



ATAR course examination, 2019

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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WA 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	10	10	90	107	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 2019*. Sitting this examination implies that you agree to abide by these rules.
- Write your answers in this Question/Answer booklet preferably using a blue/black pen. Do not use erasable or gel pens.
- 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 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 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

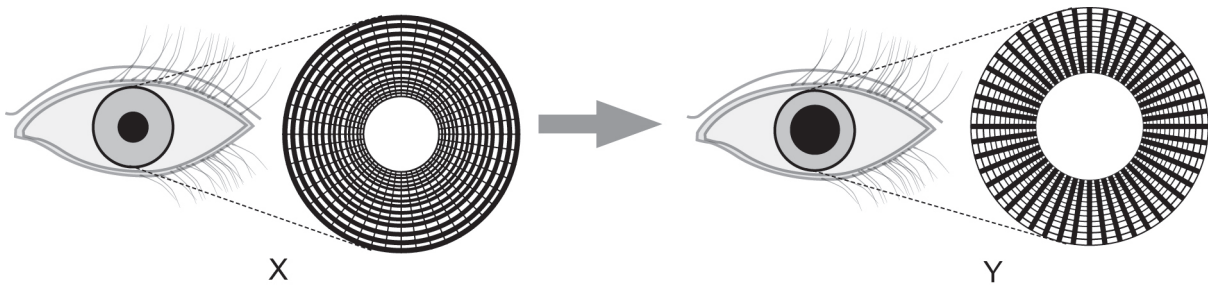
30% (30 Marks)

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.

1. A fossil hominid skull has a cranial capacity of 1485 cubic centimetres, large brow ridges and a sloping forehead. The skull is probably from a/an
- Australopithecus afarensis*.
 - Homo habilis*.
 - Homo erectus*.
 - Homo neanderthalensis*.

Question 2 refers to the diagram shown below.

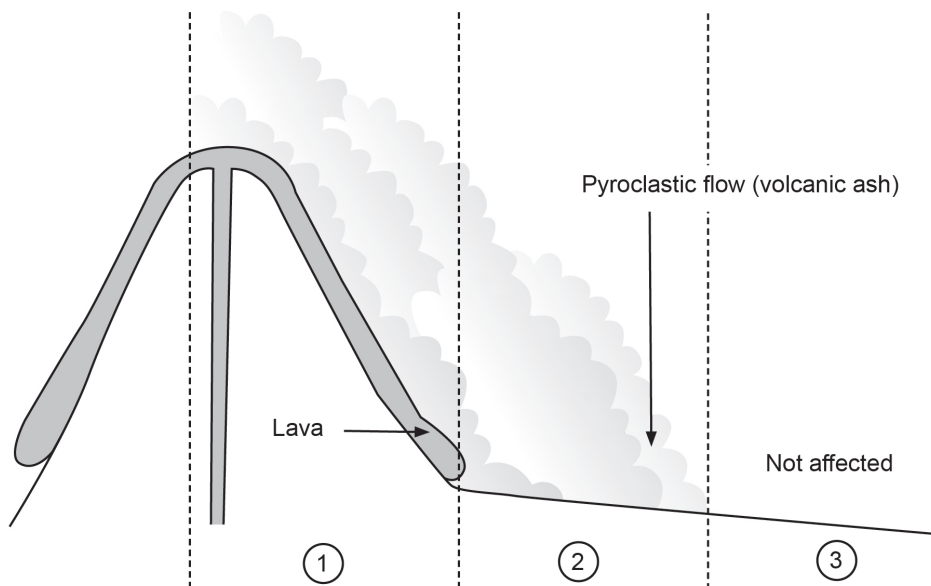


2. Which of the following statements describes the diagram correctly?
- The pupil is constricted in X. Once stimulated by the parasympathetic nervous system it will become dilated, as shown in Y.
 - The pupil is constricted in X. Once stimulated by the sympathetic nervous system it will become dilated, as shown in Y.
 - The pupil is dilated in X. Once stimulated by the parasympathetic nervous system it will become constricted, as shown in Y.
 - The pupil is dilated in X. Once stimulated by the sympathetic nervous system it will become constricted, as shown in Y.
3. The function of the corpus callosum is to
- carry impulses between the left and right hemispheres of the brain.
 - connect various areas of the cortex within the same hemisphere of the brain.
 - provide protection, support and a transport network around the brain.
 - connect the cortex to other parts of the brain and to the spinal cord.

See next page

4. In gel electrophoresis, DNA moves
- (a) toward the positive electrode.
 - (b) toward the negative electrode.
 - (c) further when the fragments are larger.
 - (d) faster when the gel is denser.

Question 5 refers to the diagram of a volcanic eruption shown below.



5. In which region/s would you expect to find the **greatest** number of preserved fossil specimens?
- (a) 1 only
 - (b) 2 only
 - (c) similar amount in 1 and 2
 - (d) similar amount in 2 and 3

6. Australian scientist Howard Florey used controlled experiments to demonstrate the effectiveness of penicillin in treating bacterial infections. Eight mice, all of similar weight and age, were each injected with 100 million streptococci, a type of bacterium. After the injection, four mice were given no further treatment and the other four were given penicillin injections.

Which of the following pair of responses identifies correctly the control of the experiment (A) and a controlled variable (B)?

	A	B
(a)	two groups of four mice	each mouse receiving the same penicillin injections
(b)	all mice of similar weight and age	each mouse receiving 100 million streptococci
(c)	mice not receiving penicillin	each mouse receiving 100 million streptococci
(d)	all mice were injected with streptococci	each mouse receiving the same penicillin injections

See next page

7. Scientists are investigating if single gene disorders, such as diabetes mellitus and cystic fibrosis, can be treated by gene therapy.

Gene therapy involves

- (a) using a person's stem cells to grow replacement organs.
- (b) inserting stem cells into a synthetic scaffold.
- (c) adding extra alleles to embryos during IVF.
- (d) using a vector to transfer alleles into cells.

Question 8 refers to the diagram shown below.

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8. The mode of action shown in the diagram is **best** described as a
- (a) lipid-soluble hormone diffusing through the membrane.
 - (b) water-soluble hormone diffusing through the membrane.
 - (c) lipid-soluble hormone initiating a secondary messenger at the membrane.
 - (d) water-soluble hormone initiating a secondary messenger at the membrane.

9. Which of the following is **not** a hypothesis as to why hominids became bipedal?

Bipedalism

- (a) freed the hands to carry food and tools.
- (b) enabled the spinal column to develop a lumbar curve.
- (c) increased height and allowed better visibility.
- (d) is a more energy-efficient way of walking.

10. Which of the following pair of responses identifies correctly the difference between sickle cell anaemia and sickle cell trait?

	Sickle cell anaemia	Sickle cell trait
(a)	provides resistance to malaria	provides no resistance to malaria
(b)	people are carriers of the genetic disease	people are not carriers of the genetic disease
(c)	involves two affected alleles for the condition	involves only one affected allele for the condition
(d)	people have malformed haemoglobin	people have crescent-shaped haemoglobin

11. Mitochondrial DNA is useful in evolutionary studies because of its

- (a) high mutation rate.
- (b) role in respiration.
- (c) location in the mitochondria.
- (d) reduced number of gene loci.

The structure shown below is usually found in the eye, nose or ear.

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12. The neuron shown in the diagram above is

- (a) unipolar.
- (b) multipolar.
- (c) a receptor.
- (d) bipolar.

13. Which of the following contains substances that act as external defence mechanisms against pathogens?

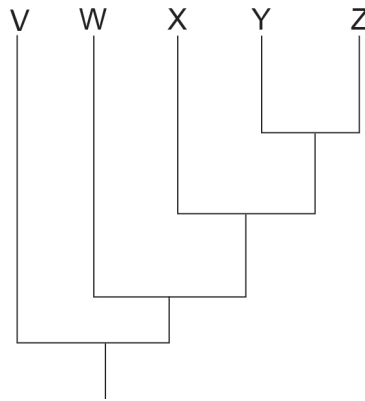
- (a) cecum, lysozyme, sweat, cerumen
- (b) cecum, lymphocytes, sweat, lysozyme
- (c) antibodies, lysozyme, lymphocytes, T-cells
- (d) lysozyme, lymphocytes, sweat, cilia

14. Gene flow occurs when

- (a) species migrate to new areas.
- (b) genes are exchanged during fertilisation.
- (c) individuals migrate to new areas.
- (d) mating occurs between related individuals.

See next page

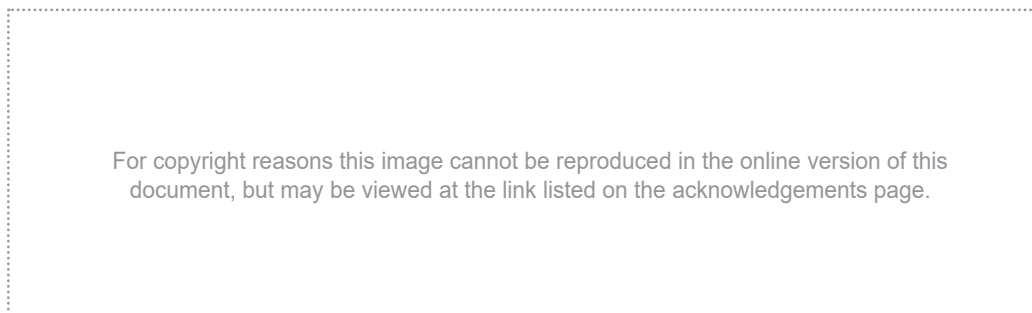
Question 15 refers to the diagram shown below.



15. In this phylogenetic tree, which two species possess the **greatest** difference?
- V and W
 - Y and Z
 - W and Z
 - X and Y
16. There are four steps involved in fossilisation and fossil discovery.
- erosion and exposure of the organism to the surface
 - death and decay of the soft parts of the organism
 - permineralisation, where mineral deposits form internal casts of the organism
 - deposition of sand and silt layers to cover the organism
- The correct order of these events is
- I, II, IV and III.
 - II, III, IV and I.
 - III, II, I and IV.
 - II, IV, III and I.
17. Scientific inquiry is based on the understanding that well-designed experiments will reveal information to help support an hypothesis. This process involves keeping certain variables constant while adjusting one variable to determine the effect on another variable. The variable that is adjusted by the experimenter is called the
- measured variable.
 - controlled variable.
 - dependent variable.
 - independent variable.
18. Which of the following **best** describes an airborne mode of transmission of a pathogen?
- exchange of blood and other body fluids by a used syringe
 - contact with contaminated vomit while cleaning it up
 - transmission from mother to baby via breastfeeding
 - sharing an elevator with an infected person who is sneezing

See next page

Question 19 refers to the diagram shown below.



19. Which regions (as indicated by the numbers 1, 2, 3, 4 and/or 5) of the kidney nephron are acted upon by the anti-diuretic hormone (ADH) and aldosterone respectively in the regulation of body fluids?

	ADH	Aldosterone
(a)	4 and 5	3, 4 and 5
(b)	3, 4 and 5	4 and 5
(c)	1, 2, 3 and 4	4 and 5
(d)	1 and 2	3, 4 and 5

20. The 'Toba catastrophe theory' suggests that the human population was almost completely wiped out around 75 000 years ago. It is believed that a super-volcano near Lake Toba in Indonesia erupted, creating a global volcanic winter that lasted 10 years. This event killed most humans, leaving as few as 40 breeding pairs of adults. According to the theory, this small population went on to repopulate the entire human species.

If true, this repopulation would be **best** described as an example of

- (a) natural selection.
 (b) random genetic drift.
 (c) gene flow.
 (d) selective breeding.
21. The stimulus for the regulation of water balance by the thirst mechanism is received by the osmoreceptors in the
- (a) cerebrum.
 (b) hypothalamus.
 (c) kidney tubule.
 (d) medulla oblongata.

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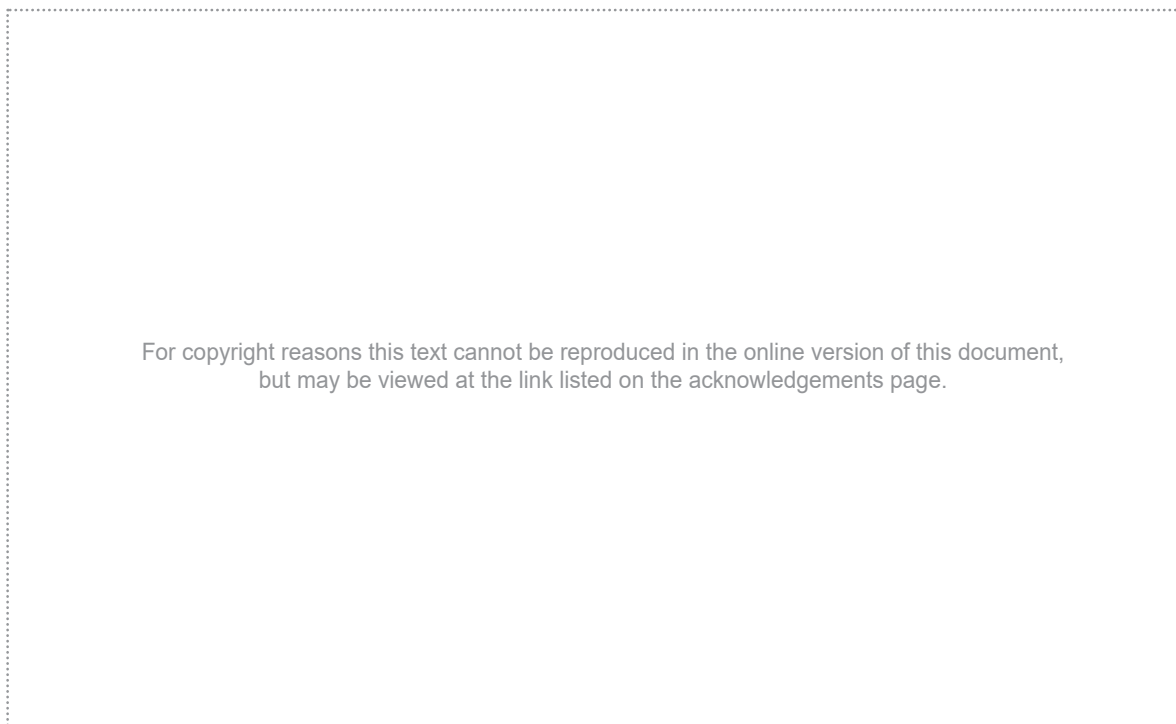
22. Enlargement of the thyroid gland due to a lack of iodine is called
- (a) exophthalmia.
 - (b) thyrotoxicosis.
 - (c) goitre.
 - (d) Graves' disease.
23. Antibiotic drugs differ in their specificity to pathogens and as such, are often classified as
- (a) bactericidal and bacteriostatic antibiotics.
 - (b) multiple drug-resistant and total drug-resistant antibiotics.
 - (c) broad-spectrum and narrow-spectrum antibiotics.
 - (d) antiviral and antifungal antibiotics.
24. Cell replacement therapy involves
- (a) injecting islet cells into a patient.
 - (b) transplanting stem cells into a patient.
 - (c) removing faulty genes and replacing with healthy ones.
 - (d) inserting a recombinant gene in the cells of a patient.
25. Which of the answers completes the following sentence below?
- In diabetes mellitus the _____ found in the _____ are destroyed.
- (a) beta cells, pancreas
 - (b) b cells, pancreas
 - (c) beta cells, liver
 - (d) alpha cells, liver
26. In humans, an example of active immunity is the
- (a) presence of 'natural flora' bacteria in different parts of the body.
 - (b) presence of antibacterial agents in body secretions.
 - (c) action of memory cells when a person is exposed to a second infection.
 - (d) action of phagocytes to kill some pathogenic bacteria on the skin.
27. In general, when compared to hormones, nervous impulses have a
- (a) short duration and a short response time and are involved in long-term adjustments.
 - (b) long duration and a long response time and are involved in short-term adjustments.
 - (c) long duration and a short response time and are involved in short-term adjustments.
 - (d) short duration and a short response time and are involved in short-term adjustments.

28. While excavating a cave, scientists discovered the skeletal remains of a hominid with the following anatomical features.

A skull with a flat forehead and a sagittal crest, massive jaws, small incisors and canines, large pre-molars and molars, and a heavy body frame about 160 cm tall. This hominid was most likely a/an

- (a) *Australopithecus afarensis*.
- (b) *Australopithecus africanus*.
- (c) *Paranthropus robustus*.
- (d) *Homo habilis*.

Questions 29 and 30 refer to the graph shown below.



29. Scientists use radioisotopes to find out the age of rocks and fossils. **X** is an isotope that decays to **Y**. Using a radioisotope dating technique, scientists found out that 75% of the **X** in a rock has decayed and they estimated the age of the rock to be about
- (a) 0.65 billion years.
 - (b) 2.5 billion years.
 - (c) 3.75 billion years.
 - (d) 1.25 billion years.
30. Which of the following dating techniques **best** describes the use of radioisotope **X**?
- (a) index fossil dating
 - (b) relative dating
 - (c) radiocarbon dating
 - (d) potassium argon dating

End of Section One

See next page

Section Two: Short answer**50% (107 Marks)**

This section has **10** 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**(11 marks)**

The diagram below is a representation of tools from the Oldowan tool culture.

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- (a) (i) Name the hominid species said to have made and used these tools. (1 mark)

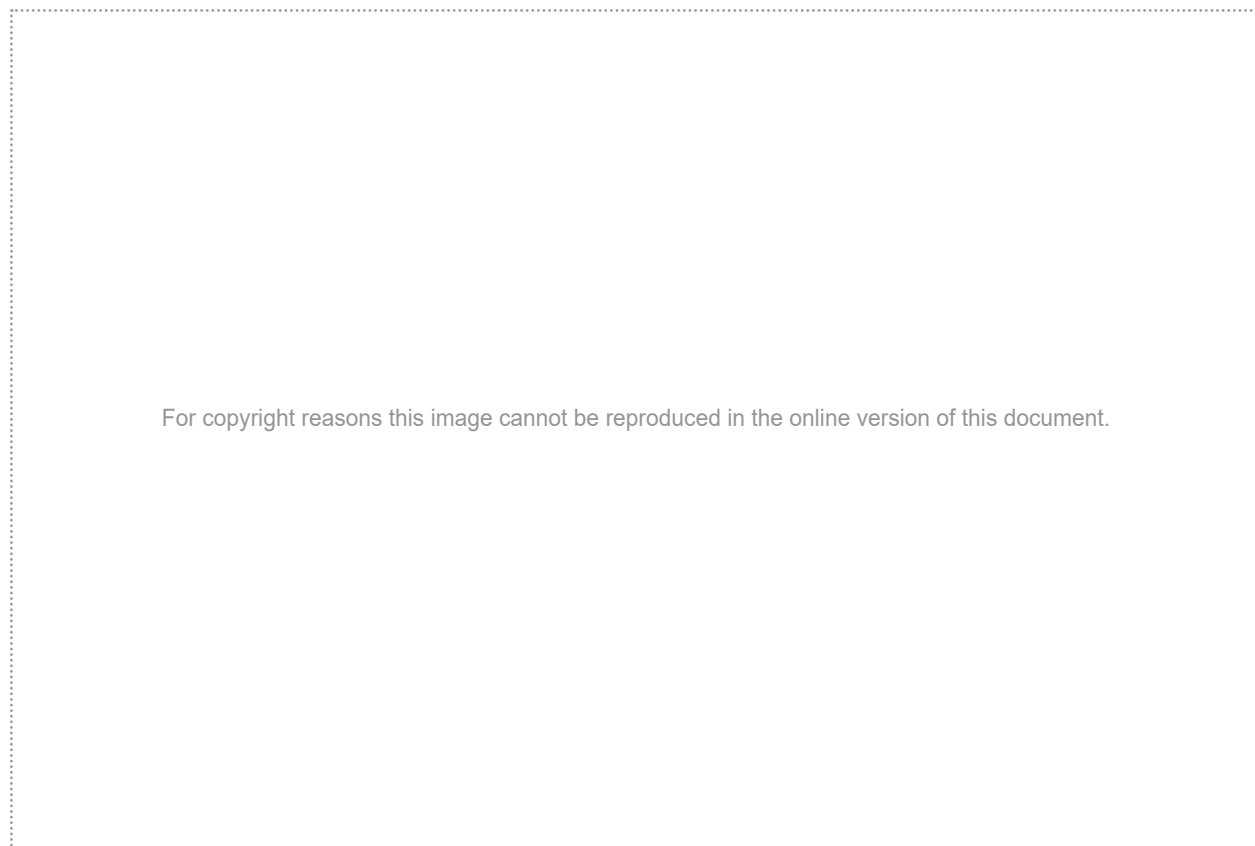
- (ii) Identify **two** ways in which hominids would have used these tools in their daily lives. (2 marks)

One: _____

Two: _____

Question 31 (continued)

Shown below are examples of tools made by other hominid species. Note: diagrams are not drawn to scale.



- (b) Using the information in the diagrams above, complete the table below. (4 marks)

Description	Select one or more of the alternatives from the diagrams labelled X, Y and/or Z
This tool culture came immediately after the Oldowan culture	
The most recent tools	
These tools are commonly referred to as hand axes	
These tools were often hafted	

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- (c) State **two** trends that are evident in the manufacturing techniques of tools from early hominids to modern humans and outline what these trends indicate about changes in hominid lifestyle. (4 marks)

One: _____

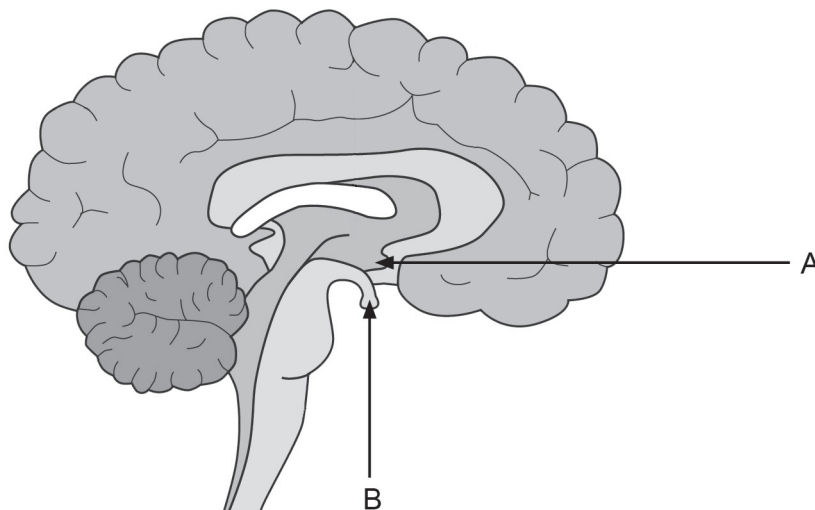
Two: _____

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Question 32

(10 marks)

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



(i) Identify structure A. (1 mark)

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

(b) Contrast the role of the cerebellum and the medulla oblongata. (2 marks)

Multiple sclerosis (MS) is a disease that destroys Schwann cells in the central nervous system.

- (c) (i) State the effect of the loss of the Schwann cells on the transmission of nerve impulses and describe why this occurs. (3 marks)

A person had a touch sensitivity test. This involved them having various areas of their skin touched very gently. In some areas, they were unable to feel the touches.

- (ii) Explain how this inability to feel the very gentle touches might not be due to MS. (3 marks)

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Question 33

(9 marks)

'The Radium Girls' of the 1920s were women who worked in United States factories applying glow paint to the dark dials of watch faces. The women used paint containing radium to create the numerals on the watch faces. The women were told to use their lips and tongue to pinch the paint brush tip in order to create a fine painting point. As a result, the women were accidentally consuming radium. The women suffered many devastating negative effects, including bone disease and various cancers.

- (a) Radium is known to cause mutations in the DNA. Therefore, radium can be classified as what type of substance? (1 mark)

- (b) Studies of the types of mutations that radium causes have shown that it can result in a change to DNA, known as aneuploidy. Examples of aneuploidy included trisomy-21 and Turner's syndrome. In these cases, there is either an extra number or a reduced number of chromosomes found in daughter cells when compared to normal cells.

- (i) When would the error occur to cause aneuploidy, including genetic disorders such as trisomy-21 and Turner's syndrome? (1 mark)

- (ii) Is aneuploidy an example of a gene or chromosomal mutation? Justify your answer. (2 marks)

- (iii) Is aneuploidy an example of a somatic or germline mutation? Justify your answer. (2 marks)

- (c) Explain how mutations can lead to changes in the allele frequencies of gene pools. (3 marks)

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Question 34

(18 marks)

A group of scientists was investigating the effect of a new form of insulin. Two subjects, both with Type 1 diabetes (diabetes mellitus), were asked to drink one litre of glucose solution. Subject A was given an injection of the standard insulin. Subject B was given an injection of the new insulin. Following the injection their blood glucose levels (BGL) were measured every 10 minutes for one hour. The scientists' computer malfunctioned just before the investigation started. As a result, they hand-wrote the measurements on a piece of paper. Their results are reproduced below.

Just before the consumption of the glucose solution Subject A's BGL was 90 mg/100 mL and subject B's was 92 mg/100 mL.

For the 1st reading Subject A was 110 mg/100 mL and Subject B was 104 mg/100 mL.

At 20 minutes Subject A's BGL was 122 mg/100 mL and Subject B had a reading of 125 mg/100 mL.

Half-way through the investigation Subject B's BGL was 135 mg/100 mL and Subject A had peaked at 126 mg/100 mL.

At 40 minutes Subject A = 105 mg/100 mL and Subject B = 115 mg/100 mL.

Subject B = 100 mg/100 mL and Subject A is 96 mg/100 mL at 50 minutes.

After one hour, Subject A was at the same BGL level as that they had started and Subject B was still 5 mg/100 mL above the level at which they started.

(a) Construct a scientific table to display these data.

(6 marks)

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- (b) In terms of experimental design, the investigation was flawed due to its small sample size. Outline the benefit to investigations of having a suitable sample size. (1 mark)

- (c) (i) Were the numerical data collected by the investigators discrete or continuous? (1 mark)

- (ii) What type of graph would they have used to display their data? (1 mark)

- (d) Calculate the percentage change in BGL for Subject A from the start of the investigation to their peak BGL. Show your workings. (3 marks)

- (e) In both subjects, the insulin caused a decrease in their BGL. Describe **three** cellular processes that normally occur in response to insulin. (6 marks)

One: _____

Two: _____

Three: _____

Question 35

(11 marks)

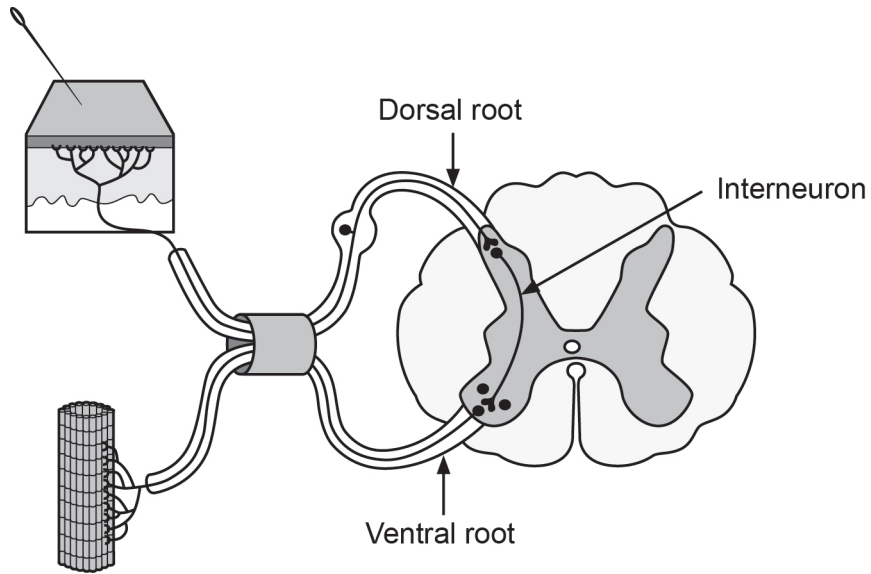
Engineers at Johns Hopkins University have recently developed technology that allows the detection of external stimuli on the fingertips of prosthetic limbs. Called an 'e-dermis', the technology presents a revolutionary development for amputee patients.

- (a) (i) Name the type of receptors engineers would have to replicate into the e-dermis to allow the detection of a small distortion of the skin when it came into contact with an object. (1 mark)

- (ii) Engineers are also interested in making the e-dermis capable of detecting temperature. Explain how specific receptors found in human skin can detect external temperatures. (4 marks)

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Question 35 (b) refers to the diagram of a spinal reflex arc show below.



- (b) (i) Outline the purpose of a spinal reflex arc. (1 mark)

- (ii) On the diagram of the reflex arc shown above, shade in the afferent pathway. (1 mark)

For the spinal reflex arc to function, the interneuron shown in the diagram must be triggered at the synapse. This creates an action potential that propagates along the neuron to be passed to the next neuron.

- (iii) Explain how an action potential continues along the interneuron. (4 marks)

Question 36

(16 marks)

On a hot, dry day, Trisha noticed several physiological changes to her body while exposed to the sun.

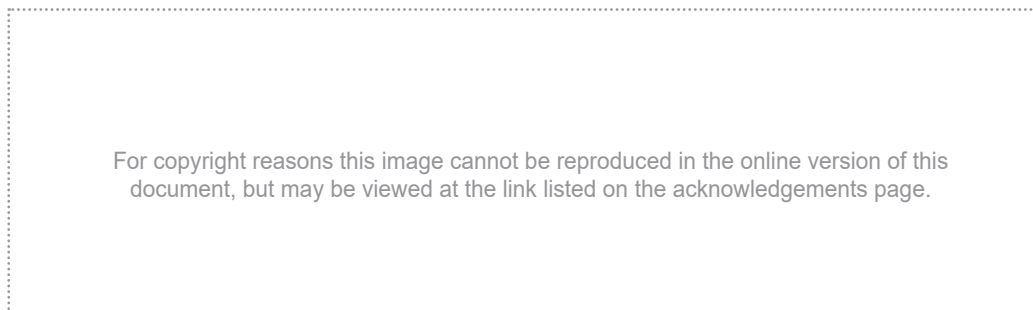
- (a) Identify **two** separate effectors and describe the physiological responses that occur in each that would help Trisha maintain her body temperature in the scenario above. (6 marks)

One: _____

Two: _____

Trisha noticed that she had similar physiological changes when she was placed in a stressful situation. These changes were brought about by secretions from the adrenal glands.

Shown below is a diagram of an adrenal gland.



See next page

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- (b) Complete the table below, contrasting the two different parts of the adrenal gland.
(10 marks)

	X	Y
Part of the adrenal gland	(1 mark)	(1 mark)
Hormone produced	(1 mark)	Adrenaline and noradrenaline
Effect of the hormone	Helps the body to deal with stress and promotes repair of damaged tissue	(1 mark)
Outline how the release of this hormone is stimulated	(3 marks)	(3 marks)

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Question 37

(10 marks)

Embryos generated by in vitro fertilisation (IVF) are screened for suitability for implantation. This involves isolating a few cells from the early embryos, amplifying the DNA regions of interest from those cells and performing DNA sequencing.

- (a) (i) Identify the biotechnology application used to amplify the DNA regions of interest. (1 mark)

- (ii) List the **three** stages involved in this biotechnology application. (3 marks)

One: _____

Two: _____

Three: _____

- (b) What is DNA sequencing? (1 mark)

- (c) State **two** ways in which the genomic information obtained by DNA sequencing of the embryo cells could be useful. (2 marks)

One: _____

Two: _____

Personal genomic tests are now accessible by Australians from online medical companies.

- (d) Propose **three** ethical considerations when accessing personal genome information. (3 marks)

One: _____

Two: _____

Three: _____

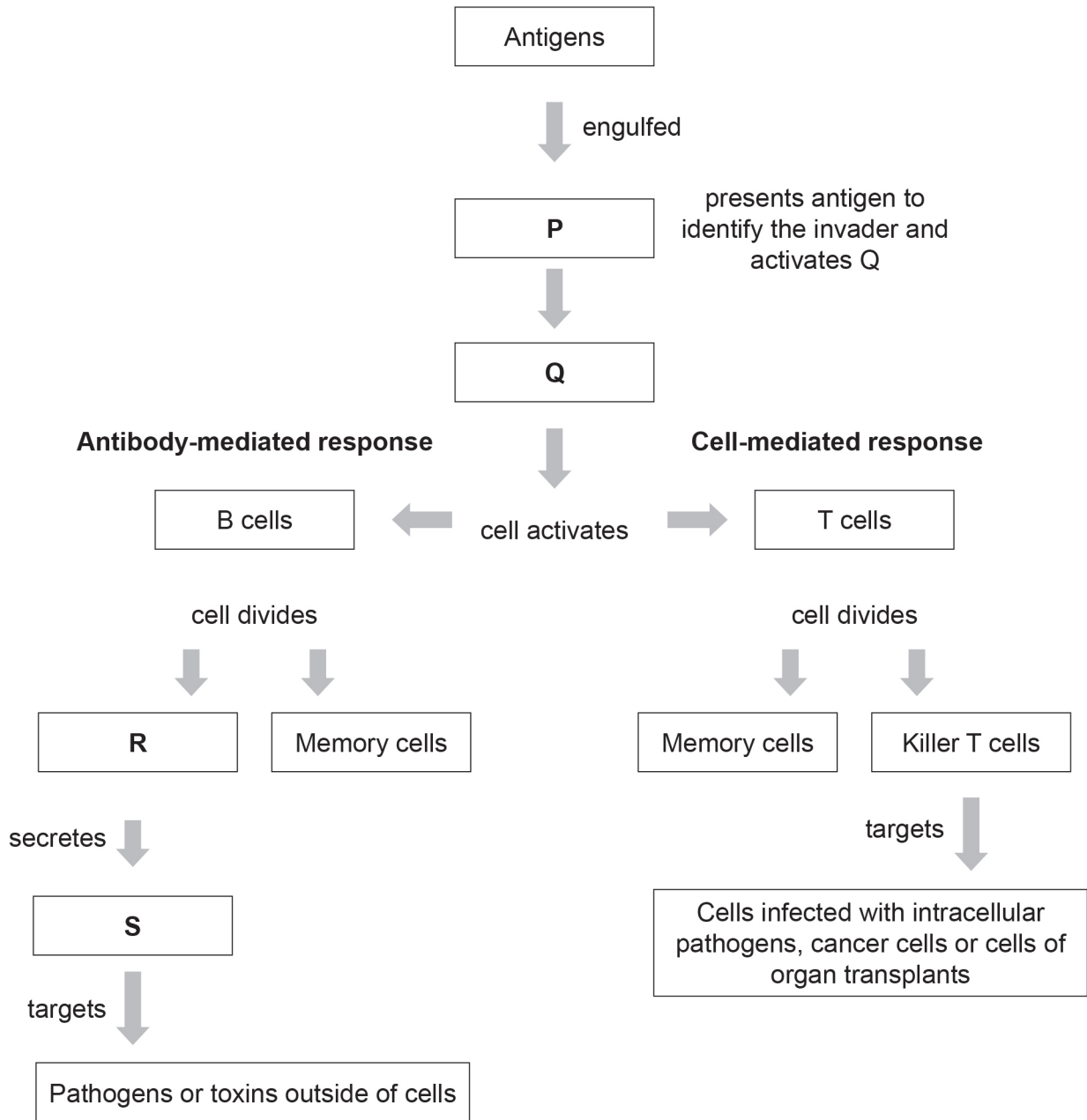
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Question 38

(9 marks)

Below is a flow chart showing the key components in an immune response of a healthy individual.



(a) Identify **P**, **Q**, **R** and **S** from the flow chart. (4 marks)

P: _____

Q: _____

R: _____

S: _____

Question 38 (continued)

- (b) Complete the table below by naming a disease that each type of vaccine is most effective against. (2 marks)

Type of vaccine	A disease that the vaccine is most effective against
Living attenuated micro-organisms	
Recombinant, sub-unit or conjugate vaccines	

Australian immunologist Ian Frazer developed Gardasil, a vaccine against human papilloma virus, a sexually-transmitted virus that is also the most common cause of cervical cancer. Health authorities recommend the vaccine for children aged between nine and 14 years.

- (c) Outline **three** concerns regarding the use of this vaccine. Your answer must include at least **one** social/cultural concern and at least **one** economic concern. (3 marks)

One: _____

Two: _____

Three: _____

Question 39**(7 marks)**

A genetic condition which is often associated with the Founder Effect is Tay Sach's disease. The disease occurs in much higher incidence among Ashkenazi Jews and members of the Cajun community of Louisiana.

- (a) Explain how the Founder Effect could account for the occurrence of Tay Sach's disease in these populations. (4 marks)

Although Tay Sach's disease is fatal, the allele has been maintained in gene pools. This is believed to be because it provides a heterozygote advantage.

- (b) (i) What is meant by the term 'heterozygote advantage'? (2 marks)

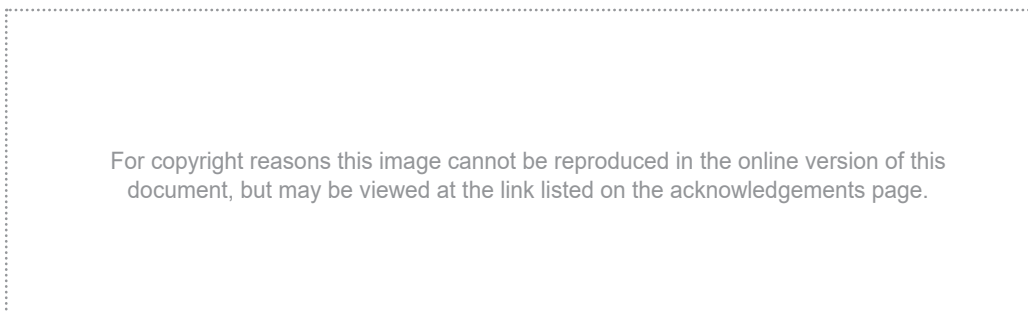
- (ii) Identify the heterozygote advantage that Tay Sach's is believed to provide. (1 mark)

Question 40

(6 marks)

At the Madjedbebe rock shelter in Kakadu (Northern Territory), archaeologists recently extracted several Aboriginal artefacts. These included hatchets, tools for seed grinding and ochre crayons used to make pigment. Through a range of techniques, the artefacts were dated at about 65 000 years old.

The diagram below shows a cross-section of the rock strata at the excavation site.



Artefacts at Madjedbebe were found in the oldest rock strata layer.

- (a) According to the diagram above, state which rock strata layer 1, 2 or 3 would the artefacts have been found by archaeologists. (1 mark)

- (b) Name the relative dating method used to identify the oldest and youngest layers from rock strata and explain how this dating method is applied. (3 marks)

Archaeologists did not only use relative dating.

- (c) Identify the evidence that supports this statement and outline why they used more than one dating method. (2 marks)

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

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

This section contains **three** questions. You must answer **two** questions. Write your answers on the pages following Question 43.

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.

Answer any **two** questions from Questions 41 to 43.

Indicate the questions you will answer by ticking the box next to the question. Write your answers on the pages that follow Question 43.

Question 41**(20 marks)**

Michael and Bruno are diving at the local swimming pool. Michael has been repeatedly diving and swimming for over an hour. His blood pH has dropped from 7.4 to 7.3. Bruno has decided he wants to try to see how long he can stay underwater during a dive. He induces hyperventilation, where he takes short, rapid breaths. This causes the carbon dioxide concentration of his blood to drop significantly.

- (a) Describe how the homeostatic mechanism for breathing control would be operating in Michael. Contrast this to Bruno, who had hyperventilated, explaining the reason for the differences. (11 marks)

Humans, like other mammals, have a diving reflex that is triggered when our face comes into contact with, or is submerged in, cool water. Thermoreceptors in the nasal cavity trigger autonomic nerves, which stimulate peripheral vasoconstriction.

- (b) Describe what peripheral vasoconstriction is, how else it can be triggered in the body and why peripheral vasoconstriction would be of benefit to a person when swimming or diving. (9 marks)

Question 42

(20 marks)

The Sentinelese are an indigenous people who inhabit North Sentinel Island in the Bay of Bengal in India. They refuse to have contact with any other groups of humans and are one of the world's last uncontacted peoples. Their skin colour is described as 'dark, shining black'.

- (a) Explain how the process of natural selection can lead to a particular phenotype becoming prevalent in a population. (10 marks)

The Sentinelese people come into regular contact with pathogens in their forest environment. If a pathogen manages to breach the external defence mechanisms, the body will respond with the non-specific inflammation response.

- (b) Define what is meant by 'non-specific' immune response, list the signs of inflammation and describe the process of inflammation. (10 marks)

 Question 43

(20 marks)

In 2012, a team of Australian and Chinese scientists discovered the bones of a new human species in the Red Deer Cave located in a province of China. Archaeologists retrieved over 30 fossilised bones, including three partial skulls, two lower jaws, isolated teeth, rib and limb bones. The fossils of this human species, now known as the Red Deer Cave people, were tested and dated at about 11 500 years old.

- (a) State the dating technique used to date the Red Deer Cave fossils and explain why this was the most appropriate technique. (4 marks)
- (b) Describe how bioinformatics and comparative genomics can be used to determine the interrelatedness between the Red Deer Cave people and other hominids. (6 marks)
- (c) For each of the following **five** characteristics of the fossilised bones, outline what evidence would show how closely related the Red Deer Cave People are to modern humans and state how each of these features benefit modern humans.
- cerebral cortex size
 - prognathism
 - dentition
 - pelvis
 - feet
- (10 marks)

End of questions

ACKNOWLEDGEMENTS

- Question 2** Pupil-reflex diagram by courtesy of examining panel.
- Question 5** Volcanic eruption diagram by courtesy of examining panel.
- Question 8** Adapted from: Landis, C.S. (2016). *Nursing assessment: Endocrine system*. Fig. 48.3. Retrieved April, 2019, from <https://nursekey.com/nursing-assessment-endocrine-system/>
- Question 12** Adapted from: Anatomy Zone. (n.d.). [...] *neuron*. Retrieved April, 2019, from [http://anatomyzone.com/anatomy-feed/\[...\]-neuron/](http://anatomyzone.com/anatomy-feed/[...]-neuron/)
- Question 15** Phylogenetic tree by courtesy of examining panel.
- Question 19** Diagram adapted from: Learn Schematic Diagram. (2019). *Labelled diagram of the nephron*. Retrieved April, 2019, from <http://learnwise.co/labelled-diagram-of-the-nephron/>
- Questions 29–30** Diagram adapted from: Science buddies staff. (2018). *Decay curve of potassium* [Graph]. Retrieved April, 2019, from https://www.sciencebuddies.org/science-fair-projects/project-ideas/Geo_p044/geology/radiometric-dating#background
- Question 31** Diagrams from: Hanson, M. (1991). *Apes and ancestors*. Auckland, NZ: Longman Paul Limited, pp. 77, 81, 85, 88.
- Question 35(b)** Spinal reflex arc diagram adapted from: Santuz, Alessandro. (2018). *Extracting muscle synergies from human steady and unsteady locomotion: methods and experiments*. Retrieved April, 2019, from https://www.researchgate.net/figure/Schematic-representation-of-a-spinal-reflex-arc-A-pin-in-the-skin-produces-an-input_fig1_327199446
- Question 36(b)** Adrenal glands image adapted from: Grossman, A. B. (2018). *Merck manual*. Retrieved April, 2019, from <https://www.merckmanuals.com/professional/endocrine-and-metabolic-disorders/adrenal-disorders/overview-of-adrenal-function>
- Question 38(a)** Flow chart by courtesy of examining panel.
- Question 40** Diagram adapted from: *Rock huge freebie. Sedimentary rocks drawing*. (n.d.). Retrieved April, 2019, from http://hanatemplate.com/explore/sedimentary-rocks-drawing.html#gal_575788

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