Questions

Q1.

Figure 12 shows the times when *Homo sapiens* and some of their ancestral species are thought to have lived.

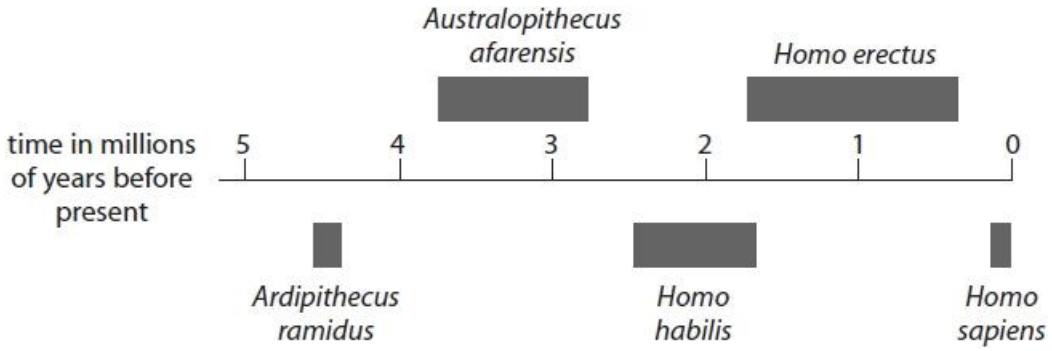

Figure 12

Fossil remains of *Ardipithecus ramidus* were discovered in Ethiopia.

(i) Calculate the number of years *Ardipithecus ramidus* is thought to have inhabited the Earth.

(2)

Answer .....

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

(2)

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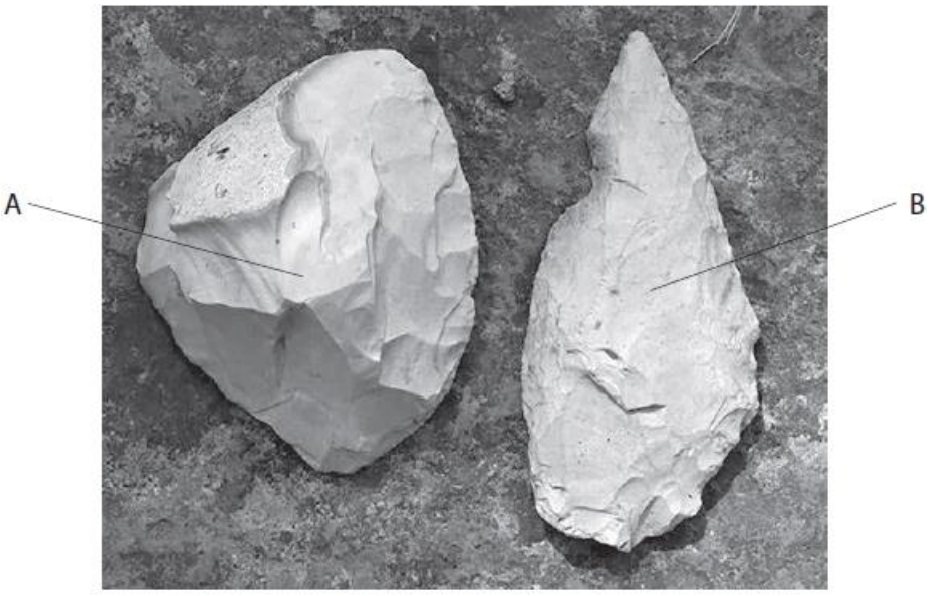
(iv) Figure 13 shows two stone tools, one used by *Homo habilis* and one used by *Homo erectus*.



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

Figure 13

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

Use information from Figure 12 and Figure 13.

(2)

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(Total for question = 8 marks)

Q2.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Stone tools can be found at sites used by our human ancestors.

Figure 3 shows tool P.

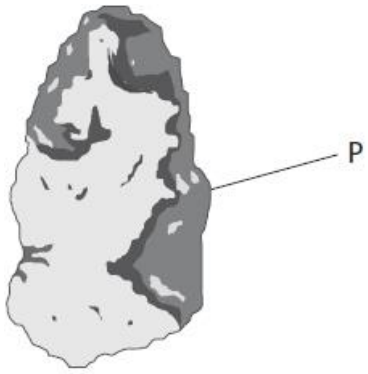

Figure 3

(i) Describe how tool P was made.

(2)

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(ii) Figure 4 shows tool Q which was found at the same site as tool P.

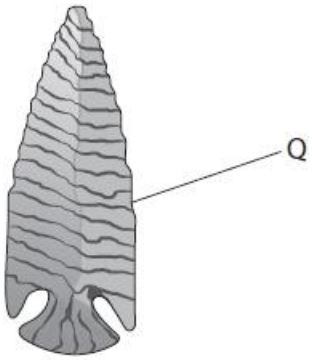

Figure 4

A scientist stated that tool Q was made by a more evolved human ancestor than tool P.
Which observation supports this statement?

(1)

- ☐ **A** tool Q is a darker colour than tool P
- ☐ **B** tool Q is more pointed than tool P
- ☐ **C** tool Q is a lighter colour than tool P
- ☐ **D** tool Q is less pointed than tool P

(iii) Tools provide evidence for human evolution.

Use words from the box to complete the sentences.

(2)

enlarge	human	migrate
mutate	natural	negative

Evolution is the change of inherited characteristics through ..... selection.

These changes occur because genes ..... .

(Total for question = 5 marks)

Q3.

The book 'On the Origin of Species' was published in 1859.

This book describes the theory of evolution.

One chapter of this book discusses pentadactyl limbs.

Figure 5 shows the bones of the pentadactyl limbs of three mammals.

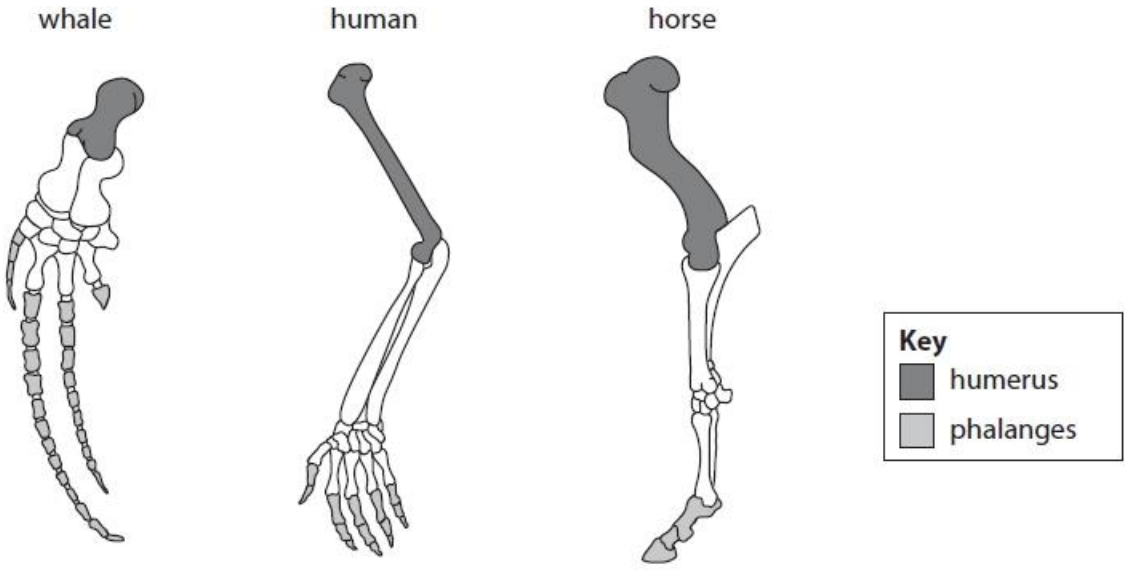

Figure 5

(i) Describe **one** difference between the humerus of the whale and the humerus of the human.

(1)

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(ii) Describe **one** difference between the phalanges of the horse and the phalanges of the human.

(1)

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(Total for question = 2 marks)

Q4.

The book 'On the Origin of Species' was published in 1859.

This book describes the theory of evolution.

One chapter of this book discusses pentadactyl limbs.

Another chapter of the book discusses how the shape of bird beaks has evolved on different islands.

Figure 6 shows two species of finch from two different islands.

(Source: © Kristel Segeren/Shutterstock)

Species A

(Source: © Maurizio De Mattei/Shutterstock)

Species B

Figure 6

These two species of finch evolved from a common ancestor that had a similar shaped beak to species B.

Beak shape is related to the food that the finches eat.

Describe how the thinner beak of species A is a result of evolution.

(4)

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(Total for question = 4 marks)

Q5.

Stone tools can be found at sites used by our human ancestors.

Figure 3 shows tool P.

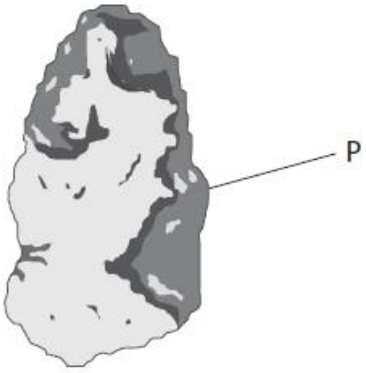

Figure 3

Figure 4 shows tool Q which was found at the same site as tool P.

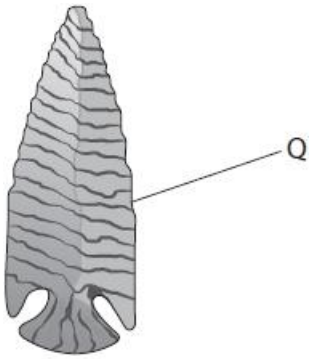

Figure 4

Fossils were also found in the soil around tool Q.

Describe **two** ways that stone tools and fossils can be dated to find out how old they are.

(2)

1 .....

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2 .....

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(Total for question = 2 marks)

Q6.

Figure 15 shows three stone tools found in different layers of rock.

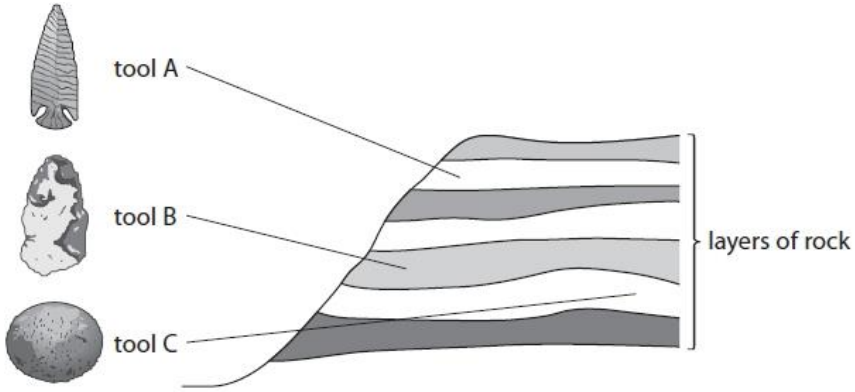

Figure 15

Explain how information from Figure 15 provides evidence for human evolution.

(6)

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(Total for question = 6 marks)

Q7.

Colistin is an antibiotic used to treat infections in the bloodstream.

Some bacteria are resistant to Colistin.

Explain how these bacteria have become resistant to Colistin.

(4)

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(Total for question = 4 marks)

Q8.

The book 'On the Origin of Species' was published in 1859.

This book describes the theory of evolution.

(i) Which scientist wrote this book explaining his theory of evolution?

(1)

- ☒ **A** Charles Darwin
- ☒ **B** Robert Hooke
- ☒ **C** Richard Leakey
- ☒ **D** Gregor Mendel

(ii) Which statement is supported by this theory of evolution?

(1)

- ☒ **A** humans are not related to any other group of animals
- ☒ **B** all species have the same genes
- ☒ **C** a meteor caused the dinosaurs to evolve
- ☒ **D** new species evolve over many generations

(Total for question = 2 marks)

Q9.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

In 2017, a new strain of *Klebsiella pneumoniae* bacteria was discovered that was resistant to 26 different antibiotics.

(i) Explain how *Klebsiella pneumoniae* bacteria developed resistance to antibiotics.

(4)

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(ii) State how the use of antibiotics could contribute to *Klebsiella pneumoniae* bacteria developing resistance to antibiotics.

(1)

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(iii) *Klebsiella pneumoniae* is a prokaryotic cell.

Which is a characteristic feature of a prokaryotic cell?

(1)

- ☒ **A** it has chloroplasts
- ☒ **B** it does not have a nucleus
- ☒ **C** it does not have ribosomes
- ☒ **D** it cannot reproduce without a host

(Total for question = 6 marks)

Q10.

Figure 7 shows the limbs of five animals.

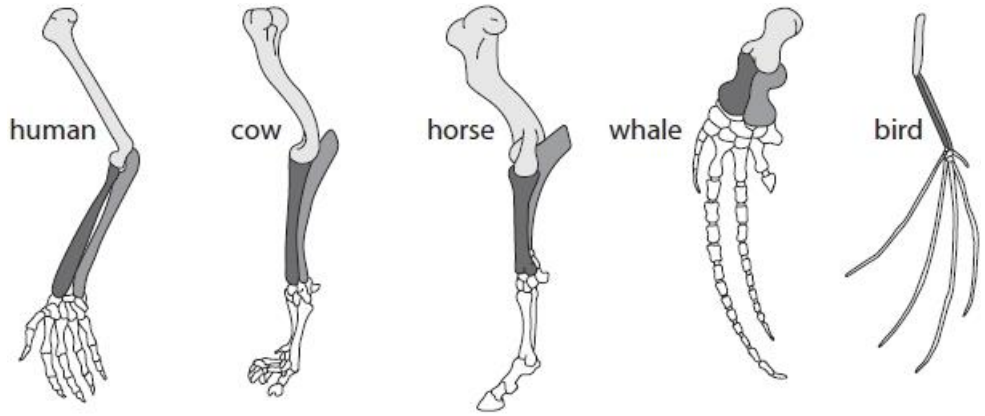

Figure 7

Describe how the structure of these limbs provides scientists with evidence for evolution.

(3)

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(Total for question = 3 marks)

Q11.

Alfred Russel Wallace travelled around Malaysia during the 1800s and wrote to Charles Darwin about the animal species he studied.

His main conclusions were very similar to those of Charles Darwin and they both contributed to the current understanding of evolution.

Describe the theory of evolution by natural selection.

(3)

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(Total for question = 3 marks)

Q12.

* 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)

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(Total for question = 6 marks)

Q13.

Figure 5 shows a great tit on a bird feeder.

© taviphoto/Shutterstock

Figure 5

Scientists have found that great tits living now have longer beaks than great tits living 50 years ago.

Genetic analysis shows changes in the sequence of the bird's DNA.

Scientists think that great tits living now have longer beaks because of the increased use of bird feeders during the last 50 years.

Explain how natural selection could have caused an increase in beak length because of the use of bird feeders.

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(Total for question = 4 marks)

Q14.

Alfred Russel Wallace travelled around Malaysia during the 1800s and wrote to Charles Darwin about the animal species he studied.

His main conclusions were very similar to those of Charles Darwin and they both contributed to the current understanding of evolution.

Wallace and Darwin did not always agree.

Darwin believed that male birds have feathers that are brightly coloured to make them more attractive to female birds.

Wallace thought that female birds have feathers that are less brightly coloured so they are more likely to survive.

(i) Explain why having feathers that are less brightly coloured increases the survival rate of females.

(2)

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(ii) Suggest why it is more important for the survival of the species that the survival rate is higher in female birds than in male birds.

(2)

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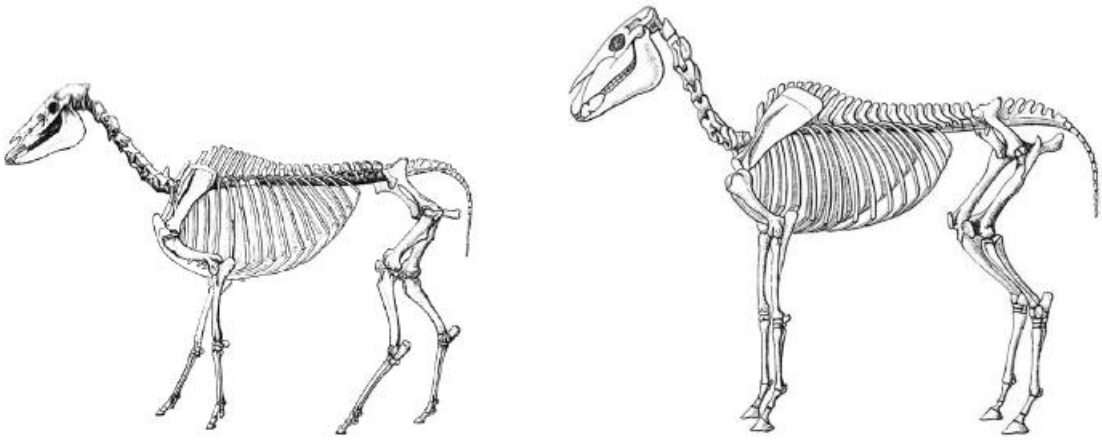
(Total for question = 4 marks)

Q15.

Hipparion is an extinct genus of horse that lived between approximately 20 million and 0.8 million years ago.

Figure 10 shows the skeletons of a *Hipparion* and a modern horse.



Hipparion modern horse

(Sources: © Morphart Creation/Shutterstock and © Hein Nouwens/Shutterstock)

Figure 10

(i) Give **one** method that can be used to date a fossil of a Hipparion.

(1)

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(ii) Give **one** reason why scientists have concluded that the modern horse has evolved from *Hipparion*.

(1)

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(Total for question = 2 marks)

Q16.

Figure 13 shows the pentadactyl limb of a bat and a cat.

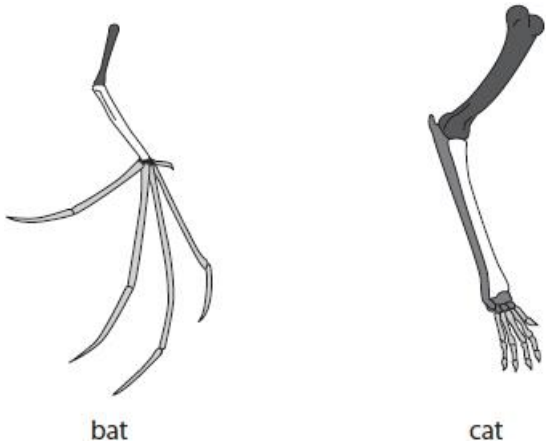

Figure 13

(i) Describe the reasons why the anatomy of the pentadactyl limb suggests that bats and cats evolved from a common ancestor.

(2)

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(ii) Genetic analysis also provides evidence for evolution.

Scientists can sequence genes from different organisms.
Describe how this type of genetic analysis provides evidence for evolution.

(2)

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(Total for question = 4 marks)

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	• 4.6 million – 4.4 million (1) • 0.2 million years/200 000 years (1)		(2)
Question number	**Answer**	**Additional guidance**	**Mark**
(ii)	An answer that combines knowledge (1 mark) and understanding (1 mark) to provide a logical description: • (scientists might look for) differences in the structural features of the fossil (1) • and *Ardipithecus ramidus* would be deeper in the rock layer than *Homo* {*habilis*/stone tools} (1)	e.g. *Ardipithecus ramidus* smaller cranial capacity	(2)
Question number	**Answer**	**Additional guidance**	**Mark**
(iii)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • likely to be out-competed by *Homo erectus* (1) • {for resources essential for survival/due to the presence of a new selection pressure} (1)	accept: named resources accept: named selection pressure, e.g. climate change, environmental change, disease	(2)
Question number	**Answer**	**Additional guidance**	**Mark**
(iv)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • stone tool B because it is more {sophisticated/worked} (1) • and *Homo erectus* lived more recently than *Homo habilis* (1)	accept: data quoted from the timeline	(2)

Q2.

Question number	Answer	Additional guidance	Mark
(i)	A description including **two** from: • by hitting it (1) • with another stone / rock / flint / something hard (1) • to knock flakes /chips off (1)	not just another object accept knapped (2)	**(2)** **AO2 1**

Question number	Answer	Mark
(ii)	B tool Q is more pointed than tool P **The only correct answer is B** ***A*** *is incorrect because colour does not tell you how advanced the maker of the tool was.* ***C*** *is incorrect because colour does not tell you how advanced the maker of the tool was.* ***D*** *is incorrect because Q is more pointed than P.*	**(1)** **AO3 2a**

Question number	Answer	Mark
(iii)	• natural (1) • mutate (1) Must be in the correct order Reject migrate against either mark	**(2)** **AO1 1**

Q3.

Question number	Answer	Additional guidance	Mark
(i)	the whale humerus is shorter / wider / stubbier	accept whale humerus is less likely to break / is stronger accept reverse arguments for humerus of human	**(1)** **AO2 1**

Question number	Answer	Additional guidance	Mark
(ii)	the horse has fewer phalanges	the horse has 3 phalanges whereas the human has 14 phalanges accept humans have smaller phalanges / the horse phalanges are thicker / stronger accept reverse arguments for human	**(1)** **AO2 1**

Q4.

Question number	Answer	Additional guidance	Mark
	A description linking four from: • there was variation in beak shape / mutations occurred that changed the shape of the beak (in some finches) (1) • thinner beaks are more suited to catching / extracting {the food available for finch A /insects / finch A's environment} (1) • the birds with thinner beaks {outcompeted / were more successful than / more likely to survive / obtained **more** food } (those with thicker beaks) (1) • (more) birds with thinner beaks reproduced and passed on **alleles** for thinner beaks (1) • this occurs over many generations / a long period of time (1)	accept reverse arguments	**(4)** **AO2 1**

Q5.

Question number	Answer	Additional guidance	Mark
	A description including **two** from: • compare with other tools / fossils (that have already been dated) (1) • from the (layer of) rock in which they are found / how deep down each was found (1) • radiometric dating / description of radiometric dating (1) • comparing to other finds (of known age) from the same layer (of rock) (1)	accept compare to other tools that are less well / better made	**(2)** **AO2 1**

Q6.

Question number	Indicative content	Mark
*	**Indicative content** **AO2 (6 marks)** **Indicative content** **Area 1 - Age of tools** • Younger rock layers towards top / older rock layers lower down • C is older than B which is older than A • Tools can be compared with other fossils from known time period • Rocks can be dated, e.g. radiometric dating **Area 2 - Quality of tools** • A is the most sophisticated / most finely worked / more specialised / more refined / more symmetrical • B shows some evidence of being worked / is rough • C most basic / most simple / less sophisticated / unworked **Area 3 – Skills and intelligence** • tools show evidence of greater human manipulation / greater skill (between C and A) • higher intelligence in more recent (species of) humans	**(6)** AO2 1

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1-2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3-4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5-6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Q7.

Question number	Answer	Additional guidance	Mark
	An explanation linking four of the following:		**AO2 1** **(4)**
	• people do not finish their course (of Colistin) (1)	accept overuse / repeated exposure (to the antibiotic)	
	• natural selection /evolution (occurs) (1)	accept they have evolved	
	• some bacteria have a mutation/ (genetic) variation (1)	accept some bacteria have a {**gene/allele**} for resistance	
	• (these) resistant bacteria survive /resistant bacteria reproduce (1)	accept the non-resistant bacteria die / the fittest bacteria survive ignore immune bacteria	

Q8.

Question number	Answer	Mark
(i)	A Charles Darwin **The only correct answer is A** ***B*** *is incorrect because Robert Hooke did not write On the Origin of Species* ***C*** *is incorrect because Richard Leakey did not write On the Origin of Species* ***D*** *is incorrect because Gregor Mendel did not write On the Origin of Species*	**(1)** **AO1 1**

Question number	Answer	Mark
(ii)	D new species evolve over many generations **The only correct answer is** D ***A*** *is incorrect because humans are related to other groups of animals* ***B*** *is incorrect because different species have different genes* ***C*** *is incorrect because dinosaurs did not evolve because of a meteor*	**(1)** **AO1 1**

Q9.

Question number	Answer	Additional guidance	Mark
(i)	An explanation including **four** of the following: • by natural selection / evolution (1) • mutation in the bacterium /variation in the population (1) • only the resistant bacteria **survived treatment by antibiotics /** resistant bacteria survive when people **don't finish the course** (1) • the resistant bacteria {reproduce / divide} (1) • offspring inherit the resistance / resistance passed onto future generations / process repeats increasing level of resistance (1)	accept *Klebsiella* for bacteria accept they evolve accept some bacteria have a **{gene/allele}** for antibiotic resistance accept non-resistant bacteria killed **by antibiotics** ignore offspring are identical	**(4)** **A02 1**

Question number	Answer	Additional guidance	Mark
(ii)	people not completing their course of antibiotics/overuse of antibiotics	accept acted as a selection pressure accept being used to treat viruses/examples ignore misuse unqualified	**(1)** **AO1 1**

Question number	Answer	Mark
(iii)	B it does not have a nucleus **The only correct answer is B** ***A*** *is incorrect because prokaryotic cells do not have chloroplasts* ***C*** *is incorrect because prokaryotic cells have ribosomes* ***D*** *is incorrect because prokaryotic cells can reproduce without a host*	**(1)** **AO1 1**

Q10.

Question number	Answer	Additional Guidance	Mark
(c)	A description linking **three** of the following: • they have a pentadactyl limb (1)	accept they have a **similar bone structure** / description of the **bone structure** ignore similar limb structure	**(3)** **AO1 1**
	• suggesting a **common ancestor** (1)	accept unlikely to have descended from different ancestors	
	• that also had a {pentadactyl limb / this limb structure} (1)		
	• how the structure has been adapted to different functions / description of the adaptations for a function (1)		

Q11.

Question number	Answer	Additional guidance	Mark
	A description including **three** of the following: • overproduction of offspring (1) • organisms in a species have {variation / mutations} (1) • there is {a struggle for existence / selection pressure / competition} (1) • the adapted organisms survive (1) • (reproduction leads to) offspring inheriting {characteristics / gene / allele /adaptation / trait} (1) • this is repeated over many generations (1)	accept there are differences within {species/organisms} accept named selection pressure /change in the environment accept survival of the fittest accept not adapted organisms die	**(3)** **AO2 1**

Q12.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** • bacteria reproduce rapidly generating a large population • there is variation among a bacterial population • some bacteria develop a resistance to antibiotics through mutation • antibiotic treatment exerts a selection pressure • bacteria resistant to antibiotics survive • antibiotic resistance inherited • non-resistant bacteria do not survive • levels of antibiotic resistance in a population of bacteria increase	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure that is clear, coherent and logical. (AO1)

Q13.

Question number	Answer	Additional guidance	Mark
	An explanation linking four of the following:		**(4)** **AO2 1**
	• the population of great tits shows variation (1)	accept there is a mutation that leads to some birds having longer beaks	
	• bird feeders provide a selection pressure (1)		
	• birds with longer beaks {can feed from bird feeders/get more food} (1)	accept there is competition for food / birds with longer beaks outcompete accept birds with shorter beaks can't get food	
	• these birds are more likely to {survive/ reproduce} / survival of the fittest (1)	accept birds with shorter beaks die out	
	• pass the {allele/gene /characteristic} for long beaks to their offspring (1)	accept offspring have long beaks	
	• over many generations the beak length of the bird population increases (1)	accept the process continues/repeats itself	

Q14.

Question number	Answer	Additional guidance	Mark
(i)	An explanation including the following: • (fewer bright feathers) would be less noticeable / they are camouflaged / they blend in (1) And **one** from: • therefore they are less likely to be eaten / by predators (1) • therefore more likely to get food / from prey (1)	 **ignore more likely to survive** accept ideas of less likely to be hunted / killed	**(2)** **A02 1**

Question number	Answer	Additional guidance	Mark
(ii)	An answer including the following: • female birds are those who {produce offspring / lay eggs} (1) • one male bird can reproduce with many female birds (1)	 accept males do not produce the {offspring / eggs} reject males don't reproduce accept {named species/in **rare** cases} females can reproduce asexually	**(2)** **AO2 1**

Q15.

Question Number	Answer	Additional Guidance	Mark
(i)	location in the rock layer / age of fossils surrounding it	accept radiometric dating / stratigraphy / comparison to other *Hipparion* fossils ignore carbon dating	**(1)** **AO2 1**

Question Number	Answer	Additional Guidance	Mark
(ii)	similar (pentadactyl) limb structure / similarities in the {skeleton / bone} structure	ignore similar body shape	**(1)** **AO3**

Q16.

Question Number	Answer	Additional guidance	Mark
(i)	• same structure of bones/examples of bone structure (1) • (structure is) unlikely to have occurred more than once during evolution / common ancestor had {the pentadactyl limb structure /similar limb structure} (1)	 accept unlikely that different ancestors would have had the same structures	**(2)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	• compare the {genes/sequence of genes} from different organisms (1) • closely related organisms have {more similar/identical} sequences /differences in sequence can show evolution (1)	accept idea of identifying similarities and differences in the {genes/sequences} accept organisms with similar gene sequences share a common ancestor	**(2)** AO 1 1