



Western Australian Certificate of Education Examination, 2014

Question/Answer Booklet

HUMAN BIOLOGICAL SCIENCE

Stage 3

Please place your student identification label in this box

Student Number: In figures

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In words

Time allowed for this paper

Reading time before commencing work: ten minutes
Working time for paper: 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 the WACE examinations

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 notes or other items of a non-personal nature in the examination room. 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 exam
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 Western Australian external examinations are detailed in the *Year 12 Information Handbook 2014*. 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.

- You must be careful to confine your responses to the specific questions asked and to follow any instructions that are specific to a particular question.
- Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.
 - Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
 - Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

See next page

Section One: Multiple-choice

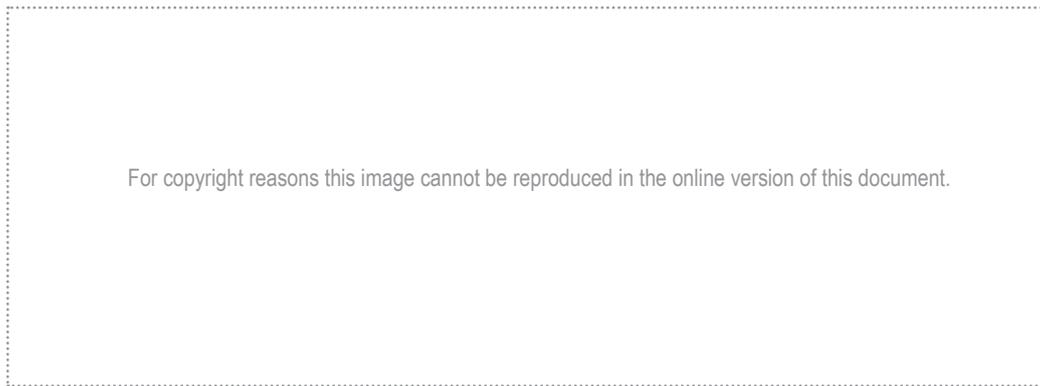
30% (30 Marks)

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. 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.

1. The purpose of the Human Genome Project was to
- (a) produce large amounts of DNA for scientific analysis.
 - (b) provide cures for genetic and communicable diseases.
 - (c) sequence the genetic code of humans.
 - (d) remove faulty genes from the DNA.

Questions 2 and 3 refer to the diagram below, which shows a cross-section of the spinal cord and associated structures.



2. If the fibres showing the pathway of a spinal reflex arc were to be included in this diagram, the direction of the nerve impulse would be
- (a) F → A → B → C.
 - (b) F → E → D → C.
 - (c) F → E → A → F.
 - (d) F → A → E → F.
3. Structure X contains
- (a) cell bodies of sensory neurons.
 - (b) ascending tracts.
 - (c) sensory receptors.
 - (d) inter-neurons.

See next page

4. The following list relates to characteristics of the nervous system.
- i. effectors are usually skeletal muscles
 - ii. involves parasympathetic and sympathetic nerves
 - iii. carries information from the CNS to effectors
 - iv. carries information from the brain to the spinal cord
 - v. nerve pathway has no ganglion
 - vi. usually controls involuntary actions

The characteristics that describe the somatic division of the peripheral nervous system correctly are

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

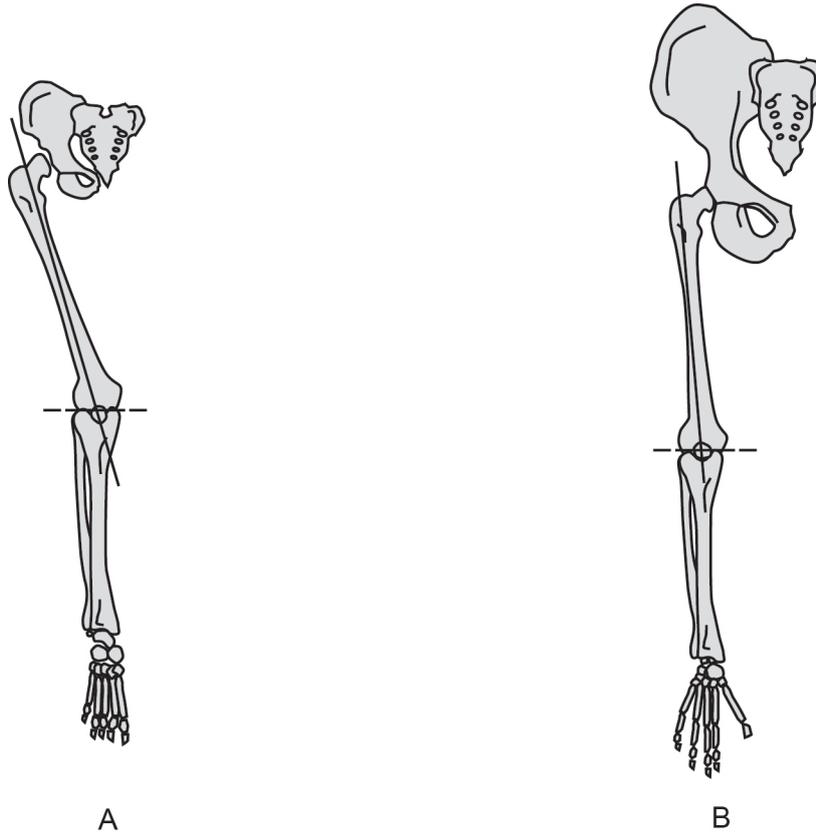
Questions 5 and 6 refer to the diagram below.



5. The type of cartilage shown in the diagram is best referred to as
- (a) fibrocartilage.
 - (b) elastic.
 - (c) hyaline.
 - (d) articular.
6. The cells in the lacuna shown in the diagram are called
- (a) chondrin.
 - (b) chondrocytes.
 - (c) osteoblasts.
 - (d) collagen.
7. During the ovarian cycle, the ovum is released from a mature follicle. The hormone that directly stimulates the release of the ovum is
- (a) follicle stimulating hormone.
 - (b) progesterone.
 - (c) luteinising hormone.
 - (d) oestrogen.

See next page

Questions 8 and 9 refer to the diagram below of primate lower limbs.



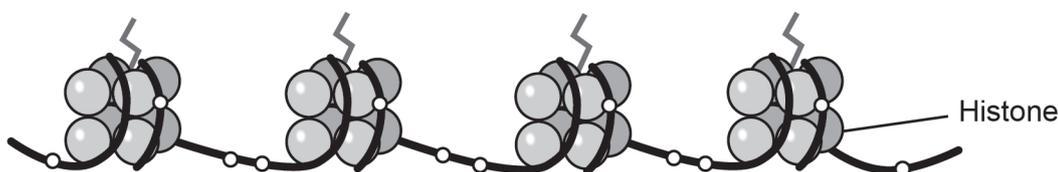
8. The femur of Primate A has a greater carrying angle than Primate B. This is because Primate A is
- (a) human and the carrying angle allows it to have a wider pelvis than an ape, to assist in childbirth.
 - (b) an ape and the carrying angle increases the length of the femur to allow for quadrupedal walking.
 - (c) an ape and the carrying angle allows the knee to bend and straighten for bipedal walking.
 - (d) human and the carrying angle places the foot under the centre of gravity for a striding gait.
9. The foot of Primate A would have
- (a) a larger calcaneus (heel bone) than Primate B.
 - (b) a longitudinal arch that is lacking in Primate B.
 - (c) greater opposability of the big toe than Primate B.
 - (d) a more flexible ankle joint than Primate B.

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10. During a science experiment, a student was required to place his left hand in cold water and his right hand in hot water for a period of 5 minutes. Which of the following would be his body's response?
- (a) parasympathetic stimulation of sweat glands in his right hand
 - (b) vasodilation in blood vessels leading to his left hand and vasoconstriction in blood vessels leading to his right hand
 - (c) parasympathetic stimulation, causing vasoconstriction in blood vessels leading to his left hand
 - (d) stimulation of thermoreceptors in the skin of both hands to send nervous impulses to his hypothalamus
11. Glucocorticoids are secreted by the adrenal cortex in response to ACTH from the pituitary gland. Which of the following is **not** an effect of glucocorticoids?
- (a) stimulate fat breakdown
 - (b) produce glucose from amino acids
 - (c) stimulate the release of insulin
 - (d) increase blood glucose levels
12. Which of the following comparisons of the nervous and endocrine systems is correct?

	Nervous system	Endocrine system
(a)	slower transmission of message	faster transmission of message
(b)	electrochemical message	chemical message
(c)	message is general, targeting a large number of cells	message can be specific or general, targeting a small or large number of tissues
(d)	response continues after stimulus stops	response stops when stimulus stops

Question 13 refers to the diagram below.

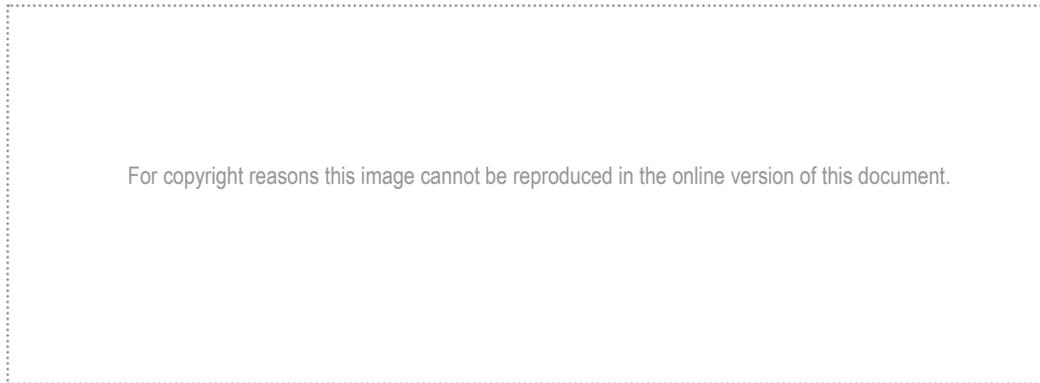


The diagram represents a small segment of DNA where the genes are activated or 'switched on' through epigenetics.

13. The best description for what is occurring in the diagram is
- (a) acetylation of histones.
 - (b) DNA replication.
 - (c) methylation of histones.
 - (d) DNA acetylation.

See next page

Questions 14 and 15 refer to the diagram below, which shows a longitudinal section of a long bone.



14. Structure C is

- (a) compact bone.
- (b) spongy bone.
- (c) the periosteum.
- (d) the medullary cavity.

15. Osteoporosis causes a severe loss of bone density. It particularly affects bone tissue with a high surface area that is exposed to bone dissolving cells, as compared with dense bone. Therefore, the area of a long bone most affected would be the part labelled

- (a) A.
- (b) B.
- (c) C.
- (d) D.

16. Researchers were looking at ways of using stem cells to regrow hair. They used adult epithelial (skin) cells to produce new cells capable of regenerating skin and hair follicles. The study involved modifying the epithelial cells by inserting three genes into the cells to change them into induced pluripotent stem cells.
- Why did researchers need to change the epithelial cells into induced pluripotent stem cells?
- (a) They needed to create a clone of identical stem cells with which to experiment.
 - (b) They needed cells capable of differentiating into the many types of skin and hair follicle cells.
 - (c) The DNA in the epithelial cells was not a perfect match for the DNA in hair follicle cells.
 - (d) Large amounts of DNA, and specifically the genes for hair growth, were required.
17. A fossilised femur was discovered in Kenya and was dated at 1.5 million-years-old. The soil conditions that would have **best** allowed for fossilisation of these remains would be
- (a) dry and acidic soils, low in oxygen.
 - (b) wet and acidic soils, low in oxygen.
 - (c) dry and alkaline soils, high in oxygen.
 - (d) wet and alkaline soils, high in oxygen.
18. Which of the following is **not** a fight-or-flight response?
- (a) increased sweat production
 - (b) constriction of the pupil of the eye
 - (c) relaxation of the walls of the urinary bladder
 - (d) decreased saliva secretion
19. Hyperthyroidism is a disease of the thyroid gland. Which of the following symptoms would a person suffering hyperthyroidism be likely to show?
- (a) weight gain
 - (b) lethargy
 - (c) weight loss
 - (d) a feeling of cold
20. Gel electrophoresis is used in DNA profiling. Which of the following is an **incorrect** statement regarding gel electrophoresis?
- (a) An electric current is passed through the gel matrix to separate DNA molecules.
 - (b) Larger DNA molecules move through the gel more slowly than smaller DNA molecules.
 - (c) Different sized DNA molecules form distinct bands on the gel.
 - (d) DNA molecules move toward the negative electrode.

21. One method used to date fossil remains is based on the Law of Superposition. This form of dating is
- (a) absolute, based on determining a very precise level of radioactive isotopes in the fossil remains.
 - (b) relative, where the deeper the rock layer in which it is found, the older the fossil remains will be.
 - (c) absolute, based on the position the body of an organism is in when fossilisation is occurring.
 - (d) relative, in which the highest levels of fluorine occur in the soil water surrounding the oldest fossils.

22. The diagram below illustrates three typical brains that belong to different groups of primates. Regions within the brains are highlighted.



On the basis of the information in the diagram, which of the following correctly matches the brain with the primate to which it most likely belongs?

	X	Y	Z
(a)	Old World Monkey	Prosimian	Great Ape
(b)	New World Monkey	Human	Prosimian
(c)	New World Monkey	Prosimian	Human
(d)	Prosimian	Old World Monkey	Human

23. Variation in skin colour involves
- (a) melanin, which is found in skin cells called melanocytes.
 - (b) melanosomes that produce melanocytes.
 - (c) determination by one pair of alleles.
 - (d) decreased UV radiation stimulating melanin production.
24. One form of radioactive dating is based on the radioactive decay of carbon-14. The half-life of carbon-14 is approximately
- (a) 10 430 years.
 - (b) 7250 years.
 - (c) 5730 years.
 - (d) 4780 years.

25. Promoter and regulator genes perform different roles in controlling the expression of structural genes. Which of the following is correct?

	Promoter gene	Regulator gene
(a)	Binds RNA polymerase to DNA	Codes for activated proteins
(b)	Begins the process of transcription	Binds RNA polymerase to DNA
(c)	Produces repressor proteins	Inhibits the process of transcription
(d)	Codes for activator proteins	Produces an enzyme to allow gene expression

26. Similarities in amino acid sequences in various proteins can be used to provide evidence for evolution. The following amino acid sequence is from a section of the human haemoglobin molecule.

proline-serine-alanine-valine-glycine-lysine

The amino acid sequences in the same region of the haemoglobin molecule in four other primates are shown below:

Primate 1 lysine-alanine-threonine-valine-leucine-lysine

Primate 2 lysine-alanine-alanine-valine-leucine-lysine

Primate 3 proline-serine-alanine-valine-leucine-lysine

Primate 4 lysine-serine-alanine-valine-leucine-lysine

On the basis of the evidence above, which of the following shows the primates from the most closely to the most distantly related to humans?

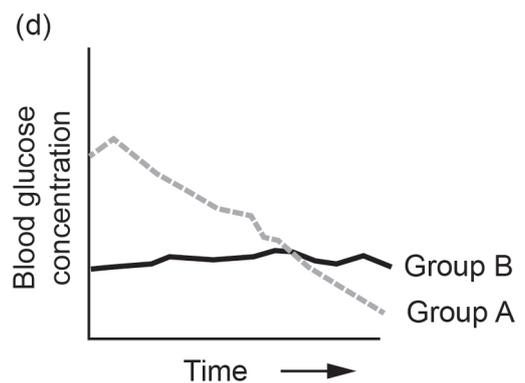
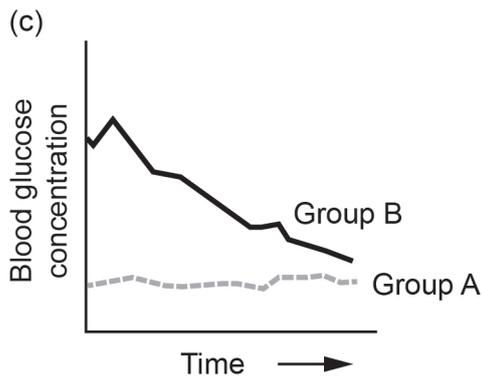
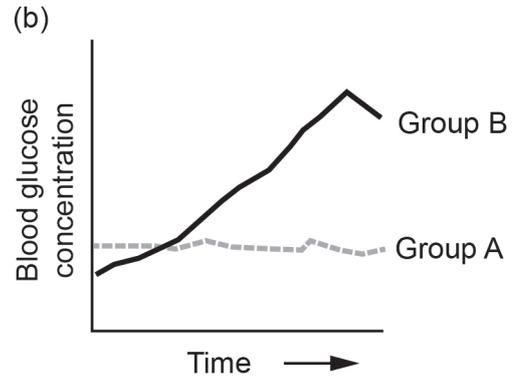
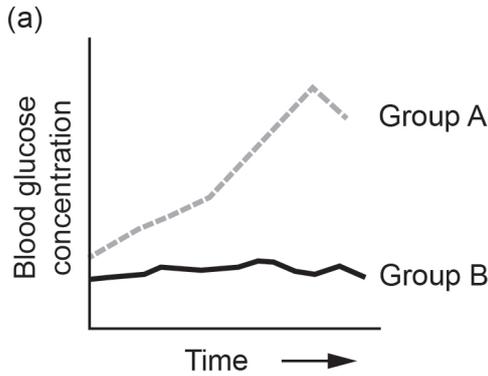
- (a) 1, 2, 4, 3
 (b) 3, 4, 1, 2
 (c) 3, 4, 2, 1
 (d) 2, 1, 4, 3
27. Jack cut his foot on a piece of rusty metal and had to go to the doctor to have stitches. The doctor also gave him an injection to prevent him from contracting tetanus.
- The immunity that Jack gained from having the injection was
- (a) passive and artificially acquired.
 (b) passive and naturally acquired.
 (c) active and naturally acquired.
 (d) active and artificially acquired.

See next page

Questions 28 and 29 refer to the information below.

During an experiment, 100g of glucose was consumed by each member of two groups of people. Their blood glucose concentrations were then measured over the next 5 hours. Group A consisted of people who had untreated Type 1 diabetes mellitus. Members of Group B did not have the disease.

28. Which of the following graphs depicts correctly the average changes in blood glucose concentration of the two groups?



29. The reason for the difference in blood concentrations over the 5 hours after consuming glucose is that in Group A, insulin

- (a) although produced, could not bind to receptors on cells to allow glucose to enter the cells.
- (b) could not be produced in the beta cells of the Islets of Langerhans.
- (c) caused excess storage of glucose as glycogen in the liver and muscles.
- (d) was produced in excessive amounts, causing high levels of glucose to be taken out of storage.

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30. Which of the following is a socioeconomic barrier to gene flow?
- (a) continuous mountain ranges
 - (b) large lake systems
 - (c) desert regions
 - (d) political beliefs

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.

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

- Planning: If you use the spare pages for planning, indicate this clearly at the top of the page.
- Continuing an answer: If you need to use the space to continue an answer, indicate in the original answer space where the answer is continued, i.e. give the page number. Fill in the number of the question that you are continuing to answer at the top of the page.

Suggested working time: 90 minutes.

Question 31**(9 marks)**

Part (a) of the question refers to the diagram below.



The structures shown in the diagram provide evidence for evolution.

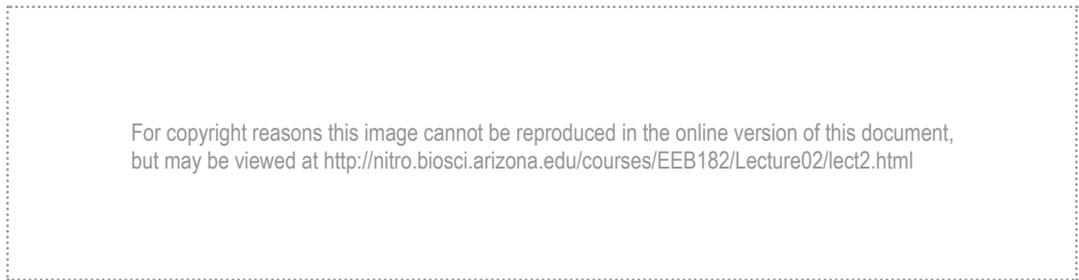
- (a) (i) What collective name is given to the structures shown in the diagram? (1 mark)

- (ii) Provide another example of a structure in the human body that could be classified in the same category as those shown in the diagram. (1 mark)

See next page

- (iii) Explain how the structures shown in the diagram could provide evidence for evolution. (3 marks)

Part (b) of the question refers to the diagram below.



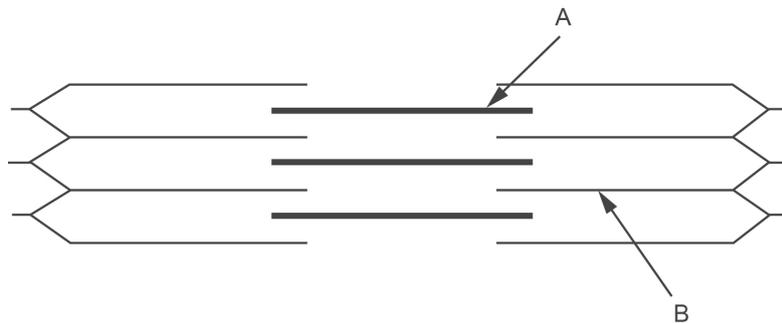
- (b) (i) What name is given to the type of evidence for evolution represented in the diagram? (1 mark)
- (ii) Describe how the evidence shown in the diagram provides support for the theory of evolution. (1 mark)
- (iii) Could a similar diagram be drawn to include humans as an example in the same category as the three organisms shown in the diagram above? Justify your answer. (2 marks)

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Question 32

(14 marks)

Part (a) of the question refers to the diagram below.



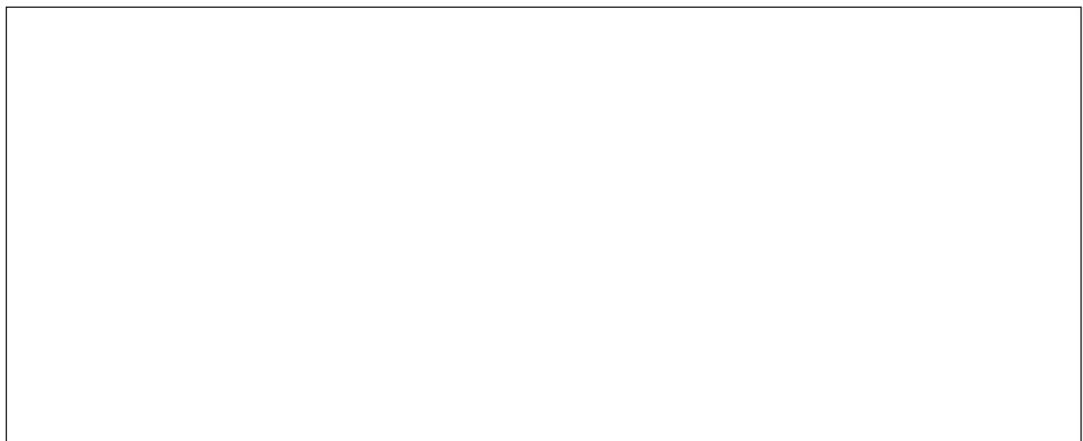
(a) The diagram represents the sliding filament model of muscle contraction. A sarcomere in a skeletal muscle is shown in the relaxed position.

(i) Identify the proteins labelled as A and B in the diagram. (2 marks)

A _____

B _____

(ii) In the box below, accurately draw the same sarcomere as it would appear when the muscle is contracted. (2 marks)



(iii) Explain what has happened to cause the change you have shown in the diagram between the relaxed and contracted positions of the sarcomere. (2 marks)

(b) Apart from skeletal muscle, there are two other muscle types in the human body.

Name **one** other muscle type and state **one** way in which the structure of this type of muscle differs from skeletal muscle. (2 marks)

(c) Experiments are being conducted in which mice are injected with a gene that causes muscles to grow. This has the potential to enable gene therapy to recreate damaged muscle in people with diseases such as muscular dystrophy. The gene in the mice experiments is produced using recombinant DNA technology.

(i) Two enzymes are involved in recombinant DNA technology. These are called 'restriction enzyme' and 'DNA ligase'.

Describe the role of each of these enzymes in the production of the gene that was injected into the laboratory mice. (4 marks)

Restriction enzyme: _____

DNA ligase: _____

(ii) Large numbers of the gene are needed for the experiment. Describe how they are produced using recombinant DNA technology. (2 marks)

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Question 33

(10 marks)

Linha São Pedro is a district of a remote Brazilian town. Its original settlers can be traced back to a region in Germany. The population has a high frequency of twin births, with 10% of births between 1990 and 1994 being twins. Studies have shown a high recurrence of twin births within families over time that cannot be attributed to lifestyle factors. It has been concluded by some scientists that the high frequency of twin births is due to genetic factors and is an example of the founder effect.

- (a) Describe the past and present conditions required in the Linha São Pedro population to enable the founder effect to occur. (3 marks)

- (b) The Linha São Pedro population could also be a useful group to study for a better understanding of epigenetics. Explain why the scientists would be interested in the Linha São Pedro population for a study in epigenetics. (2 marks)

- (c) Tay-Sachs disease is genetically inherited. It is a lethal recessive disease that is relatively common in certain populations.

Identify a population that has a high incidence of Tay-Sachs disease. (1 mark)

- (d) The high incidence of Tay-Sachs disease in certain populations can also be accounted for by the founder effect. However, some scientists also support the theory of heterozygous advantage. This means that the Tay-Sachs disease allele continues in the population due to natural selection. If this theory is accepted, what benefit must people carrying the affected Tay-Sachs disease allele have compared with non-carriers? (1 mark)

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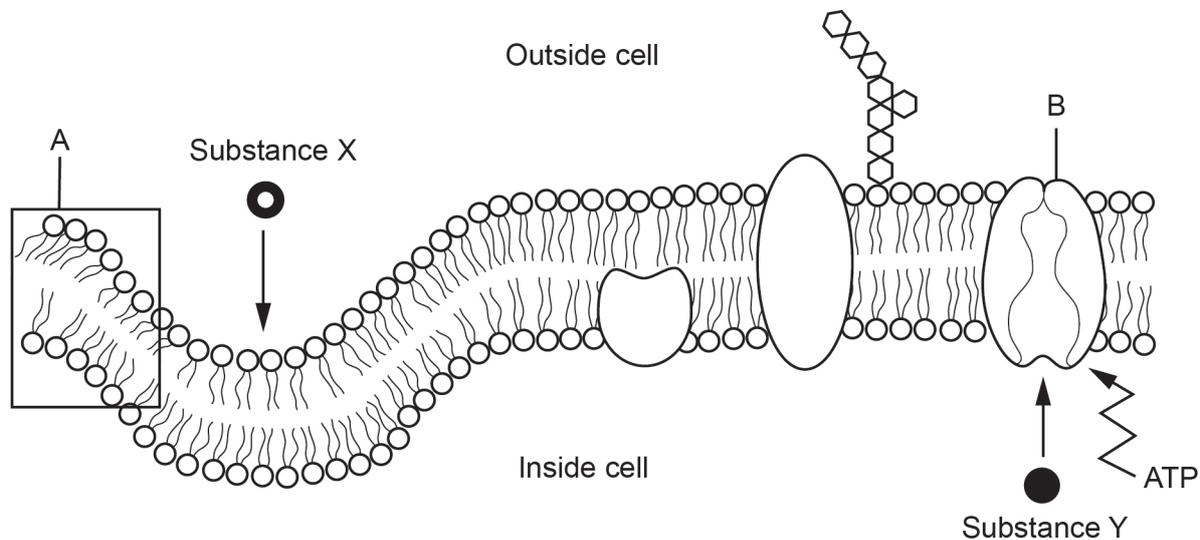
(e) List **three** features required for natural selection to occur in a population. (3 marks)

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Question 34

(13 marks)

The following question refers to the diagram below of a cross-section of part of the cell membrane. The arrows (→) indicate the direction of movement by substances X and Y as they are about to cross the cell membrane.



- (a) Name and describe the structure of the part of the cell membrane labelled A. (3 marks)

- (b) Identify the type of protein labelled as B in the diagram. (1 mark)

- (c) Explain how Substance X is able to move from the outside to the inside of the cell. (2 marks)

Question 35

(15 marks)

An experiment was conducted on the effects of fluid consumption on urine production. The experiment involved the comparison of water consumption with the consumption of saline solution. Saline solution is a sterile solution of water and salt (normally sodium chloride). The experiment involved 30 subjects, 15 who consumed one litre of water in a five minute period and 15 who consumed one litre of saline solution in the same five minute period. All subjects were required to stay in a small room maintained at a temperature of 25 °C and were asked to perform minimal physical activity. Urine production over the three hours following fluid consumption was recorded for all subjects. The results for each group were averaged and are presented below.

Time (minutes)	Urine production (mL)	
	Water consumption	Saline solution consumption
0	24	18
30	360	21
60	450	27
90	255	36
120	48	29
150	30	34
180	27	24

- (a) (i) Propose a hypothesis for the experiment. (1 mark)

- (ii) List **two** variables that were controlled in the experiment. (2 marks)

- (b) Suggest how researchers could increase the

- (i) validity of the experiment. (1 mark)

- (ii) reliability of the results. (1 mark)

- (c) Graph the data in the table on the grid below. (5 marks)

A spare grid is provided at the end of this Question/Answer Booklet. If you need to use it, cross out this attempt.



- (d) (i) Identify the hormone directly involved in the maintenance of water balance in the body and state the specific part of its target organ that it influences. (2 marks)

- (ii) On the basis of the results of the experiment, the consumption of which fluid, water or saline, would have triggered the release of the hormone identified in part (d)(i)? (1 mark)

- (iii) Explain why people suffering dehydration are given either a saline solution to drink or a saline intravenous drip rather than only water. (2 marks)

Question 36

(10 marks)

Part (a) of the question refers to the diagram of the brain below.



(a) Identify structures A, B and C indicated by arrows on the diagram. (3 marks)

A _____

B _____

C _____

(b) Ataxia is a condition associated with disorders of the central nervous system in which there is a lack of muscle coordination. In one form of ataxia, although a person's muscles are able to move, they show symptoms such as shaking or tremor.

(i) In which part of the brain would damage have occurred to cause this form of ataxia? (1 mark)

(ii) Name **two** other symptoms, apart from shaking or tremor, that a person would have if the area in part (b)(i) was damaged. (2 marks)

(iii) Explain why a person with this form of ataxia can still move their muscles even though this movement cannot be coordinated. (2 marks)

(c) The brain is a very delicate organ and needs to be protected from damage by other structures that surround it. Name **one** of these structures and explain how it protects the brain. (2 marks)

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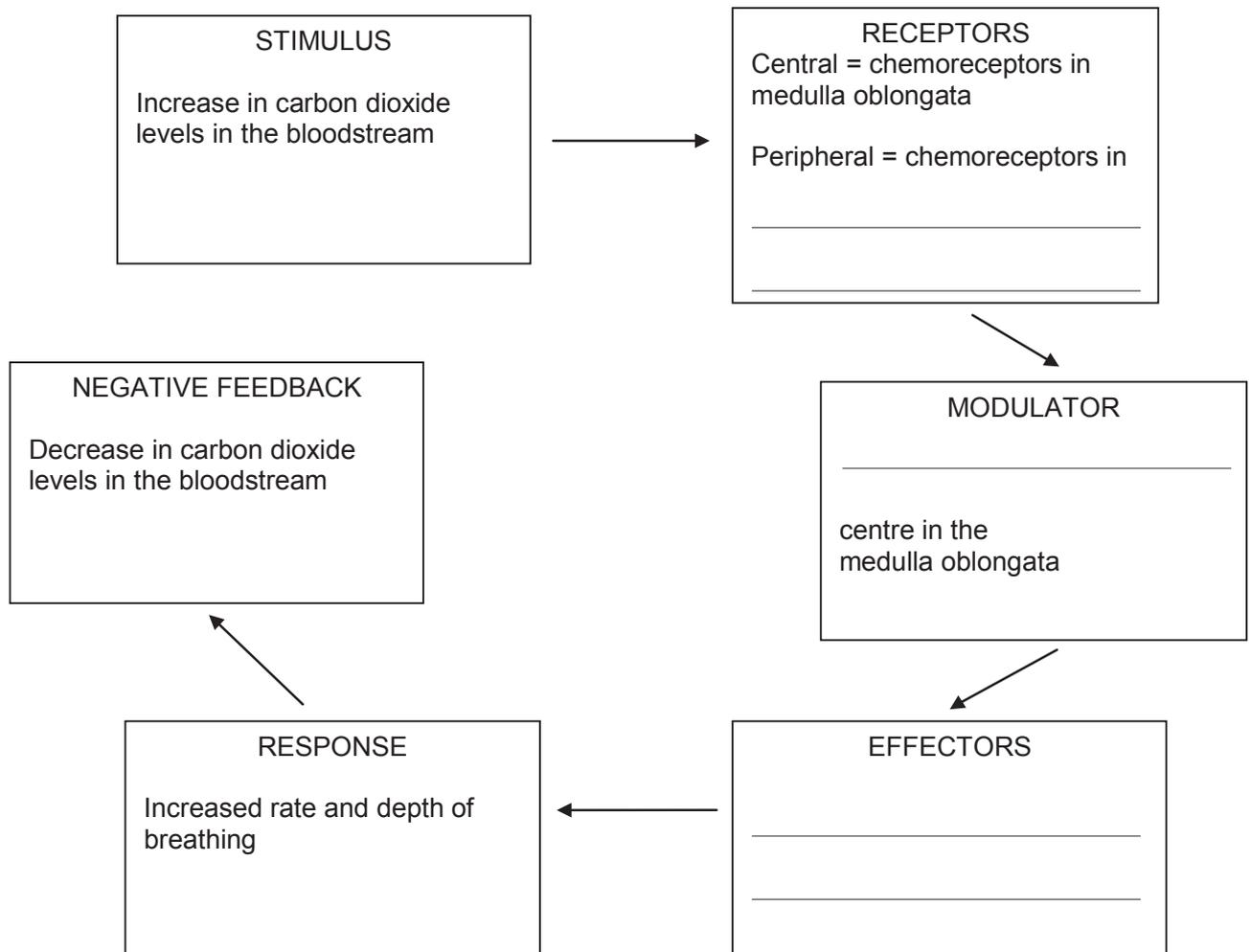
Question 37

(11 marks)

During cell respiration, carbon dioxide is produced as a waste product. If the rate of cell respiration is increased, carbon dioxide levels in the blood will also increase. The removal of excess carbon dioxide requires an increase in rate and depth of breathing.

Below is a negative feedback model showing that an increase in breathing rate is required to remove the excess carbon dioxide.

- (a) The feedback loop below is incomplete, as information is missing from the receptors, modulator and effectors boxes. Complete the feedback loop by writing the appropriate word/s in the spaces provided. (3 marks)



- (b) There are two main modes of transmission of messages in the body. These are carried out either by hormones or nerves. Which of these is stimulating the effectors in the diagram above? (1 mark)

Question 38

(8 marks)

Parts (a) and (b) of the question refer to the hominin skull diagrams A, B, C, and D shown below.



- (a) Place the skulls A, B, C, and D in the correct evolutionary sequence, from oldest to most recent.

(1 mark)

- (b) Describe the evolutionary trend that can be seen in hominin fossils associated with the jaw. Explain why this trend is believed to have occurred.

(2 marks)

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- (c) The hunter-gatherer way of life was gradually replaced by the agricultural way of life in various regions of the world. Give **three** reasons for the lifestyle change from a hunter-gatherer to an agricultural way of life. (3 marks)

- (d) Outline **two** cultural developments that accompanied the change from a hunter-gatherer to an agricultural way of life. (2 marks)

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Question 39

(10 marks)

Parts (a), (b) and (c) of the question refer to the diagram of a neuron below.



(a) Identify the region of the axon labelled as structure X. (1 mark)

(b) State **one** function of the structure labelled Y. (1 mark)

(c) The arrows drawn along the axon show the direction of a nervous impulse. The impulse in this neuron would travel via saltatory conduction. Describe how a nervous impulse is propagated along this type of fibre. (4 marks)

(d) Calcium plays an important role in the functioning of the nervous system. Explain how the thyroid and parathyroid glands ensure calcium supplies are balanced.

(i) Thyroid (2 marks)

(ii) Parathyroid (2 marks)

End of Section Two

See next page

Section Three: Extended answer

20% (40 Marks)

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

Spare pages are included at the end of this booklet. They can be used for planning your responses and/or as additional space if required to continue an answer.

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Responses may 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 first question you will answer by ticking the box next to the question. Write your answer on pages 34–39. When you have answered your first question, turn to page 40 and indicate the second question you will answer on that page.

Question 40 **(20 marks)**

An elderly man visited the doctor and was diagnosed with osteoarthritis in his left hip joint. The doctor needed to inform the man about the disease and how it could be treated.

- (a) Summarise the information about osteoarthritis that the doctor would have provided to the man. Include in your answer the possible causes and risk factors that could lead to developing the disease, its effects on the body and the treatment options for osteoarthritis sufferers. (11 marks)
- (b) The hip joint is classified as a synovial joint. Name and describe **four** different types of synovial joints and identify to which one of these types the man's affected hip joint belonged. (9 marks)

See next page

Question 41

(20 marks)

Tuberculosis is an infectious disease that is caused by a bacterium called *Mycobacterium tuberculosis*.

- (a) If a person is infected with *Mycobacterium tuberculosis*, antibodies are produced to fight the infection.

Describe the immune response that produces antibodies and explain how the antibodies act to fight the bacterial infection. (8 marks)

- (b) It is difficult to gain a sample of the *Mycobacterium tuberculosis* bacteria from patients and the bacterial cultures grow very slowly in the laboratory. Polymerase Chain Reaction (PCR) based tests have enabled more rapid detection of small numbers of the bacteria.

Name and describe the **three** steps involved in the PCR process. (12 marks)

 Question 42

(20 marks)

- (a) Describe the roles of the hypothalamus and pituitary gland and explain how they work together. (12 marks)

- (b) Contrast the modes of action of steroid and amine hormones. (8 marks)

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

Question 40 **(20 marks)**

An elderly man visited the doctor and was diagnosed with osteoarthritis in his left hip joint. The doctor needed to inform the man about the disease and how it could be treated.

- (a) Summarise the information about osteoarthritis that the doctor would have provided to the man. Include in your answer the possible causes and risk factors that could lead to developing the disease, its effects on the body and the treatment options for osteoarthritis sufferers. (11 marks)
- (b) The hip joint is classified as a synovial joint. Name and describe **four** different types of synovial joints and identify to which one of these types the man's affected hip joint belonged. (9 marks)

Question 41 **(20 marks)**

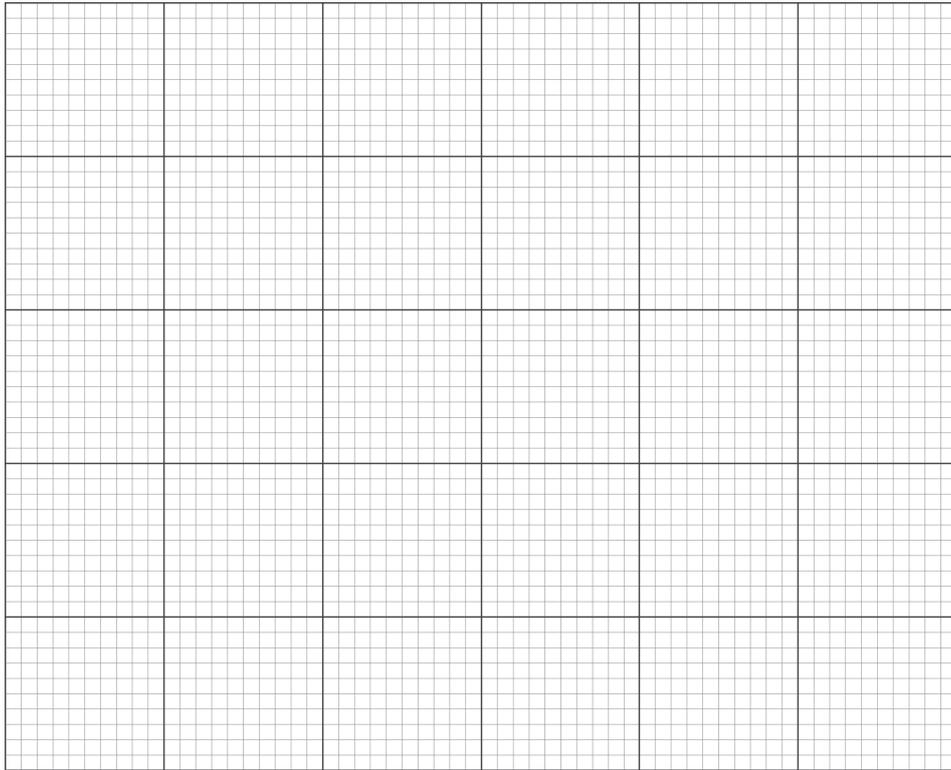
Tuberculosis is an infectious disease that is caused by a bacterium called *Mycobacterium tuberculosis*.

- (a) If a person is infected with *Mycobacterium tuberculosis*, antibodies are produced to fight the infection.
- Describe the immune response that produces antibodies and explain how the antibodies act to fight the bacterial infection. (8 marks)
- (b) It is difficult to gain a sample of the *Mycobacterium tuberculosis* bacteria from patients and the bacterial cultures grow very slowly in the laboratory. Polymerase Chain Reaction (PCR) based tests have enabled more rapid detection of small numbers of the bacteria.
- Name and describe the **three** steps involved in the PCR process. (12 marks)

Question 42 **(20 marks)**

- (a) Describe the roles of the hypothalamus and pituitary gland and explain how they work together. (12 marks)
- (b) Contrast the modes of action of steroid and amine hormones. (8 marks)

End of Questions



DO NOT WRITE IN THIS AREA AS IT WILL BE CUT OFF

ACKNOWLEDGEMENTS

Section One

- Questions 2–3** Adapted from: Meachen, G.N. (1969). Spinal cord [Image]. In *A first course in human physiology* (Rev. ed.). London: University Tutorial Press, p. 277.
- Questions 5–6** Adapted from: *Cartilage* [Image]. Copyright 2011 Pearson Education. Retrieved February, 2014, from www.highlands.edu/academics/divisions/scipe/biology/faculty/harnden/2121/images/cartilage.jpg
- Questions 8–9** Primate lower limb [Diagram]. (1994). In *West Australian Test Papers*. Year 12 Human Biology test paper (q. 35). South Perth, WA: West Australian Test Papers.
- Questions 13** Adapted from: Luong, L.D. (2009, July 2). DNA segment [Image]. In *Basic principles of genetics* (Lecture 17). Retrieved March, 2013, from <http://cnx.org/content/m26565/1.1/>. Licensed under a Creative Commons Attribution 3.0 Unported licence.
- Question 14–15** Adapted from: Spence, A.P., & Mason, E.B. (1992). Section on bone [Images]. *Human anatomy and physiology*. Eagan, MN: West Publishing, p. 157.
- Question 22** Adapted from: WestOne Services. (n.d.). Primate brains [Image]. In *Human Biological Science: Unit 3B*. Retrieved February, 2014, from http://tle.westone.wa.gov.au/content/file/969144ed-0d3b-fa04-2e88-8b23de2a630c/1/human_bio_science_3b.zip/content/001_evol_trends/page_06.htm

Section Two

- Question 31 (a)** Adapted from: *Human structures* [Image]. (1998). Copyright 1998 WBC/ McGraw Hill. Retrieved February, 2014, from www.evolutionnews.org/
- Question 31 (b)** Adapted from: *Representation of evolution* [Image]. (1996). Retrieved February, 2014, from <http://nitro.biosci.arizona.edu/courses/EEB182/Lecture02/lect2.html>
- Question 34 (a)–(e)** Adapted from: Victorian curriculum and Assessment Authority (VCAA). (2008). *VCE Biology: Written examination 1* (p. 10, q. 1). Retrieved February, 2014, from www.vcaa.vic.edu.au/Documents/exams/biology/2008biol1-web.pdf
- Question 36 (a)** Adapted from: Wolters Kluwer Health, Inc.–Lippincott Williams & Wilkins. (n.d.). *Image no. sa108007*. Retrieved February, 2014, from www.fotosearch.com/LIF112/sa108007/. LifeART image copyright (2014) Wolters Kluwer Health, Inc.–Lippincott Williams & Wilkins. All rights reserved.

Question 38 (a)–(b) Adapted from: Benton, M.J., & Harper, David A.T. (2009). Hominin skulls [Diagrams]. In *Introduction to paleobiology and the fossil record*. Retrieved February, 2014, from www.blackwellpublishing.com/paleobiology/figure.asp?chap=17&fig=Fig17-21&img=c17f021

Question 39 (a)–(c) Adapted from: WestOne Services. (n.d.). Neuron [Image]. In *Human Biological Science: Unit 3B*. Retrieved February, 2014, from http://tle.westone.wa.gov.au/content/file/969144ed-0d3b-fa04-2e88-8b23de2a630c/1/human_bio_science_3b.zip/content/002_nervous_control/page_13.htm

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