Government of **Western Australia**
School Curriculum and Standards Authority

ATAR course examination, 2021

Question/Answer booklet

HUMAN BIOLOGY

Place one of your candidate identification labels in this box.

Ensure the label is straight and within the lines of this box.

WA student number: In figures

In words

Number of additional answer booklets used (if applicable):

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time: three hours

Materials required/recommended for this paper

To be provided by the supervisor

This Question/Answer booklet
Multiple-choice answer sheet

To be provided by the candidate

Standard items: pens (blue/black preferred), pencils (including coloured), sharpener, correction fluid/tape, eraser, ruler, highlighters

Special items: up to three calculators, which do not have the capacity to create or store programmes or text, are permitted in this ATAR course examination

Important note to candidates

No other items may be taken into the examination room. It is **your** responsibility to ensure that you do not have any unauthorised material. If you have any unauthorised material with you, hand it to the supervisor **before** reading any further.

Ref: 21-037
HBY
2022/5559
Web version of 2021/61356

Structure of this paper

Section	Number of questions available	Number of questions to be answered	Suggested working time (minutes)	Marks available	Percentage of examination
Section One Multiple-choice	30	30	40	30	30
Section Two Short answer	7	7	90	106	50
Section Three Extended answer Unit 3	2	1	50	20	10
Unit 4	2	1		20	10
				Total	100

Instructions to candidates

1. The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2021: Part II Examinations*. Sitting this examination implies that you agree to abide by these rules.

2. Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.

3. Answer the questions according to the following instructions.

   Section One: Answer all questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

   Section Two: Write your answers in this Question/Answer booklet. Wherever possible, confine your answers to the line spaces provided.

   Section Three: Consists of two parts each with two questions. You must answer one question from each part. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

4. You must be careful to confine your answers to the specific questions asked and to follow any instructions that are specific to a particular question.

5. Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

See next page

Section One: Multiple-choice **30% (30 Marks)**

This section has **30** questions. Answer **all** questions on the separate Multiple-choice answer sheet provided. For each question, shade the box to indicate your answer. Use only a blue or black pen to shade the boxes. Do not use erasable or gel pens. If you make a mistake, place a cross through that square, then shade your new answer. Do not erase or use correction fluid/tape. Marks will not be deducted for incorrect answers. No marks will be given if more than one answer is completed for any question.

Suggested working time: 40 minutes.

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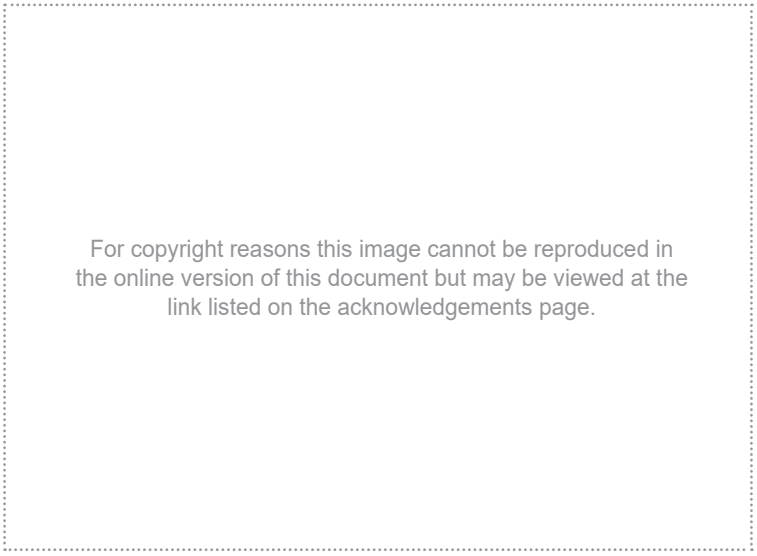
1. Which of the following is a response when the parasympathetic nervous system is activated?

   (a) increased heart rate and breathing rate
   (b) pupil dilation
   (c) increased activity of the gastrointestinal tract
   (d) vasodilation of blood vessels in the skin

Question 2 refers to the phylogenetic tree shown below.



2. On the basis of the phylogenetic tree, which of the following organisms are the **most** closely related?

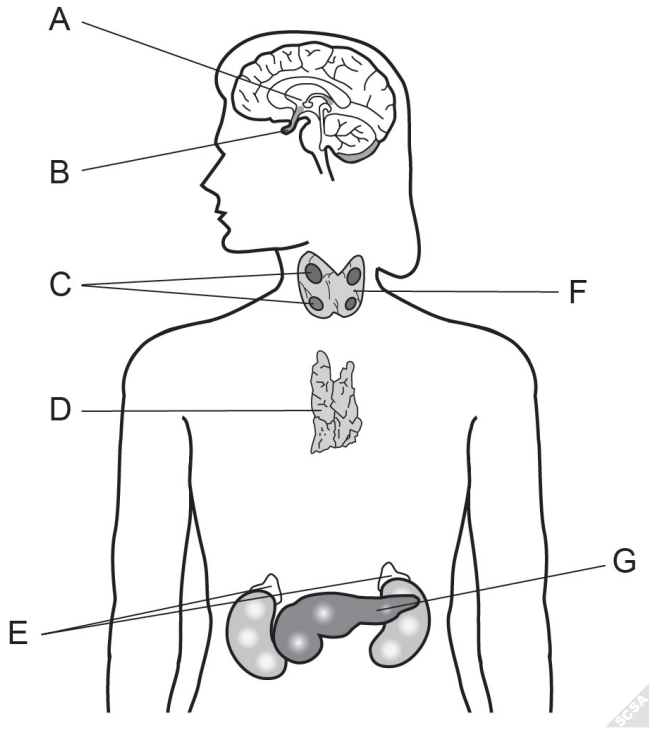
   (a) *H. erectus* and *A. africanus*
   (b) *H. habilis* and *H. rudolfensis*
   (c) *H. ergaster* and *H. erectus*
   (d) *H. heidelbergensis* and *H. sapiens*

3. Homeostatic response mechanisms require the transfer and recognition of information from a sensory receptor and an effector. The transmission of this information

   (a) may involve both the endocrine and nervous systems.
   (b) relies only on hormones for a short-term response.
   (c) is usually a conscious process.
   (d) is under control of the autonomic system only.

See next page

Questions 4 and 5 refer to the diagram shown below.



4. Which of the following identifies correctly the endocrine gland, with the hormone it secretes and the target organ?

	Endocrine gland	Hormone secreted	Target organ
(a)	D	Adrenaline	Brain
(b)	E	Cortisol	Stomach
(c)	F	Thyroid	Kidneys
(d)	G	Glucagon	Liver

5. Which of the endocrine glands labelled is/are responsible for controlling metabolic rate?

(a) F only
(b) F and C
(c) B only
(d) B and F

See next page

6. Comparative genomics refers to research in which

(a) the complete DNA sequence of an organism is compared to one of another species.
(b) computerised data on the molecular structure of the genome of a species is analysed.
(c) chromosomes are extracted and gene sequences of a species are mapped.
(d) proteins, RNA and DNA of one species are compared to that of another species.

7. An example of natural active immunity is a

(a) breastfed baby who does not catch a cold that they are exposed to.
(b) hospital worker who is vaccinated against the flu.
(c) person bitten by a snake who is given anti-venom antibodies.
(d) child who contracts chicken pox and does not get the disease again.

8. A student was examining a collection of hominin fossil skulls that were missing their labels. The student was asked to identify the skulls based on the skull features they could observe. Below is a summary the student made of the observed characteristics of the skulls.

Skull X – a less prognathic jaw than skull Y, but a prominent brow ridge present

Skull Y – smallest cranial capacity of all three skulls, no sagittal crest and a relatively small and narrow facial profile

Skull Z – largest cranial capacity of all three skulls, lacks a forehead and occipital bun present

According to the information, hominins X, Y and Z are most likely

	X	Y	Z
(a)	*Homo neanderthalensis*	*Homo habilis*	*Homo erectus*
(b)	*Homo habilis*	*Homo neanderthalensis*	*Homo erectus*
(c)	*Homo habilis*	*Homo erectus*	*Homo neanderthalensis*
(d)	*Homo erectus*	*Homo habilis*	*Homo neanderthalensis*

9. Which of the following statements about the meninges is correct?

They are membranes

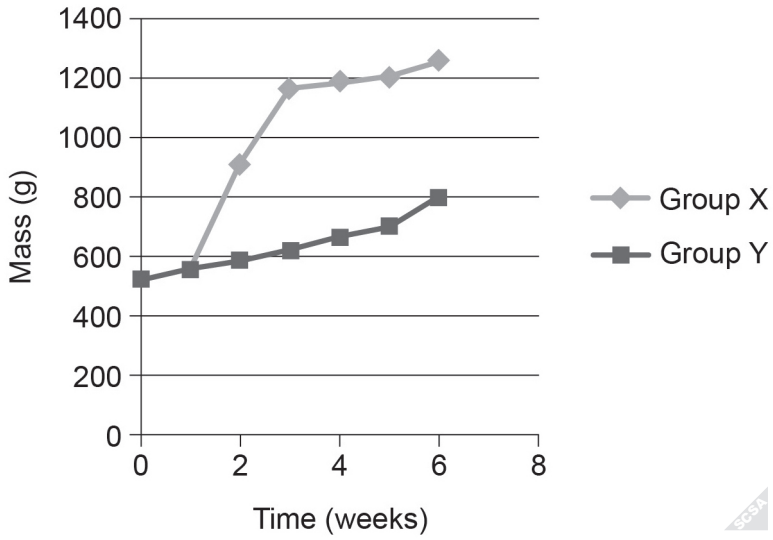
(a) that surround the axon of a neuron.
(b) and fluids found around the brain and spinal cord.
(c) that cover and protect the brain.
(d) that are not found around the lower spinal cord.

See next page

Questions 10 and 11 refer to the information shown below.

An experiment was conducted to investigate the effect of a calcium-based diet supplement on growth rates in guinea pigs. Fifty young guinea pigs were divided into two equal groups. Guinea pigs in Group X were fed a diet containing the supplement; those in Group Y received the same food, but without the supplement. Each week the guinea pigs were weighed and their mass recorded. The average mass of the guinea pigs in each group over the six-week trial period is shown in the graph below.

Effect of a calcium-based diet supplement on growth rates in guinea pigs



10. The independent variable for this experiment would be

(a) amount of calcium consumed.
(b) time (weeks).
(c) the supplement.
(d) Group X.

11. Which of the following would **not** improve the reliability of this experiment?

(a) increasing the sample size
(b) duplicating the experiment
(c) randomly selecting the guinea pigs
(d) replicating the experiment multiple times

12. Cytochrome C is a ubiquitous protein, meaning it is present in all types of cells. The amino acid sequence for Cytochrome C is identical for chimpanzees and humans. Compared to humans, the amino acid sequence in Rhesus monkeys shows one difference.

This information suggests that

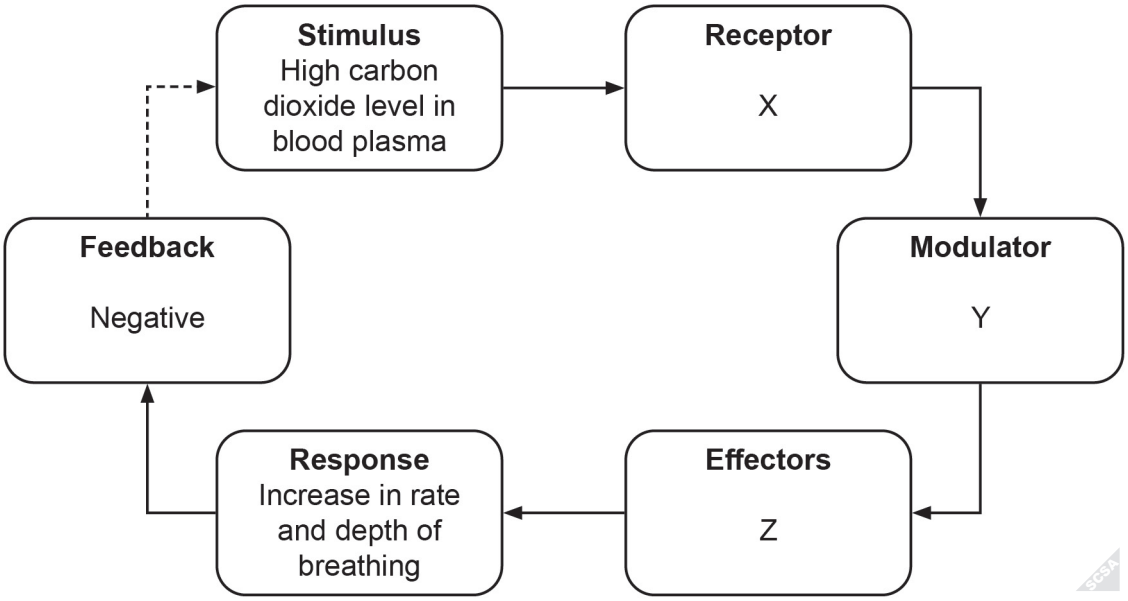
(a) humans and chimpanzees had a common ancestor.
(b) humans and chimpanzees evolved at the same time.
(c) humans evolved from Rhesus monkeys, and chimpanzees evolved from another primate group.
(d) chimpanzees evolved from Rhesus monkeys, and humans evolved from chimpanzees.

See next page

13. Which of the following are all selection pressures which could reduce genetic variation in a population?

(a) disease, increased competition and climate change
(b) increased food availability, disease and climate change
(c) increased competition, reduced environmental pollutants and disease
(d) reduced land availability, increased food availability and climate change

Questions 14 and 15 refer to the diagram shown below.



14. The correct labels for 'X', 'Y' and 'Z' for the diagram shown are

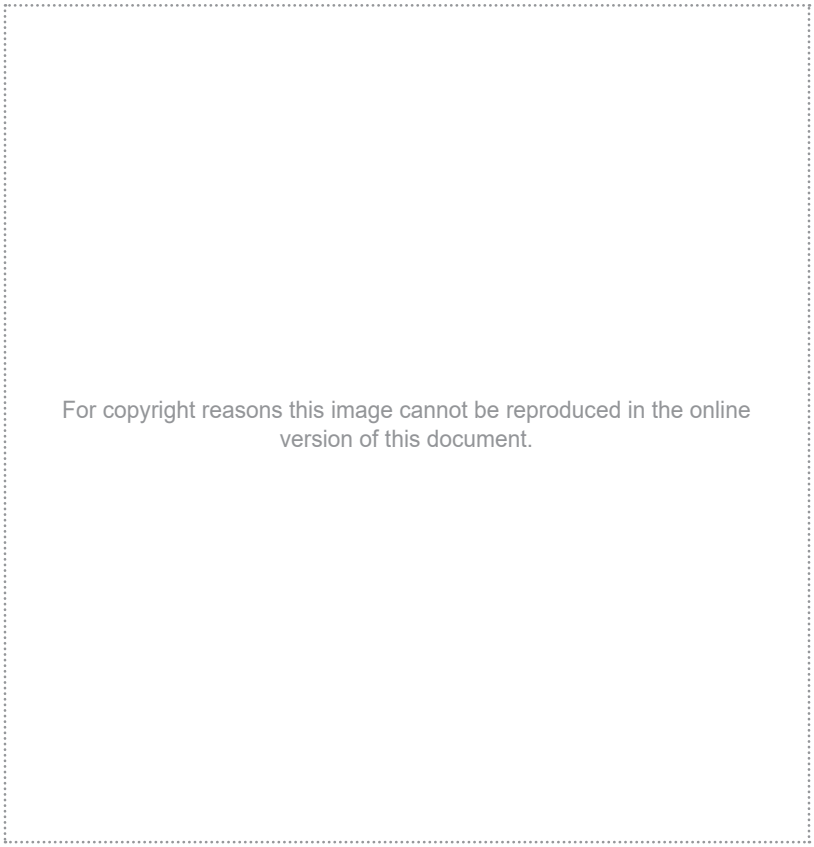
	X	Y	Z
(a)	osmoreceptor	cerebellum	diaphragm and intercostal muscles
(b)	chemoreceptor	medulla oblongata	ribcage and intercostal muscles
(c)	thermoreceptor	hypothalamus	diaphragm and alveoli
(d)	chemoreceptor	medulla oblongata	diaphragm and intercostal muscles

15. Where are receptors X located?

(a) skin and hypothalamus
(b) carotid artery and aorta
(c) carotid artery and hypothalamus
(d) aorta and cerebellum

See next page

Question 16 refers to the diagram shown below.



16. On the basis of the theory of natural selection, the **best** prediction for the future of populations 'A', 'B' and 'C' is that

(a) Y indicates gene flow is maintained between populations A, B and C so the populations would expect to evolve separately into unique species.
(b) X indicates gene flow is not maintained between populations A, B and C due to large water bodies, but this should have little impact on the evolution of the different species.
(c) X indicates that, over time, populations A, B and C could become different species due to geographical barriers and reproductive isolation between the populations.
(d) Y indicates that populations A, B and C should become one species in the future as gene flow is maintained and reproductive isolation is not evident between populations.

17. Which row identifies correctly components of the central and peripheral nervous systems?

	Central nervous system		**Peripheral nervous system**	
(a)	spinal cord	brain	autonomic	medulla oblongata
(b)	somatic	autonomic	spinal cord	cerebellum
(c)	brain	spinal cord	sympathetic	somatic
(d)	sympathetic	parasympathetic	somatic	brain

See next page

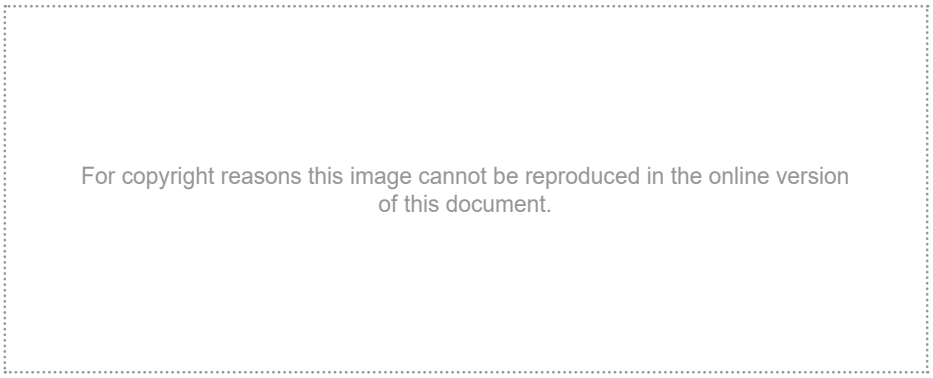
18. Shown below is a list of steps involved in gel electrophoresis and some incorrect statements that could be associated with the process.

I. DNA moves from positive to negative electrode.
II. An electric current is passed through the gel.
III. DNA pieces are placed at one end of the gel.
IV. DNA moves from negative to positive electrode.
V. Smaller pieces of DNA move faster through the gel.
VI. DNA bands form.
VII. Larger pieces of DNA move faster through the gel.

Which of the following orders the steps of gel electrophoresis correctly?

(a) III – II – IV – V – VI
(b) II – III – I – V – VI
(c) II – III – IV – VII – VI
(d) III – II – I – VII – VI

Question 19 refers to the diagram shown below.



19. What name is given to the final stage in the process shown in the diagram?

(a) aggregation
(b) agglutination
(c) neutralisation
(d) activation

20. A limitation of potassium-argon dating is that it

(a) does not provide an absolute date, only a relative one.
(b) can only date organic material younger than 70 000 years.
(c) does not provide a good statistical measure of the age of an artefact.
(d) can only date rocks older than 100 000 years.

See next page

21. The purpose of peripheral vasoconstriction in temperature regulation is to

(a) reduce blood oxygen levels when cold thermoreceptors are triggered.
(b) increase blood oxygen levels when hot thermoreceptors are triggered.
(c) conserve body heat when cold thermoreceptors are triggered.
(d) reduce heat loss when hot thermoreceptors are triggered.

22. Which of the following statements does **not** support the theory of natural selection?

(a) Organisms reproduce at a rate greater than can be supported by the environment.
(b) Genotypic variation is exhibited in the phenotypes of individuals.
(c) Selective agents act on the alleles in a gene pool.
(d) Similar individuals mate and produce offspring with favourable traits.

23. The effect of an antibiotic on a bacterial species was tested by spreading a culture of the bacteria on agar plates and adding a disk of absorbent paper soaked in the antibiotic, as shown in the diagram below. The plate was incubated for 24 hours at 30 ºC and the bacterial growth was examined.

Which of the following would be a suitable control for this experiment?

(a) repeat the experiment exactly, but with no bacteria
(b) incubate at human body temperature
(c) use a disk with no antibiotic
(d) use a disk with a different antibiotic

24. Which of the following contains adaptations that contribute to bipedalism?

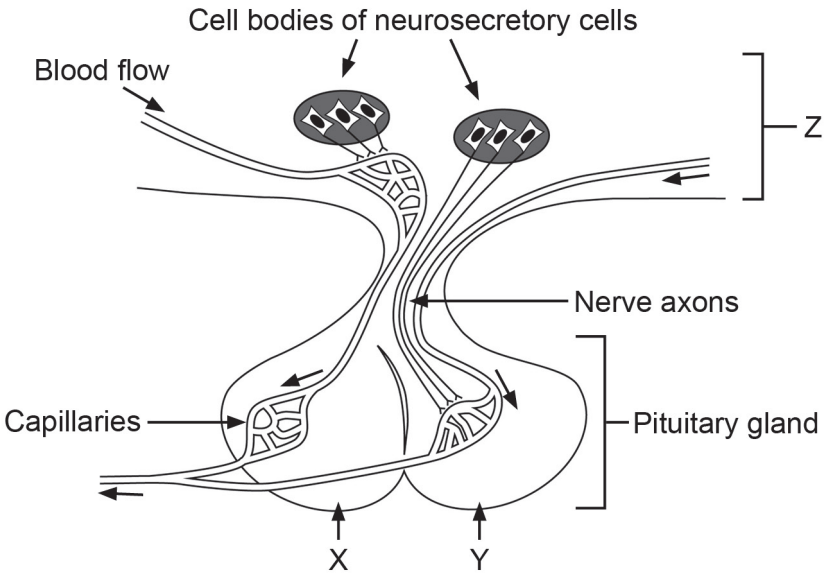
(a) S-shaped curve, increased size of lumbar vertebrae, centralisation of the foramen magnum
(b) C-shaped curve, increased size of lumbar vertebrae, centralisation of the foramen magnum
(c) S-shaped curve, increased size of lumbar vertebrae, long, narrow pelvis
(d) C-shaped curve, increased size of thoracic vertebrae, centralisation of the foramen magnum

See next page

25. The myelin sheath is

(a) fatty tissue that speeds up the neural impulse through the cell body.
(b) grey matter that changes up the neural impulse along a dendrite.
(c) white matter that reduces the speed of a neural impulse along an axon.
(d) fatty tissue that speeds up the neural impulse along sections of the axon.

Questions 26 and 27 refer to the diagram below.



26. In which location/s is growth hormone produced?

(a) X
(b) X and Y
(c) Z
(d) X and Z

27. Which of the following hormones are released from structure 'Y'?

(a) antidiuretic hormone and adrenocorticotropic hormone
(b) adrenocorticotropic hormone and oxytocin
(c) follicle stimulating hormone and luteinising hormone
(d) antidiuretic hormone and oxytocin

See next page

28. Alpha and Beta Thalassemia have similarities and differences in their inheritance patterns. Which of the following is correct?

(a) Both are autosomal dominant conditions controlled on multiple gene loci.
(b) Alpha Thalassemia is fatal for homozygote individuals while Beta Thalassemia is not.
(c) Both are autosomal recessive conditions that result in affected individuals having four defective globin genes.
(d) Beta Thalassemia is fatal for heterozygote individuals while Alpha Thalassemia is not.

29. Human-made objects associated with the remains of *Homo* species are **best** described as

(a) tools.
(b) artefacts.
(c) artifices.
(d) fossils.

30. One of the ethical considerations that must be adhered to during animal research relates to when and how animals can be used. Which of the following is **not** part of an ethical reason to test on animals?

(a) The research has the potential to significantly benefit humans.
(b) The financial cost of testing on animals is less than humans.
(c) A minimum number of animals will be used during the study.
(d) The use of animals is essential and cannot be substituted for.

End of Section One

See next page

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Section Two: Short answer **50% (106 Marks)**

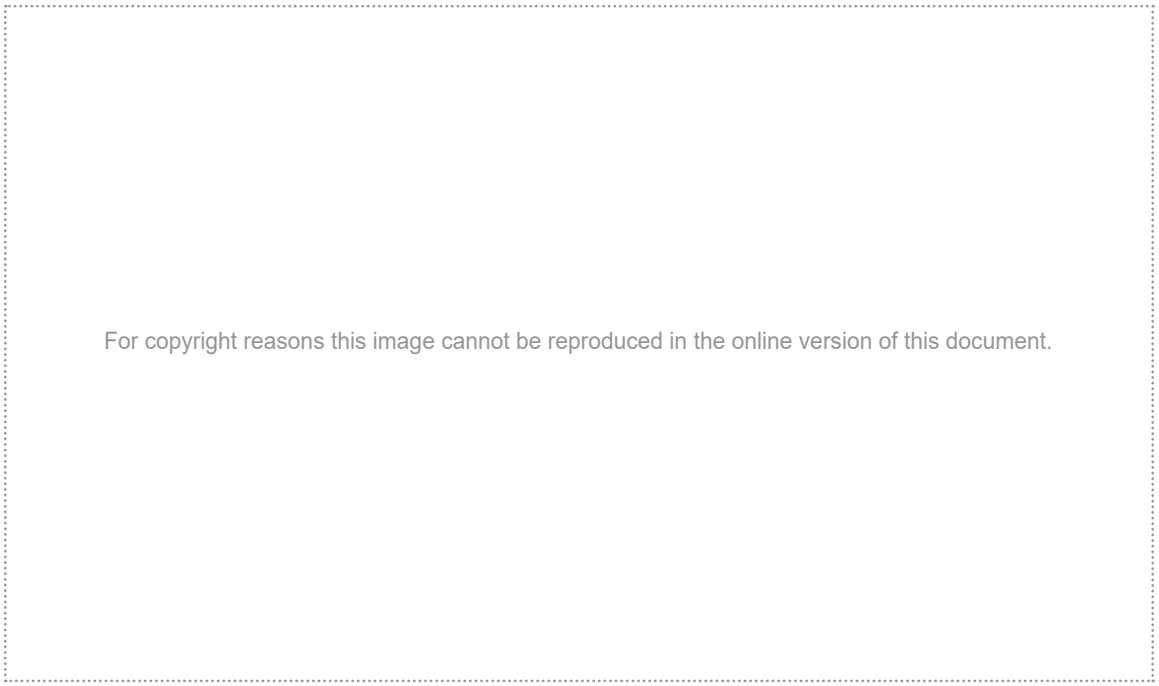
This section has **seven** questions. Answer **all** questions. Write your answers in the spaces provided.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 90 minutes.

Question 31 **(12 marks)**

The following question refers to the diagram of the brain shown below.



(a) (i) Identify structure 'Z'. (1 mark)

(ii) State **one** function of structure 'Y'. (1 mark)

(iii) Indicate on the diagram, with a line and label, where the corpus callosum would be located. (1 mark)

(b) (i) Which region, A or B, shows structures that would be found in the outer layer of structure 'X'? (1 mark)

(ii) Justify your decision in part (b)(i). (2 marks)

A man injured his back in a diving accident. Doctors were concerned there was damage to his spine and neural pathways. They touched different areas of his skin with a sharp point and asked him to indicate each time if he felt a sharp point. The sharp point should be felt in two ways, one of which would be pain.

(c) (i) What other sensation would be experienced by the man? (1 mark)

(ii) Describe how this sensation would be detected and registered by the man. (2 marks)

The man felt the sharp point when the point touched his arms, but not when the point touched his legs.

(d) Suggest what this information could tell the doctors about the damage to the man's spinal cord. Explain your answer. (3 marks)

Question 32 **(17 marks)**

In 2009, the University of California discovered a mutated gene that has been shown to produce naturally short sleepers. The gene was found in a family who all normally went to bed around 11 pm and woke up naturally around 5 am. The mutated gene, known as DEC2, is believed to affect the circadian rhythm and results in people who don't need as much sleep as the average person.

(a) DEC2 is a gene mutation. How do gene and chromosomal mutations differ? (2 marks)

(b) In the study, the mutation was found in several family members. What does this tell you about where the original mutation occurred? Justify your response. (2 marks)

(c) Mutations can be caused in several ways. For each of the three ways stated below, describe how they may produce new mutations. (6 marks)

Mutagens:

DNA replication:

Cell division:

See next page

(d) If researchers wanted to further investigate the link between the DEC2 gene and sleep, they would need to set up an experimental study.

(i) Propose a possible hypothesis for the study. (1 mark)

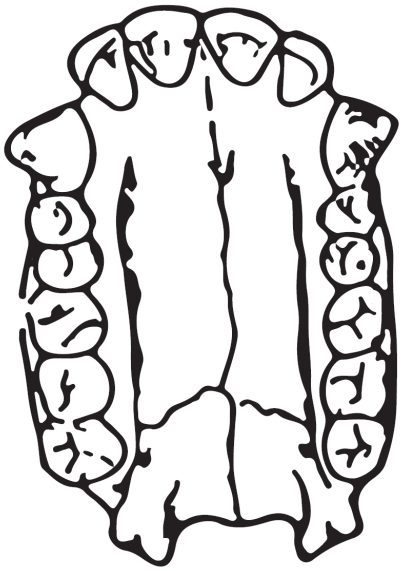
(ii) In the study, what would the control group consist of, and what purpose would it have? (2 marks)

(e) A mutation, such as the DEC2 gene, could be favourable to the human population. Explain how a favourable gene like this could lead to changes in allele frequencies of a gene pool. (4 marks)

See next page

Question 33 **(11 marks)**

The following question refers to the jaw diagram shown below.



(a) Is the jaw pictured from a great ape or a human? Justify your answer by identifying **one** feature that supports your conclusion. (2 marks)

(b) The evolution from great ape to human has involved several changes to the cranium. For the following cranial features, contrast great ape and human craniums. (3 marks)

Brow ridges: _____

Facial profile: _____

Foramen magnum: _____

See next page

(c) With hominins becoming bipedal there were several changes to their hands and feet. Describe what these changes were and how they contributed to bipedalism and mobility of their digits. (6 marks)

Evolutionary changes to the feet	(2 marks)
Contribution to bipedalism	(1 mark)
Evolutionary changes to the hands	(2 marks)
Contribution to the mobility of digits	(1 mark)

See next page

Question 34 **(12 marks)**

Approximately 1 in 25 people from the Ashkenazi Jewish community in Australia will be a genetic carrier for Tay-Sachs as well as other genetic conditions, such as cystic fibrosis. There are several theories as to why the frequency of these genetic conditions is high in the Ashkenazi Jewish population.

(a) State what is Tay-Sachs. (1 mark)

(b) Explain how the high incidence of Tay-Sachs within the Ashkenazi Jewish community in Australia is an example of the founder effect. (4 marks)

A genetic carrier screening program for Tay-Sachs disease was carried out at a high school that has a significant number of Jewish students. One process the specimens were passed through during screening was polymerase chain reaction (PCR).

(c) Outline what occurs in each stage of the PCR process. (3 marks)

Denaturing:

Annealing:

Extension:

See next page

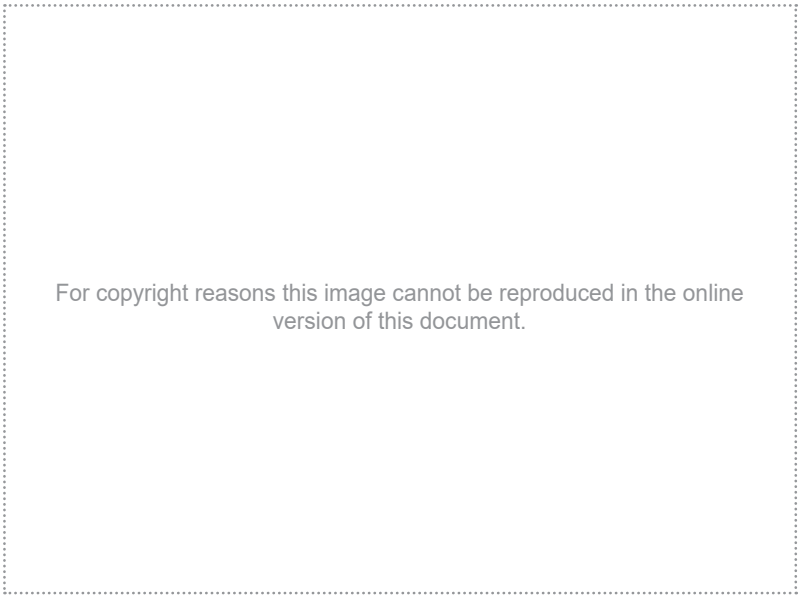
During the Second World War, tuberculosis (TB) ran unchecked in Eastern European Jewish settlements. Often, healthy relatives of children with Tay-Sachs disease did not contract TB, even when exposed repeatedly.

(d) Using the theory of natural selection, explain why Tay-Sachs disease still exists in the Ashkenazi Jewish populations today. (4 marks)

See next page

Question 35 **(21 marks)**

Two parts of the human body are highlighted in the diagram below. Both parts play a role in providing external defence mechanisms to the entry of pathogens into the body.



(a) For each part, outline **one** mechanism that functions to prevent the entry of a pathogen into the internal environment. (2 marks)

X: _____

_____

Y: _____

_____

Lyme disease is caused by a bacterium known as *Borrelia burgdorferi*. Typical symptoms of the illness include fever, headache, fatigue, joint pain and a skin rash.

(b) The bacterium that causes Lyme disease is known to be transmitted to humans through the bite of infected blacklegged ticks.

(i) Identify the type of disease transmission that Lyme disease displays. (1 mark)

_____

(ii) Lyme disease is not believed to be transmitted from person to person but, if it was, describe how a mode of direct person to person transmission could occur. (2 marks)

_____

_____

_____

See next page

(c) Many of the symptoms associated with Lyme disease are caused by inflammation triggered in response to the bacterium.

(i) What is the role of inflammation in the prevention of disease? (2 marks)

(ii) Explain the process of inflammation that causes an area to become red, swollen and hot. (4 marks)

See next page

Question 35 (continued)

(d) Lyme disease is treated by antibiotics. However, due to the nature of the disease it could also be potentially treated with a vaccine. Complete the table below, outlining the differences in how an antibiotic and a vaccine provide protection against infection. (8 marks)

	Antibiotics	**Vaccines**
Time when the treatment should be administered	(1 mark)	(1 mark)
How the treatment fights the pathogen	(2 marks)	(2 marks)
Length of duration of defence against the pathogen	(1 mark)	(1 mark)

The decision to participate in immunisation programs can be influenced by the social, economic and cultural context in which it is considered.

(e) Provide **one** social/cultural and **one** economic argument to justify the decision to participate in immunisation programs. (2 marks)

Social/cultural: _____

_____

_____

Economic: _____

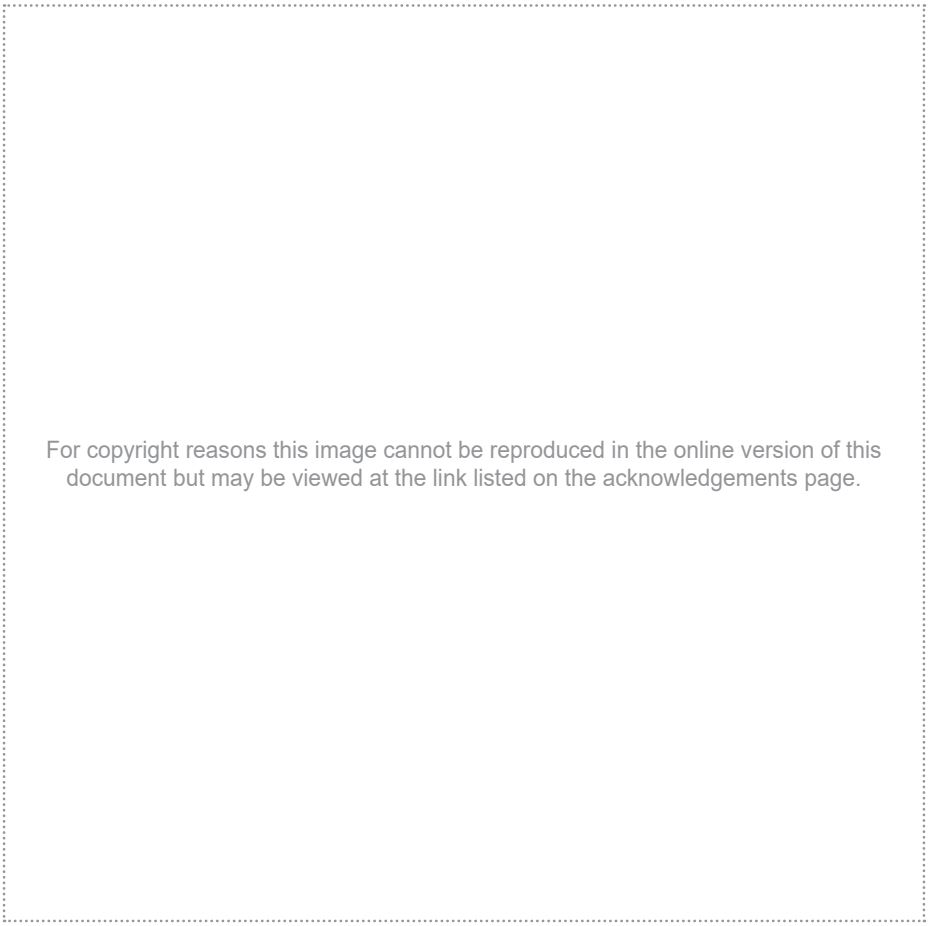
_____

_____

See next page

Question 36 **(19 marks)**

The following question refers to the diagram shown below.



(a) Identify chemical 'X'. (1 mark)

(b) Describe how chemicals 'X' and 'Y' differ in the way in which they reach their target cell/s. (2 marks)

See next page

Question 36 (continued)

(c) (i) Identify which pathway has the quicker response time. (1 mark)

(ii) Describe **one** characteristic of the pathway you chose in part (c)(i) that is significant in making the difference in response time. (2 marks)

The concentration of glucose in human blood is kept within a narrow normal range. All body cells need a continuous supply of glucose. To prevent the concentration of glucose in the blood falling below the normal range, the pancreas releases a hormone.

(d) (i) State the name of this hormone. (1 mark)

(ii) Describe how this hormone causes an increase in blood glucose concentration. (3 marks)

Type 1 diabetes is an autoimmune disease in which the immune system mistakenly attacks insulin-producing cells found in the pancreas. Researchers in the Type 1 diabetes field have aimed to develop a treatment that preserves and restores function to these cells.

(e) Explain how Type 1 diabetes can affect the control of blood sugar levels. (4 marks)

(f) Synthetic insulin can be used to treat Type 1 diabetes. Describe the steps involved in producing the functioning bacterial cell that can be used to make synthetic insulin. (5 marks)

See next page

Question 37 **(14 marks)**

(a) Read the following paragraph and fill in the missing information. (3 marks)

The first hominins were the australopithecines. They had a gracile body; the two known species are called *Australopithecus* _____ and *Australopithecus* _____ . A robust hominin called _____ *robustus* existed around the same time.

(b) It is thought that the earliest use of tools would have been by australopithecines using sticks and stones picked up from the local environment, whereas *Homo habilis* is the first hominin known to have produced tools.

(i) What is the name given to the tools made by *Homo habilis*? (1 mark)

_____

(ii) Describe how the tools identified in part (b)(i) were made. (2 marks)

_____

_____

_____

_____

(c) Dated fossils of *Homo habilis* and *Homo erectus* indicate that they were both present on Earth at the same time. List **two** anatomical differences between the two species. (2 marks)

One: _____

_____

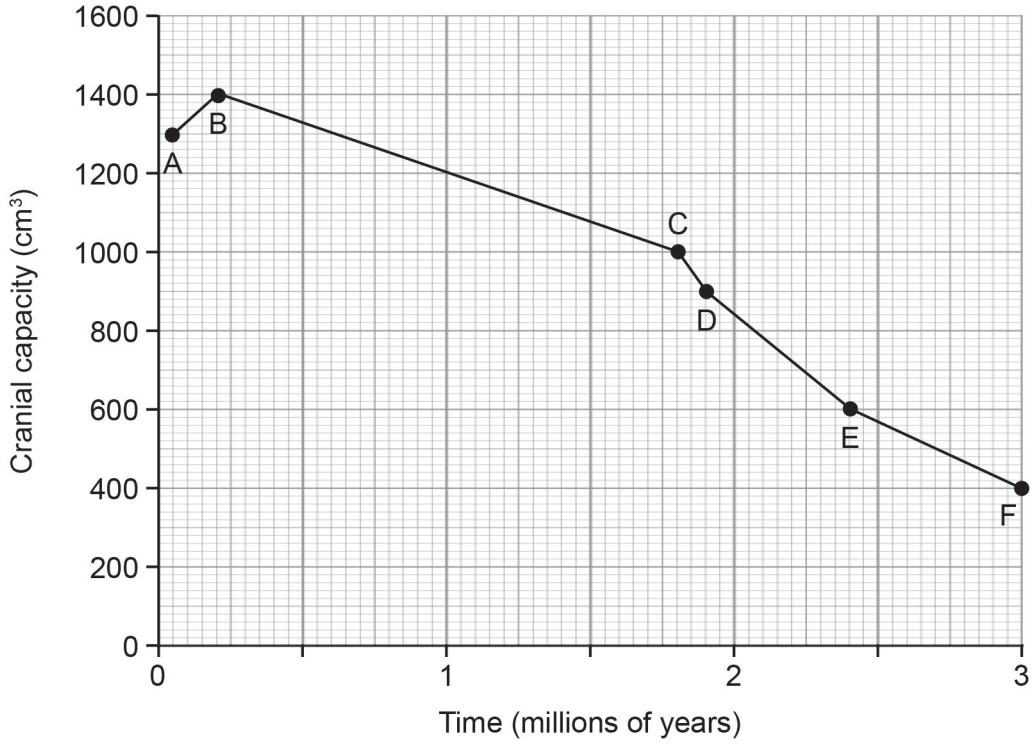
Two: _____

_____

See next page

(d) The graph below shows the average cranial capacity for several hominin fossils graphed against the fossils' age.

Average cranial capacity of hominin fossils



(i) Calculate the difference in cranial capacity between fossils B and E. (1 mark)

(ii) What percentage of fossil D's cranial capacity would be taken up by that of fossil F? Show your working. (3 marks)

(iii) State what hominin species fossil B is most likely from, and propose why, although older, it has a greater cranial capacity than fossil A. (2 marks)

End of Section Two

See next page

Section Three: Extended answer **20% (40 Marks)**

This section contains **four** questions. You must answer **two** questions.

Questions 38 and 39 are from Unit 3. Questions 40 and 41 are from Unit 4. Answer **one** question from Unit 3 and **one** question from Unit 4.

Responses could include clearly labelled diagrams with explanatory notes; lists of points with linking sentences; clearly labelled tables and graphs; and annotated flow diagrams with introductory notes.

Supplementary pages for planning/continuing your answers to questions are provided at the end of this Question/Answer booklet. If you use these pages to continue an answer, indicate at the original answer where the answer is continued, i.e. give the page number.

Suggested working time: 50 minutes.

Unit 3

Choose **either** Question 38 **or** Question 39.

Indicate the question you will answer by ticking the box next to the question. Write your answer on pages 31–35. When you have answered your first question, turn to page 36 and indicate on that page the second question you will answer.

☐ **Question 38** **(20 marks)**

During a trip to the Australian bush, a young man was lost for over six hours. The day on which he was lost was particularly hot, with temperatures peaking at 42 °C. After a day's rest, the young man recovered from his experience with no lasting ill-effects.

(a) Describe the physiological mechanisms that would have been operating to maintain his internal body temperature during the six hours he was lost in the bush. (10 marks)

(b) Explain how the mechanisms required to maintain homeostasis of the man's internal body temperature would have also triggered the homeostatic processes involved in the maintenance of his body fluid concentration. (10 marks)

☐ **Question 39** **(20 marks)**

Flynn was standing at second base during a game of baseball. The batter hit the ball straight at him. Without thinking, Flynn put his baseball glove up to stop the ball from hitting his face and his face flinched (involuntarily turned) away from the incoming ball.

(a) Describe the components of the mechanism that produced the flinching response. (8 marks)

(b) Explain how a nerve impulse travels along an axon and between neurons. (12 marks)

See next page

Question number: _____

See next page

Question number: _____

See next page

Question number: _____

See next page

Question number: _____

See next page

Question number: _____

See next page

Unit 4

Choose **either** Question 40 **or** Question 41.

Indicate the question you will answer by ticking the box next to the question. Write your answer on the pages provided.

☐ **Question 40** **(20 marks)**

Excavations of the sediments at an Aboriginal rock shelter in Juukan Gorge found flaked stone artefacts and a 4000 year-old belt made of plaited hair. A survey of the sediments provided a pollen record charting thousands of years of environmental changes.

(a) Name and describe **two** techniques that could be used to date the stone artefacts and **one** technique that could be used to date the hair belt. (12 marks)

(b) The mitochondrial DNA (mtDNA) in the plaited hair belt was associated with the DNA of today's traditional owners. Describe what mitochondrial DNA is and explain how it can be used to demonstrate a genetic relationship. (8 marks)

☐ **Question 41** **(20 marks)**

It is estimated that millions of hominins pre-dating the modern *Homo sapiens* have populated the Earth and yet only 6000 individuals are represented in the hominin fossil record.

(a) Explain why there are so few fossils in the fossil record. (10 marks)

(b) Explain, using examples, how the comparative studies of anatomy can be used for the construction of phylogenetic trees. (10 marks)

End of questions

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

Supplementary page

Question number: _____

ACKNOWLEDGEMENTS

Question 2 *Figure 7* (a) [Phylogenetic tree]. (n.d.). Retrieved June, 2021, from https://www.researchgate.net/figure/Hypothetical-cladogram-a-and-phylogenetic-tree-b-of-evolution-within-the-genus-Homo_fig6_278682043

Question 16 Adapted from: Bennett, E. (2016). [Gene flow diagram, slide 2] Retrieved June, 2021, from https://slideplayer.com/slide/9697228/

Question 19 Adapted from: Maher33. (2018). *Antibody opsonization* [Diagram]. Retrieved June, 2021, from https://en.wikipedia.org/wiki/Antibody_opsonization#/media/File:Antibody_Opsonization.svg
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Question 23 Adapted from: Agar diffusion method 1 [Diagram]. (2016). Retrieved June, 2021, https://commons.wikimedia.org/wiki/File:Agar_Diffusion_Method_1.jpg
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Adapted from: Scottish Qualifications Authority. (2015). *National Qualifications 2015 Biology: Section 1 - Questions* (Q. 8). Retrieved June, 2021, from http://www.standrewspaisley.com/uploads/6/0/2/3/60230905/nh_biology_all_2015[1].pdf

Questions 26, 27 Adapted from: OCR. (2008). *Advanced GCE Human Biology exam 2867: Genetics, homeostasis and ageing* (p.12, fig. 4.1) [Diagram]. OCR.

Question 31 Region A & B image adapted from: Newton, T. J. & Joyce, A. (2009). *Human perspectives: Book 2* (5th ed., p. 80, fig. 6.2) [Diagram]. McGraw-Hill Education.

Question 33 Newton, T. J. & Joyce, A. P. (1995). *Human perspectives: Book 2* (3rd ed., p. 113, fig. 9.9) [Diagram]. McGraw-Hill.

Question 35 Adapted from: Parker, N., Schneegurt, M., Tu, A., et al. (2020) *Fig. 13.1.7: ...* Retrieved June, 2021, from https://bio.libretexts.org/Courses/Manchester_Community_College_(MCC)/Remix_of_Openstax%3AMicrobiology_by_Parker_Schneegurt_et_al/13%3A_Innate_Nonspecific_Host_Defenses/13.01%3A_1st_Line_defense-_Physical_and_Chemical_Defenses
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Question 36

Adapted from: Hillis, D., Sadava, D., Hill, R., et al. (2014). *Principles of life for the AP course* (2nd ed., fig. 35.1) [Diagram]. W. H. Freeman. Retrieved June, 2021, from https://www.macmillanhighered.com/BrainHoney/Resource/6716/digital_first_content/trunk/test/hillis2e/hillis2e_ch35_2.html

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