



ATAR course examination, 2017

Question/Answer booklet

HUMAN BIOLOGY

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Place one of your candidate identification labels in this box.
Ensure the label is straight and within the lines of this box.
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Student number: In figures

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In words

Time allowed for this paper

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

Number of additional
answer booklets used
(if applicable):

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: non-programmable calculators approved for use in this 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.



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	9	9	90	100	50
Section Three Extended answer	3	2	50	40	20
Total					100

Instructions to candidates

- The rules for the conduct of the Western Australian external examinations are detailed in the *Year 12 Information Handbook 2017*. Sitting this examination implies that you agree to abide by these rules.
- 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. 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 three questions. You must answer two questions. Tick the box next to the question you are answering. Write your answers in this Question/Answer booklet.

- 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.
- Supplementary pages for the use of planning/continuing your answer to a question have been 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.

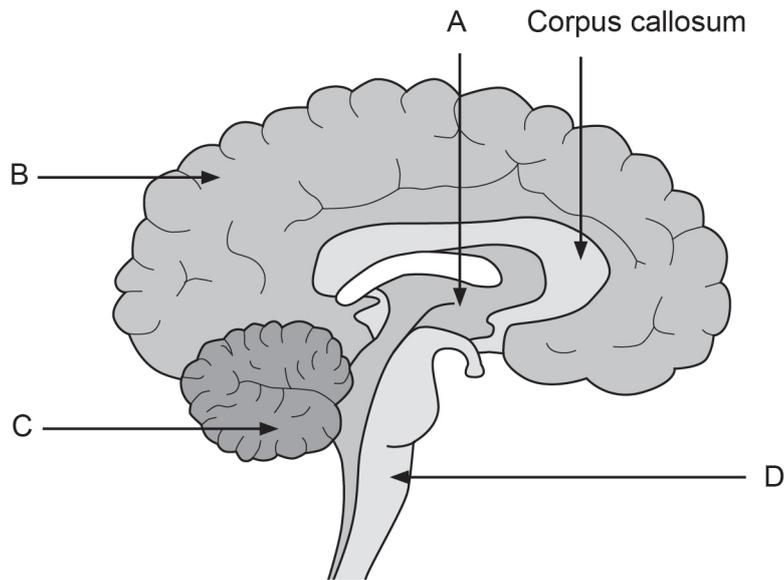
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Section One: Multiple-choice**30% (30 Marks)**

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. 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.

Questions 1 and 2 refer to the brain diagram shown below.



1. Which part of the brain is responsible for regulating heart rate?
 - (a) A
 - (b) B
 - (c) C
 - (d) D

2. The corpus callosum relays information to and from the
 - (a) cerebral hemispheres.
 - (b) hemispheres of the cerebellum.
 - (c) hypothalamus.
 - (d) spinal cord.

3. The adrenal cortex is stimulated to produce aldosterone when
 - (a) there is an increase in water reabsorption from the collecting duct of the nephron.
 - (b) adrenocorticotrophic hormone is released from the posterior pituitary gland.
 - (c) there is a high level of potassium ions present in the bloodstream.
 - (d) there is a high level of sodium ions in the distal tubule of the nephron.

See next page

4. A researcher recorded the body temperature of seven participants during an investigation into the effects of exercise. The results are shown below.

37.4, 37.9, 36.8, 37.2, 38.0, 37.2, 37.5

Which of the following calculates correctly the mean, median and range for the results?

	Mean	Median	Range
(a)	37.5	37.2	1.1
(b)	37.4	37.4	1.2
(c)	37.2	37.5	1.0
(d)	37.4	37.2	1.2

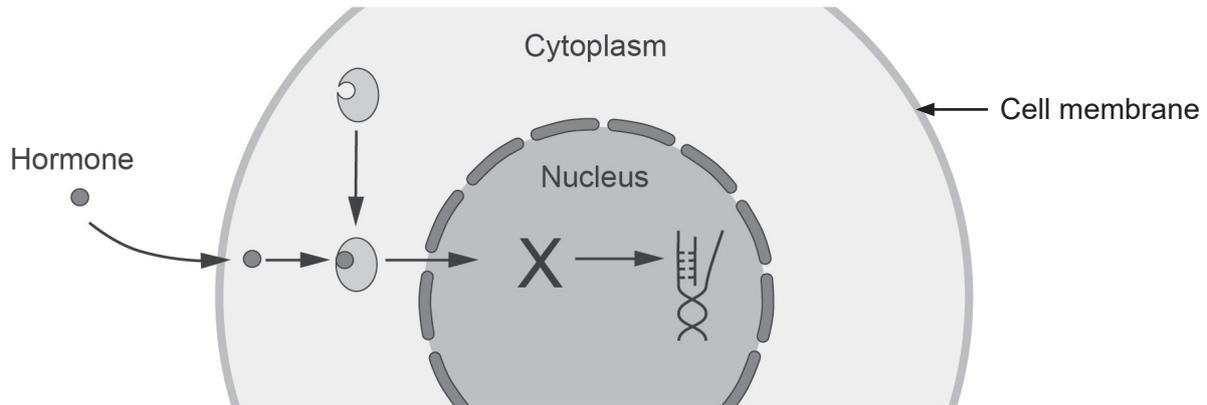
Questions 5 and 6 refer to the diagram shown below.



5. Which of the specimens above are **most** likely to be bipedal?
- (a) I, II and IV
 - (b) I, II, III and IV
 - (c) III, V and VI
 - (d) V and VI
6. Which of the following characteristics would you also expect to find specimen VI to display?
- (a) broad pelvis, C-shaped vertebral column and centrally-positioned foramen magnum
 - (b) narrow pelvis, C-shaped vertebral column and posterior foramen magnum
 - (c) broad pelvis, S-shaped vertebral column and centrally-positioned foramen magnum
 - (d) narrow pelvis, S-shaped vertebral column and posterior foramen magnum
7. Evidence for evolution includes data from comparative anatomy. When comparing two species, such evidence would be obtained from
- (a) chromosome numbers.
 - (b) mitochondrial DNA.
 - (c) shared environments.
 - (d) homologous structures.

See next page

Questions 8 and 9 refer to the diagram shown below, which depicts how a hormone enters and affects a cell.



8. The hormone represented in this diagram is
- lipid soluble and binds with a receptor on the cell membrane.
 - water soluble and binds with a receptor in the nucleus.
 - lipid soluble and binds with a receptor in the cytoplasm.
 - water soluble and binds with an intracellular receptor.
9. At point X in the diagram, a
- secondary messenger binds to DNA.
 - hormone-receptor complex binds to RNA.
 - secondary messenger binds to RNA.
 - hormone-receptor complex binds to DNA.
10. Which of the following comparisons between B cells and T cells is correct?

	B cells	T cells
(a)	Originate in the bone marrow	Originate in the thyroid
(b)	Differentiate into killer, suppressor and helper cells	Differentiate into plasma cells
(c)	Form the cells needed for antibody-mediated immunity	Form the cells needed for cell-mediated immunity
(d)	Can inhibit the immune system	Can react against transplanted organs

11. A ship is wrecked and the survivors, a group of ten men and ten women, manage to reach an island. They are never found and so have had no contact with the outside world. Of the survivors, 12 have blue eyes, 4 have green eyes and 4 have brown eyes. After a while, the population on the island grows and after more time the only eye colour of the population is blue.

The process by which a population's gene pool changes significantly from the original population is known as

- founder effect.
- random genetic drift.
- natural selection.
- mutation.

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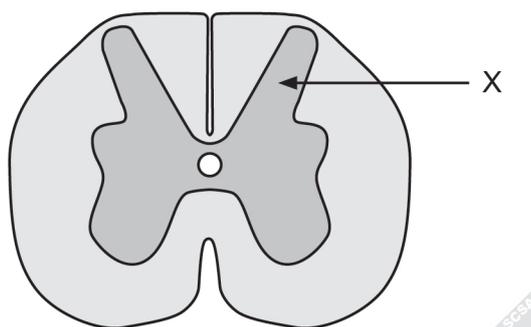
12. The following is a list of possible factors that scientists using biotechnology in their research might consider.
- (i) The research should not knowingly cause harm to individuals or the environment.
 - (ii) The course of action should protect the rights of everyone involved.
 - (iii) The course of action should provide the most cost efficient outcomes.
 - (iv) The research should have the potential to provide significant benefits for everyone involved.
 - (v) The information gained from the research should advance scientific understanding in the field.

Which of the above statements are ethical considerations that **must** be met before undertaking research that employs biotechnology?

- (a) (i), (ii), (iii) (iv)
- (b) (i), (ii), (iv)
- (c) (ii), (iii), (iv), (v)
- (d) (i), (ii), (v)

Question 13 refers to the diagram shown below.

Cross-section of the spinal cord



13. Which of the following is correct about the part labelled X?
- (a) grey matter, which is also found on the outer surface of the cerebrum
 - (b) white matter, which is also found on the outer surface of the cerebrum
 - (c) grey matter, which is also found inside the cerebrum
 - (d) white matter, which is also found inside the cerebrum
14. When a baby is born, it has already acquired immunity during the pregnancy, as antibodies are passed from the maternal blood into the foetal bloodstream. This type of immunity is called
- (a) active and artificial.
 - (b) passive and artificial.
 - (c) passive and natural.
 - (d) active and natural.

15. Which of the following is the **best** way of improving the reliability of an investigation?
- (a) ensure correct calibration of equipment
 - (b) incorporate more controlled variables into the experimental design
 - (c) repeat the entire investigation
 - (d) make the investigation into a double-blind study

Question 16 refers to the teeth diagram shown below.

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16. Compare Teeth X and Teeth Y in the diagram. Teeth X belong to a human because
- (a) there is a diastema present.
 - (b) there are fewer premolars.
 - (c) the canines are much larger than incisors.
 - (d) the dental arcade is U-shaped.
17. The following statements relate to natural selection.
- (i) Some genotypes provide a better chance of survival in specific environments.
 - (ii) Members of different species show some similarities in phenotype.
 - (iii) Some characteristics are heritable and are passed on to offspring.
 - (iv) Members of the same species show variation in phenotype.

Which of the statements support the theory of natural selection?

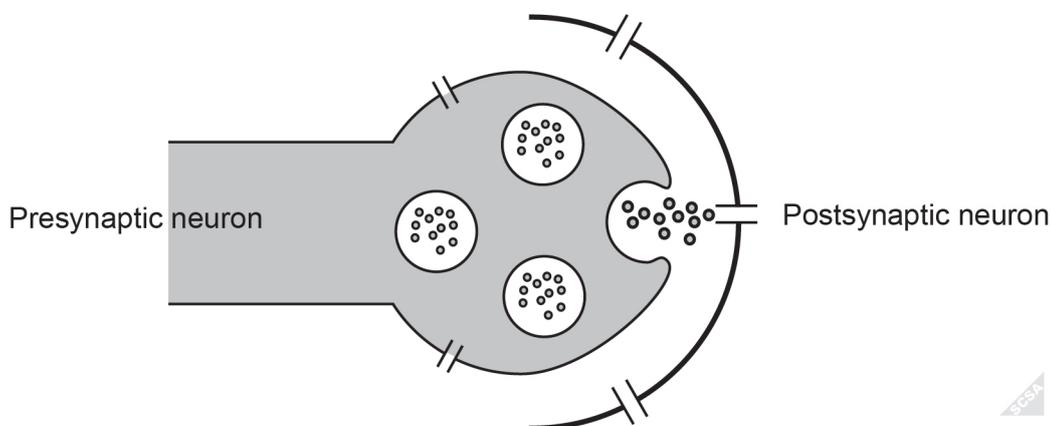
- (a) (i), (ii), (iv)
- (b) (ii), (iv)
- (c) (i), (iv)
- (d) (i), (iii), (iv)

18. One hour after consuming a glucose drink, the blood glucose concentration of two people was determined. One of these people suffered from Type 1 diabetes. Person A had a blood glucose concentration of 11 mmol/litre and Person B had a blood glucose concentration of 6 mmol/litre. Just before consuming the drink both people had a blood glucose concentration of 5 mmol/litre.

The reason for the difference between A and B was that

- (a) A was diabetic and therefore was unable to store glucose as glycogen in the liver.
 (b) B was diabetic and therefore lost excess glucose through the kidneys.
 (c) A was diabetic and therefore required less glucose in cells for respiration.
 (d) B was diabetic and therefore was unable to release sufficient glucose from muscle cells.
19. Which of the following are features of a reflex action?
- (a) spontaneous, involuntary and rapid
 (b) involuntary, stereotyped and require a stimulus
 (c) require a stimulus, voluntary and rapid
 (d) stereotyped, spontaneous and voluntary
20. When a nerve impulse reaches the end of a neuron, it is not connected directly to the adjacent neuron. There is a gap between the neurons called a synapse.

The diagram below is a representation of a synapse.



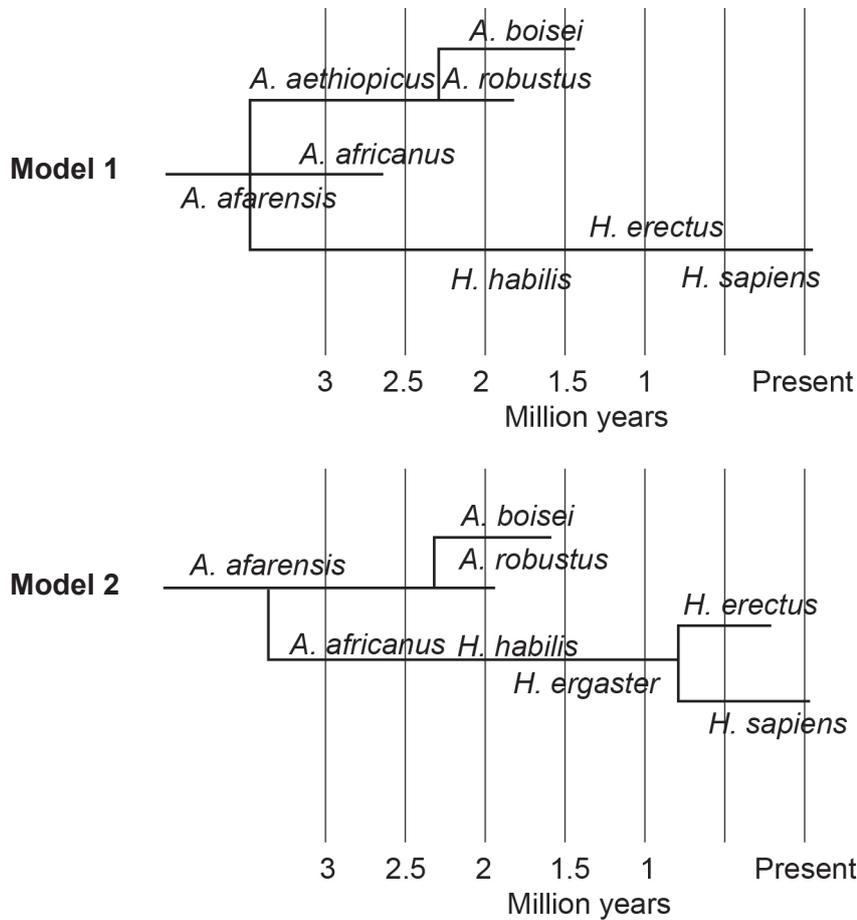
Which of the following is involved in enabling the nerve impulse to reach the adjacent neuron?

- (a) Mitochondria in the postsynaptic membrane release neurotransmitters into the synapse.
 (b) Vesicles in the presynaptic knob are stimulated by the entry of calcium ions to release neurotransmitters.
 (c) Neurotransmitters diffuse across the synapse and bind to receptors on the presynaptic knob.
 (d) Calcium ions are released by vesicles in the postsynaptic membrane and cross the synapse to release neurotransmitters.

See next page

Questions 21 and 22 refer to the diagram shown below.

The two models of phylogenetic trees below show two different interpretations of the relationships between groups of hominids over the last 3 million years.



21. There is agreement between the two interpretations in some aspects of these models. According to both models, how many million years ago did **three** fossil species exist?
- (a) 3
 (b) 2.5
 (c) 2
 (d) 1.5
22. Which of the following statements shows a difference between Models 1 and 2?
- (a) Model 1 shows *H. habilis* as having no influence on the development of *H. sapiens*.
 (b) Model 1 shows *H. erectus* occurring at the same time as *H. habilis*.
 (c) Model 2 shows *H. ergaster* and *H. habilis* as being descendants of *H. erectus*.
 (d) Model 2 shows *A. africanus* as an ancestor of *H. ergaster* and *H. sapiens*.

See next page

23. Opening a closed door quickly, you are surprised by someone standing on the other side. Your pupils dilate and your heart and breathing rates increase. Which branch of the nervous system has been activated?
- (a) central
 - (b) somatic
 - (c) parasympathetic
 - (d) sympathetic
24. When reinfected by the same antigen, the immune response is quicker. This is due to the presence of
- (a) memory cells.
 - (b) killer T-cells.
 - (c) B-cells.
 - (d) helper T-cells.
25. Proteins are used in comparative studies to determine evolutionary relationships. Which of the following characteristics of proteins is considered when studying them for this purpose?
- (a) shape of the protein molecule
 - (b) complexity of the protein molecule
 - (c) sequence of amino acids in the protein
 - (d) number of nucleotides in the protein
26. Which of the following statements **best** describes evolution?
- (a) Evolution can occur in a population without causing any changes in gene frequency.
 - (b) The development of new features occurs when a species settles into a new, uninhabited territory.
 - (c) Evolution alters the genetic variation in a population.
 - (d) The process occurs more readily in larger populations.
27. There are gaps in the fossil record because
- (a) fossils can be destroyed by the earth's movements.
 - (b) the gaps represent time periods where no life existed on the earth.
 - (c) fossils decompose and disappear over time.
 - (d) incorrect dating of fossils places them in the wrong time periods.
28. A gene pool is
- (a) all the different genes found in an ecosystem.
 - (b) all the different alleles in an interbreeding population.
 - (c) the alleles in a group of individuals that cause a genetic disease.
 - (d) the total number of genes found in a species.

Question 29 refers to the tool diagram shown below.



29. The tool shown above, described as a laurel-leaf, is associated with the tool culture named

- (a) Aurignacian.
- (b) Magdalenian.
- (c) Oldowan.
- (d) Solutrean.

30. Which of the following is correct in relation to the afferent and efferent nervous systems?

	Afferent nervous system	Efferent nervous system
(a)	Carries nerve impulses from the receptors to the CNS	Carries nerve impulses from the CNS to the receptors
(b)	Carries nerve impulses to the voluntary muscles from the CNS	Carries nerve impulses to the CNS from the voluntary muscles
(c)	Carries nerve impulses from the CNS to the receptors	Carries nerve impulses from the receptors to the CNS
(d)	Carries nerve impulses from the receptors to the CNS	Carries nerve impulses from the CNS to the voluntary muscles

End of Section One

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Section Two: Short answer

50% (100 Marks)

This section has **nine (9)** questions. Answer **all** questions. Write your answers in the spaces provided.

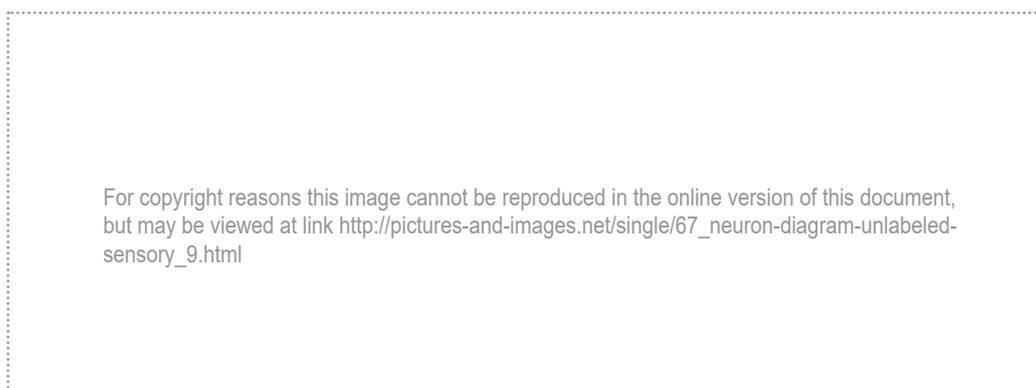
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Suggested working time: 90 minutes.

Question 31

(9 marks)

Parts (a) and (b) refer to the diagram of a neuron shown below.



(a) What type of neuron is shown in the diagram? (1 mark)

(b) How does the position of the cell body in other types of neurons differ from the position shown in the diagram? (2 marks)

- (c) The nervous and endocrine systems work together to coordinate functions of all body systems. However, they differ in several ways.

Complete the table below to outline **three** of these differences.

(6 marks)

	Nervous system	Endocrine system
Speed of action		
Duration of action		
Specificity of message		

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Question 32

(13 marks)

The fictional concept of zombies is highly popular in the entertainment media. Zombies do not exist but the concept of a zombie being caused by a disease transmitted by a pathogen can be analysed scientifically on the basis of the evidence provided. There are reported cases of people displaying symptoms, much like that of a zombie, when poisoned by a neurotoxin called Tetrodotoxin (TTX). TTX is found in species of pufferfish, blue-ring octopus and angelfish.

- (a) Reported cases of TTX poisoning have been caused by the ingestion of contaminated food. Is the ingestion of contaminated food classified as direct or indirect disease transmission? (1 mark)

- (b) In the entertainment media, the zombie disease is usually transmitted by a bite from an infected person. What type of disease transmission would this be? Describe how the pathogen would be transmitted. (3 marks)

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- (c) Whether analysing the fictional zombie disease or zombie symptoms caused by TTX, many zombie symptoms are due to its effects on various parts of the nervous system. Using your knowledge of the functions of the nervous system, complete the table below by identifying where the dysfunction would most likely occur to bring about the stated zombie symptoms. Provide a scientific reason for your choice. (6 marks)

Zombie symptom	Structure/s of the nervous system affected	Reason
Jerky movements when walking		
Reduced perception of pain stimulus		
Inability to speak		

- (d) If there was a zombie disease as portrayed in the entertainment media that was caused by the transmission of a pathogen, then potentially an antibiotic or a vaccine could be developed to treat it.

Outline **three** differences between antibiotics and vaccines. (3 marks)

Question 33

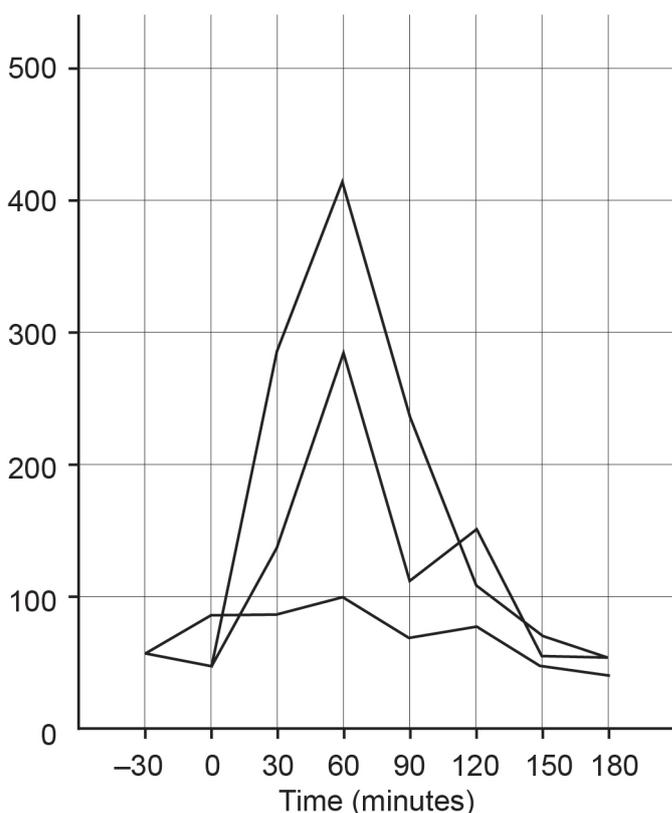
(11 marks)

Scientists decided to investigate how urine production was affected by drinking different salt solutions. They chose three groups of 10 volunteers. Each group drank 1 litre of different solutions: Group 1 distilled water; Group 2 10% salt solution; and Group 3 30% salt solution. Urine samples were collected from each person that participated in the experiment 30 minutes before they drank the solution and then every 30 minutes afterward, and the volume of urine was then recorded. The graph and table below show the average volume of urine collected every 30 minutes from each group.

Time (minutes)	Average urine production (mL)		
	Group 1 Distilled water	Group 2 10% Salt solution	Group 3 30% Salt solution
-30	56	58	55
0	48	47	51
30	287	138	85
60	415	285	98
90	235	112	67
120	103	82	77
150	68	54	46
180	54	52	40

The graph shown below is a student's attempt to represent the data shown in the table.

Effect on urine production



See next page

- (a) Identify **three** errors in the graph. (3 marks)

- (b) Why was urine collected from each volunteer 30 minutes prior to their drinking 1 litre of their solution? (2 marks)

- (c) Identify **two** variables **not** indicated in the information for this question that needed to be maintained across all three groups during the investigation to ensure a fair test was conducted. (2 marks)

- (d) State **one** factor that is changed in the normal internal environment due to the drinking of 1 litre of 30% salt solution. (1 mark)

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Question 33 (continued)

- (e) At what time would the blood concentration of ADH be the lowest for the people in Group 1? Justify your answer. (3 marks)

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Question 34

(12 marks)

(a) An athlete had pH levels in his blood measured immediately before and after a 100 metre sprint. The results showed a decrease in pH from 7.45 to 7.35.

(i) Why did the blood pH levels change? (2 marks)

(ii) The decrease in pH was detected by receptors that initiated a response to a change in the rate of breathing.

Describe the events that enabled this change in the breathing rate to occur.

(4 marks)

(b) Under normal circumstances, the level of oxygen in the blood does not influence breathing rate. Under what circumstance will oxygen have an effect and what effect will it be? (2 marks)

- (c) There are many diseases that affect the ability to breathe normally. One of these is cystic fibrosis. This is a genetic disease, one symptom of which is excess mucous in the lungs that causes breathing difficulties. Recently there has been much discussion and trialling of treatments involving gene therapy and cell replacement therapy for cystic fibrosis. A combined gene and cell replacement therapy strategy for treatment is also being explored.

How could gene therapy and cell replacement therapy be combined as a treatment?

(4 marks)

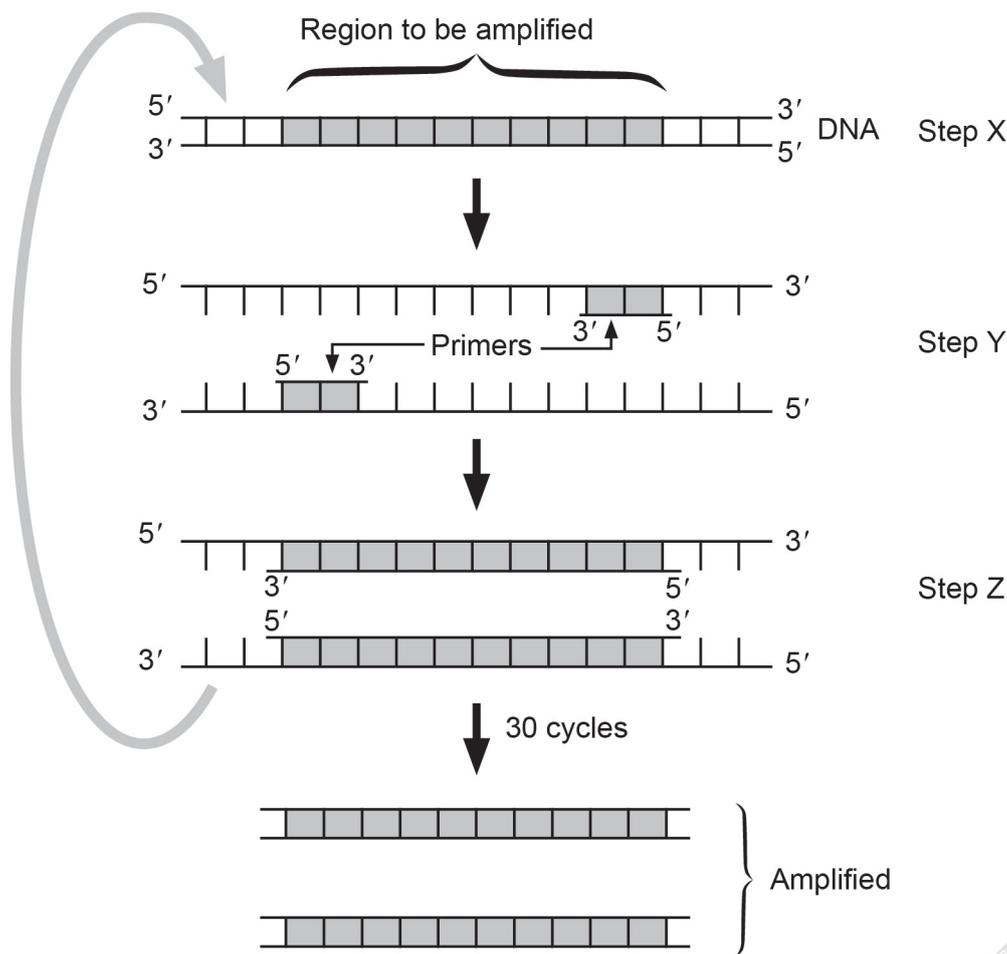
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Question 35

(10 marks)

Parts (a) and (b) of the following question refer to the PCR diagram shown below.



(a) Complete the table below, which is based on the diagram shown above. (5 marks)

What is required for Step X to proceed?	
What happens to the DNA at Step X?	
What is the process occurring at Step Y?	
What is added at Step Z?	
At what temperature does Step Z occur?	

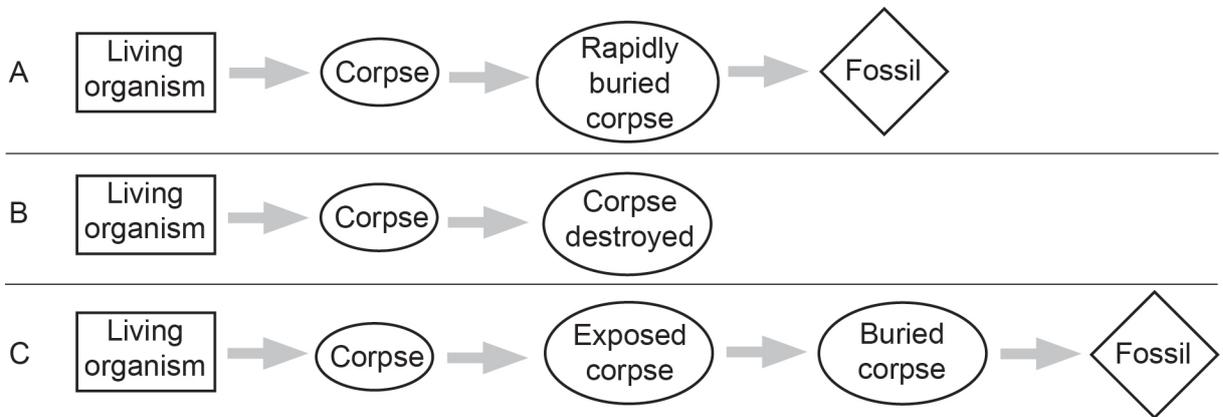
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- (b) Why is amplification of DNA created by PCR useful in the study of human evolution? (1 mark)

Three hominids were killed in different circumstances. They were:

- (i) While hunting for mammoth, a male was killed by a snow avalanche.
- (ii) While searching for fruit in the forest, a female was killed by a falling branch.
- (iii) A male who was resting at the base of a volcano was killed by lava and ash during a rapid eruption.

Each of these circumstances could potentially lead to the formation of fossil remains of the hominid. The three different processes that the hominid in each circumstance underwent are represented below.



- (c) Match the circumstances (i) and (iii) to the most likely sequence of events – A, B or C. Write A, B or C below. (2 marks)

(i) _____

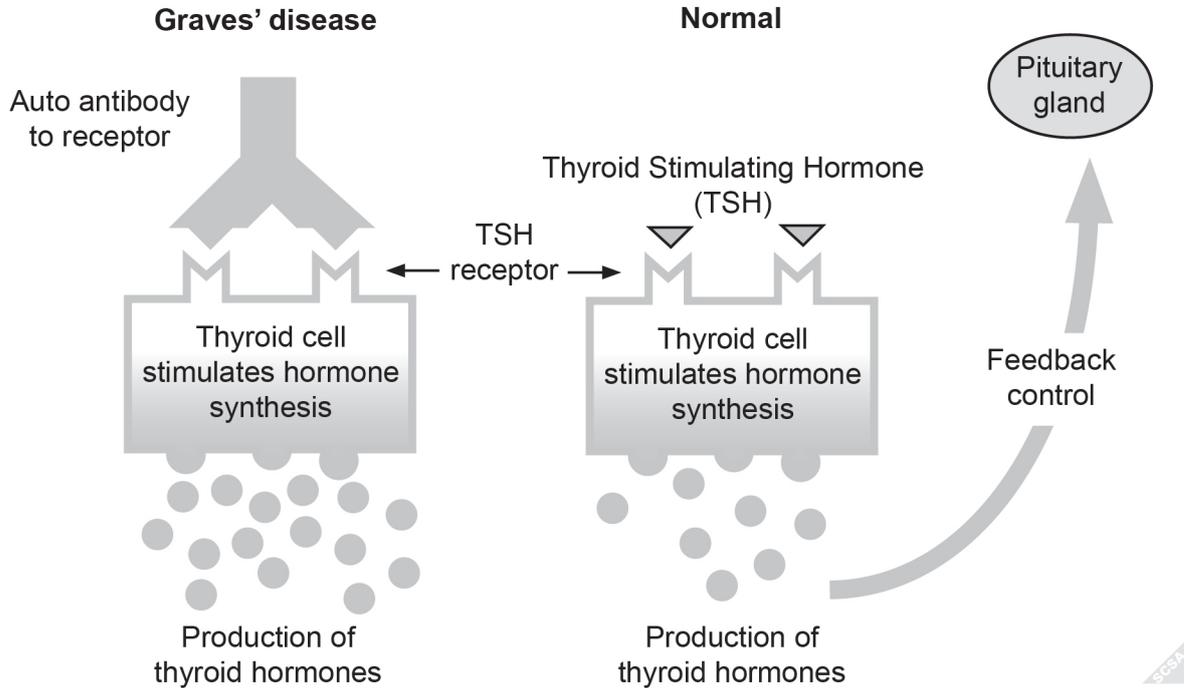
(iii) _____

- (d) On the basis of the information provided, identify the circumstance that would probably result in the best preserved and complete fossil specimen. Provide a reason for your answer. (2 marks)

Question 36

(11 marks)

Graves' disease is an autoimmune condition affecting the thyroid gland. The diagram below is a representation of how it alters thyroid function.



(a) According to the information in the diagram, is Graves' disease a type of hypothyroidism or hyperthyroidism? (1 mark)

(b) Identify **two** symptoms you would expect someone with Graves' disease to display. (2 marks)

(c) Explain how Graves' disease can be treated. (3 marks)

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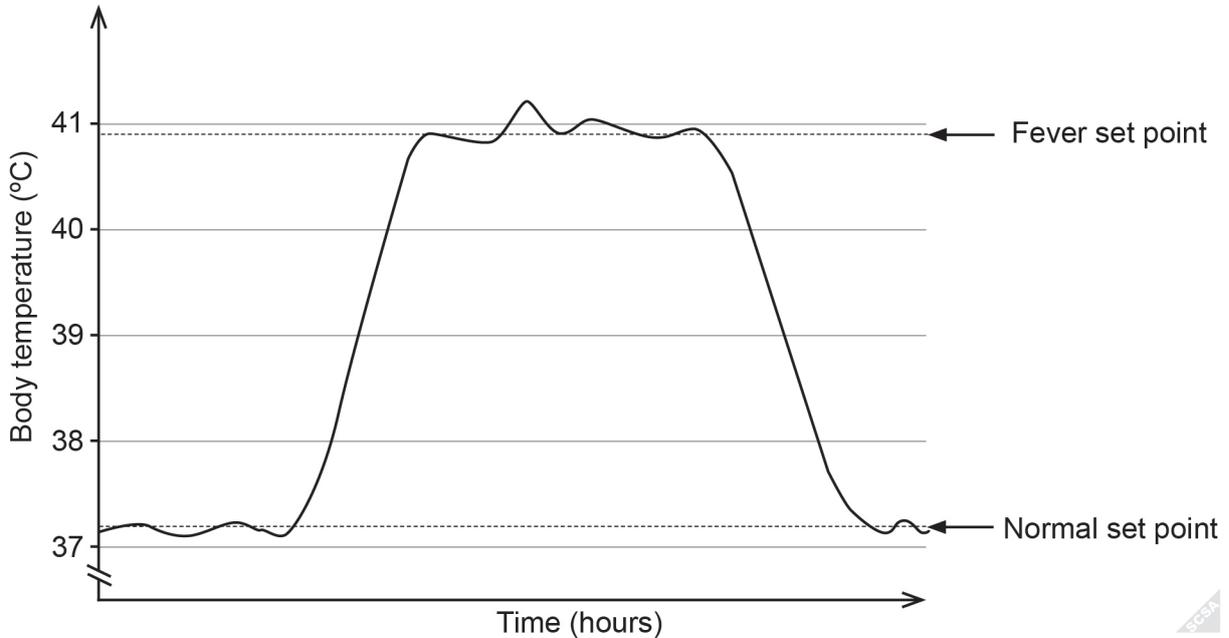
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Question 37

(11 marks)

Pathogens such as bacteria and viruses are initially prevented from entering the body by external barriers. However, if they manage to pass through these barriers, they are targeted by several non-specific and specific immune responses. One of these responses is fever, which results in changes in body temperature.

Below is the outline of a graph showing the change in body temperature after a pathogen enters the body.



The set point is the point at which the thermostat in the hypothalamus is set to maintain optimum body temperature. In humans it is normally set at 37 °C, which is the point at which the body functions most efficiently.

- (a) As the set point rises from 37 °C to 41 °C on the graph, the hypothalamus is stimulated and responses occur that attempt to raise body temperature by increasing the production of heat.

Name **two** mechanisms that would be activated in this situation. (2 marks)

- (b) As the set point falls from 41 °C back to 37 °C other mechanisms respond to the lower body temperature by increasing heat loss.

Name and describe **one** of these mechanisms. (3 marks)

- (c) Explain how a bacterial pathogen stimulates the hypothalamus to reset the thermostat and therefore results in a fever. (4 marks)

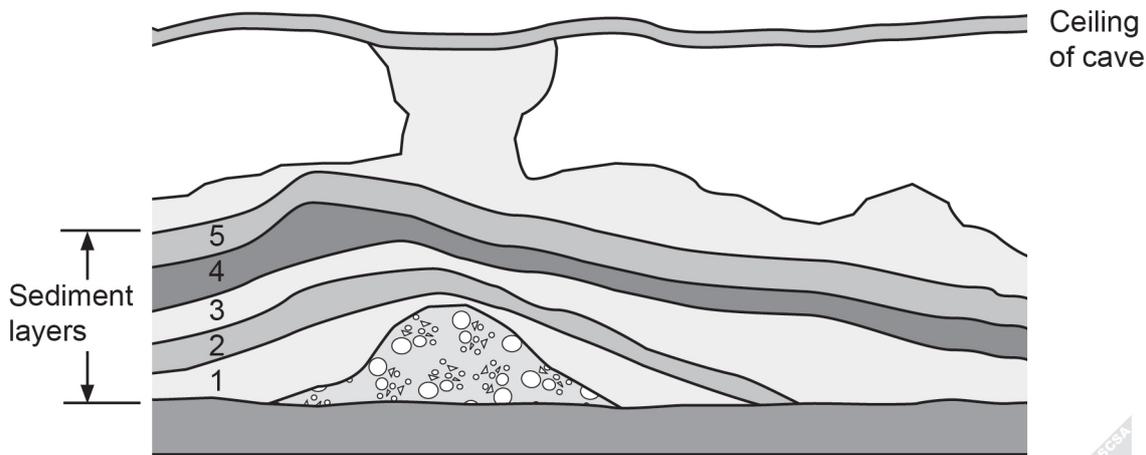
- (d) Describe **one** way in which the increased body temperature associated with a fever assists in fighting a pathogen during an infection. (2 marks)

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Question 38

(13 marks)

The following question refers to the information and diagram shown below.



The diagram above shows a limestone cave that contains an abundance of fossil specimens and artefacts dated from 100 000 to 2 million years ago. Sediment and animals fell into the cave over time. Animals were unable to escape and died in the cave, to be covered by sediment layers and preserved.

- (a) (i) Which relative dating method could be used to date the fossil specimens and artefacts within the cave by comparing them to each other? (1 mark)

- (ii) Using the relative dating method identified in part (a)(i), state which layer in the cave is the oldest. Justify your answer. (3 marks)

- (b) In layer 2, an index fossil was found. Explain what an index fossil is and how it helps archaeologists investigating a site. (3 marks)

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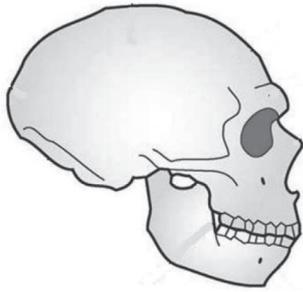
In layer 3, the following tool was discovered.



- (c) (i) What name is given to this type of tool? (1 mark)

- (ii) Who is the first hominid believed to have made this type of tool? (1 mark)

In another layer within the cave, a partial hominid skeleton was discovered. A diagram of its skull is shown below.



- (d) (i) Name the hominid specimen shown above and state **one** distinguishing feature shown in the diagram that enables it to be identified. (2 marks)

- (ii) In which layer of the cave would you expect this fossil to have been found? Provide a reason for your answer. (2 marks)

See next page

Question 39

(10 marks)

Since World War I, mustard gas has been used as a weapon in chemical warfare. Within 24 hours of exposure to mustard gas, victims develop chemical burns, which appear as large blisters to the exposed skin and respiratory surfaces.

In 1940, Auerbach and Robson completed the first research into the other potential effects of mustard gas. They exposed *Drosophila* flies to mustard gas and then examined the chromosomal damage in the flies' offspring over several generations. Their results showed a dramatic increase in the number of chromosomal mutations compared to the control group.

Najafi and others (2014) studied human victims 25 years after their exposure to mustard gas during the Iraq-Iran War. It found there were 122 different mutated genes in the respiratory pathways of the victims.

- (a) The studies described above outline how mustard gas has been shown to cause mutations. Mustard gas can therefore be classed as a (1 mark)

- (b) Auerbach and Robson were studying chromosomal mutations. Describe **two** types of these mutations that can occur in organisms. (4 marks)

- (c) The 2014 study examined mutated genes. Describe how this type of mutation differs from a chromosomal mutation. (2 marks)

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- (d) Explain why Auerbach and Robson studied the offspring flies, not the parent flies, and what information this gave about the type of mutations that occurred. (3 marks)

End of Section Two

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

This section has **three (3)** questions. You must answer **two (2)** questions. Write your answers on the lined pages provided.

Supplementary pages for the use of planning/continuing your answer to a question have been 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.

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.

Suggested working time: 50 minutes.

Answer any **two (2)** questions from Questions 40 to 42.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on pages that follow.

Question 40**(20 marks)**

- (a) All bipedal hominids have many features in common. However, the species of genus *Australopithecus* and genus *Paranthropus* display differences from the species of genus *Homo*.

Identify **four** differences that may be observed in the various species of *Australopithecus* and *Paranthropus* when compared with those species that belong to genus *Homo*. For each of the four differences identified, state how it differs from the genus *Homo*.

(8 marks)

- (b) A group of archaeologists found two fossil skeletons. One, found in Africa, was identified as *Australopithecus afarensis* and the other, found in Europe, was identified as *Homo sapiens*.

State which absolute dating method would be most appropriate to determine the age of each fossil and the reason for your choice. Describe each of these methods. **(12 marks)**

See next page

Question 41**(20 marks)**

For each inherited genetic disease, identify a population in which the disease is prevalent, outline the cause and main symptoms experienced by affected individuals and describe how the disease is inherited and the effect it has on the gene pool of populations.

- (a) sickle-cell anaemia (7 marks)
- (b) Tay-Sachs disease (6 marks)
- (c) thalassemia (7 marks)

Question 42**(20 marks)**

- (a) Describe how a nerve impulse is propagated along a myelinated nerve fibre. How does a nerve impulse propagated along an unmyelinated nerve fibre differ? (10 marks)

- (b) Human growth hormone was originally extracted from the pituitary glands of cadavers (dead human bodies). It was a very difficult and unsafe procedure and there was often a shortage of the hormone. However, scientists succeeded in developing this hormone in bacteria by using recombinant DNA technology.

Describe the process that produces human growth hormone by recombinant DNA technology. (10 marks)

ACKNOWLEDGEMENTS

- Questions 5–6** Adapted from: Wheatcroft, W. G. (2008). *Footprint comparison* [Images]. Retrieved March, 2017, from www.bigfootencounters.com/biology/orang-pendek.htm
- Questions 8–9** Adapted from: Purves, W. K., Orians, G. H., & Heller, H. C. (1995). *Life: The science of biology* (4th ed.). Sunderland, MA: Sinauer Associates, & Salt Lake City, UT: W.H. Freeman, p. 821, fig. 36.19. Retrieved March, 2013, from www.cartage.org.lb/en/themes/sciences/lifescience/generalbiology/physiology/endocrinesystem/MechanismsHormone/MechanismsHormone.htm
- Question 16** [Generalized dentition image]. (2004). Retrieved March, 2017, from www.yorku.ca/kdenning/++2140%202006-7/2140-24oct2006.htm
- Question 29** *Laurel-leaf tool* [Image]. (n.d.). Retrieved March, 2017, from www.abovetopsecret.com/forum/thread959326/pg1
- Question 31** Abbotsford Collegiate. (n.d.). *Neurons* [Image]. Retrieved November, 2009, from www.abbysenior.com/biology/nervous_system.htm
- Question 38(c)** [...] [Image]. Retrieved March, 2017, from [www.bradshawfoundation.com/origins/\[...\]_tools.php](http://www.bradshawfoundation.com/origins/[...]_tools.php)
- Question 38(d)** Potter, J. (2006, July 19). [...] [Image]. Retrieved March, 2017, from [https://commons.wikimedia.org/wiki/File:\[...\]jpg](https://commons.wikimedia.org/wiki/File:[...]jpg)
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