

Candidate Marks Report

Series : 6 2018

This candidate's script has been assessed using On-Screen Marking. The marks are therefore not shown on the script itself, but are summarised in the table below.

Centre No :	Assessment Code :	J257
Candidate No :	Component Code :	03
Candidate Name :		

Total Marks :

In the table below 'Total Mark' records the mark scored by this candidate.
'Max Mark' records the Maximum Mark available for the question.

Answer all the questions.

1 The Galapagos Islands are a group of 13 islands found in the Pacific Ocean.

(a) Charles Darwin visited the Galapagos Islands during the 19th century.

He collected samples and made observations.

This work helped Darwin to develop a new explanation for the evolution of species.

(i) Which of the following are observations made by Darwin?

Tick (✓) two boxes.

There are differences between fossils and living examples of similar organisms.

Pea plants with red flowers can produce offspring with white flowers.

There is usually extensive variation within a population of a species.

Some bacteria have become resistant to antibiotics.

Isolated populations of the same species living in different places have different characteristics.

[2]

(ii) Darwin suggested a theory to explain his observations.

Write down the name of the theory he suggested.

The theory of natural selection..... [1]

(b) Algae live in the marine environment around the Galapagos Islands.

Photosynthesis takes place in the cells of algae.

(i) In which cell structure does photosynthesis take place?

chloroplasts..... [1]

(ii) Many factors can limit the rate of photosynthesis.

Which factor will not limit the rate of photosynthesis in the algae?

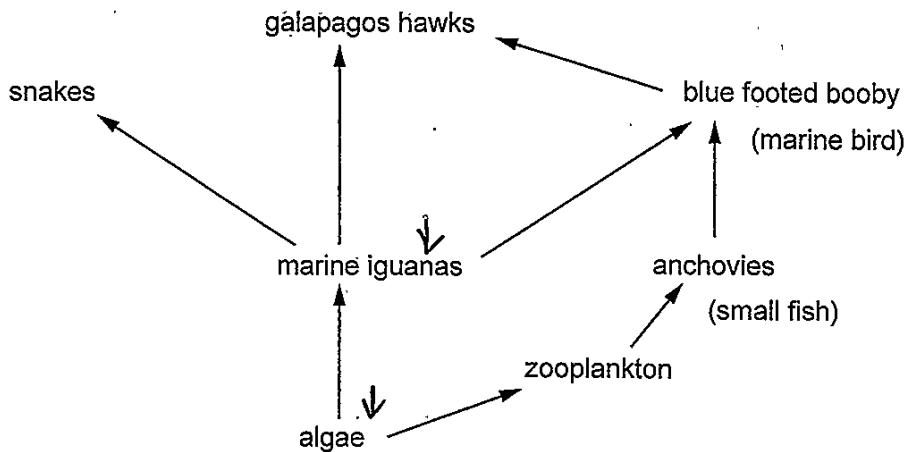
Put a ring around the correct answer.

carbon dioxide concentration light intensity temperature water availability

[1]



(c) The food web shows the feeding relationships of some Galapagos Islands species.



- (i) A weather event called El Niño occurs every three years. This causes the population of algae to decrease.

Explain what effect this could have on the population of marine iguanas.

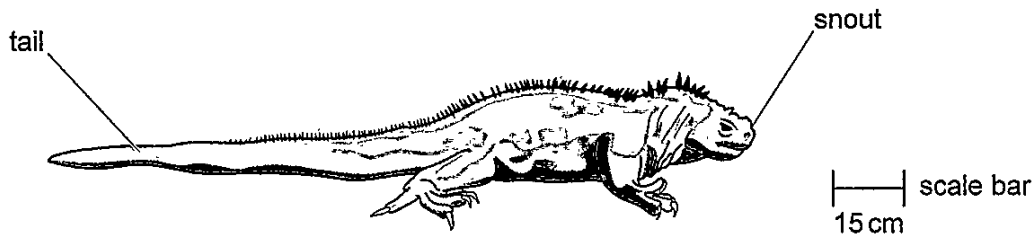
The population of marine iguanas will decrease as they wouldn't have any food (algae is their only source of food.) The population could also ^{decrease} ~~increase~~ as blue footed boobys would prey on more iguanas as ~~they~~ there will be less anchovies to prey on. [2]



Scientists have discovered that during this event the marine iguanas can shrink in size.

- (ii) The length of the marine iguana is determined by measuring the distance from the snout to the end of the tail.

Below is a drawing of a marine iguana.



Use the scale bar to calculate the actual length of this marine iguana in metres.

$$10 \text{ cm} \times 15 = 150 \text{ cm} \div 100 = 1.5 \text{ m}$$

Length of marine iguana = 1.5 m [2]

- (iii) Some marine iguanas can shrink by up to 20% of their original length.

Calculate the length of this marine iguana after maximum shrinkage.

$$\frac{20}{100} \times 1.5 = 0.3$$

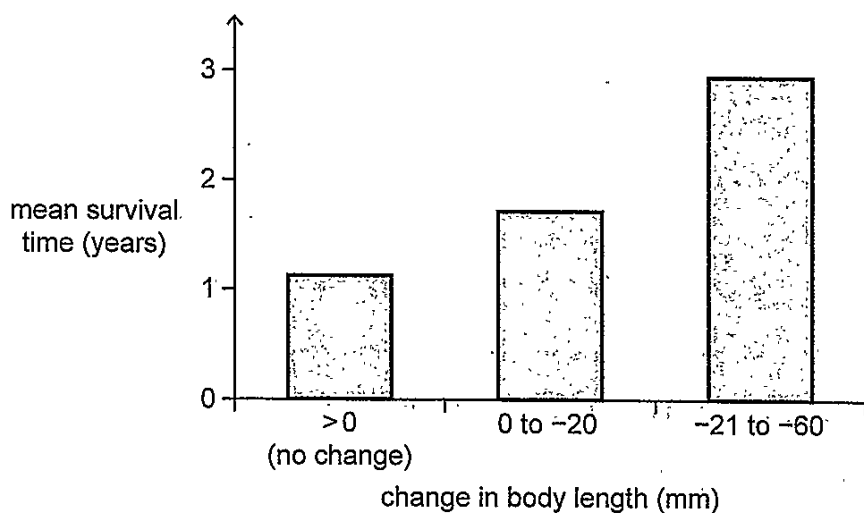
$$1.5 - 0.3 = 1.2$$

Length after maximum shrinkage = 1.2 m [1]



Scientists calculated the change in body length of the iguanas and measured how long they survived during the El Niño event.

The results are shown in the graph.



(iv) What can be concluded from the data?

Tick (✓) **two** boxes.

- ✗ The marine iguanas that decreased in size the least survived longer.
- ✗ The change in body length made no difference to the survival time of the marine iguanas.
- ✓ The marine iguanas that decreased in size the most on average lived for a greater length of time.
- ✓ The marine iguanas that did not decrease in size survived for approximately 2 years less than the marine iguanas that decreased in size by up to 60 mm.
- ✗ The marine iguanas that decreased in size by 20 mm survived more than double the length of time than those that did not change in size.

[2]



2 A student is carrying out a field investigation to determine the population of woodlice in the school's wildlife garden.

(a) Describe a method the student could use to determine the population size of woodlice.

The student can collect randomly a sample of woodlice and mark them. Next, let them out in the garden and allow them to distribute for approximately 24 hours. After that the student should randomly sample the same amount of woodlice and count how many were previously marked.

From the garden

$$\text{population} = \frac{(\text{number in 1}^{\text{st}} \text{ sample} \times \text{number in 2}^{\text{nd}} \text{ sample})}{\text{number in 2}^{\text{nd}} \text{ sample previously marked.}}$$

(b) Woodlice are often found under logs and bark where it is damp.

Suggest why woodlice prefer damp places.

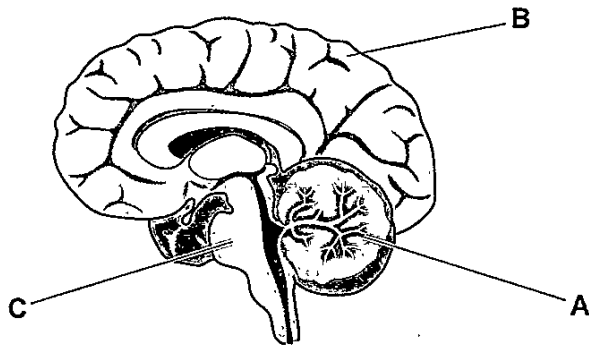
The temperature would be suitable in damp places for the enzymes in their bodies to work the best.

[2]



- 3 Different areas of the brain are responsible for different functions.

Three areas have been labelled A, B and C on the diagram of the brain.



- (a) (i) The table describes the functions of areas A, B and C.

Complete the table by writing the correct area of the brain for each function.

Area of the brain	Function
<i>A - cerebellum</i>	Responsible for conscious movement.
<i>B - cerebral cortex</i>	Responsible for intelligence, memory, consciousness and language.
<i>C - Brain stem</i>	Responsible for the regulation of heart rate and breathing rate.

[2]

- (ii) Scientists want to find out more about the functions of the brain. One way they can do this is to use patients with brain damage.

Suggest why there are concerns about using patients with brain damage.

Experiments carried out could potentially cause more damage to their brains and this could be fatal. [1]

- (iii) Write down **one other** way scientists could study the brain.

Using fMRI scanners. [1]

- (b) The cerebral cortex is a highly folded area of the brain made up of billions of neurons.

Describe the features of a neuron that allow it to transmit electrical impulses quickly and over long distances.

Neurons have long axons covered in myelin sheath to insulate the electrical impulses and carry them over a long distance. The dendrites also aid in the fast transmission of impulses as they can cover large areas and pick up impulses from many places. [2]



- (c) Parkinson's disease is a disease of the central nervous system.

It is caused by the loss of neurons in one part of the brain. These neurons are responsible for producing a transmitter substance called dopamine.

- (i) Dopamine acts as a transmitter substance in parts of the brain and nervous system that control movement.

Which neurons are most likely to be affected by Parkinson's disease?

Tick (✓) one box.

Relay neurons only.

Relay and motor neurons.

Sensory neurons only.

Sensory and motor neurons.

[1]

- (ii) At a synapse, transmitter substances are released from the first neuron.

Which word describes how the transmitter substances move across the gap from the first neuron to the second neuron?

Tick (✓) one box.

Active transport

Diffusion

Net movement

Osmosis

[1]

- (iii) Scientists have been investigating the use of stem cells in the treatment of Parkinson's disease.

Suggest **one** feature of stem cells that makes them useful in the treatment of Parkinson's disease.

They are able to specialise into any type of cell including neurones which could replace the ones lost due to the disease. [1]



4. Plants respond to their environment.

(a) (i) What term is used to describe a plant's growth response to light?

phototropism [1]

(ii) The growth response to light can be explained by the distribution of the plant hormone auxin in the plant shoot.

Jamal finds three diagrams that could explain what happens in the plant shoot.

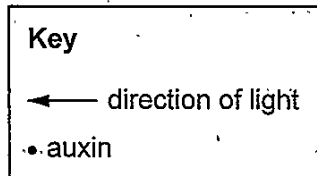


Diagram A

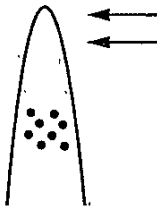


Diagram B

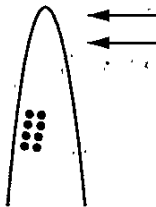
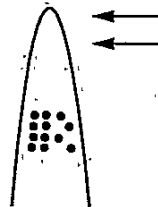


Diagram C



Which diagram, A, B or C, best explains what happens to make the plant shoot grow towards the light?

Explain your choice.

Diagram *B*

Explanation: *It shows that the auxins would move to the shady side of the plant (opposite to where the light hits) and would then stimulate the growth of those cells so the plant would bend towards the light.* [2]



- (iii) Jamal's teacher gives him two boxes of cress seedlings, each box contains ten seedlings.

Describe an experiment Jamal could do to investigate the growth response to light in the cress seedlings.

(so no other light enters)
 He could cover one box with a dark material and shine
 a light through a hole in the side. He should cover the
 other box as well with a dark material ^{this time with} and ~~shine~~
 no light.
~~a light through the opposite side to the one before.~~
 Next he should keep ^{both} ~~both~~ boxes in the same environment
 with equal amounts of nutrients for 2-3 days. He
 could then compare the direction of growth in both
 boxes. [4]

- (b) A gardener is growing fruit. He wants to ripen his fruit quickly and decides to use the plant hormone gibberellin.

Do you agree with his choice of hormone?

Explain your answer.

(germination)
 No, as gibberellin enhances the growth of seeds and
 not the ripening of fruit. [2]

- (c) Plants can be infected by communicable diseases, so they need to protect themselves against pathogens.

Describe one chemical defence and one physical defence that plants have against pathogens.

Chemical defence latex is produced to stop pathogens entering
 the plant.

Physical defence waxy cuticle is water proof and provides a physical
 barrier to prevent pathogens entering the plant. [2]

- (d) State the function of stomata in plants.

Stomata open and close to control the amount of water
 and gases leaving the leaf. [1]



5 Cancer is a non-communicable disease.

(a) (i) Describe what causes cancer.

Cancer is caused by a mutation in cells^{DNA} which cause them to divide uncontrollably. The mutation can be caused by gas radioactive sources. [2]

(ii) Identify one factor that could increase a person's risk of developing cancer.

Exposure to radioactive rays of gamma [1]

(iii) In the past it has been estimated that 1 in 3 people will develop cancer in their lifetime.

Recent estimates suggest the ratio is 1 in 2.

The UK population is 65 640 000.

If the recent estimate is correct, how many people can be expected to develop cancer?

Give your answer to 2 significant figures.

$$65\,640\,000 \div 2 = 32\,820\,000$$

$$= 33\,000\,000$$

Number of people = *33 000 000* [2]

(iv) Suggest why the figure calculated in (a)(iii) will be an estimation.

Certain people would be more susceptible to developing cancer than others. [1]

(b) Cancer of the ovaries is a common type of cancer. Most women diagnosed with cancer of the ovaries will have an operation to remove their ovaries.

(i) Before the operation, the doctor will discuss the risks of the operation with the patient. This is a high risk operation.

Suggest why a patient would decide to go ahead with this operation.

If the cancer spreads to other parts of the body there would be more dangerous / fatal consequences. [1]



After surgery, the patient may have chemotherapy to kill any remaining cancer cells.

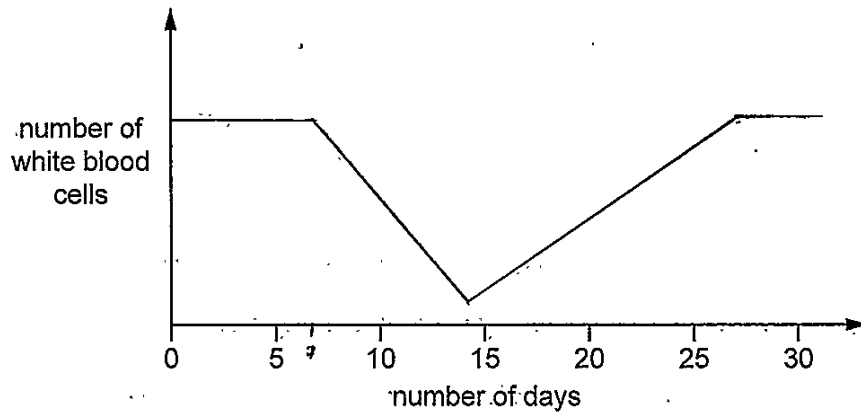
Chemotherapy also kills white blood cells.

A doctor describes this effect to the patient.

The chemotherapy will last 3 weeks. It will kill the cancer cells and also some of your white blood cells. The white blood cells will fall in number between days 7 and 14 of the treatment. They will be at their lowest on or around day 14. By the end of the treatment they should have returned to normal levels.



- (ii) Draw a line graph on the axes below to show what happens to the number of white blood cells during each cycle of chemotherapy.



[2]

- (iii) During the chemotherapy treatment, the patient is advised to seek urgent medical attention if they become ill and have a raised temperature.

Suggest between which days the patient is most at risk of becoming ill.

Use data from the graph in your answer.

from days 10 to 20 *would not*
~~The white blood cells would decrease so there would be~~ [1]
~~enough left to fight off any patho~~



(iv) Why is a high temperature in the human body a problem?

A high temperature would lead to enzymes in the body to become denatured. As the shape of the active site changes, substrate molecules can not fit in to react so the rate of reaction goes down. This would mean that important chemical reactions in the body wouldn't take place.

[3]

(c) New drugs and treatments have to go through rigorous clinical trials.

A clinical trial was conducted to see if using a particular combination of chemotherapy drugs increased survival rates for a type of cancer of the ovaries.

The two drug combinations being tested were:

- drugs 1 and 2
- drugs 3 and 4.

(i) The table shows some details of the clinical trial design.

Use your knowledge of clinical trials to justify each part of the design.

Design	Justification
Only women took part in the trial.	<i>The drug is tested to see if it would specifically target the ovarian cancer.</i>
All women who took part in the trial had ovarian cancer.	<i>The drugs ^{are} tested on the disease to see how well it works and if there are any potential side effects.</i>
A placebo was not used.	<i>All women had a chance of getting treated.</i>
An open trial was conducted.	<i>Both doctors and patients know which drug is given to whom.</i>

[4]



The results of the trial are shown in the table.

	Group A (Drugs 1 and 2)	Group B (Drugs 3 and 4)
Number of women who took part in the trial.	305	314
Number of women who were still alive two years after treatment.	247	222
Most severe side effects.	<ul style="list-style-type: none"> • A drop in total blood cell number • Nerve damage • Joint pain 	<ul style="list-style-type: none"> • Loss of appetite • Diarrhoea • Feeling or being sick • High temperature • Low white blood cell number

- (ii) Use the information in the table to recommend which drug combination the doctors should use.

Justify your decision.

Group A because it has a lower number of side effects and ~~many~~ ~~number of women who died after the~~ ~~the~~ it has a higher survival percentage compared to Group B.

[2]

- (iii) Explain why scientists should communicate findings such as these to a range of audiences.

People affected by ^{or who} ~~these~~ have friends and family affected by this cancer would be aware of potential side effects caused by the new drugs.

[1]

- (d) Scientists have been developing the use of monoclonal antibodies in cancer treatment.

Monoclonal antibodies specific to a cancer cell antigen are produced and are injected into the blood of a cancer patient.

Describe how monoclonal antibodies are used to treat cancer.

^{with a tracer or chemical}
The monoclonal antibodies are injected and they move to cancer region. The antibodies hit onto the antigen of the cancer cell. If a tracer is on the antibody a special camera is used to detect it and find out where the cancer cells are. If a chemical is on the antibody, it deactivates / destroys the cancer cell without damaging any healthy living cells.

[3]



- 6 The female-mosquito *Aedes aegypti* is responsible for the transmission of diseases such as Zika virus.

In May 2015, Zika virus was reported in Brazil and began to spread rapidly.

The mosquito feeds mainly on human blood. The virus is spread when a female *Aedes aegypti* mosquito bites an infected human and then bites an uninfected human.

- (a) Zika virus is a communicable disease.

Visitors to Brazil in 2016 were concerned that they could become infected with the virus.

There is no vaccination for this virus.

- (i) Explain what a communicable disease is and suggest how a visitor to Brazil could reduce the risk of becoming infected with Zika.

is a disease that
A communicable disease can be spread from organism to
organism. To reduce the risk of becoming infected, visitors
can use anti-mosquito sprays or lotions to stop mosquito
bites. [2]

- (ii) The first ever human case of Zika was discovered in Nigeria in 1954. The timeline below shows how Zika spread.



The Zika virus can also be transmitted by sexual intercourse.

People were concerned that hosting the Olympic games in Brazil in 2016 would increase the spread of the virus to other countries:

Suggest how the virus could be spread to other countries and how this could be prevented.

The virus could be infect people arriving to the Olympic
games from around the world through contact and mosquito
bites. When the people go back to their countries after
infected, the disease could spread in the countries as well. [2]
This could be prevented by using condoms during sexual
intercourse and avoiding mosquito bites.



- (b) (i) The mosquito responsible for the spread of Zika has become resistant to some of the insecticides used to kill it.

Explain how a population of mosquitoes could have become resistant to an insecticide.

*When a population of mosquitoes
~~when the insecticide is put on it~~ are exposed to the insecti-
 -de for the first time, mosquitoes that are not resistant
 die off, leaving some that had mutated to have resistance
 mosquitoes
 before. The resistant ~~mosquitoes~~ then reproduce and pass
 on the gene for resistance to their offspring giving birth
 to a population of mosquitoes who are all resistant. [3]
 to the insecticide.*

- (ii) One way scientists tried to solve the problem was to make genetically engineered mosquitoes that had a 'kill switch' gene. This gene caused the mosquitoes' offspring to die.

Describe the steps a scientist would use when genetically engineering a mosquito to have the 'kill switch' gene.

*The scientist should insert the gene into the DNA of the
 gametes and fertilize it to allow
 mosquito and allow it to reproduce. No a mosquito to
 be born. This mosquito would have the kill switch gene.
 [3]*

- (iii) The 'kill switch' gene codes for the production of a protein called tTAV.

The tTAV protein blocks the transcription of other genes essential for mosquito survival.

When breeding the mosquitos in the laboratory a chemical called tetracycline is used. Tetracycline binds to the tTAV protein and deactivates it.

Suggest why scientists use tetracycline when breeding the genetically engineered mosquitos.

*The chemical deactivates tTAV temporarily to allow
 the offspring to grow and develop so they would have [1]
 the gene which then kills later generations of offspring.*



- (iv) Scientists thought using genetically engineered mosquitos was a better solution than using insecticide.

Do you agree?

Explain your reasons.

Yes because using insecticide would lead to generations of mosquitoes being born resistant to the insecticide so more and more insecticides ^(more stronger ones) should be made to kill off those generations, therefore using insecticides wouldn't help to eradicate the virus, ^{and ~~will~~ making more} while ~~genetically~~ efficient insecticides would incur large costs. [3]



7 A gene affects whether people have dimples in their cheeks. There are different variants of this gene.

An individual with the dominant variant, D, of this gene will have dimples.

(a) Jack and his wife Nina both have dimples.

Their daughter Mia does not have dimples.

(i) Complete the table to show the genotype of each individual.

Individual	Genotype
Jack	<i>Dd</i>
Nina	<i>Dd</i>
Mia	<i>dd</i>

D | *D* | *d*
D | *DD* | *Dd*
d | *Dd* | *dd*

[3]

(ii) Jack and Nina decide to have another child.

What is the probability that the second child will have dimples?

Use the Punnett square to show your working.

Jack <i>D</i> <i>d</i>	<i>D</i>	<i>d</i>
Nina <i>D</i> <i>d</i>	<i>DD</i>	<i>Dd</i>
<i>d</i>	<i>Dd</i>	<i>dd</i>

Probability that the child will have dimples = $\frac{3}{4}$ [2]

(b) Scientists consider this trait an 'irregular' dominant trait. This is because sometimes a person can have dimples but their children do not.

What could be responsible for this difference?

Heterozygous alleles..... [1]



- 8 Amaya reads an article in a magazine which explains that genes code for the production of a taste receptor on the tongue.

Taste receptors are proteins.

- (a) Complete the sentences to describe how a protein is made.

Use words from the list.

Each word can be used once, more than once, or not at all.

amino acids bases DNA fatty acids gene
genetic variant mitochondrion mRNA protein ribosome

A copy of the DNA is made from mRNA.

This molecule travels to a ribosome in the cytoplasm.

Here amino acids are joined together to form a protein.

A mutation would create a genetic variant and therefore a different receptor.

[4]

- (b) Scientists think that a mutation created the type of receptor that allows someone to taste a bitter substance.

Explain how a mutation could affect the structure of the receptor protein.

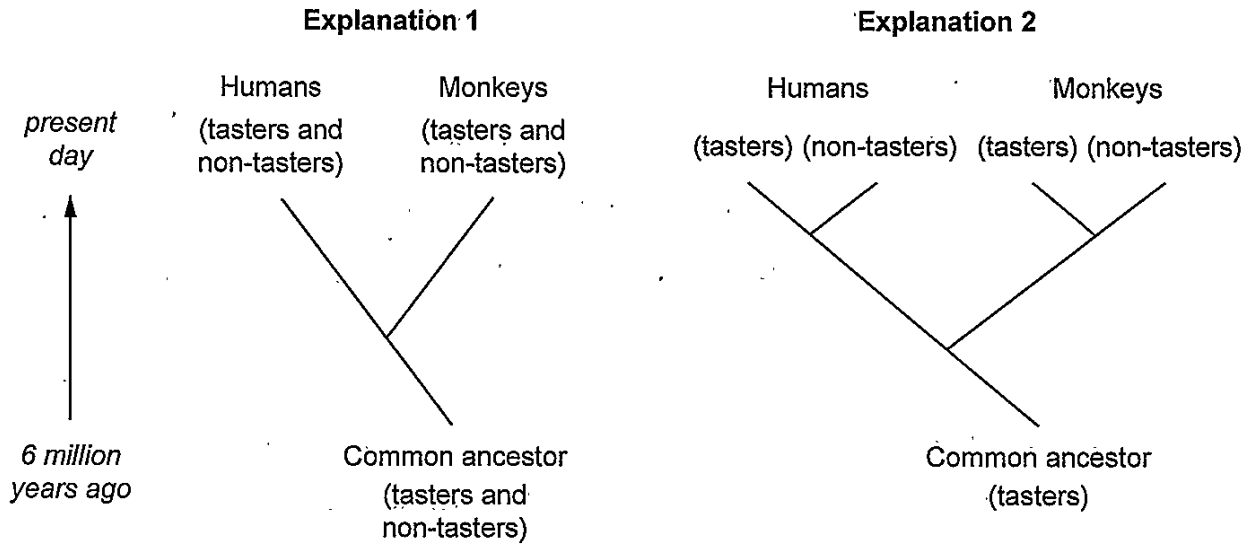
An insertion, deletion or substitution of a base could change the base sequence that codes for a certain protein leading to a different / dysfunctional protein to be made. This would affect how the receptor protein works.

[2]



(c) Monkeys also have different variants of the gene that affects how they taste bitterness.

Scientists have proposed two explanations for how the non-tasting variants could have evolved in humans and monkeys.



Scientists have discovered that the non-tasting variants in humans and monkeys have different DNA sequences, even though they have the same effect.

Which explanation of how they evolved is most likely to be correct?

Explain your answer.

Explanation ¹ because ~~not~~ ^{new} tasting and non-tasting variants could have occurred from mutations in ~~at~~ ^{at different ways} as there is a higher chance of ~~something~~ ^{the organism being ~~non-tasting~~ non-tasting} even ~~that~~ ^{if} they have different DNA sequences. [2]

END OF QUESTION PAPER



ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

Lined area for writing answers, consisting of a vertical margin line on the left and horizontal dotted lines extending across the page.



Area with horizontal dotted lines for writing.

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