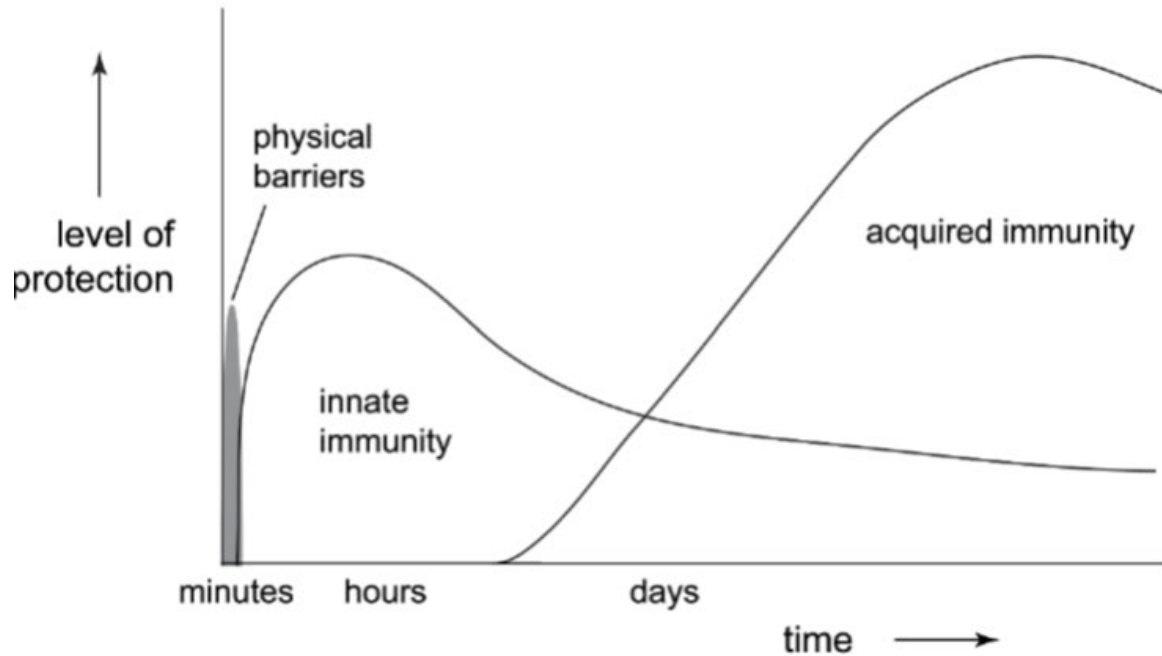
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Question 32 continued on page 32

- e) After exposure to a pathogen both the innate and adaptive immune systems function to protect the body and minimise the effects of the pathogen.

The following graph summarises the timeline of the level of these activities.



Interpret the information from the graph above and evaluate the effectiveness of the different measures of protection over different time periods. 5m

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-END OF EXAMINATION -

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

Question 21

Criteria	Marks
- Justifies the statement - Explains the importance of internal fertilisation to life on land - Describes two or more examples of internal fertilizers - Describes two or more examples of external fertilizers	5
- Explains the importance of internal fertilisation to life on land - Describes two or more examples of internal fertilizers - Describes two or more examples of external fertilizers	4
- Explains the importance of internal fertilisation to life on land - Describes one example of internal fertilizers - Describes one example of external fertilizers	3
- Provides information relevant to internal fertilisation to life on land - Identifies example of internal fertilizer - Identifies example of external fertilizer	2
Provides relevant information	1

Sample response

The colonisation of land by living organisms represented an enormous evolutionary opportunity, new niches were opened up and successful species were able to avoid competition and increase their chances of survival and reproduction. Prior to the colonisation of land, species were able to rely on a watery, fluid medium to allow sperm and eggs to come into contact and fertilisation to occur. Coral, for example, release sperm and egg cells into the ocean and successfully reproduce. No internal reproductive structures are necessary and continuation of the species is possible, although at a considerable cost in terms of unsuccessful gametes. In freshwater environments amphibians, such as the great crested newt, rely on external fertilization with the male spraying sperm onto the eggs of his chosen female. On land no such watery medium is present so sperm are not able to travel to eggs external to the organism's body. Desiccation of the sperm and eggs due to lack of moisture is inevitable if they are

released onto dry land. Crocodiles are capable of internal fertilisation, sperm are introduced into the female's cloaca by the male and fertilise eggs inside her body. These eggs develop and are laid on land. The female crocodile is able to protect her eggs and babies when they hatch and a greater survival rate is possible. Humans are another example of a successful internal fertiliser, sperm are introduced to the female via the penis and fertilisation occurs in the Fallopian tube. Babies complete their development inside the female with no risk of desiccation and once born are given great care.

Question 22a

Criteria	Marks
Ovary or corpus luteum	1

Question 22b

Criteria	Marks
- Explains role of progesterone in fertilization - Explains role of progesterone in pregnancy - Explains role of progesterone in birth	6
- Explains two of the following and describes the other - role of progesterone in fertilization - role of progesterone in pregnancy - role of progesterone in birth	5
- Describes two of the following and explains the other - role of progesterone in fertilization - role of progesterone in pregnancy	4

• role of progesterone in birth	
• Describes role of progesterone in fertilization • Describes role of progesterone in pregnancy • Describes role of progesterone in birth	3
• Provides relevant information about the role of progesterone in human reproduction	2
• Provides some relevant information about reproductive hormones	1

Sample response

Progesterone is a hormone produced throughout the reproductive cycle in human females. During the menstrual cycle progesterone is produced by the corpus luteum and has a role in regulating the cycle so that ovulation occurs at the right time. After ovulation progesterone promotes the maintenance of the endometrium to allow for successful implantation, should fertilization occur. During early pregnancy progesterone stimulates the development of blood supply to the endometrium allowing for the developing embryo to be nourished. Progesterone production shifts to the placenta at around 12 weeks and throughout pregnancy it stimulates the development of breast tissue, prevents lactation and causes the strengthening of the pelvic muscles. Progesterone levels increase throughout pregnancy and prevent premature birth. Progesterone levels decline just before birth allowing other hormones to stimulate that process.

Question 23a

Criteria	Marks
• Replication	1

Question 23b

Criteria	Marks
• Explains the role of ligase in repairing breaks in DNA strands • Explains need to link Okazaki fragments in the lagging strand	3
• Describes the role of ligase in joining strands of DNA • Identifies the difference between leading and lagging strands	2

Identifies a function of ligase	1
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Sample response

Question 24a

DNA ligase is an enzyme with the primary function of maintaining the structural integrity of DNA. Ligase is able to join together broken strands of DNA where breaks occur for any reason. Breaks in DNA are an essential part of replication in the lagging strand of DNA. The enzymes which promote replication, in particular DNA-polymerase, work in the 5-3 direction along the separated DNA strand. This works well in the leading strand, however the two strands of DNA are constructed in opposite directions. This means that the lagging strand goes in the 3-5 direction. DNA in the lagging strand must therefore be replicated in sections (called Okazaki fragments) to enable DNA-polymerase to function. The fragments must be reconnected and DNA-ligase is the enzyme which completes this task.

Criteria	Marks
Sex-linked	1

Question 24b

Criteria	Marks
- Punnett squares accurately constructed - Correctly shows genotype ratio - Correctly shows phenotype ratio	3
- Punnett squares used - Correctly shows genotype ratio OR - Correctly shows phenotype ratio	2
Provides relevant information about genotypes and/or phenotypes	1

Sample response

	Xw	Y
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XW	XWXw	XWY
Xw	XwXw	XwY

Genotypes

1:1:1:1 XWXw:XWY:XwXw:XwY

Phenotypes

1:1:1:1 wild type female:white eye female:wild type male:white eye male

Question 25

Criteria	Marks
2 points of similarity between the effects on the organism and offspring 2 points of difference between the effects on the organism and offspring	4
2 points of similarity between the effects on the organism and offspring AND 1 point of difference between the effects on the organism and offspring OR 1 point of similarity between the effects on the organism and offspring 2 points of difference between the effects on the organism and offspring	3
1 point of similarity between the effects on the organism and offspring 1 point of difference between the effects on the organism and offspring	2
Relevant comment about mutations	1

Sample response

Germline mutations occur in gametes (or the cells which become gametes) and can be passed on to offspring after fertilization. Somatic mutations occur in ordinary body cells and cannot be passed on to offspring. Both types of mutation involve change to DNA sequences and can be caused by a range of mutagens. Both types of mutation can be harmful, neutral or beneficial to the organism. Only germline mutations can give rise to natural selection and evolution.

Question 26

Criteria	Marks
• Defines gene flow • Defines genetic drift • Clarifies the difference between	3
• Defines gene flow • Defines genetic drift	2
• Defines gene flow OR • Defines genetic drift	1

Sample response

Gene flow is any movement of individuals, and/or the genetic material they carry, from one population to another. Genetic drift is change in allele frequencies in a population from generation to generation that occurs due to chance events. Gene flow involves movement of genetic materials between populations and is non-random whereas genetic drift occurs within one population and is random.

Question 27

Criteria	Marks
• States clear criteria • Defines genetic engineering • Defines biodiversity • Provides relevant example illustrating positive effect on biodiversity • Provides relevant example illustrating negative effect on biodiversity • Explains reasons for increase and/or decrease in biodiversity • Evaluates the effect	8
• States relevant criteria • Defines genetic engineering • Defines biodiversity • Provides relevant information illustrating effect on biodiversity • Explains reasons for increase and/or decrease in biodiversity • Attempts to evaluate the effect	7
• Defines genetic engineering • Defines biodiversity	6

• Provides information on the effect of genetic engineering on the environment • Describes reasons for increase and/or decrease in biodiversity • Provides some judgement on the effect	
• Defines genetic engineering • Defines biodiversity • Provides information on the effect of genetic engineering on the environment • Describes reasons for increase and/or decrease in biodiversity	5
• Defines genetic engineering OR • Defines biodiversity • Provides information on the effect of genetic engineering on the environment • Describes reasons for changes in biodiversity	4
• Defines genetic engineering OR • Defines biodiversity • Provides some information on the effect of genetic engineering on the environment • Identifies reasons for increase and/or decrease in biodiversity	3
• Provides information on the effect of genetic engineering on the environment • Identifies a reason for increase and/or decrease in biodiversity	2
• Relevant comment on biodiversity or genetic engineering	1

Sample response

In order to evaluate the effect of genetic engineering on biodiversity the following criteria need to be addressed. 1. Does genetic engineering increase biodiversity? 2. Does genetic engineering decrease biodiversity? 3. To what extent does genetic engineering affect biodiversity?

Genetic engineering is the process of using recombinant DNA technology to alter the genetic makeup of an organism. Since the 1960s scientists have been able to manipulate the genetic make up of organisms by altering, adding to or removing sections of DNA. This often involves inserting DNA from one organism into the genome of another. Biodiversity (from “biological diversity”) refers to the variety of life on Earth at all its levels, from genes to ecosystems, and can encompass the evolutionary, ecological, and cultural processes that sustain life. It can be seen that the act of genetically engineering an organism must have some effect on biodiversity by these definitions. Some examples can be used to illustrate this point. The introduction of genes which increase resistance to glyphosate weedkiller to crop species, for example soy beans has increased biodiversity in the sense that the genome of soy bean plants has increased. The same could be said for any other example of genetic engineering that adds genetic material to a species (e.g.s Bt cotton or “golden rice”). As most types of genetic

engineering add genes to species there is an overall increase in biodiversity in the first instance with genetic engineering. Reduction in biodiversity can result from the follow on effects of genetic engineering on other species within an ecosystem. Using these same examples weedkiller resistant soybeans will outcompete other plant species when glyphosate is present. This will have a negative effect on biodiversity, reducing the number of individuals from other species in an area. Bt cotton contains an engineered gene from a bacteria which produces a protein which is toxic to the cotton's major pest. Whilst the biodiversity represented by the Bt cotton genome is increased the biodiversity of the wider ecosystem is reduced by the removal of the bollworm it kills. The knock on effect of removing a species from a food web is complex but usually results in a reduction in biodiversity. Similarly "golden rice" containing a gene to aid production of Vitamin A has impacts on the rice (increasing biodiversity on a genetic level) but also on other organisms in a complex way. Higher survival rates in humans will have knock on effects in other organisms.

It is a complex problem to clearly determine the direction of impacts of genetic engineering on biodiversity on Earth. What is certain is the fact that biodiversity is affected. It seems likely that the overall effects on ecosystems is in a negative direction but that this is not an inevitable result of all examples of genetic engineering.

Question 28

Criteria	Marks
• Defines biotechnology • Explains at least two benefits AND • At least two limitations of biotechnologies • Gives specific relevant example	6
• Defines biotechnology • Explains at least two benefits AND • At least two limitations of biotechnologies • Gives one example	5
• Defines biotechnology • Explains one benefit AND • One limitation of biotechnologies • Gives one example	4
• Describes one benefit AND • One limitation of biotechnology	3
• Describes one benefit OR • One limitation of biotechnology	2
• Identifies one benefit OR	1

- | | |
|---|--|
| <ul style="list-style-type: none"> • One limitation of biotechnology | |
|---|--|

Sample response

Biotechnology is the branch of applied science that uses living organisms and their derivatives to produce products and processes. Some aspects of biotechnology can be used to provide insights into the genetic health of individuals; for example genetic profiling can be used to determine the particular alleles possessed by individuals. This can be a tremendous benefit to individuals who may wish to plan their lives. Huntington's disease is an example of a genetic disorder which has a late onset leading to mental deterioration and death. Individuals with knowledge of their genetics in this regard have the benefit of planning for the onset of the disease and may be able to choose not to have children to prevent passing this condition on. For an individual this is an obvious benefit (albeit in often tragic circumstances). If the same genetic profiling information was in the hands of, for example, a person's bank or employer the consequences might be very negative for that individual. Banks would be less likely to lend money, insurance companies less likely to insure and employment opportunities would diminish.

Question 29:

a) Identify two trends

Criteria	Marks
Students clearly identify TWO trends from the data. Answers could include: - Percentage of smokers has been steadily declining in australia - Number of males and persons with lung cancer has declined since 1982 - Number of females with lung cancer has increased since 1982 - There has been a slight decrease in the number of indigenous smokers since 2002	2
Students clearly identify ONE trend from the data	1

b) Assess TWO strategies

Criteria	Marks
Identifies TWO specific strategies from the material to discuss positive and negative impacts Makes a statement on the impact of the strategies with THOROUGH link to indigenous population	5
Identifies TWO general examples to discuss positive and negative	4

impacts. Makes a statement on the impact of the strategy with limited link to indigenous population	
Identifies ONE specific strategy from the material OR TWO general examples to discuss positive and negative impacts. Makes a statement on the impact of the strategy with no clear link to indigenous population	3
Identifies ONE strategy implemented and an attempt to reference data and indigenous populations	2
Student describes one strategy implemented	1

Sample answer:

The number of indigenous australians who are smoking has decreased slightly over the time that the various strategies have been implemented. The steepest drop occurred following the ban of smoking indoors and the commencement of anti smoking campaigns. This drop indicates that the ban was effective in discouraging people from smoking.

While individual strategies such as banning point of sales displays have not been following by a large drop in the smoking rates, the suite of strategies as a whole has reduced the smoking rates by around 3% in indigenous populations and 16% in the general population. Overall the reduction in the amount of aboriginal people smoking has not drastically reduced could be due to a range of factors such as anti smoking campaigns not being rolled out in rural, remote and isolated communities. another negative impact of these strategies are they are not targeted to the indigenous communities which could limit reception by the indigenous communities. However, because lung cancer is an exposure- related cancer, it takes time to develop so individuals being diagnosed with lung cancer are likely to be older and have had significant smoke exposure before the government interventions were implemented.

As smoking is a significant risk factor for developing lung cancer, it is likely that these measures will be very successful in reducing the incidence of lung cancer in the future.

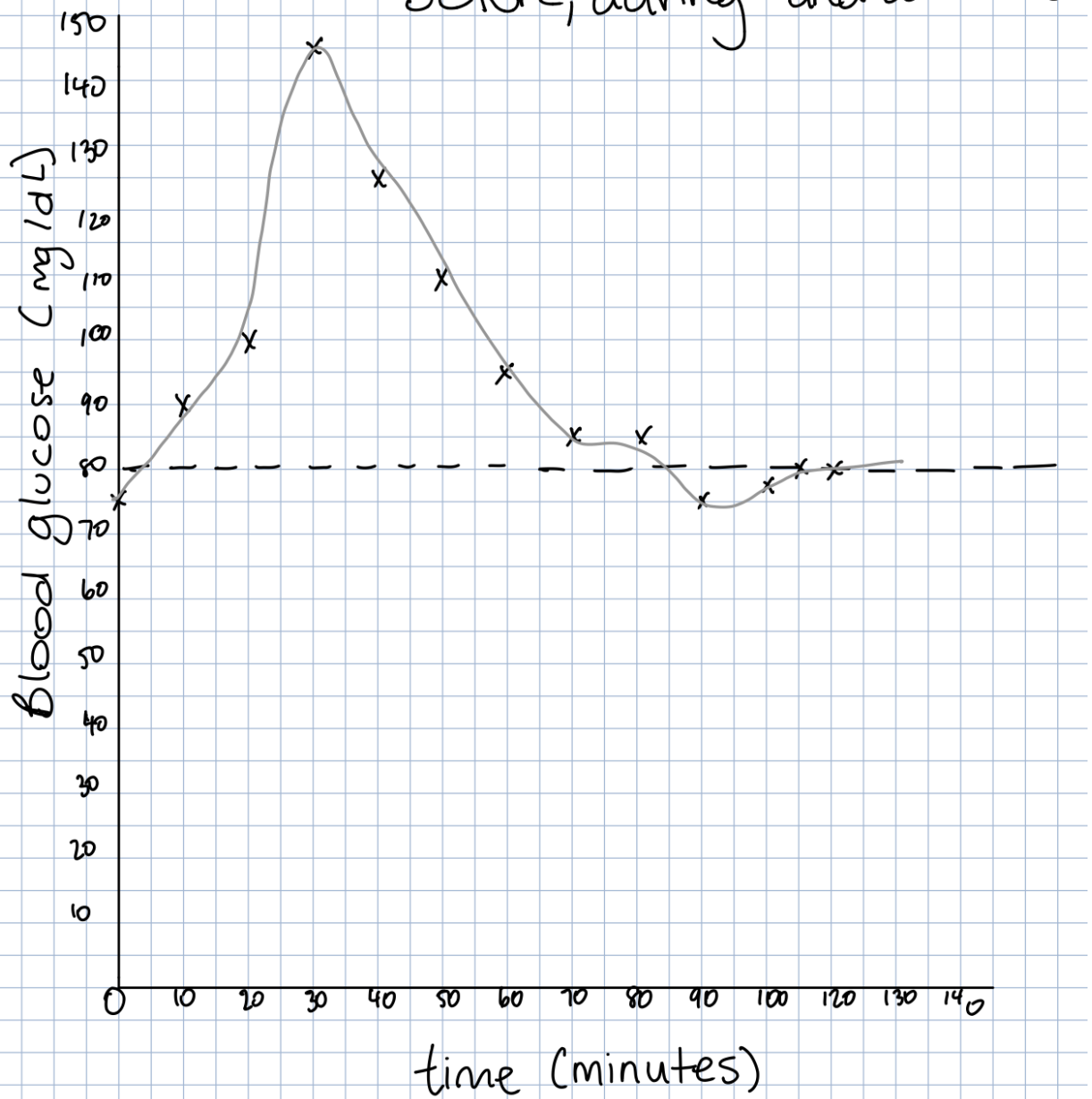
Question 30:

a) Graph

Criteria	Marks
Students construct a line graph with the following components: - Axis labels with units - uniform scale - Data plotted accurately - Relevant title	5*

*One mark deducted for each component missing

Blood glucose levels
before, during and after meal.



b) Describe shape of the graph

Criteria	Marks
Students describes the shape of all parts of the graph	2
Student identifies the shape of the graph	1

Sample answer:

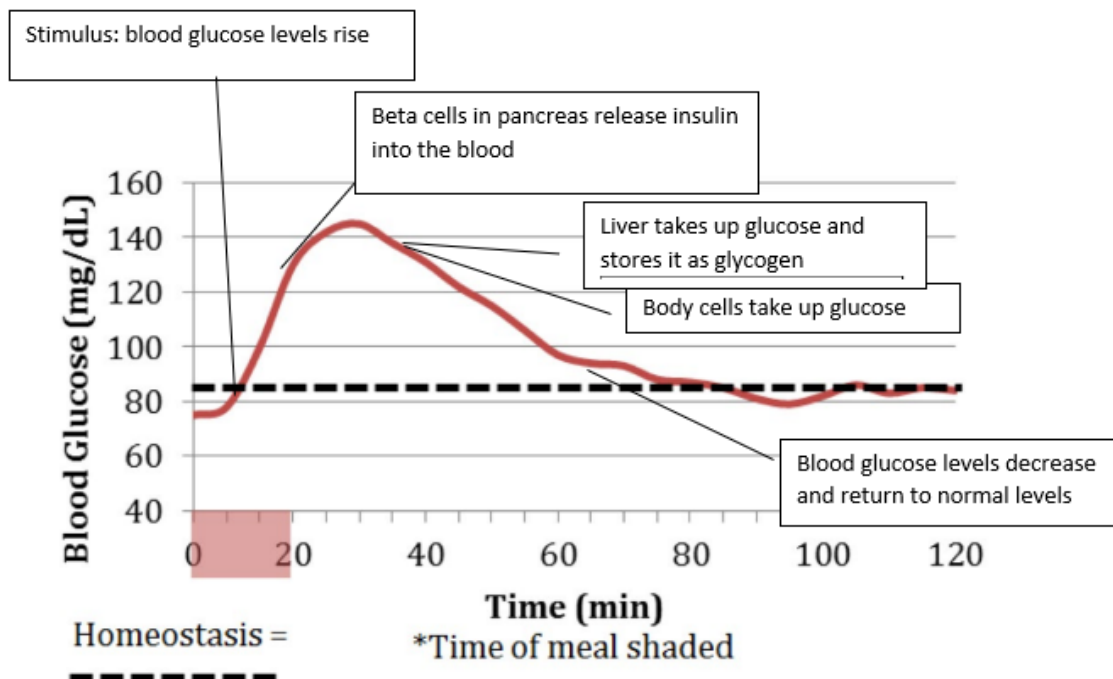
The shape of the graph is an increase in blood glucose from 10-40 minutes. The blood glucose then decreases from 50- 100 minutes where it then plateaus at around 80mg/dL.

c) Annotate on the graph to show the feedback mechanism

Criteria	Marks
Students accurately annotate with all 5 key events in the feedback loop: - Stimulus - blood glucose rises - Beta cells in pancreas release insulin into the blood - Liver takes up glucose and stores it as glycogen - Body cells take up glucose - Blood glucose levels decrease and return to normal levels	5*

*one mark deducted for each component missing

Sample answer:



Question 31:

Criteria	Marks
Students accurately identifies a pathogen of an Australian plant and states the response of the plant	2
Student identifies a pathogen of an Australian plant	1

Sample answers:

Answers could include:

- Botrytis (grey mould)
- Ink disease is an attack by a fungus called *Alternaria alternata* which affects kangaroo paws. Ink spot shows up as blackening of the leaves and flower stems. The disease usually starts at the leaf tips, then spreads down the leaves into the rhizomes. If uncontrolled, ink spot may kill weak plants of dwarf hybrids and kangaroo paw species

Question 32 a

Marking Criteria	Mark
*Provides reasons for the response by the body *Describes the purpose of the inflammation response *Specifies that the innate immune system is responsible for response.	3
*Provides a reason for symptoms eg increased blood flow *Describes purpose of inflammation response OR *Specifies that the innate immune system is responsible for response	2
*Provides some relevant information eg. gives reasons for symptoms, identifies inflammation process, identifies innate immune response	1

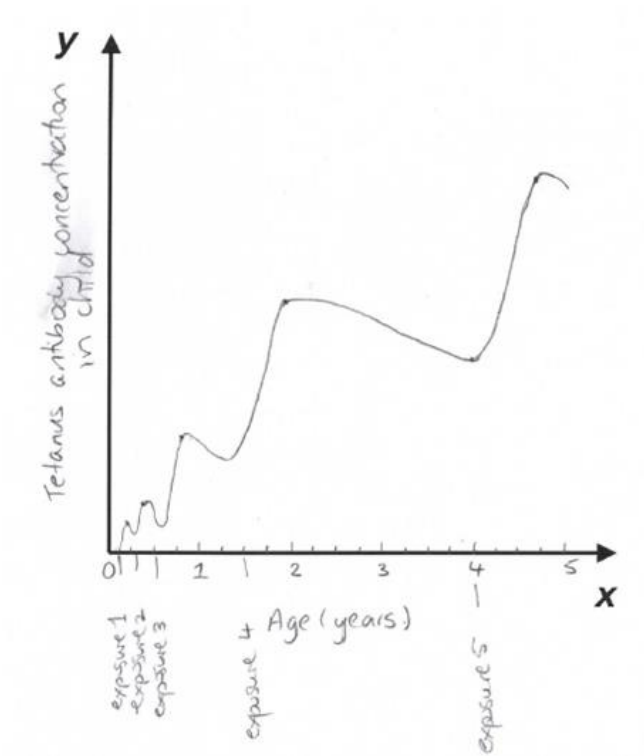
Sample answer

The response that has occurred is due to the innate immune system. The redness, hot feeling and swelling at the site of the scratch are due to the inflammation response which is a part of the second line of defence. Blood vessels dilate, which allows increased blood flow to the area - the increase in blood flow causes redness and the hot feeling associated with inflammation. The area swells as more fluid enters the space surrounding the scratch, this is also due to increased blood volume.

Question 32 b

Marking Criteria	Mark
*Correctly labels both axes with units *Correct scale for axes *Has 5 antibody peaks *Antibody peaks successively increase in size and do not drop below previous low.	4
*Satisfies 3 of the categories above	3
*Satisfies 2 of the categories	2
*Provides some relevant information	1

Sample Answer



Question 32 c

Marking Criteria	Mark
*Discusses the interaction of B and T cells in relation to antibody production. *Relates increase in antibody level to subsequent vaccinations.	3
*Discusses the role of B cells in relation to antibody production OR *relates increase in antibody level to subsequent vaccinations.	2
*Provides some relevant information	1

Sample Answer:

When the child is vaccinated against tetanus, they are injected with a weakened or attenuated form of the virus - this material is within the injection that they are given. The body contains B cells and T cells. When the B cells initially encounter the antigen they utilise this and present it on their surface. The presentation of the antigen causes T helper cells to activate the B cells. Activated B cells then become antibody generating plasma cells or memory cells. The memory B cells remain in the bloodstream and if the antigen is encountered they cause the production of plasma B cells to produce antibodies. Each time the child is exposed to the tetanus antigen a higher level of antibodies occurs in the blood as shown in the graph after each injection.

Question 32 d

Marking Criteria	Mark
*Outlines TWO methods and states how <u>each</u> minimises chance of infection	3
*Outlines ONE method and states how it minimises chance of infection OR *Outlines TWO methods	2
*Provides some relevant information	1

Sample Answer:

The first method that could be used to minimise the chances of the baby becoming infected with a disease is to breastfeed the baby. The mother will have antibodies in her blood for a number of antigens and these antibodies are transferred in the breast milk that is supplied to the baby, these antibodies will provide passive immunity to protect the baby from pathogens.

The second method that could be used to minimise the chances of the baby becoming infected with a disease is to ensure that all people who come in contact with the baby have been

vaccinated against the diseases that could be transferred - this is known as herd immunity. If a large number of people are vaccinated against the disease this reduces the chances of the disease occurring with the community and spreading to others - minimising disease spread in the community will minimise the chances of the baby coming into contact with the disease and becoming ill.

Question 32 e

Marking Criteria	Mark
*Criteria for judgement *Specific reference to the graph given *Interpretation of the graph *Detailed information on how each defence mechanism works with specific examples	5
*Criteria for judgement *Specific reference to the graph given *Interpretation of the graph *Information on how each defence mechanism works	4
*Specific reference to the graph given *Interpretation of the graph *Information on how 2 of these defences works	3
*Interpretation of the graph *Some reference to how 1 of these defences works	2
*Provides some relevant information	1

Sample Answer:

Criteria for judgement: How effective is each type of measure in protecting the body of different time periods?

Physical barriers are a part of the innate immune system and form the first line of defence against pathogens. This line of defence includes the waterproof skin layer, mucus membranes and different acidic environs of the body eg. skin and stomach. As shown in the diagram this level of defence is highly effective over a limited time (a number of minutes) this is because once the physical barrier has been overcome it offers limited protection and is ineffective in preventing further issues associated with the pathogen. Effective in the short term, but not the long term.

Innate immunity in the graph above refers to the second line of defence which involves processes such as inflammation and phagocytosis. Innate immunity does not occur until the physical barriers have been breached but starts soon after this. Innate immunity causes an increase in the amount of blood flowing to the area where the pathogen is located - in the case of a wound increased blood supply will lead to redness and a feeling of increased heat at the site. Phagocytosis will result in white blood cells such as macrophages engulfing and destroying

pathogens that occur within the blood. Innate immunity is a non specific defence mechanism that is effective over a short period of time (as shown in the graph) minutes to hours, it can also assist in the days after the exposure to the pathogen. Effective in the short term, but not effective in the long term.

Acquired immunity is a part of the third line of defence, this involves specificity of antibodies that are produced against a particular pathogen. The adaptive immune system is responsible for the third line of defence but this will only occur if the physical barriers and non specific responses have been unable to prevent the entry of the pathogen. In the third line of defence B cells will acquire the antigen for the pathogen and display it on their surface. Helper T cells will interact with the B cells, this will result in B cells differentiating to form plasma cells - which produce antibodies of memory cells which remain in the blood until the next encounter with the pathogen. T cells seek out infected cells and attach to these and destroy them, these are called cytotoxic T cells. T cells differentiate into 4 types, helper, cytotoxic, memory and suppressor. Helper cells assist with B cell activation. Cytotoxic cells destroy, suppressor assist in stopping the cytotoxic cells from destroying cells and memory T cells remain in the blood to activate a response if the pathogen is encountered again. As shown in the graph, this response is ineffective when initial exposure occurs but leads to a high level of protection in the days and weeks after initial exposure.

Each response is effective for a given time period and this is why they work together. Positive aspects is that they confer different types of responses from non targeted to targeted, but the negative is that each subsequent line of defence will not occur until after the previous one has been activated - in the case of rapidly multiplying pathogens this could results in death as the system takes too long to respond.