



Sydney Boys High School

Student Number

Biology Trial 2022

General Instructions

- Reading time – 5 minutes
- Working time – 3 hours
- Write using black or blue pen
- Draw diagrams using pencil
- Board-approved calculators may be used
- Write your Student Number at the top of this page and also on the multiple choice answer sheet

Total marks – 100

Part

20 marks

- Attempt Questions 1–20
- Allow about 35 minutes for this part

Part

80 marks

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

Part A – 20 marks

Attempt Questions 1 – 20

Use the multiple-choice answer sheet.

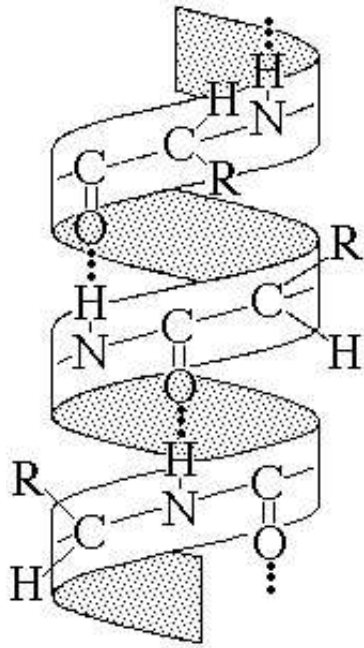
1. The following double-stranded DNA contains sequence of a eukaryotic gene:

5'-ATGGCC TCACACAGGAAACAGCTAT GGCCATGAGCACGCCAGTC T CGGCT-3'
3'-TACCGGAGTGT GTCC T T TGTCGATACC GGTACT CGTGCGGTCAGAGCCGA-5'

Transcription begins at the underlined A/T at base pair AND proceeds to the right. What are the first 12 nucleotides of the resulting mRNA?

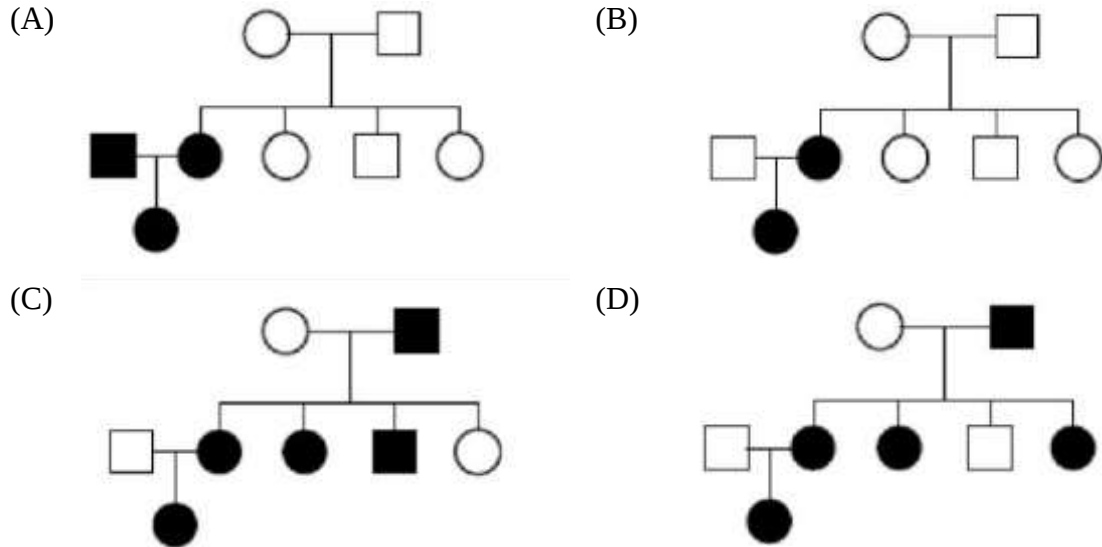
- (A) 3' AAACAGCUAUGG 5'
 - (B) 5' AAACAGCUAUGG 3'
 - (C) 3' TTTGUCGAUACC 5'
 - (D) 5' TTTGUCGAUACC 3'
2. Which one of the following is the source of progesterone in early pregnancy?
- (A) Placenta
 - (B) Pituitary
 - (C) Corpus luteum
 - (D) Blastocyst
3. Artificially acquired passive immunity refers to immunity from:
- (A) Transfer of antibodies from mother to foetus across the placenta
 - (B) Recognition of an antigen by B cells
 - (C) Injection of the antigen in a vaccination
 - (D) Injection of antibodies
4. Hunting of the northern elephant seal off the Pacific coast in the 1890s reduced its population to only 20 survivors. Their population has since rebounded to over 30 000, but they have much less genetic variation than a population of southern elephant seals that was not so intensely hunted. This is an example of which mechanism of evolution?
- (A) Bottleneck effect
 - (B) Founder effect
 - (C) Selective breeding
 - (D) Natural selection

5. The following diagram best illustrates

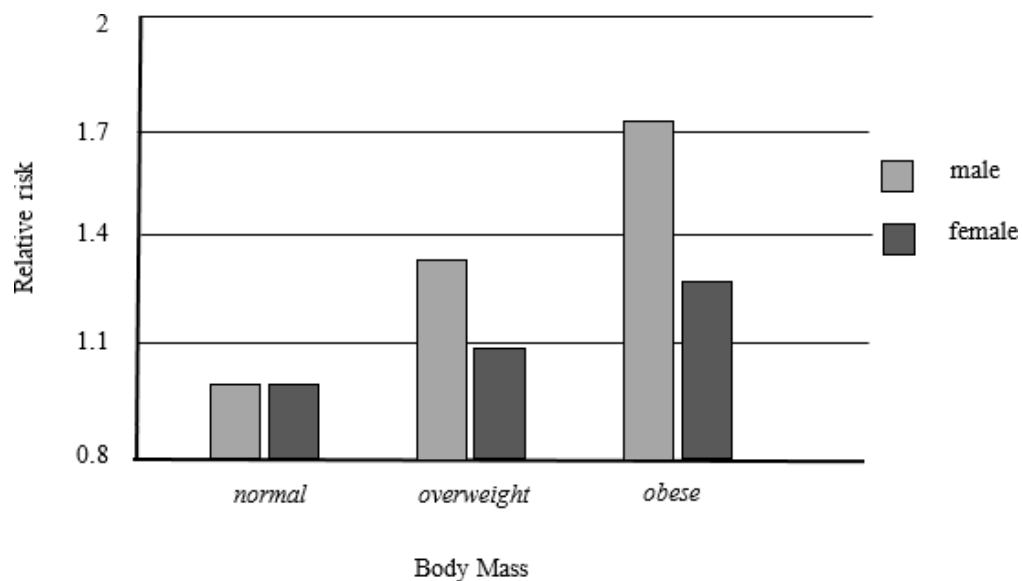


- (A) Primary structure of a polypeptide
 - (B) Quaternary structure of a protein
 - (C) Double helix structure of DNA
 - (D) Secondary structure of a protein
6. In the immune response, antibodies are produced that are specific to the antigens of the pathogen causing the infection. Which cell produces antibodies as part of the immune response?
- (A) Red blood cell
 - (B) Macrophage
 - (C) Plasma cell
 - (D) Natural Killer Cells
7. Which statement correctly describes fungi and protozoans?
- (A) Fungi and protozoans are unicellular.
 - (B) Fungi and protozoans have chloroplasts.
 - (C) Fungi have a cell wall and protozoans do not.
 - (D) Fungi are procaryotic and protozoans are eucaryotic.

8. Which pedigree represents an X-linked dominant trait?



9. Colon cancer is one of the main types of cancer affecting the Australian population. The graph below shows the effect of body mass on the relative risk of contracting colon cancer for men and women.

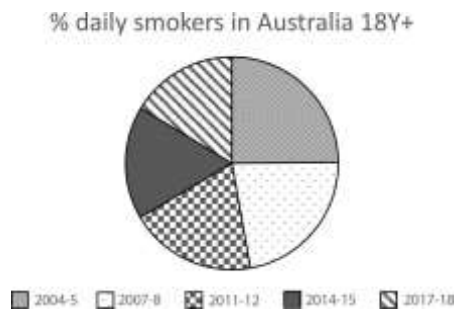


Which one of these statements is best supported by these data?

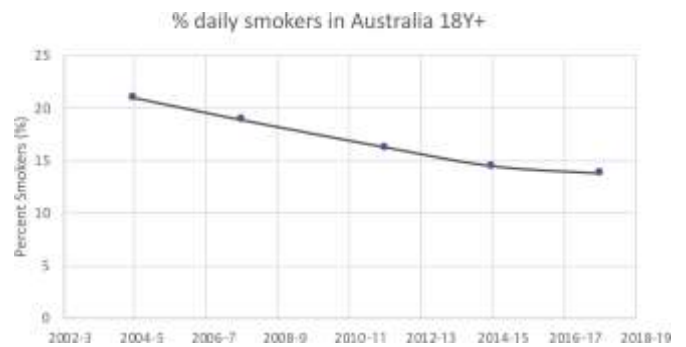
- (A) Gender is not a factor which affects the relative risk of developing colon cancer.
- (B) Gaining weight increases the colon cancer risk for men more than it does for women.
- (C) The increased risk is most likely due to other health effects of obesity rather than colon cancer.
- (D) Men and women of normal weight are at no risk of developing colon cancer.

10. A group of four investigated the rates of smoking in Australian adults. Each student graphed their data as shown. Which of the graphs produced is the most suitable representation?

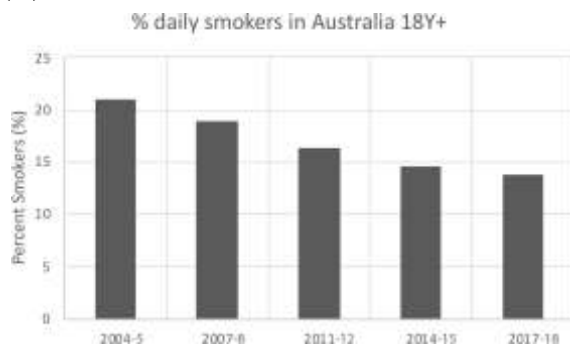
(A)



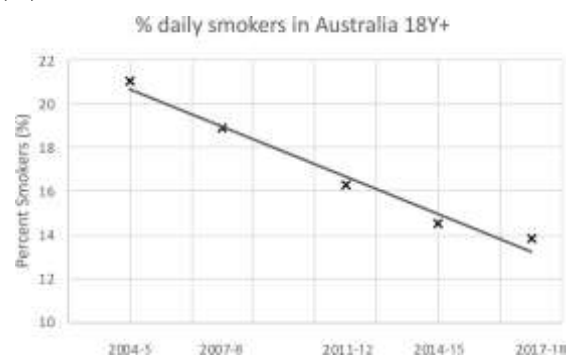
(B)



(C)



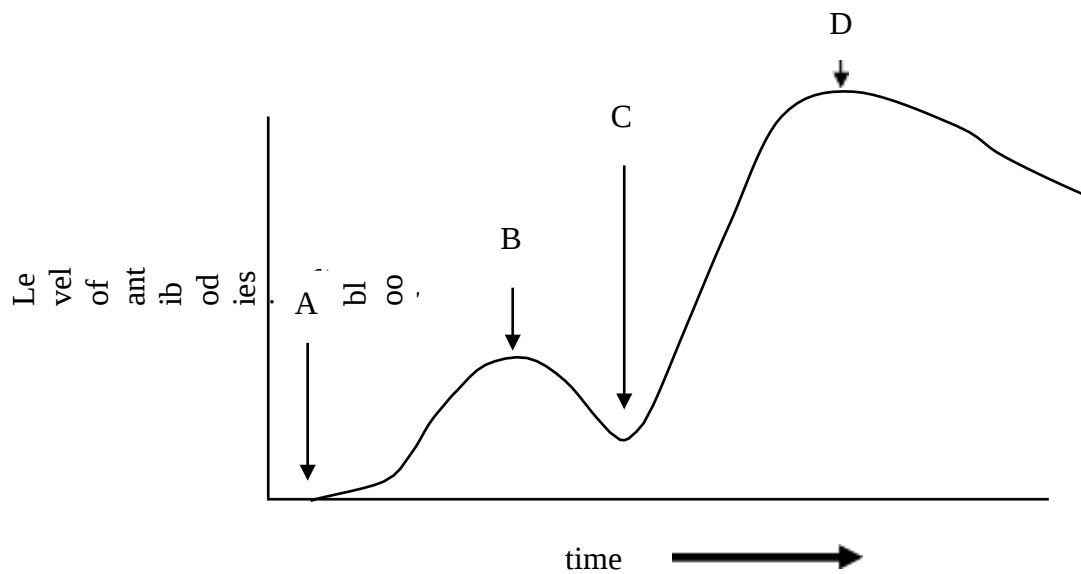
(D)



11. In DNA replication, what role does the enzyme DNA polymerase have?

- (A) It adds nucleotides to a DNA strand
- (B) It adds RNA primers to a DNA strand
- (C) It is used to unwind the DNA double helix
- (D) It reconnects complementary base pairs in the DNA double helix

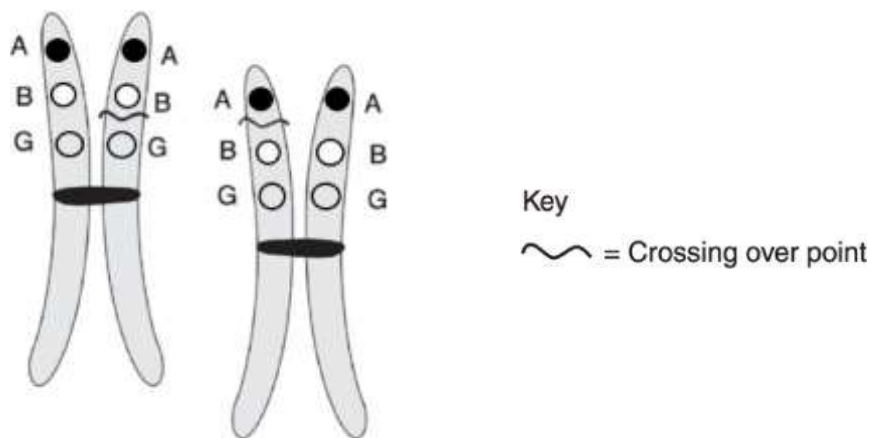
12. The graph below shows how antibody levels change in the blood as a part of the primary and secondary immune responses.



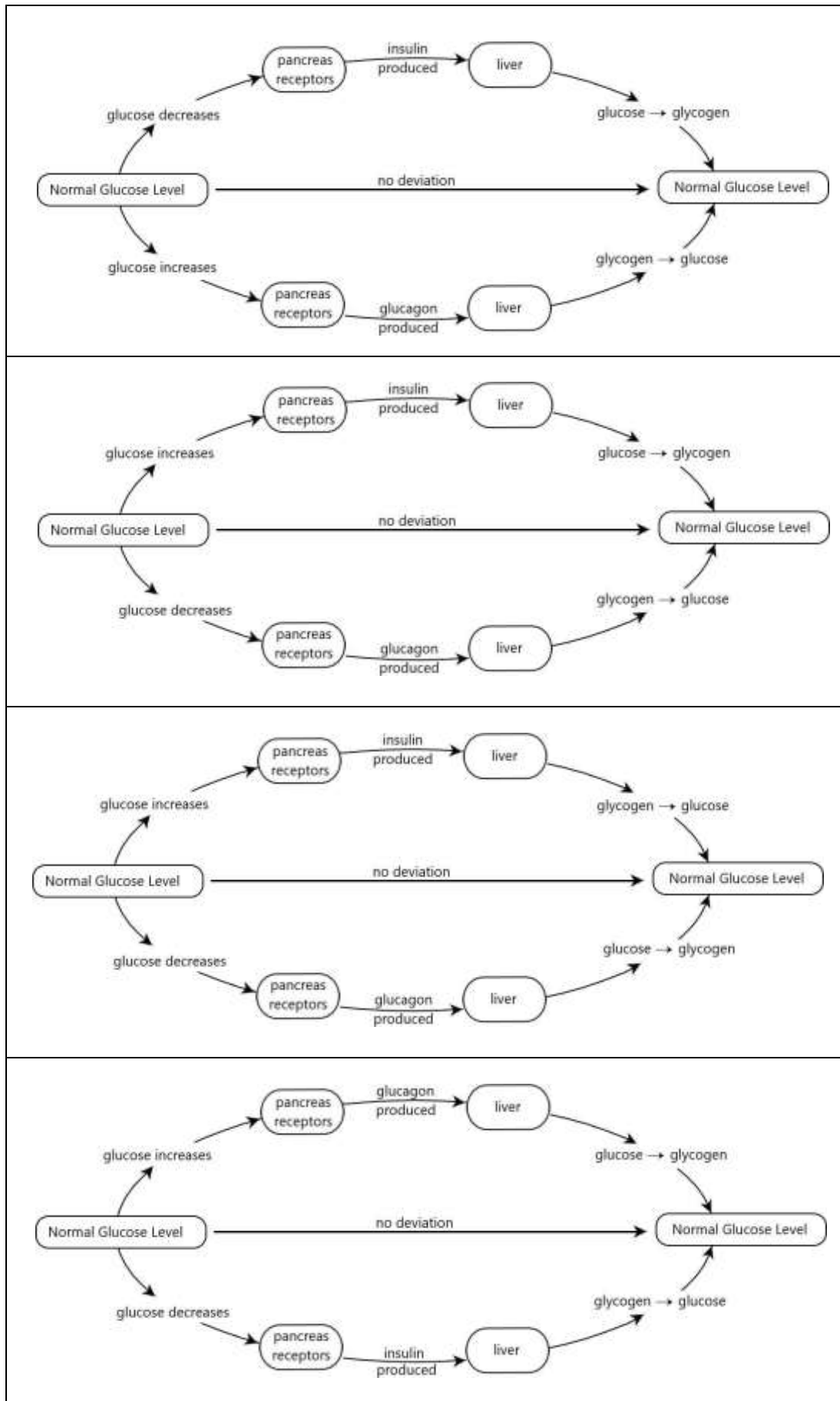
Which letter represents the time of the second exposure to the antigen?

- (A) A
 - (B) B
 - (C) C
 - (D) D
13. A gene has three alleles in a population: G1, G2 and G3. The frequency of G1 in that population is 60% or 0.6. G2 has a frequency of 0.25. What is the frequency of G3?
- (A) 0.75
 - (B) 0.15
 - (C) 40%
 - (D) 25%
14. For which of the following purposes would an investigator use Koch's postulates?
- (A) To demonstrate that microorganisms can be grown in cell culture
 - (B) To refute the theory of spontaneous generation
 - (C) To determine the prevalence of a particular non-infectious disease
 - (D) To determine the cause of a particular infectious disease

15. Three genes, A, B and G, are arranged along a homologous pair of chromosomes. The figure below shows how the homologous chromosomes have misaligned during meiosis and the point at which crossing over occurs.



- Which mutation will result from this error?
- (A) Duplication of gene A & B on one chromosome
 - (B) Deletion of G on one chromosome
 - (C) Duplication of A on one chromosome
 - (D) Deletion of B on one chromosome
16. Which of the following is an example of a physiological adaptation in an endotherm to maintain homeostasis?
- (A) Lizards moving into the sunlight to raise body temperature
 - (B) Surface blood vessels in a human constricting on a cold day
 - (C) Animals in cold climates having thick fur coats
 - (D) Shivering to cool down.
17. Which of the following statements about mutagenic agents is correct?
- (A) All electromagnetic radiation is mutagenic
 - (B) Thymine dimers caused by UV radiation prevent accurate replication
 - (C) Nucleotides from viral DNA insert themselves into the bonds between base pairs.
 - (D) Non-ionising radiation can cause double stranded breaks



18. Which diagram correctly represents a negative feedback loop controlling the level of glucose in the bloodstream of a healthy human?

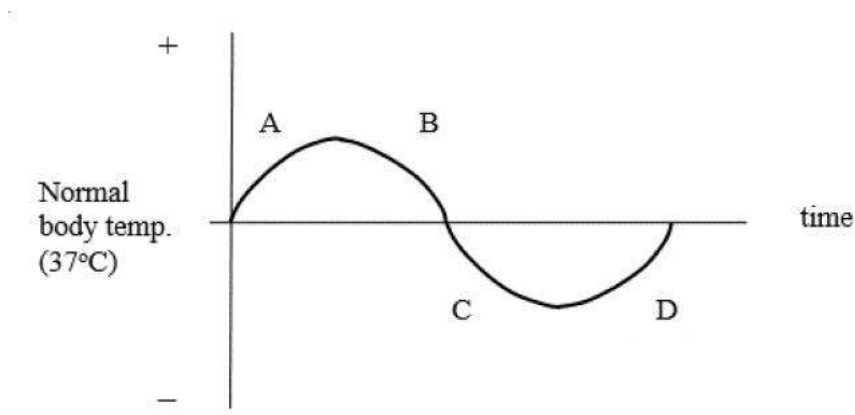
(A)

(B)

(C)

(D)

19. Which of the following best describes the term 'prevalence of a disease'?
- (A) the proportion of people in a population who have a disease at a given time
 - (B) the rate at which people develop a disease in a given time
 - (C) the number of people who die from a disease on a given day
 - (D) the number of people hospitalised due to a disease on a given day
20. The graph below, which shows how body temperature varies in humans.



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

- (A) A
- (B) B
- (C) C
- (D) D

Part B

Answer the questions in the spaces provided.

Question 21 (6 marks)

The following image shows a Lego model of eukaryotic DNA.

Marks



- (a) Outline the limitations of this model to describe the structure of eukaryotic DNA.

3

Question 21 continues on page 11

Question 21 (continued)

Marks

3

(b) Describe TWO differences between prokaryotic and eukaryotic DNA.

Question 22 (3 marks)

3

Using an example, demonstrate how genotype and the environment affect phenotype.

Question 23 (4 marks)

Marks

4

Describe the function of RNA in polypeptide synthesis

Question 24 (7 marks)

7

Mendel's Law of Independent Assortment (1865) states the inheritance of one pair of factors (now known as genes) is independent of the inheritance of other pairs of factors. That is the inheritance of one trait has no effect on the inheritance of another.

Mendel's Law of Dominance states that in a heterozygote, one trait will conceal the presence of another trait for the same characteristic.

Evaluate whether these two laws still apply today.

Question 23 (4 marks)

Marks

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Question 25 (7 marks)

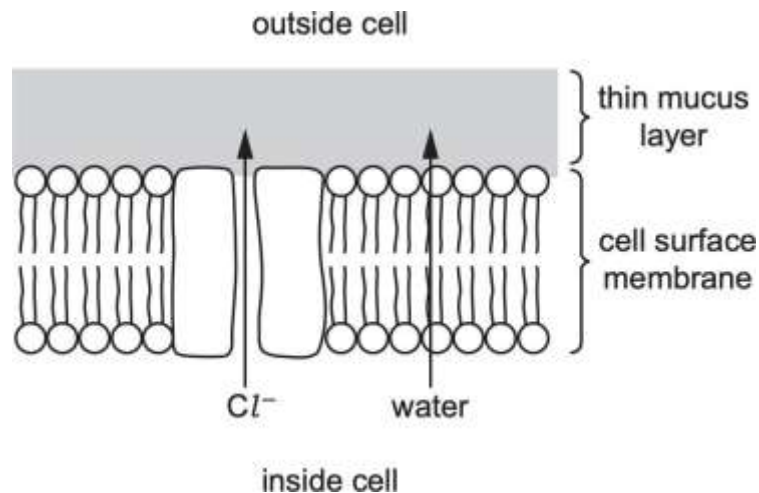
Cystic fibrosis is an inherited genetic disease that can affect many body systems, including the respiratory system.

Cystic fibrosis (CF) is caused by mutations of a gene coding for transmembrane protein (CFTR) which acts as an ion pump.

?

The normal allele of the CFTR gene codes for a transport protein that transports chloride ions out of epithelial cells.

Fig is a diagram of part of the cell surface membrane and the mucus layer of an epithelial cell with normal CFTR proteins.



This disease can be classified according to the effect of the different gene mutations on the CFTR protein.

In most cases of CR, the transport proteins are misfolded.

In severe cases of CF, the transport proteins are not added to the cell surface membrane. This causes the mucus layer to be thick and sticky.

- (a) Explain how a mutation in the CFTR gene could result in no CFTR protein being synthesised.

Question 25 (7 marks)

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.....

Question 25 continues on page 15

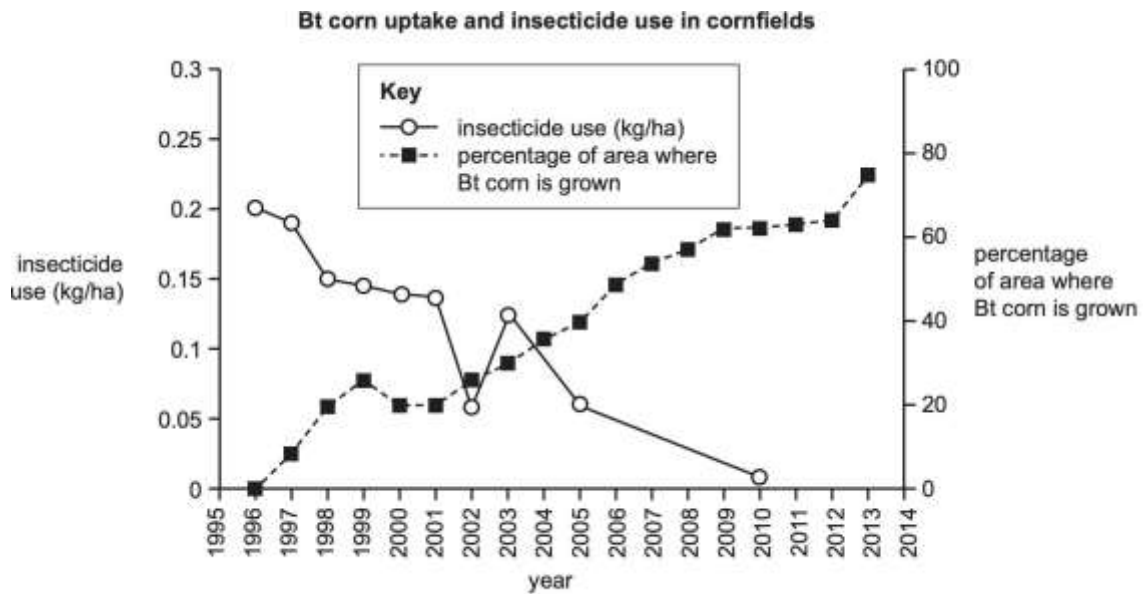
- (b) Explain why the absence of CFTR proteins will cause the mucus layer to be thick and sticky.

- (c) Outline why people with cystic fibrosis are more likely to suffer from lung infections than people without cystic fibrosis.

Question 26 (9 marks)

Bt plants have been genetically modified to produce a toxin that kills insect pests.

The figure below shows information about the use of Bt crops and insecticide in corn fields.



Source: 'Smarter Pest Control', special section, *Science*, vol. 341, 16 August 2013, p. 731

(a) Using the data provided explain how the use of BT plants can affect biodiversity.

4

Question 26 (9 marks)

Question 26 continues on page 17

Question 27 (5 marks)

2

- (a) Define somatic and germ cells.

- (b) Outline the differences in the effects of somatic mutations and germ-line mutations on an organism. 3

Question 28 (4 marks)

4

Compare the adaptations of TWO different pathogens that facilitate their entry into and transmission between hosts.

.....

Question 29 (2 marks)

2

Outline a contemporary application of traditional Aboriginal medicine.

.....

Question 28 (4 marks)

.....

Question 30 (6 marks)

- (a) In the space below draw a labelled diagram to outline the steps involved in phagocytosis of a bacterial cell. **3**

- (b) Describe the role of inflammation in the immune response. **3**

Question 31 (12 marks)

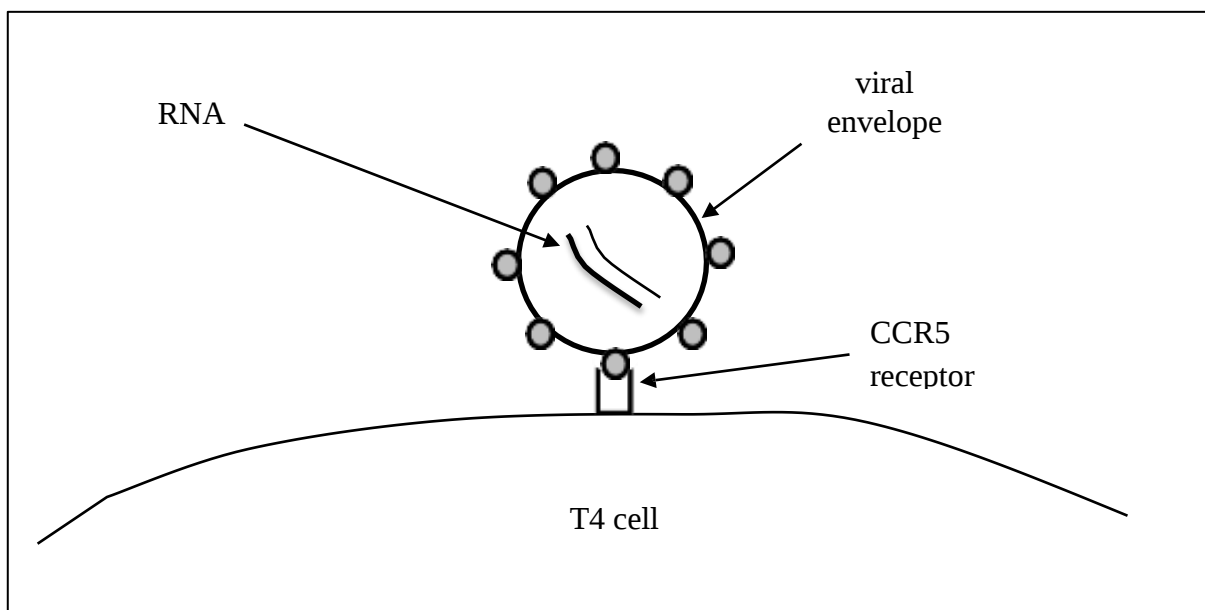
Study the information below to help you answer this question about the Human Immunodeficiency Virus

The Human Immunodeficiency Virus (HIV) first came to notice in the developed world in the 1980's.

The virus is thought to have made the species jump from monkeys to humans in West Africa, probably because of people killing and eating monkeys for food.

The HIV virus targets the T4 lymphocytes (Helper T cells), reproducing inside them and destroying them in the process.

The virus attaches to a specific receptor on the membrane of the T4 cell, as represented in the diagram below.



HIV is transmitted via body fluids. Most commonly via semen in sexual intercourse, but also via blood between intravenous drug users.

Over time, an HIV infection can develop into Acquired Immune Deficiency Syndrome (AIDS). Sufferers lose the ability to combat otherwise minor infections.

About 10% of people of European descent carry a mutation called the CCR5 delta 32 mutation.

It is a recessive allele, and in homozygous individuals (fewer than 1% of the population), it disables the CCR5 receptor, preventing entry of the virus and conferring resistance to HIV.

Question 31 continues on page 22

Question 31 (continued)

Marks

- (a) With reference both to HIV and to one other pathogen which you have studied, assess the importance of a knowledge of a pathogen's mode of transmission in controlling the disease it causes. **4**
- (b) Referring to your knowledge of the human immune system, explain why, over time, HIV infection can lead to the symptoms of AIDS. **4**

Question 31 continues on page 23

Question 31 (continued)

Marks

- (c) Using your knowledge and the information at the start of this question, outline TWO procedures that could be employed to prevent the spread of HIV.

4

Question 32 (3 marks)

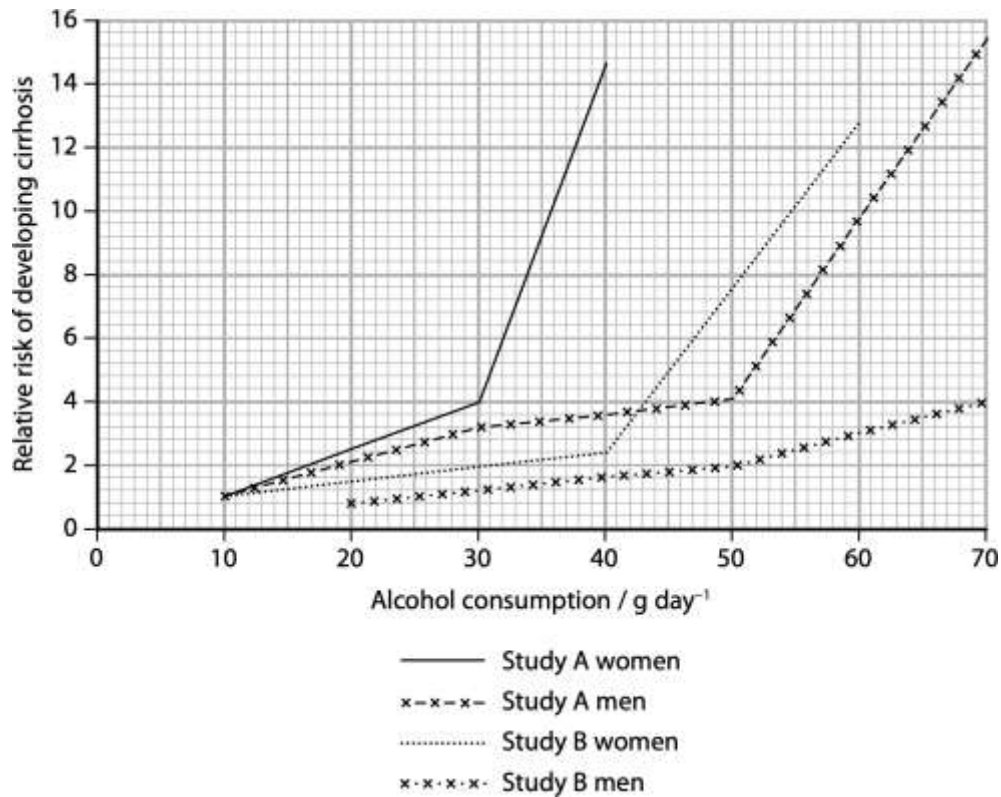
3

Describe ONE cause and the effect of a named nutritional disease.

.....

Question 33 (12 marks)**Marks**

Cirrhosis is a disease of the liver that is associated with alcohol abuse. Two studies, study A and study B, were carried out to determine the relative risk of developing cirrhosis in relation to the mass of alcohol consumed each day by men and women. The graph below shows the results of these two studies



(a) Explain the relationship shown by the data

3

(b) Compare the relative risk of men and women developing cirrhosis.

2

Question 33 (12 marks)

Marks

Question 33 continues on page 25

(c) Assess the reliability of these results.

2

(d) It has been suggested cirrhosis mortality rates may be more closely related to consumption of certain alcoholic beverages – specifically spirits – than to total alcohol consumption. The following outlines a method used to test this hypothesis.

5

1. Selected 144 patients at their first diagnosis of cirrhosis.
2. Selected 144 control individuals
3. Checked that there were an equal number of male and female participants in each group.
4. A scientifically valid questionnaire was given to both groups about their average consumption of spirits, beer and wine.
5. Discovered that there were more wine drinking respondents than spirits or beer drinking respondents.
6. Removed some of the wine drinkers until both groups had equal numbers
7. Analysed data, wrote the paper and published it in a scientific blog.

From the information provided, analyse the methodology used by this scientist

Question 33 (continued)

Marks

END OF EXAM

Multiple Choice

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

Question 21 (a)

Marking Criteria	Marks
Three limitations of the model described in detail with references to structure and molecular components.	3
Above lacking thorough detail	2
Brief statements with no detail	1

- Lack of Representation in showing the different types of bonds involved eg Hydrogen bonds between base pairs not represented
- Lack of representation of the four different bases
- Does not differentiate between the sugar and phosphate groups
- Not true representation of the actual shapes and sizes of the atoms in DNA

Question 21 (b)

Marking Criteria	Marks
Describes TWO ways in which the structure of DNA differs between eukaryotes and prokaryotes (4 DIFFERENCES DESCRIBED)	3
Describes TWO ways in which the structure of DNA differs between eukaryotes and prokaryotes (3 DIFFERENCES DESCRIBED)	2
Describes ONE way in which the structure of DNA differs between eukaryotes and prokaryotes (2 DIFFERENCES DESCRIBED)	1

Prokaryotic DNA is in the form of a single circular chromosome, Eukaryotic DNA is in the form of discrete linear molecules.

Prokaryotic DNA is not associated with histone proteins, Eukaryotic DNA is associated with histone proteins.

Prokaryotic DNA has only one copy of each gene, Eukaryote has multiple copies of genes.

Prokaryotic DNA has very little non-coding, Eukaryotic DNA large sections of non-coding DNA.

Prokaryotic DNA:

- Is naked (i.e. not bound with proteins and therefore doesn't form chromatin)
- Genomes are compact (contain little repetitive DNA and no introns)
- Contains extra-chromosomal plasmids
- Is circular in shape

Eukaryotic DNA:

- Is bound to histone proteins
- Genomes contain large amounts of non-coding and repetitive DNA (including introns)
- Do not contain plasmids (but organelles such as the mitochondria may contain their own chromosomes)
- Are linear in shape

Question 22

Criteria	Marks
• Makes evident the relationship between genes and phenotypic expression • Makes evident the relationship between the environment and phenotypic expression • Outlines an example	3
• Sketches in general terms the relationship between genes and phenotypic expression OR • sketches in general terms the relationship between the environment and phenotypic expression • Identifies examples of phenotypic expression	2
• Identifies a feature of the influence of genes on phenotype OR identifies an example of the influence of environment on phenotype	1

Relationship between genes and phenotype - The genotype of an organism describes the specific alleles for a particular gene, and the phenotype describes the appearance of the organism associated with the genotype.

Relationship between environment and phenotype - The phenotype is variable depending on the genetic makeup of the organism and also influenced by the surroundings to which the organism is subjected. Genes play an important part in influencing phenotype, but genes are not the only influence. Environmental conditions, such as temperature and availability of nutrients can affect phenotypes.

There are certain situations in which the environment affects not only the growth and health of an organism, but also the use or deployment of the organism's genes.

Genes play an important part in influencing phenotype, but genes are not the only influence. Environmental conditions, such as [temperature](#) and availability of nutrients can affect phenotypes. For example, temperature affects coat [colour](#) in rabbits.

The dark points on the Himalayan rabbit are caused by a gene that codes for a [temperature-sensitive enzyme](#). The enzyme, which causes a darkening of the rabbit's fur, is active only in the cooler parts of the body such as the tail, feet, ears, and area around the nose.

Modern twin studies have shown that almost all human traits are at least partly influenced by genetic differences. Some characteristics, such as height, show a strong genetic influence, while other characteristics have an intermediate level of genetic influence, such as with intelligence.

Question 23

	Marks
Describes in detail the function of both tRNA and mRNA in polypeptide synthesis. Role of both in transcription and translation	4
sketches in general terms the function of tRNA and mRNA	3
Indicates some features of tRNA and mRNA	2
Provides some information about RNA	1

Two types of RNA are involved in protein synthesis: mRNA and tRNA. mRNA carries a copy of the genetic information in a DNA molecule out of the nucleus into the cytoplasm, where it attaches to a ribosome. tRNA then enables translation to occur. tRNAs in the cytoplasm collect amino acids and take them to the ribosomal complex. Each triplet of bases in mRNA corresponds to a complementary triplet of bases in tRNA and this in turn determines which amino acid will be brought to the ribosome to be assembled into a protein.

Transcription – occurs when the double helix DNA unzips and a single strand of mRNA is made, using part of the non-coding strand of a DNA molecule as a template. The sequence of nucleotide bases on the mRNA molecule is the same as the DNA coding strand, except that it has U instead of T. The mRNA moves out of the nucleus and into the cytoplasm, where it encounters some of the millions of ribosomes in the cell.

Translation - occurs when mRNA is ‘read’ by ribosomes and translated into a polypeptide, with the help of tRNA. (On one end of the tRNA there are three unpaired bases called an anticodon, which attach the tRNA to its complementary bases on the mRNA strand.)

The other end of the tRNA is able to bind with an amino acid temporarily.

- Translation occurs when the ribosomes move along the mRNA molecule and, as they do so, they attach tRNA molecules to mRNA by temporarily pairing the bases of the tRNA anticodons with their complementary triplets of bases (codons) on the mRNA.
- The amino acids from the tail end of each tRNA are linked to one another by an enzyme to form a polypeptide chain.
- The tRNAs move away from the mRNA, leaving the growing chain of amino acids, and move back into the cytoplasm where they can pick up another amino acid and be reused.
- The polypeptide chain is then processed in the cell. It may be joined to one or more other polypeptides and be further processed and folded into the correct shape for its functioning, forming the final protein end product.

Question 24

Marking Criteria	Marks
<u>Mendel’s Law of Independent Assortment</u> • Describes correct points for (1) • Describes correct points against (1) • Judgement bases on the points described (1)	7
<u>Mendel’s Law of Dominance</u> • Describes correct points for (1) • Describes correct points against (1) • Judgement bases on the points described (1)	
• Detailed and well sequenced answer using appropriate scientifically terminology (1)	

Mendel’s Law of Independent Assortment. The allele a gamete receives for one gene does not influence the allele received for another gene if they are located on separate, non-homologous chromosomes.

During meiosis each pair of homologous chromosomes line up at the equator of the spherical cell. For each homologous pair, the chromosomes assort to one side or the other. The alignment of any pair of homologous chromosomes is independent of all the other pairs. Thus, the mixture of unlinked genes in gametes is random.

However, each chromosome contains hundreds or thousands of genes, organized linearly on chromosome. The segregation of alleles into gametes can be influenced by **linkage**, in which genes that are located physically close to each other on the same chromosome are more likely to be inherited as a pair.

Crossing over of genetic material between non-sister chromatids can occur when homologous chromosomes line up during meiosis. Therefore it is possible for two genes on the same chromosome to behave independently, or as if they are not linked.

Although possible it is not entirely independent so his Law of independent assortment does not still apply.

Mendel's Law of Dominance applies to simple autosomal dominant traits.

For every gene there are 2 copies. Alleles are different forms of a gene. If two different alleles are present for an autosomal dominant trait, the trait expressed is referred to the dominant trait. The trait that is hidden is referred to as the recessive trait.

Exceptions to this Law includes incomplete dominance and codominance.

Incomplete dominance. Two alleles may produce an intermediate phenotype when both are present, rather than one fully determining the phenotype.

Codominance. Two alleles may be simultaneously expressed when both are present, rather than one fully determining the phenotype.

These rules still form the foundation of our understanding of inheritance—that is, how traits are passed on and how an organism's genotype (set of alleles) determines its phenotype (observable features). However, we now know of some exceptions therefore do not still apply.

Question 25 (a)

Criteria	Marks
1. mutation changes the sequence of bases 2. reference to stop code / idea of {insertion / deletion / eq} changes all triplets / frame shift 3. {transcription / translation} does not occur / mRNA too short / protein too short / a different protein is made	3

Question 25(b)

Criteria	Marks
any two from: 1 chloride ions / Cl ⁻ , do not leave / stay inside, epithelial cell ; 2 (so) no, difference of water potential between inside and outside of cells ; 3 no osmosis (of water) out of the cell ; consequently stickier/thicker mucus	2

Question 25(c)

Criteria	Marks
idea that mucus {traps / eq} {bacteria / pathogens} ; idea that {bacteria / mucus containing the bacteria} cannot be removed (by cilia);	2

Question 26(a)

Criteria	Marks
- Identify negative correlation between % area of BT crops and insecticide use (1) - explain the identified relationship (1) Insecticide kills many different species of invertebrates - Explain how BT crops can affect biodiversity (2) Biodiversity of plant decreases – monocultures Targeted pest will decrease Biodiversity of all other invertebrates will increase	4
3 of the above lacking detail	3
2 of the above	
1 of the above or some relevant information	

- 1 Bt corn has been engineered to be resistant to insect attacks, and as a result the need for spraying of pesticides is reduced. This is shown in the graph by a significant reduction in the use of insecticides between 1996 and 2010, from 0.2 kg/ha to less than 0.01 kg/ha. Spraying these chemicals can result in the death of many species of invertebrates, which in turn can impact soil health and limit the ability of some plants to grow, and remove food sources from food webs. It is therefore likely that planting Bt corn will increase the local biodiversity because only target pest species will be impacted by the crop.

Question 26(b)

Criteria	Marks
• Provides a concise description of either restriction enzyme or CRISPR-Cas9 recombinant DNA technology	3
• Provides some details of either restriction enzyme or CRISPR-Cas9 recombinant DNA technology	2
• Provides some relevant information	1

Sample Answer

Answer could refer to restriction enzyme or CRISPR-Cas9 gene editing.

DNA is isolated from a cell and the target DNA is cut out using a restriction enzyme, creating sticky ends. A bacterial plasmid is cut with the same restriction enzyme, leaving the same sticky ends. The target DNA binds to the plasmid by complementary base pairing of the sticky ends. DNA ligase is used to bond the sugar-phosphate backbone of the DNA. The resulting recombinant plasmid can be taken up by a plasmid-free bacterium, which replicates and amplifies the target DNA, or can be wrapped in a lipid coat (making a liposome) that can be injected into a recipient.

OR

In CRISPR-Cas9 technology, a guide RNA is made with a base sequence that is complementary to a specific sequence on the target DNA. The guide RNA is attached to a Cas9 enzyme. The RNA-Cas9 complex recognises and binds to the DNA that is to be modified. The Cas9 enzyme cuts the DNA and a desired piece of DNA (gene) can be inserted, forming recombinant DNA.

Question 26 (c)

Criteria	Marks
• Describe one social implication relevant to the use of BT plants	2
• Identifies one social implication	1

Some examples

Improved farm worker safety due to decrease pesticide use

Reduced production cost due to increase in yield

Reduce poverty in some countries, allows to be grown in areas of high pest infestation etc

Patenting etc can impact the farmer community etc due to

Question 27 (a)

Criteria	Marks
• Defines somatic cells AND germ cells	2
• Defines somatic cells OR germ cells/ identifies the type of cells	1

A somatic cell is any cell in the body that is not a gamete (sex cell) or a stem cell. (*It is diploid, meaning it has two sets of chromosomes.*)

A germ cell is a gamete. This is a cell that can unite with a cell from the opposite sex to form a new individual. *(It is haploid, meaning it has one set of chromosomes.)*

Question 27 (b)

Criteria	Marks
• Provides a clear outline of TWO differences	3
• Identifies 1 differences	2
• Provides some relevant information	1

Somatic mutations occur in body (somatic) cells and germ-line mutations occur in gametes (sex cells). Somatic mutations are not inherited by the offspring. In germ-line mutations, the offspring inherit the mutation and carry it on to future generations. Somatic mutations affect only the tissue derived from the mutated body cell, while germ-line mutations affect every cell of the organism.

Question 28

Criteria	Marks
Describes adaptations of TWO pathogens and outlines how they are similar AND Describes adaptations of TWO pathogens and outlines how they are different	4
Describes adaptations of TWO pathogens and outlines how they are similar OR Describes adaptations of TWO pathogens and outlines how they are different	3
Describes adaptations of TWO pathogens (entry and transmission) or Describes adaptations of one pathogens and outlines how they are similar (entry and transmission) OR Describes adaptations of one pathogens and outlines how they are different (entry and transmission)	2
Describes adaptations of ONE pathogen (entry and transmission)	1

Question 29

Criteria	Marks
Outline a contemporary application of traditional Aboriginal medicine	2
Identify a traditional Aboriginal medicine or an application without correctly naming	1

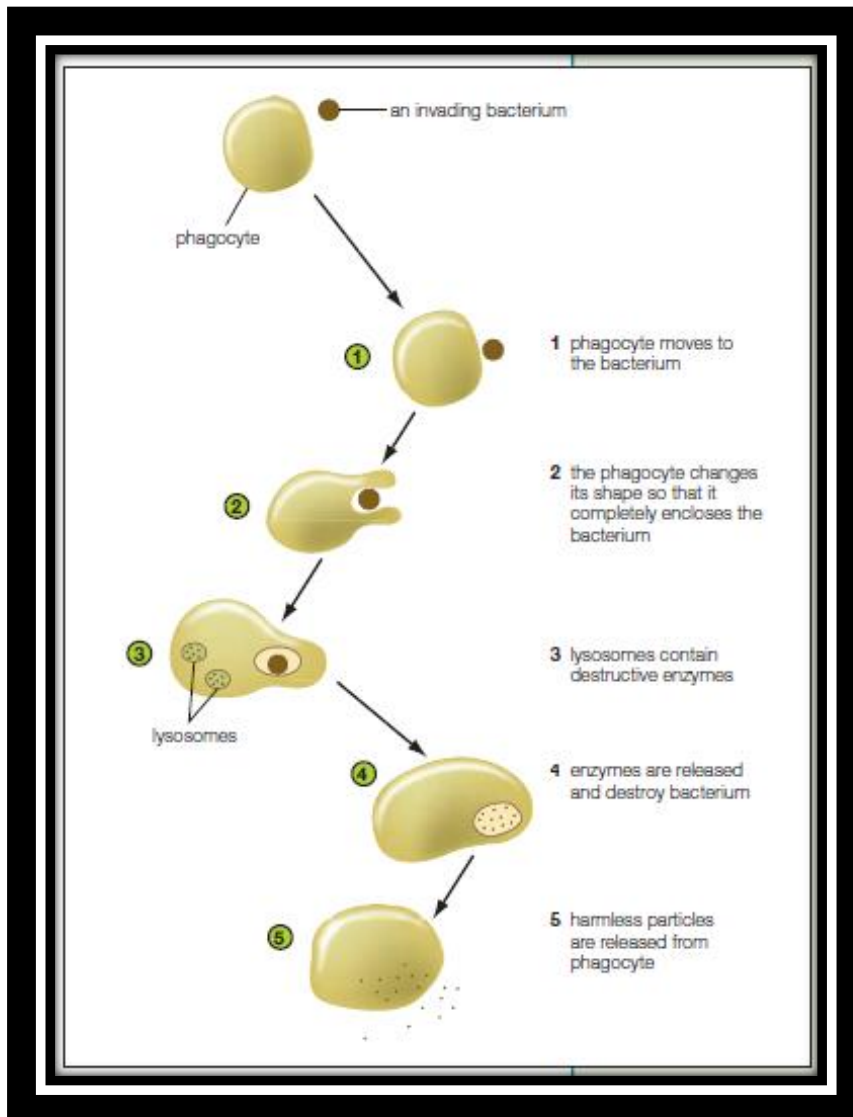
Smoke Bush – HIV treatment

Question 30 (a)

Criteria	Marks
Phagocytosis is shown with a series of diagrams including detailed labels	3
Phagocytosis is shown with a series of diagrams including labels – some steps missing	2
Phagocytosis is sketched with limited detail	1

Step	Description
1.	Bacteria attaches to the macrophage's cell membrane.
2.	Bacteria is engulfed, forming a phagosome.
3.	Phagosome fuses with a lysosome.
4.	Lysosomal enzymes and reactive oxygen species destroy the bacteria.
5.	Digestive material is released from the macrophage.

These are the steps involved in phagocytosis by a macrophage. It's important to remember in particular that the mechanisms through which bacteria are destroyed during phagocytosis is through the fusing of the phagosome (containing the bacteria) with the lysosome. The lysosome contains antimicrobial enzymes, reactive oxygen species, reactive oxygen species, and has a low pH (i.e. is acidic), and these are the ways bacteria are destroyed.



Question 30(b)

Criteria	Marks
Makes evident the role of the inflammatory response. - Explaining increased blood flow (release of chemicals, area becomes hot, swollen etc) - Effects of increased blood flow - Explain blood vessel permeability	3
Provides characteristics and features of the inflammatory response	2
Identifies a feature of the inflammatory response	1

Inflammation is a non-specific immune response that involves the release of chemicals such as cytokines, histamines etc. This causes the capillaries to dilate which increases the blood flow to the site of infection causing the site to redden, swell and become warm. Increase in temperature inhibits growth of pathogen and inactivate enzymes and toxins released by pathogen.

The extra blood carries phagocytes to destroy the pathogen, enables clotting to occur and prevents pathogens spreading. Increased blood flow into the site of infection brings more antibodies white blood cells to engulf the pathogen.

Inflammation response also increases the permeability of the blood vessels allowing WBC's etc (all of the above) to the site of infection.

Question 31(a)

Marking Criteria	Marks
• Mode of transmission and control of HIV linked • Mode of transmission and control of another NAMED pathogen linked • Assessment made of the importance of knowledge about transmission for development of controls.	4
• Mode of transmission and control of HIV linked • Mode of transmission and control of another NAMED pathogen linked • NO assessment	3
• Mode of transmission and control of HIV linked OR • Mode of transmission and control of another NAMED pathogen linked	2
• Mode of transmission of another pathogen linked	1

Knowledge about the mode of transmission of a pathogen is critical to the development of controls for the disease it causes.

For example, knowledge that HIV is transmitted primarily through body fluids, particularly through sexual intercourse, informed the decision to promote condom use and make them readily available to people.

The knowledge that Malaria is caused by a pathogen that is transmitted by a mosquito vector has allowed the development of controls which break the life cycle of the pathogen and prevent its transmission. Use of mosquito repellents and nets are part of the control measures for malaria.

Question 31(b)

Marking Criteria	Marks
• Detailed explanation given in terms of: - Role of Helper T cells - Role of B cells & Cytotoxic T cells - How reproduction of HIV leads to destruction of T-helper cells - Identify consequence of decrease in numbers of T-helper cells - Link low cell numbers to the development of opportunistic infections.	4
• 1-3 of the above	1-3

Helper T cells play a crucial role in the immune response.

When an antigen is detected and brought by macrophages to the lymph node, Helper T cells act to sensitise B cells and Killer T cells against that specific antigen. B cells then clone to make plasma cells, which produce antibodies to combat the pathogen, Killer T cells clone to make active Killer T cells which will attack the antigen. When inside the T-helper cell, the HIV pathogen uses the cells organelles to produce HIV proteins and reproduce. The virus replicates until there is no more room and then the cell bursts. Any decrease in the number of Helper T cells will compromise this response. Once Helper T cells reach a low level, they are unable to sensitise B cells and Killer T cells and pathogens are able to infect the body unopposed. It is these opportunistic infections which are the symptom of AIDS and which cause the death of the patient.

Question 31(c)

Marking Criteria	Marks
- Identification of 2 opportunities from stimulus material - Outline of 2 procedures that can be used	4
• Identification of 2 opportunities from stimulus material • Briefly outline of 2 procedures that can be used OR • Detailed outline 2 procedures that could be used	3
• Outline 1 procedure that could be used OR • Briefly outline 2 procedures that could be used	2
• Briefly outline a procedure that could be used	1

NB: HIV transmitted via semen and blood both refer to body fluids so is only regarded as one opportunity from the stimulus

The existence of an allele which disables the CCR5 receptor, effectively conferring resistance to HIV, raises the possibility of a genetic therapy for HIV.

The fact that this allele is recessive makes it unlikely that attempts to introduce the allele to the organism via a vector would be successful. The presence of dominant alleles within the organism would override its effect.

The allele would need to be introduced to the fertilised zygote and would need to replace both alleles present to have an effect. This level of manipulation has not yet been performed on humans.

A more likely genetic therapy might be to develop genetically modified bone marrow cells and use them in a bone marrow transplant. Then lymphocytes would be produced which don't have the functional receptor and resistance would be conferred. This would require treatment to kill the patient's own bone marrow cells. It would come with significant risks and would only really be justified in patients with AIDS for whom other remedies have failed.

Question 32

Criteria	Marks
Identifies a nutritional disease Describes the cause of the disease Describes the effects of the disease	3
Identifies a nutritional disease Identifies the cause of the disease Identifies the effects of the disease	2
Identifies a nutritional disease & Identifies the cause of the disease OR Identifies the effects of the disease	1

NB: starvation not accepted

Question 33 (a)

Criteria	Marks
- Identifies the relationship between alcohol consumption and cirrhosis - Identifies the risk increases above 40g per day - correct manipulation of figures e.g. increase in risk by 10.4 between 40 and 60 g per day, increase in risk of 1.4 between 10 and 40 g per day	3

Increase in alcohol consumption increases risk of developing cirrhosis. risk increases much higher above 40 g per day ; increase in risk by 10.4 between 40 and 60 g per day, increase in risk of 1.4 between 10 and 40 g per day ;

NB: there is no SPIKE

Question 33(b).

Criteria	Marks
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Outlines how they are SIMILAR & DIFFERENT 1. identifies that women have a greater risk than men / eq ; 2. identifies little difference between them from 10-30g per day ; 3. identifies that the steeper increase in risk is at lower alcohol consumption in women e.g. women steeper increase above 30 g per day while the steep increase for men is above 50 g per day / eq ;	2
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women have the same risk as men at lower alcohol consumptions

women (always) have a steeper increase

same risk when women consume 30g/day and men consume 50g/day

Question 33(c) Assess the reliability of these results

Criteria	Marks
• Refers to consistency of results • Makes a judgment	2
• Refers to consistency of results	1

1. the {results / conclusions / eq} of both studies are (fairly) similar suggesting that the results are reliable / eq ; 2. comments on the numbers of people in the studies / eq ; 3. comment on lack of {error bars / statistical analysis /eq}; 4. idea that the results do not reliably show at what level risk increases significantly

ACCEPT results show same pattern e.g. men lower than women in both studies 2. e.g. we don't know the sample size IGNORE number of studies 3. ACCEPT no information about the range of results in each study

Question 33(d)

Criteria	Marks
The design of this study cannot validly lead to a link between disease and its likely causes. • A valid questionnaire is good but • The number of subjects is low. The sample should be larger and broader. Ideally, the study should have a variety of equal categories, eg age, ethnicity, not just male: females equal. • Should have pair-matched control individuals. • Participants should not be eliminated on the basis of their answers as this reduces the scientific validity - Bias • This method looks at cirrhosis rates not cirrhosis mortality rates. • The final data should be peer reviewed for publication.	5