1 Figure 1 shows the times when *Homo sapiens* and some of their ancestral species are thought to have lived.

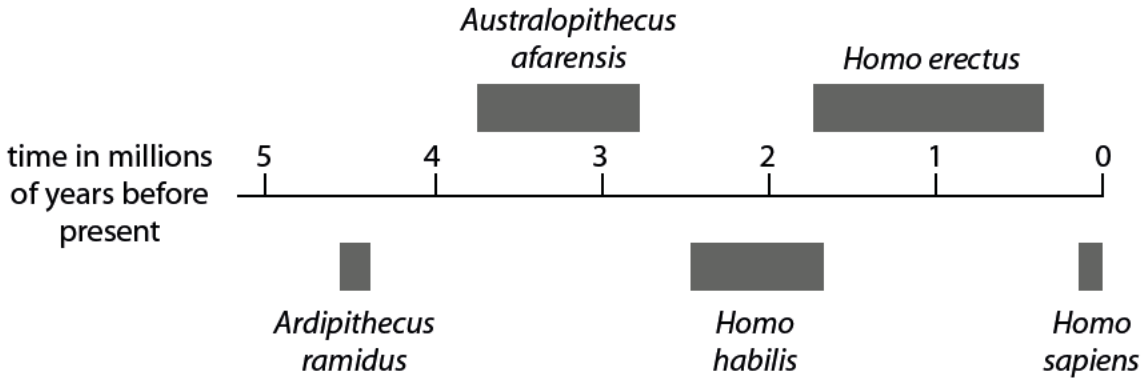


Figure 1

(a) Fossil remains of *Ardipithecus ramidus* were discovered in Ethiopia.

(i) Describe the evidence that scientists might have used to show that *Ardipithecus ramidus* inhabited the Earth earlier than *Homo habilis*.

(2)

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(ii) Suggest an explanation for the extinction of *Homo habilis*.

(2)

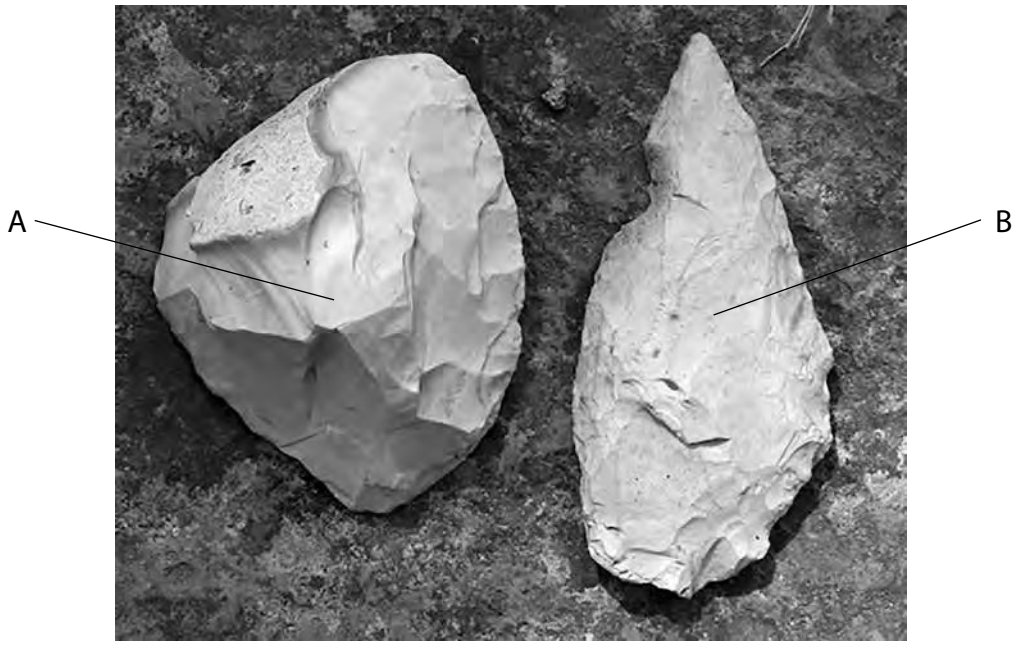
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(iii) Figure 2 shows two stone tools, one used by *Homo habilis* and one used by *Homo erectus*.



(Source: Frederic Surmely/look at sciences/Science Photo Library)

Figure 2

Explain which stone tool was most likely to be used by *Homo erectus*.

Use information from Figure 1 and Figure 2.

(2)

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(b) The population of humans on Earth has increased significantly leading to food shortages.

The growth of drought-resistant crop plants could lead to an increase in food supply.

Describe how drought-resistant crop plants can be produced.

(3)

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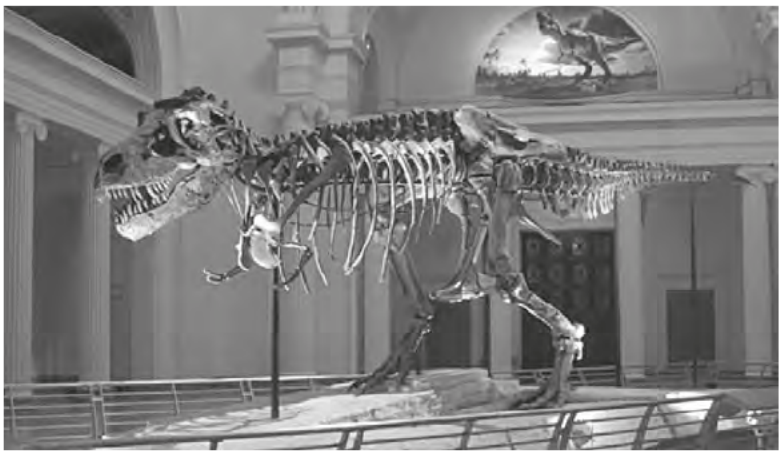
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(Total for Question 1 = 9 marks)

2 In 2005, a scientist claimed to have found red blood cells in the fossilised bones of a *Tyrannosaurus rex* that lived 68 million years ago.



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(a) (i) Complete the sentence by putting a cross (☒) in the box next to your answer.

A group of the same type of cells, such as red blood cells, is known as

(1)

☒ **A** an organ

☒ **B** an organ system

☒ **C** an organism

☒ **D** a tissue

(ii) The scientist said that each red blood cell found contained a nucleus.

In humans, each mature red blood cell does not have a nucleus.

Suggest why not having a nucleus in a red blood cell is an advantage.

(2)

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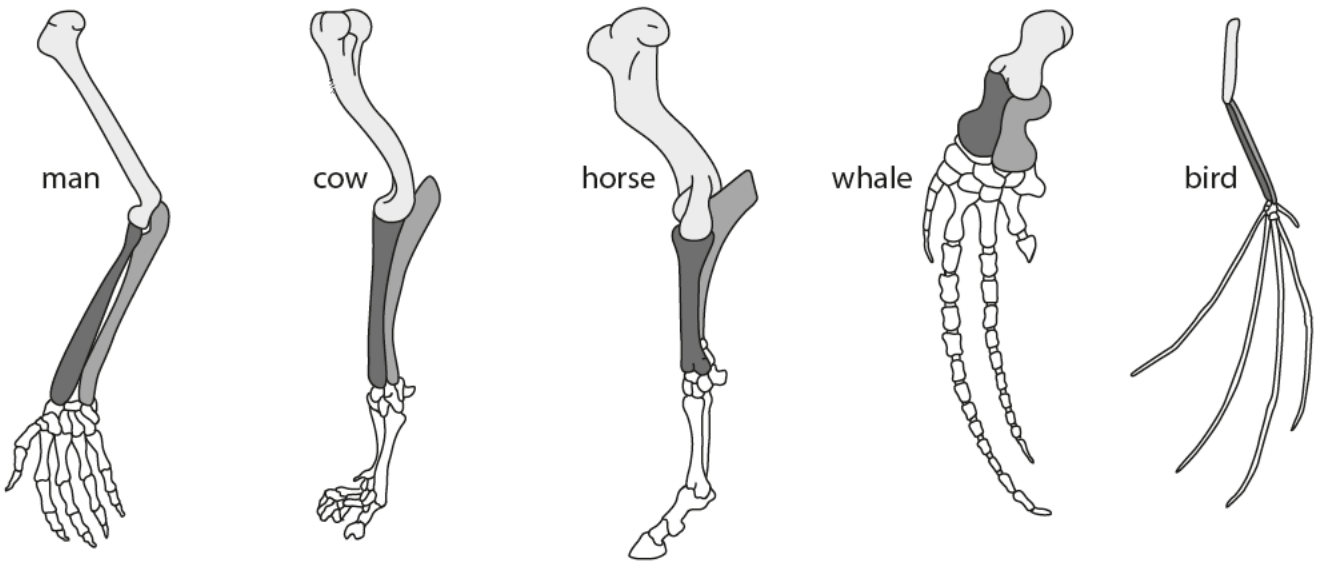
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(b) Explain why fossils of dinosaurs are often incomplete.

(3)

*(c) The diagram shows some limbs of modern-day animals.



Explain how the study of the limbs of different species of vertebrates provides evidence for evolution.

(6)

(Total for Question 2 = 12 marks)

3 When bacteria divide they replicate their genome and synthesise their cell wall.

Figure 12 outlines the stages of bacterial replication.

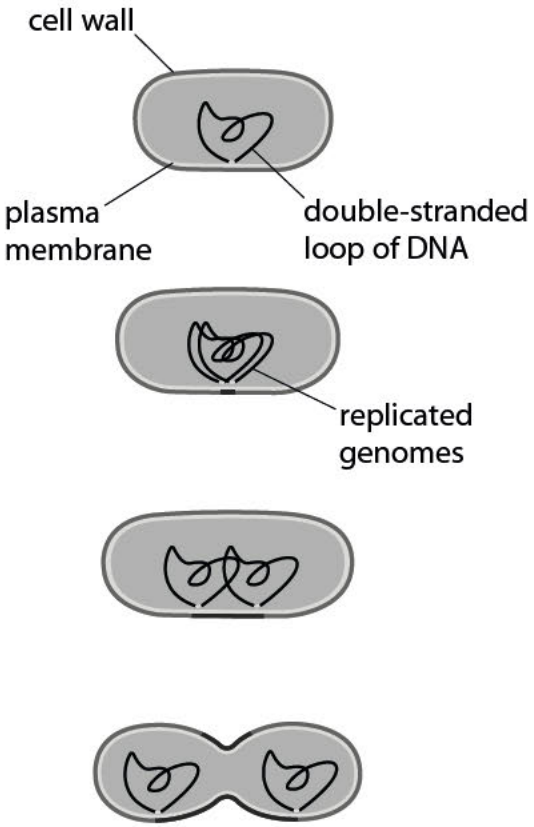


Figure 12

(a) Penicillin inhibits the synthesis of the cell wall in bacteria.

Explain the effect of penicillin on bacterial and human cells.

(3)

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(b) Penicillin, isolated from a fungus, was the first antibiotic used to treat bacterial infections and is still widely used today.

Scientists have genetically engineered bacteria to produce large amounts of penicillin.

Describe how scientists would produce a genetically modified bacterium that produces penicillin.

(4)

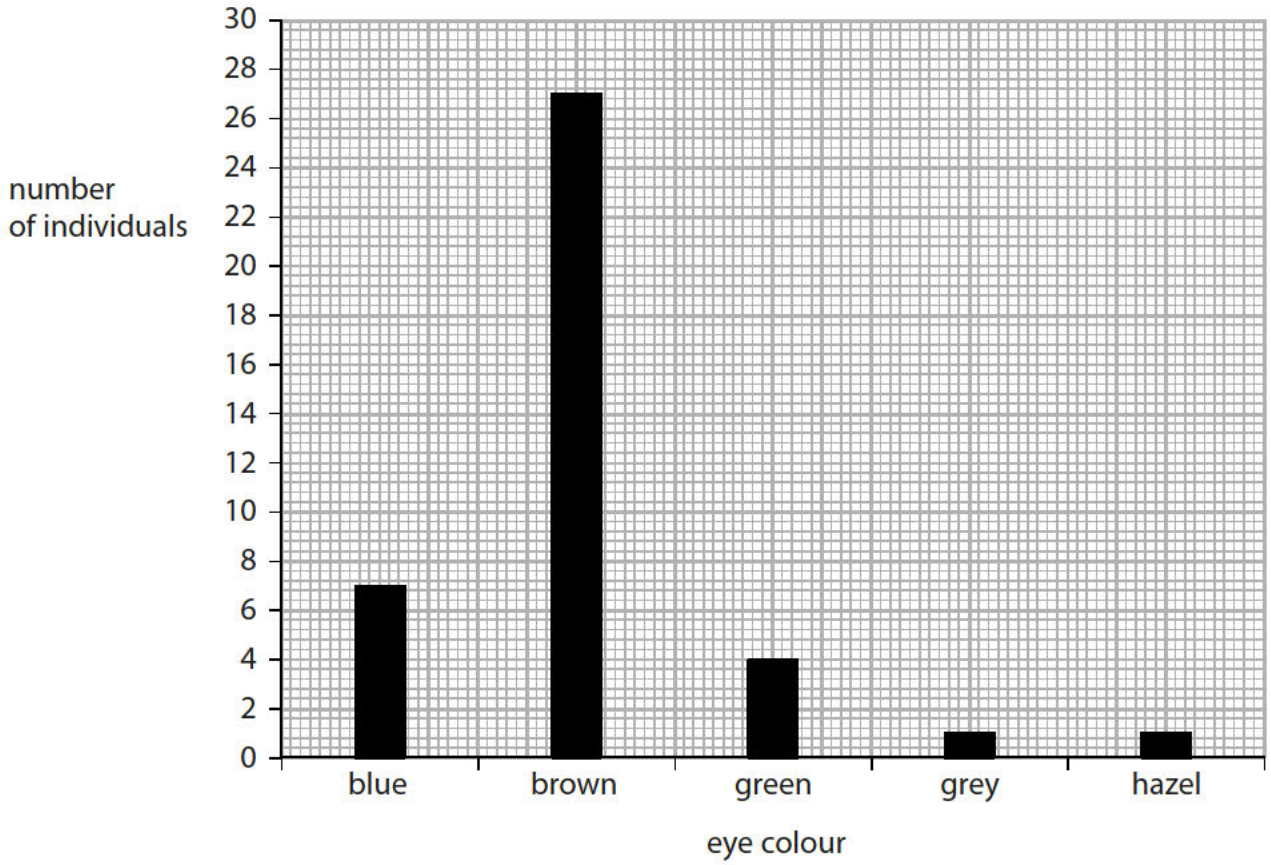
*(c) MRSA is a bacterium that has evolved to become resistant to antibiotics.

With reference to Darwin's theory of evolution by natural selection, explain how MRSA bacteria have evolved to become resistant to antibiotics.

(6)

(Total for Question 3 = 13 marks)

4 (a) The graph shows the variation in eye colour in a human population.



(i) How many individuals had their eye colour recorded in this human population?

Put a cross (☒) in the box next to your answer.

(1)

☐ **A** 7

☐ **B** 27

☐ **C** 30

☐ **D** 40

(ii) Calculate the percentage of individuals with brown eyes in this human population.

(2)

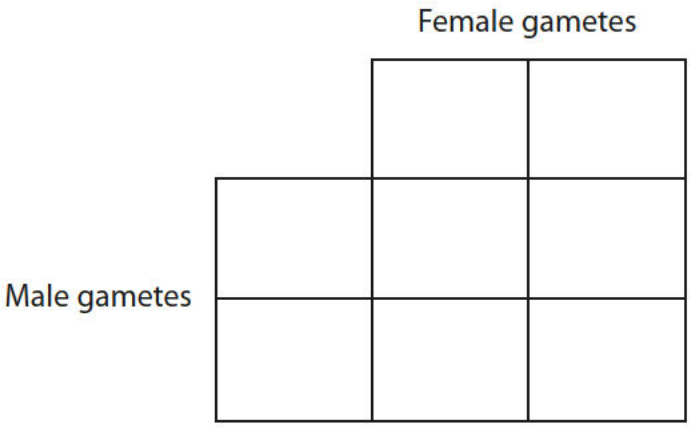
answer = ...%

(b) An individual's eye colour is determined by the alleles they inherit from their parents.

A female parent with the genotype **(bb)** had blue eyes and a male parent with the genotype **(Bb)** had brown eyes.

(i) Complete the Punnett square to show the gametes of the parents and the genotypes of the offspring.

(2)



(ii) If these two parents have one child, state the probability that this child would have blue eyes.

(1)

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(iii) Give the genetic term that describes the genotype **(bb)**.

(1)

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(c) Variation may arise due to the geographic isolation of a species.

Explain how geographic isolation of members of one species can lead to a new species evolving.

(3)

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(Total for Question 4 = 10 marks)