



Sydney Boys High School

Student Number

Biology Trial 2021

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 A Pages 2-9

20 marks

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

Part B Booklet 1 – pages 10 – 17

Booklet 2 – pages 18 – 26

80 marks

- Attempt Questions 21–34
- Allow about 2 hours and 25 minutes for this part

Part A – 20 marks
Attempt Questions 1 – 20
Use the multiple-choice answer sheet.

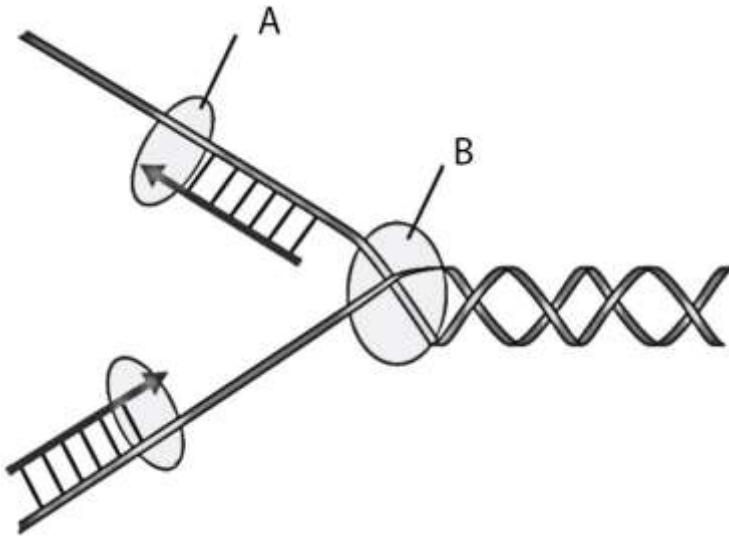
1. The following double-stranded DNA contains sequence of a eukaryotic gene:

5'-ATGGCC TCACACAGGAAACAGCTAT GGCCATGAGCACGCCAGTC TCGGCT-3'
3'-TACCGGAGTGTGTCC TT TGTCGATACCGGTACT 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. The primary hormone secreted by the corpus luteum is
- (A) LH
 - (B) FSH
 - (C) Progesterone
 - (D) Oxytocin
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

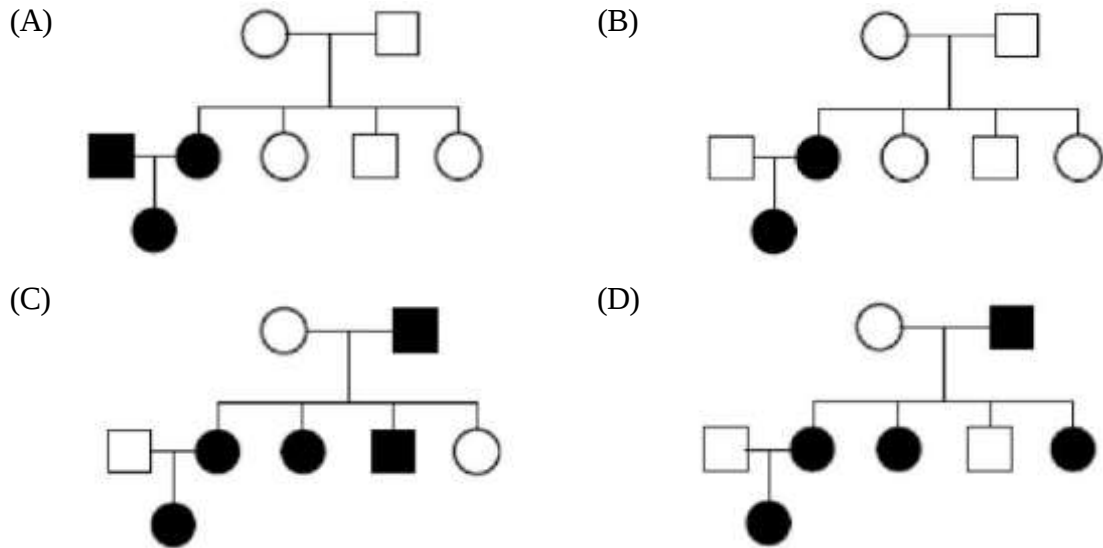
5. The diagram below shows a simplified representation of the process of DNA replication. A, and B are enzymes involved in the process.



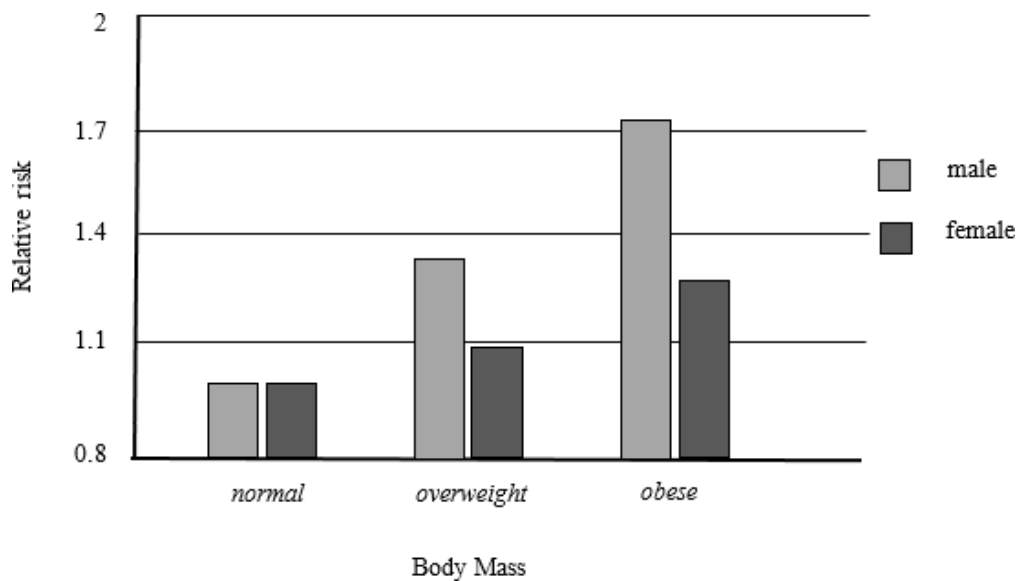
The enzyme labelled A is

- (A) DNA Ligase
 - (B) Helicase
 - (C) DNA polymerase
 - (D) Primase
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.

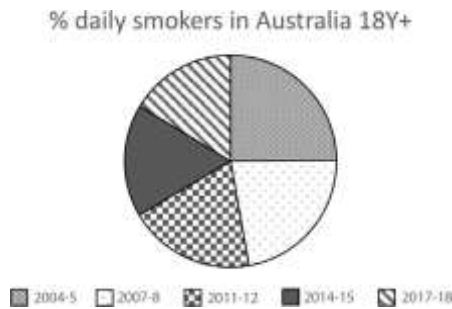


Which one of these statements is best supported by these data?

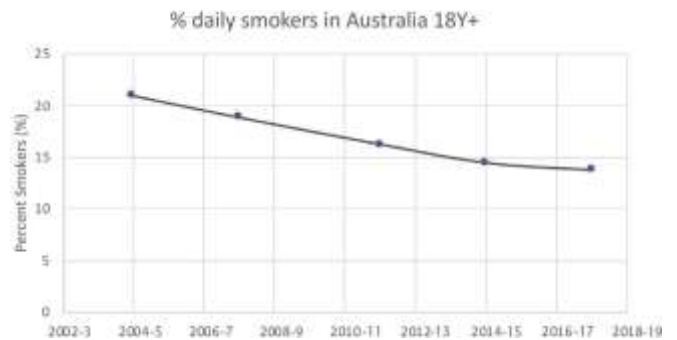
- (A) Gender is not a factor which affects the relative risk of developing colon cancer.
- (B) Gaining weight increases the colon cancer risk for men more than it does for women.
- (C) The increased risk is most likely due to other health effects of obesity rather than colon cancer.
- (D) Men and women 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?

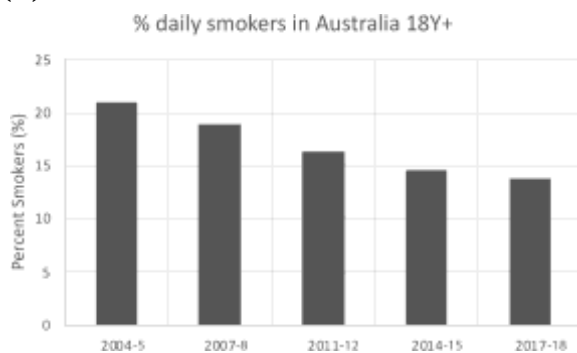
(A)



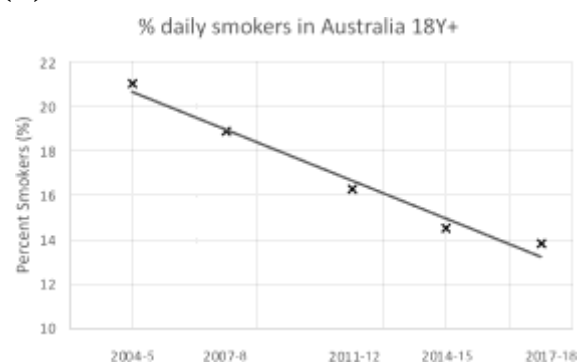
(B)



(C)



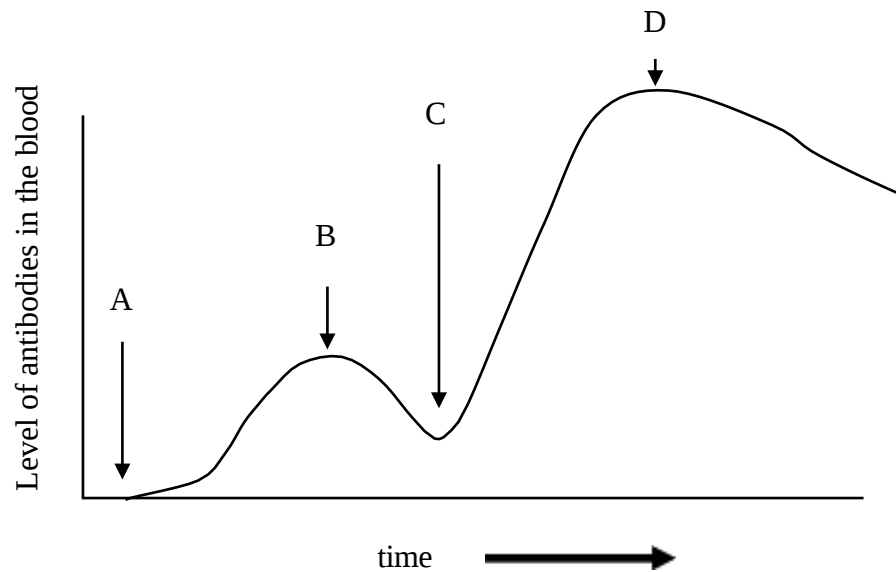
(D)



11. Polymerase Chain Reaction (PCR) is a laboratory technique used to amplify specific segments of DNA. Which one of the following is a correct statement regarding the PCR process?

- (A) Taq polymerase catalyses the addition of nucleotides to a DNA strand
- (B) The number of copies of DNA is quadrupled in each cycle
- (C) Helicase is used to unwind the DNA
- (D) DNA must be transcribed into RNA before it can be copied.

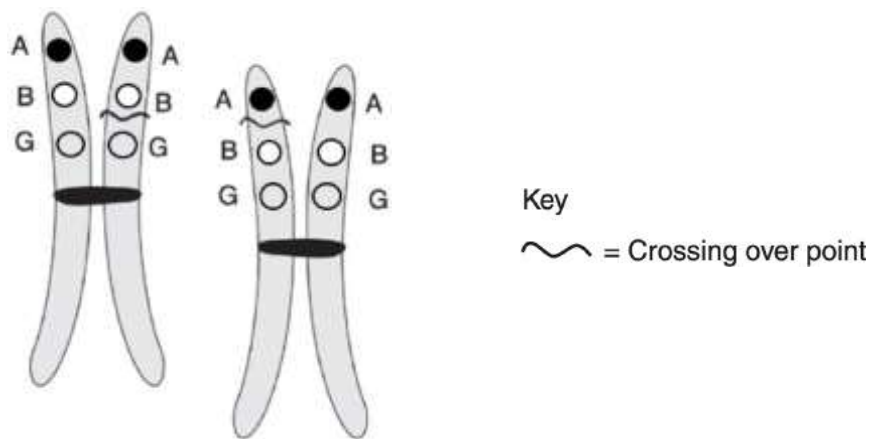
12. The graph below shows how antibody levels change in the blood as a part of the primary and secondary immune responses.



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

- (A) A
 - (B) B
 - (C) C
 - (D) D
13. Mutations in non-coding sections of DNA:
- (A) can affect both introns and exons.
 - (B) can affect transcription of coding sections of DNA.
 - (C) have no effect on the phenotype of individuals.
 - (D) are more common in prokaryotes than eukaryotes.
14. 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%

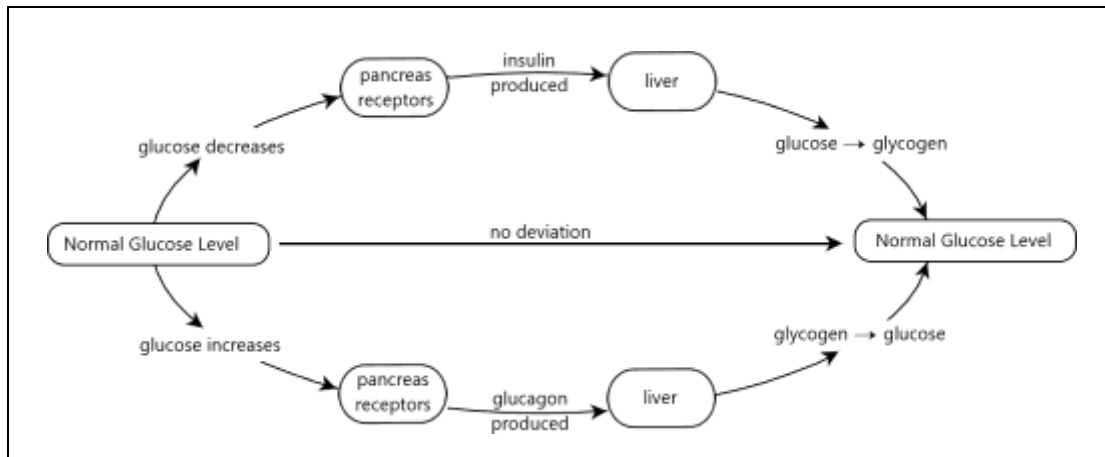
15. For which of the following purposes would an investigator use Koch's postulates?
- (A) To demonstrate that microorganisms can be grown in cell culture
 - (B) To refute the theory of spontaneous generation
 - (C) To determine the prevalence of a particular non-infectious disease
 - (D) To determine the cause of a particular infectious disease
16. 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.



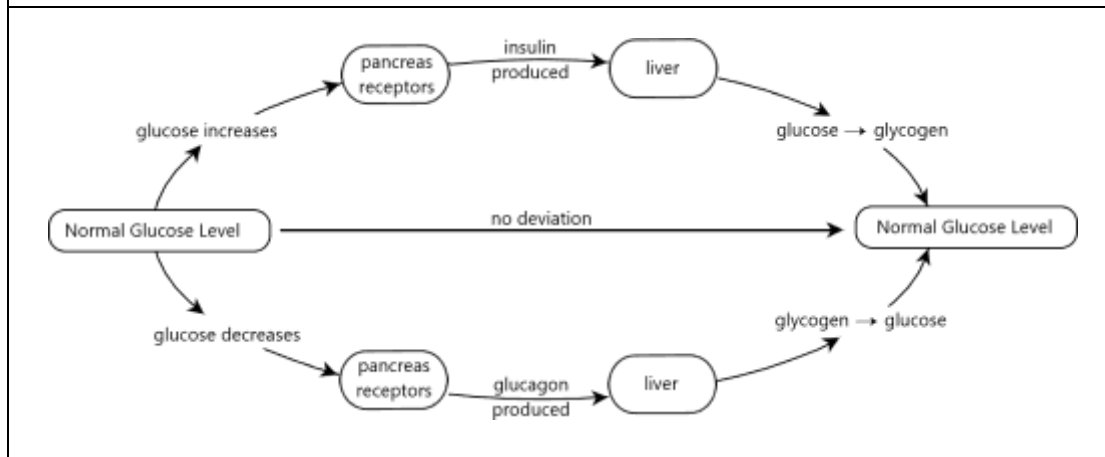
- Which mutation will result from this error?
- (A) Duplication of gene A & B on one chromosome
 - (B) Deletion of G on one chromosome
 - (C) Duplication of A on one chromosome
 - (D) Deletion of B on one chromosome
17. Which of the following is an example of a physiological adaptation in an endotherm 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.

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

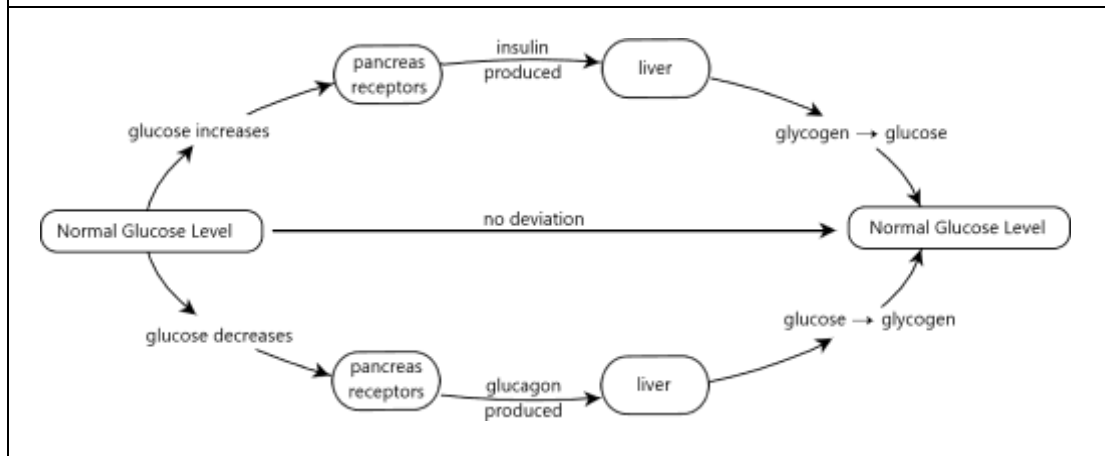
(A)



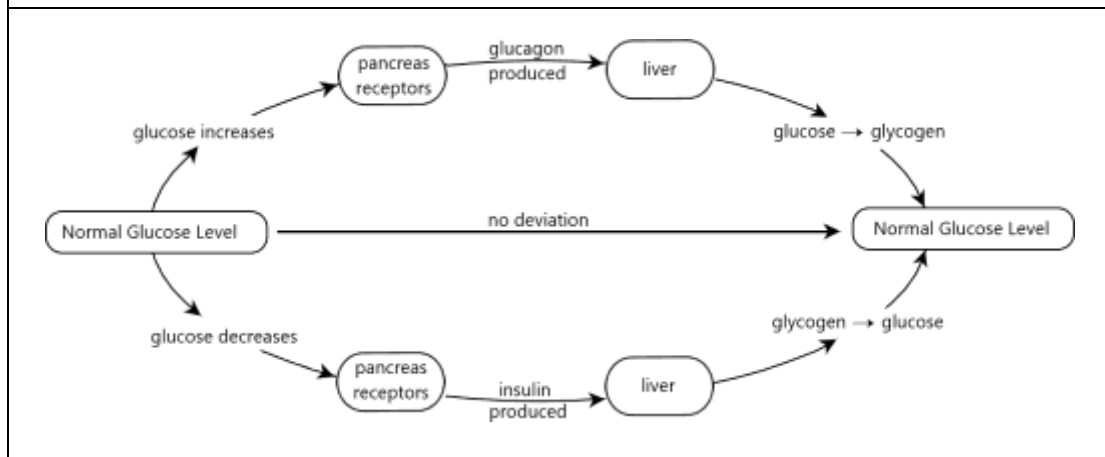
(B)



(C)



(D)



19. The photograph below shows the leaf structure of a typical Sydney bushland plant.



This structure helps the plant conserve water because:

- (A) the reduced surface area minimises water loss through transpiration.
 - (B) the orientation minimises exposure to sunlight, reducing overheating.
 - (C) the spines deter predators from eating water storage tissues.
 - (D) the small volume reduces the need of the plant for water for photosynthesis.
20. Which of the following statements about mutagenic agents is correct?
- (A) All electromagnetic radiation is mutagenic
 - (B) Thymine dimers cause 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

Part B

Answer the questions in the spaces provided.

Question 21 (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

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Question 22 (3 marks)

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

3

Question 23 (3 marks)

Outline how population genetics data from a named collaborative scientific project has been used to explore human evolution.

3

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

Bt corn uptake and insecticide use in cornfields

Key

- — insecticide use (kg/ha)
- - - percentage of area where Bt corn is grown

Year	Insecticide use (kg/ha)	percentage of area where Bt corn is grown
1996	0.20	0
1997	0.19	10
1998	0.15	20
1999	0.145	25
2000	0.14	20
2001	0.135	20
2002	0.06	25
2003	0.125	30
2004	0.105	35
2005	0.06	40
2006	0.05	45
2007	0.04	50
2008	0.03	55
2009	0.02	58
2010	0.01	60
2011	-	62
2012	-	65
2013	-	75

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

- 12 -

Question 24 (continued)

(b) Describe one social implication relevant to the use of BT plants.

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Question 25 (3 marks)

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

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Question 26 (12 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 26 continues on page 15

Question 26 (continued)

(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.

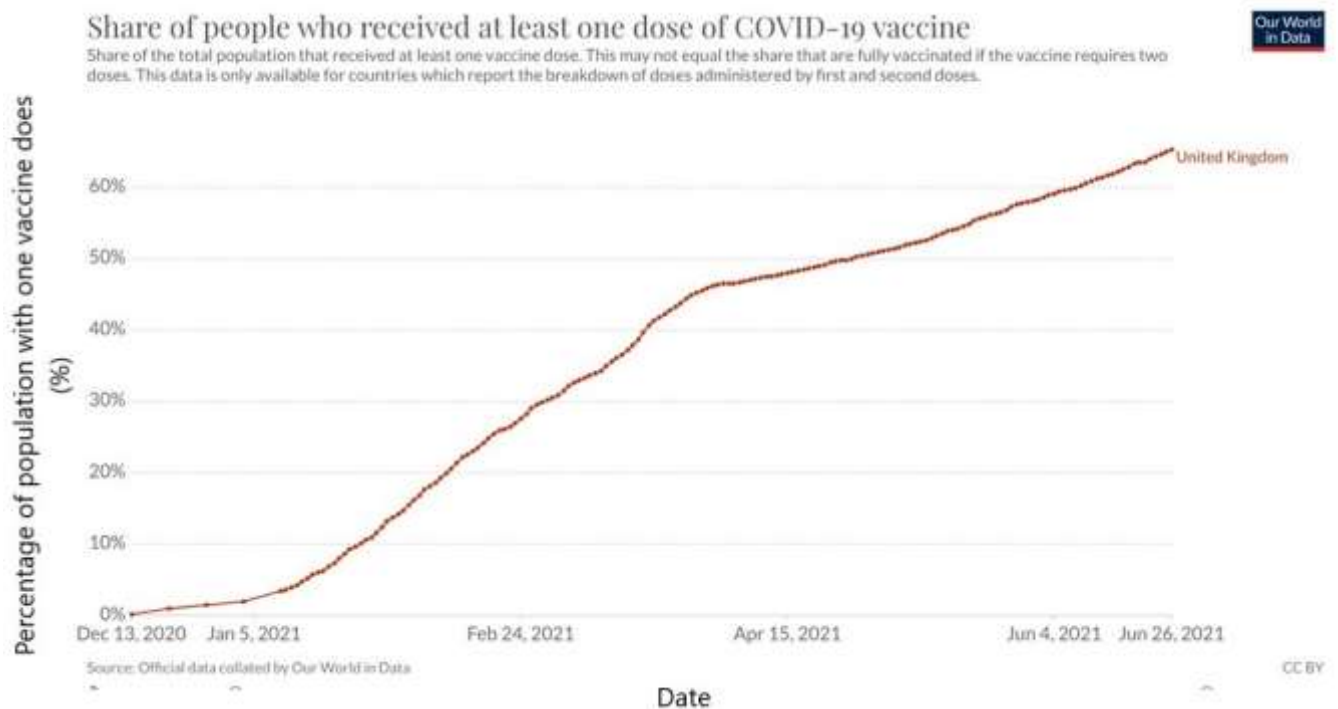
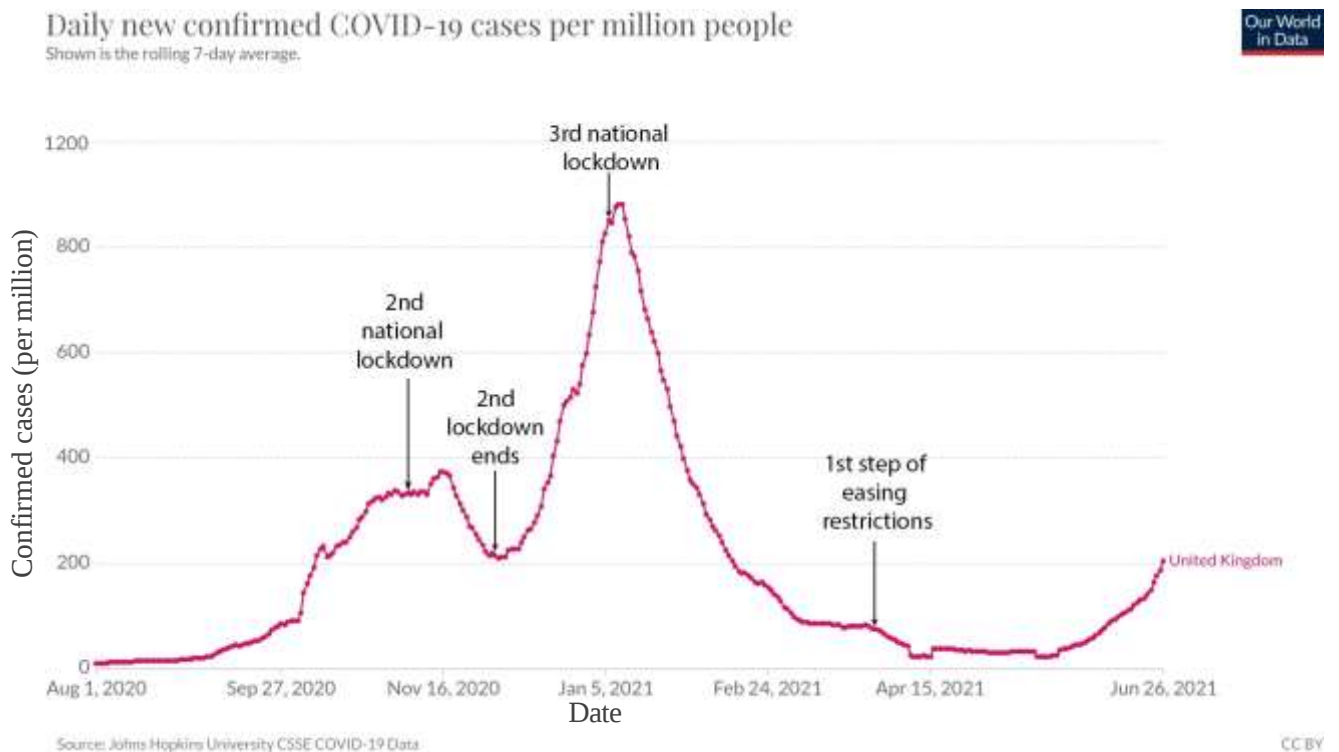
5

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 27 (7 marks)

The graphs below show covid related data for the UK.



Question 27 continues on page 17

Question 27 (continued)

1

- (a) Identify the peak daily incidence of Covid-19 in the UK between August 2020 and June 2021.

- (b) With reference to the data, explain why the combined use of vaccination programs and limiting the mobility of individuals is a more effective way of controlling disease than using only one of these strategies.

6

Exam (Questions 28-33) continues in booklet 2



Sydney Boys High School

Student Number

Biology Trial 2021 – Booklet 2

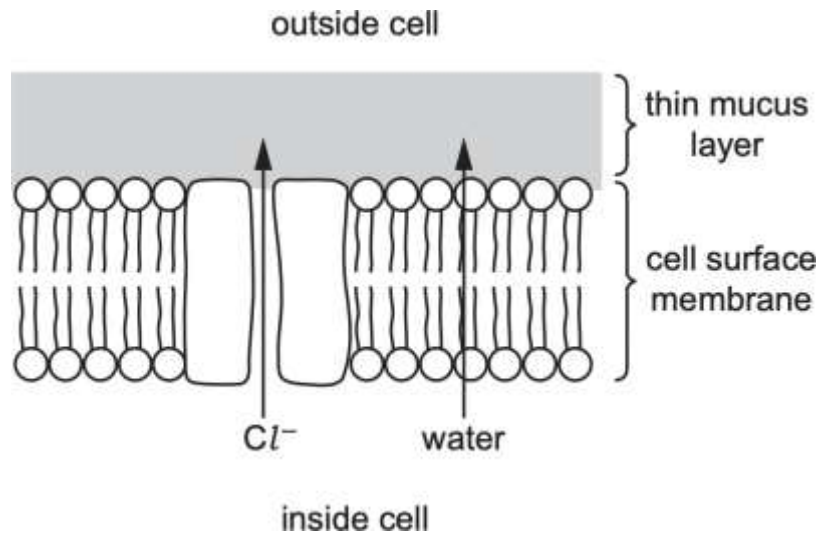
Question 28

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.



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.

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Question 28 continues on page 20

Question 28 (continued)

- (b) Explain why the absence of CFTR proteins will cause the mucus layer to be thick and sticky. **2**

- (c) Outline why people with cystic fibrosis are more likely to suffer from lung infections than people without cystic fibrosis. **2**

- (d) Assess the potential for the use of genetic engineering to prevent cystic fibrosis. **4**

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Question 29 (5 marks)

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. Evaluate whether his laws still apply today.

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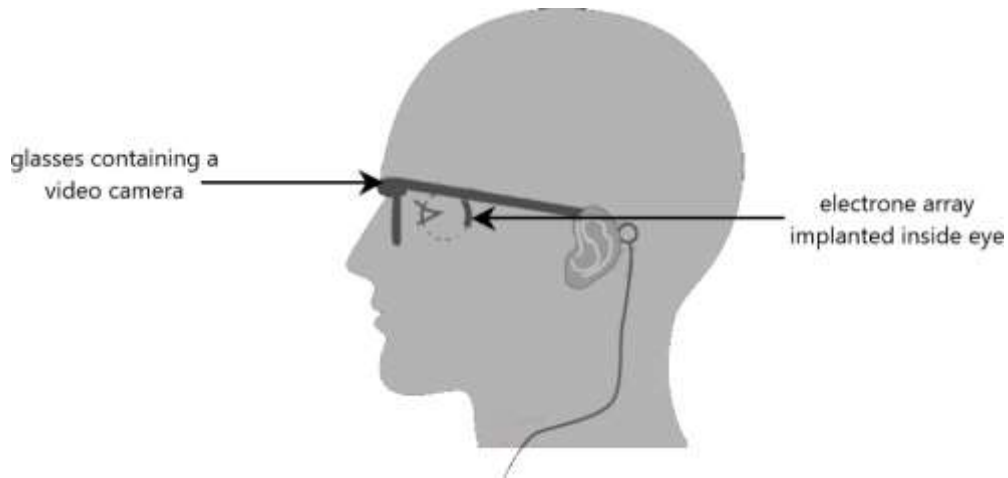
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Question 30 (5 marks)

Research is continuing into the development of a 'bionic eye' which can restore sight to blind people.



A video camera mounted on a pair of glasses records the scene digitally and transmits it wirelessly via radio waves to a receiver.

This communicates wirelessly with an array placed within the eye which in turn stimulates the optic nerve electrically.

The image generated by the brain has much less resolution than that produced in normal sight, but it is a great improvement on having no vision at all.

Compare the bionic eye with the cochlear implant, in terms of both its method of operation and its effectiveness.

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Question 31 (8 marks)

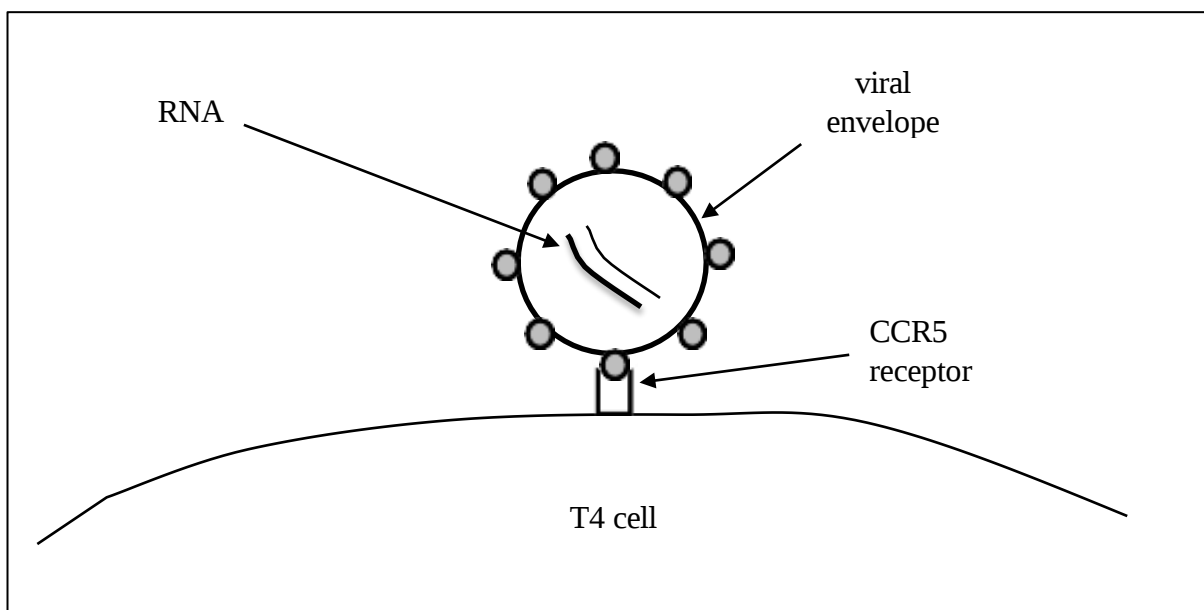
Study the information below to help you answer this question about the Human Immunodeficiency Virus

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 23

Question 31 (continued)

- (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

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

- (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 32 (5 marks)

Describe and justify the model you constructed to compare DNA in prokaryotes and eukaryotes.

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Please turn over

Question 33 (7 marks)

Compare the process and assess the effectiveness of gene cloning and whole organism cloning.

7

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	C	C	C	D	B	C	A	C	B	B	D	D	B	B	A	B

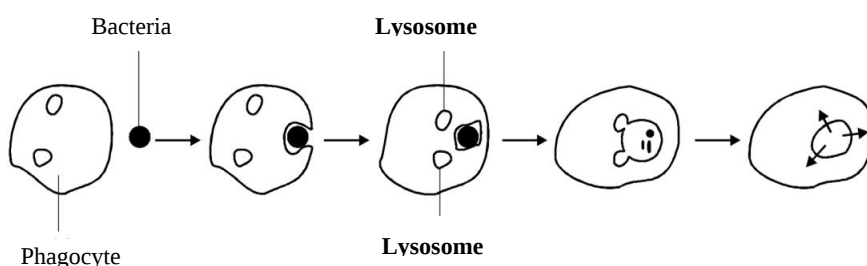
Question 21 –

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

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 21(b) Describe the role of inflammation in the immune response.

Criteria	Marks
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• 1 mark for explaining that the inflammatory response involves increased blood flow • 1 mark for explaining this increases blood vessel permeability • 1 mark for explaining that therefore there is an increased recruitment of immune cells to the site of infection	3
2 of above	2
1 of above	1

Inflammation is a non-specific immune response. The body brings blood and fluid to the location of damaged cells or infection causing it to redden, swell and warm.

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.

Question 22 Using an example, demonstrate how genotype and the environment affect phenotype.

Criteria	Marks
Identifies a named example Describe how genotype affects phenotype Describe how environment affects phenotype	3

Question 23 Outline how population genetics data from a named collaborative scientific project has been used to explore human evolution.

Criteria	Marks
Outlines how population genetics is used to explore human evolution Identifies a named collaborative project. Describes what the results from the project has taught us about human evolution.	3
2 of above	2
1 of above	1

Population genetics is the study of genetic variation within a population. This includes the study of frequency of genes & alleles within a population and among populations over time.

Population genetics is the study of genetic characteristics of populations and how or why the allele frequencies change over time and space. It has been used to contribute to our understanding of human evolution in studies that compared the DNA of groups, including Neanderthals and Denisovans. By averaging the rates of mutation of nuclear and mitochondrial DNA, estimates have been made of the time of divergence of these groups and modern *Homo sapiens* from common ancestors. Latest estimates are that divergence in the lineage occurred over half a million years ago.

There has been an ongoing debate as to whether Neanderthals and modern *Homo sapiens* interbred and were the same species. Evidence suggests that modern European humans interbred with Neanderthals in Europe and today this group contains between 1% and 4% Neanderthal genes in their DNA (there is no evidence in the DNA in people of African origin). The Neanderthal genes are associated with skin and hair colour, skin tanning and burning tendencies, mood and sleeping patterns.

(4 marks)

Question 24 (a) Using the data provided explain how the use of BT plants can affect biodiversity.

Criteria	Marks
- Identify negative correlation between % area of BT crops and insecticide use - Explain the identified relationship - Explain how BT crops can effect biodiversity.	1

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 24 (b) Describe one social implication relevant to the use of BT plants.

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

Identifies one social implication	1
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Question 25 Describe ONE cause and the effect of a named nutritional disease.

Criteria	Marks
Identifies a nutritional disease Describes the cause of the disease Describes the effects of the disease	3

Question 26 (a) Explain the relationship shown by the data

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

Commented [MN1]: 1. Increase in alcohol consumption increases risk of developing cirrhosis / eq ; 2. idea that risk increases much higher above 40 g per day ; 3. 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 ;

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 ;

Question 26(b) Compare the relative risk of men and women developing cirrhosis.

Criteria	Marks
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 ; 4. explains that can't compare above 40g per day ; 5. credit manipulation of figures e.g. increase of 13.6 for women between 10 and 40 g per day AND increase of 2.6 for men between 10 and 40 g per day, 0.8 higher risk for women than men at 30g per day;	2

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 26(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 26 (d) analyse the methodology used by this **scientist**

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. This method looks at cirrhosis rates not cirrhosis mortality rates. The final data should be peer reviewed for publication.	5

Commented [MN2]: HSC 2012

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.

This method looks at cirrhosis rates not cirrhosis mortality rates.

The final data should be peer reviewed for publication.

Question 27 (a) Identify the peak daily incidence of Covid-19 in the UK between August 2020 and June 2021

Criteria	Marks
Identifies peak incidence	1

Question 27 (b) With reference to the data, explain why the combined use of vaccination programs and limiting the mobility of individuals is a more effective way of controlling disease than using only one of these strategies

Criteria	Marks
Outline the use of vaccines Outline the use of limiting mobility of individuals Explain why vaccine alone is not effective Explain why the use of limiting mobility alone is not effective Justify (with reference to data) the use of vaccines and limiting mobility	6

BOOKLET 2

Question 28(a) Explain how a mutation in the CFTR gene could result in no CFTR protein being synthesised.

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

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

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

Question 28(d)

Marking Criteria	Marks
- Assessment of potential made, featuring: - Outline of a genetic technique - Identification of opportunity from stimulus material - A point supporting the possibility of such a development - A point opposing the possibility of such a development.	4
1-3 of the above	1-3

Question 29

Marking Criteria	Marks
- Describe points for - Describe points against - Judgement based on the points described	5
- Describe points for - Describe points against	4
- Simple description of points for - Simple description of points against - Judgement based on the points described	3
- Simple description of points for - Simple description of points against	2

Question 30

Marking Criteria	Marks
- Similarity in the mode of action of both technologies described. - Difference in mode of action described. - Similarity in effectiveness described - Difference in effectiveness described.	4
1-3 of the above	1-3

Both technologies involve the use of an electronic sensor – a microphone in the cochlear implant and a video camera in the bionic eye. However, the cochlear implant then sends electronic signals to the auditory nerve, while the bionic eye sends electrical impulses to the optic nerve.

Both technologies are able to restore a level of function to the senses of vision and hearing respectively. However, for both, the quality of the input is not as good as in normally functioning eyes or ears. The cochlear implant passes on a distinct number of frequencies, as does the bionic eye, giving lower resolution.

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
1-3 of the above.	1-3

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
- Explanation given in terms of: - Role of Helper T cells - Role of B cells or Killer T cells - Consequence of decrease in numbers - Likely 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. 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 32

Marking Criteria	Marks
Detailed description of the model with molecular components correctly identified(2)	4-5

All components of model justified with reference to differences and similarities between DNA in prokaryotes and eukaryotes. (3)	
Description of model incomplete or with some aspects of molecular components absent or oversimplified Low level justification for design and structure of model	2-3

Question 33

Marking Criteria	Marks
gene cloning produces copies of a single gene; whole-organism cloning produces copies of the entire genome of the organism(1 marks) processes: gene cloning –by recombinant DNA using bacteria, etc (1 mark) whole organism –by somatic cell nuclear transfer , etc(1 mark) benefits: gene cloning –production of useful products(insulin, gene probes, etc) whole organism –production of commercially desirable agricultural products(2marks) extra depth of knowledge, general introduction or extra details (1 mark)	7