

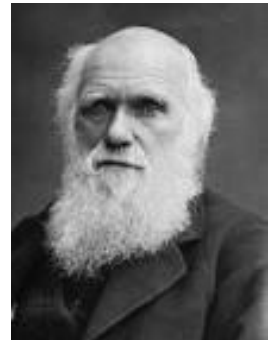
PISA Style Scientific Literacy Question

On the Origin of Species

On the Origin of Species – Text 1

Read the following extract from Charles Darwin's book 'On the Origin of Species'

'Can it then be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each being in the great and complex battle of life, should sometimes occur in the course of thousands of generations? If such do occur, can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having an advantage, however slight, over others, would have the best chance of surviving and procreating their kind? On the other hand, we may feel that any variation in the least degree injurious would be rigidly destroyed'.



Question 1 : ON THE ORIGIN OF SPECIES

In this piece of text, Darwin is explaining his theory of evolution. He called this

- A Natural Selection
- B Adaptation
- C Inheritance
- D Variation

Question 2 : ON THE ORIGIN OF SPECIES

At the time, Darwin's theory was not widely accepted. Which of the reasons below would explain why people did not support his idea?

Reason why people did not support Darwin's theory	Yes or No ?
There was little scientific evidence to support his theory	Yes / No
The theory of creationism as taught by the church was widely believed and accepted	Yes / No
People did not know about Darwin's theory because there was no radio or television	Yes / No
Other scientists had come up with similar theories to Darwin	Yes / No

Question 3 : ON THE ORIGIN OF SPECIES

Mali says that the theory of natural selection as described by Darwin in the text does not apply so well for humans. Which of the following statements best supports her argument?

- A Humans all look slightly different to one another
- B Some humans are able to run very fast but others are not
- C Humans tend to look after other humans who are sick or have disabilities
- D Humans compete with one another for homes, food and other resources

On the Origin of Species – Text 2

'When we see leaf-eating insects green, and bark feeders mottled grey, the alpine ptarmigan white in winter, the red-grouse the colour of heather, and the black-grouse that of peaty earth, we must believe that these tints are of service to these birds and insects in preserving them from danger.

'Hence I can see no reason to doubt that natural selection must be most effective in giving the proper colour to each kind of grouse, and in keeping that colour, once acquired, true and constant'.

Question 4 : ON THE ORIGIN OF SPECIES

What process is Charles Darwin talking about in this piece of text?

- A Adaptation
- B Reproduction
- C Variation
- D Inheritance

Question 5 : ON THE ORIGIN OF SPECIES

In this piece of text Darwin is describing colour as being important to helping these organisms to survive. Which statement fits best with the information in the text to describe how Darwin thinks the colour helps the survival of the organisms?

- A It makes them attractive to mates
- B It camouflages them from predators
- C It makes them obvious to predators
- D It regulates their temperature by absorbing different amounts of sunlight

Question 6 : ON THE ORIGIN OF SPECIES

What would be the effect on the red grouse if large areas of heather were to be cleared?

SCORING : ON THE ORIGIN OF SPECIES

Question 1

Full credit :

A Natural Selection

No credit :

Other responses

Missing

Narrative

Natural selection is the process by which the organisms with the most favourable or advantageous characteristics will go on to survive and breed. The theory of Natural Selection is often linked to the phrase 'Survival of the fittest'. Natural selection says that the organisms which are less well adapted and not able to compete successfully will not go on to survive and breed.

Adaptation is the term used to describe the ways in which an organism is suited to survive in a particular habitat or environment.

Inheritance is the process by which characteristics are passed on from one generation to another via the genes.

Variation is the differences between the organisms within a species or population.

Framework Categories	2015 Framework
Knowledge Type	Knowledge of the content of science
Competency	Explain phenomena scientifically
Context	Natural resources – local Environmental quality - global
Cognitive demand	Low

Question 2

Full credit :

Yes, Yes, Yes, No, in that order.

No credit :

Other responses

Missing

Narrative

Yes – the lack of evidence would have been a reason to reject Darwin’s theory. People would want to see evidence of the process happening before they believed it.

Yes – People were much more religious in Darwin’s time, and paid more attention to the teachings of the church than perhaps they do now. The theory of creationism was widely accepted in Darwin’s time. People may also have been afraid to speak out against the church leaders at that time.

Yes – People were less well educated and many would not have been able to read at the time. There was no radio or television to spread information about Darwin’s ideas to a wide audience. People may not have supported Darwin’s theory because they did not know about it.

No – The fact that other scientists (such as the Welsh scientist Alfred Russel Wallace) had come up with similar theories should have been a reason for people to support Darwin’s theory. People are more likely to believe something if they hear the same information from a number of different sources.

Framework Categories	2015 Framework
Knowledge Type	Epistemic
Competency	Interpret data and evidence scientifically
Context	Natural resources – local Environmental quality - global
Cognitive demand	Medium

Question 3

Full credit :

C Humans tend to look after other humans who have injuries or disabilities

No credit :

Other responses

Missing

Narrative

A – this is an argument *for* natural selection, as the theory of natural selection is based on variation between organisms

B – this is again an argument *for* natural selection, as this statement refers to a characteristic that could give an advantage over others.

C – this is the best statement to support Mali’s argument that natural selection does not occur in humans. In the wild, those who are poorly adapted or have disadvantageous characteristics are not able to compete successfully and do not survive and breed. Humans tend to support those of their kind that have characteristics that could be seen as disadvantageous and help them so they are able to survive and breed. Because of this it could be said that natural selection does not occur in the human population.

D - this is also an argument *for* natural selection, because the theory of natural selection says that those who are able to compete better will be the ones that will survive and breed (survival of the fittest).

Framework Categories	2015 Framework
Knowledge Type	Knowledge of the content of science
Competency	Explain phenomena scientifically
Context	Natural resources – local Environmental quality - global
Cognitive demand	Medium

Question 4

Full credit :

A Adaptation

No credit:

Other responses

Missing

Narrative

A is correct. Darwin is explaining the ways that each of these organisms adapt to their environment in terms of their colour helping to camouflage them from predators.

B - Reproduction is the process by which species are continued – more organisms of that species are produced.

C - Variation is the differences in characteristics between the organisms in a population.

D - Inheritance is the process by which characteristics are passed on from one generation to another via the genes.

Framework Categories	2015 Framework
Knowledge Type	Knowledge of the content of science
Competency	Explain phenomena scientifically
Context	Natural resources – local Environmental quality - global
Cognitive demand	Low

Question 5

Full credit :

B It camouflages them from predators

No credit :

Other responses

Missing

Narrative

A – There is no reference in the text to their colour making them attractive to mates. Darwin is only referring to them being preserved from danger.

B – Darwin says ‘we must believe that these tints are of service to these birds and insects in preserving them from danger’. The most likely danger that he is referring to is being eaten by predators. This statement is the best fit – that the colour will help them to hide, or camouflage them, from predators.

C – This statement does not fit with what Darwin says, he says that the tints may preserve them from danger – this statement says the opposite, that the tints make them more likely to be seen by predators.

D – Darwin does not make any reference to temperature regulation in the text. The focus of the text is the way that the tints help to preserve them from danger.

Framework Categories	2015 Framework
Knowledge Type	Knowledge of the content of science
Competency	Explain phenomena scientifically
Context	Natural resources – local Environmental quality - global

Cognitive demand	Medium
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Question 6

Full credit :

Numbers would reduce/ go down / decrease / they would die because they would be more obvious to / eaten by predators / could not hide in the heather/ could not be camouflaged by the heather (***both statements must be linked***)

Partial credit :

They would die out
 Numbers would go down / reduce / decrease
 They would be more obvious to predators
 They would get eaten by predators
 They could not hide in the heather
 They would not be camouflaged by the heather
 (these statements not linked)

Numbers would go down because they had no food
 Numbers would go down because they have nowhere to live / their habitat is gone
 They would have to find somewhere else to live

No credit:

Numbers would go up

Missing

Narrative

The information in the text suggests that the heather is providing camouflage for the red grouse, so if the heather were to be cleared we would likely see the numbers of red grouse decreasing because they are visible to predators and are being eaten. It may also be the case that some of the red grouse will move away from the area to find another area of heather where they can hide from predators. The text does not suggest that the red grouse rely on the heather for food, only that it provides camouflage, so answers which suggest that the numbers will decrease because the red grouse have no food are not correct.

Framework Categories	2015 Framework
Knowledge Type	Knowledge of the content of science
Competency	Explain phenomena scientifically

Context	Natural resources – local Environmental quality - global
Cognitive demand	Medium