



Answers Evolution

Year 10 Science

Chapter 3

p39	<ol style="list-style-type: none">1 Evolve means to develop gradually.2 The basic idea of biological evolution is that all species on Earth share a common ancestor. The common ancestor, through biological evolution, has given rise to the massive diversity of species both living and extinct.3 A species is a group of organisms that are capable of reproducing to produce fertile offspring. For example, a male lion and a female tiger can reproduce to produce a liger. However ligers are infertile, thus lions and tigers are different species.4 Speciation is the term used to describe the formation of new and distinct species in the course of evolution.5<ol style="list-style-type: none">a) True - The theory of evolution explains the diversity of life.b) False - The theory of evolution provides an explanation for the origin of life.c) True - The theory of evolution assumes that all species share a common ancestor.d) True - Geographical isolation is one way by which new species occur.e) True - The second name in <i>Homo sapiens</i> identifies the species (The first name indicates the genus).
p41	<ol style="list-style-type: none">1 Which of the following is the better description of natural selection?<ol style="list-style-type: none">c) Natural selection is the process by which individuals better suited to their environment tend to survive and produce more offspring.2 Charles Darwin based the process of natural selection on his observation of the following key points:<ul style="list-style-type: none">• More offspring are produced than can possibly survive.• The individuals in a species have a wide range of variation.• The individuals in a species with characteristics that most suit the environment are more likely to survive and reproduce.• The genetic traits that aid the individuals to survive are passed onto their offspring.3 Briefly describe why there were:<ol style="list-style-type: none">a) The English Industrial Revolution in the early to mid 1800s produced large amounts of pollution. The pollution blackened the trees with soot and killed the lichen. It was then noticed that most of the peppered moths had large amounts of black peppering on their wings. It was suggested that their dark colour allowed them to blend with the dark-coloured trees.b) Since the Clean Air Act of 1950, trees have begun to lose their black soot coating and the lichens have regrown. The black peppered moth is now preyed upon more often than the white peppered moth. The white peppered moth is now more common.

p43

1

Beak shape	Suitable for
large powerful	larger harder seeds
small	small seeds in low vegetation
long pointed	pollen and nectar in cactus lowers
sharper	grasping insects

- 2 A single migration suggests that a single freakish weather condition allowed a group of finches to migrate from South America.
- 3 The Galapagos Islands are relatively newly formed and predators haven't been present on the islands during the evolution of the finches.
- 4 The *Geospiza magnirostris*, with a beak suited to eat harder seeds, is more likely to survive if hot and dry spells become more common on the Galapagos Islands and leave mainly harder seeds.

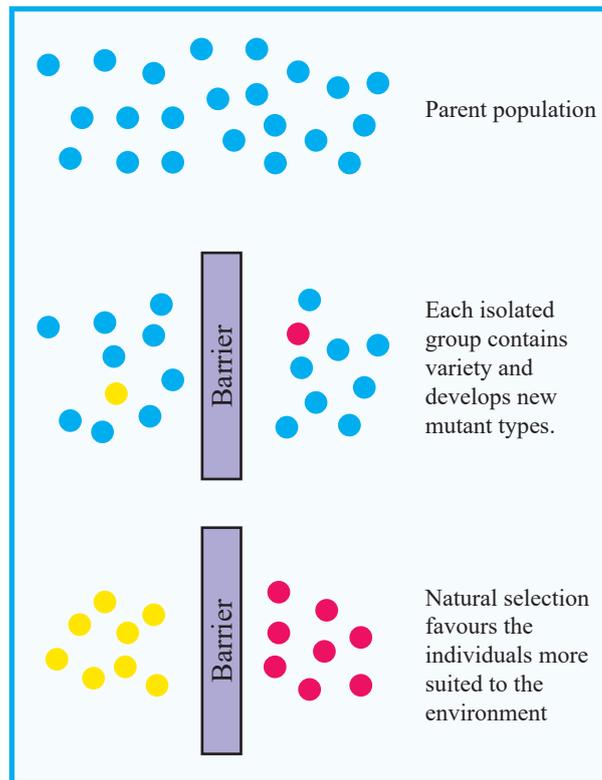
p47

1 **Speciation** is the term used to describe the formation of new and distinct species in the course of evolution.

2 What are thought to be the two major factors in the process of speciation?

- **Isolation.** A group of organisms may evolve into a new species if it is isolated from the parent population.
- **Adaptation by natural selection.** An isolated population will have adaptations which increase its survival in the local environment. This natural selection modifies the population to the extent that it becomes a new species.

3 Draw a labelled sketch showing how, over many generations through isolation and natural selection, a parent population can be split into two separate species.



4 Isolation of groups of individuals from the parent population is considered a major factor in the formation of new species. Describe three different ways in which groups can be isolated from their parent population.

- **Geographical barriers** such as mountain ranges, rivers, and seas can separate a group from its parent population.
- **Ecological barriers** such as different habitats, breeding areas, salinity, and pH can separate a group from its parent population.
- **Reproductive barriers** such as different physical appeal, mating ritual, and mating times can separate a group from its parent population.

p47	<p>5 Island speciation proposes that:</p> <ul style="list-style-type: none"> • Plants and animals migrate to geographically isolated islands from a nearby mainland. • The geographically isolated group develops new mutant types and natural selection favours the individuals more suited to the environment. • Over many generations, and as groups migrate from island to island, speciation occurs.
p49	<p>1 Artificial selection or selective breeding has been used by farmers for thousands of years to ‘select’ desirable characteristics from their plants and animals.</p> <p>2 A classic example of artificial selection is the selective breeding, over many generations, of cabbage, cauliflower, broccoli, brussels sprouts, and kohlrabi from an ancestral population of wild mustard (<i>Brassica oleracea</i>).</p> <p>3 Another classic example is the selective breeding of domesticated dogs, <i>Canis familiaris</i>, from an ancestral grey wolf some 15,000 years ago. The Great Dane is the result of many generations of selective breeding. The desired traits of the Great Dane are speed, agility, strength, and endurance. The Great Dane was bred for hunting European wild boar.</p> <p>4 Which two varieties of fruit plant would you choose to cross to produce a plant with abundant disease resistant fruit?</p> <p>Either variety 3 and variety 2 or variety 3 and variety 4</p>
p51	<p>1 Complete the hypothesis ‘If all organisms have a common ancestor then ...’.</p> <p>If all organisms have a shared ancestry, then all living things should have certain characteristics in common.</p> <p>2 Using Pierre Belon’s 1555 illustrations of a human skeleton and a bird skeleton, indicate 10 anatomical similarities.</p> <p>The main difference between a bird skeleton and a human skeleton is that the bird’s skeleton is adapted for flight. For example, the bones of a bird are hollow. There are many similarities between a human and bird skeleton:</p> <p>The humerus, the radius, and the ulna are similar (Bones of the arm).</p> <p>The cranium is similar (Bone covering the brain).</p> <p>The scapula is similar (Shoulder bone).</p> <p>The femur is similar (Thigh bone).</p> <p>The ribcages are similar.</p> <p>The spine is similar (Bone).</p> <p>The human tibia and fibula is similar (Bones of the lower leg).</p> <p>3 A human has 23 pairs of chromosomes and chimpanzees have 24 pairs of chromosomes. What is the explanation for this difference given that humans and chimpanzees are assumed to have a common ancestor?</p> <p>The human chromosome 2 is an almost exact match for two separate chimpanzee chromosomes if they were fused together. This suggests a common ancestor for humans and chimpanzees.</p> <p>4 DNA evidence suggests that humans and chimpanzees are more closely related than are humans and orangutans. Can you find any evidence from the skeletons on the opposite page to support the DNA evidence?</p> <p>The skull shape of the chimpanzee is more closely related to the skull shape of the human.</p> <p>The radius and ulna shape of the chimpanzee is more closely related to the radius and ulna shape of the human.</p>

p53

- 1 Complete the following hypothesis: 'Evolutionary theory predicts that, **if** all organisms have a shared ancestry, **then** the fossil record

If all organisms have a shared ancestry, **then** the fossil record should show a succession of species.

- 2 The fossil record contains evidence of around 25,000 species of past life. Why is it thought that this is only a small fraction of the variety of past life?
The fossil record of evolutionary history is incomplete because soft-bodied species are unlikely to be fossilised, fossilisation will only happen in specific conditions, and many fossils are destroyed by weathering and earth movements. The conclusion is that the fossil record shows only a very small fraction of the variety of past life.
- 3 Does the fossil evidence support the theory that all organisms have a shared ancestry?
While the fossil record provides some evidence, the fossil record doesn't show a continuous transition from a common ancestor through to the massive diversity of later species.
- 4 The table suggests that mammals have been on Earth for 245 million years.

p55

- 1 Complete the hypothesis '**If** all organisms have a common ancestor **then**'.
If all organisms have a shared ancestry, **then** all living things should have certain characteristics in common.
- 2 **Biogeography** is the study of the distribution of species and ecosystems both geographically and over time.
- 3 Explain why marsupials are found in both Australia and South America.
Continental drift provides an explanation for the geographical isolation of marsupials and other species. It is generally thought that marsupials originated in Asia, diversified and dispersed through Gondwanaland around 65 million years ago. It is theorised that marsupials moved from South America to Antarctica to Australia about 50 million years ago before Australia was separated by continental drift.
- 4 Provide two biogeographical examples supporting the theory of a common ancestor and continental drift.
Support for the theory of a common ancestor and continental drift is provided by:
 - The protea family of plants are found only in southern South America, southern South Africa, Australia, and New Zealand.
 - There are about 40 species of southern beech distributed across Australia, South America, and New Zealand.
 - Platypus fossils have been found in South America.
 - The *Fitzroya tasmanensis* conifer grows only in South America. Fossils of this conifer are found in Tasmania.
- 5 If marsupials were dispersed throughout Gondwana then marsupial fossils should exist in southern South Africa. Why would it be expected that marsupials once lived in southern South Africa?
Gondwana is a supercontinent that is theorised to have existed from about 500 to 180 million years ago. Gondwana included South America, Africa, India, Antarctica, and Australia. The existence of Gondwana suggests that If marsupials were dispersed throughout Gondwana then marsupial fossils should exist in southern South Africa.

<p>p56</p>	<ol style="list-style-type: none"> 1 Genetically modified crops are agricultural plants that have been genetically modified to introduce a new trait. 2 Genetically modified crops attractive to farmers and consumers because they produce produce with new traits such as disease resistance, pest resistance, new flavour, improved nutrients, etc, 3 Genetic modification is achieved by adding or removing nucleotide sequences from the DNA of the plant. One common method is to shoot, under pressure, DNA sequences into the nucleus of a target plant cell. A second method is to attach desired DNA sequences onto a bacteria that naturally insert genes into target plant cells. 4 A number of groups are concerned about the use of genetically modified crops. There are concerns genetically modified foods may be harmful when eaten, that genetically modified organisms may cause ecological damage, that genetic modification is ‘unnatural’, that accidents may happen when using biotechnology, etc.
<p>p57</p>	<ol style="list-style-type: none"> 1 A mutation is a change in the sequence of nucleotides in the DNA of an organism. 2 A mutant is the term given to an organism displaying a mutation. 3 Mutations can have many causes. The majority of mutations are caused by faulty copying of DNA during cell division for growth and repair. 4 Mutations are considered to be completely random. For example, buffalo fly develop resistance to insecticides. It is theorised that buffalo fly with insecticide resistances are part of the buffalo fly population and become more frequent when insecticides are applied. It is not thought that the insecticides induce resistant mutations. 5 Apply the same theory to how disease-causing organisms develop antibiotic resistance. It may be theorised that disease-causing organisms with antibiotic resistances are part of the disease-causing organisms population and become more frequent when antibiotics are applied. It is not thought that the antibiotic induces resistant mutations.

p60

- 1 Evolve means to develop gradually.
- 2 The basic idea of biological evolution is that all species on Earth share a common ancestor. The common ancestor, through biological evolution, has given rise to the massive diversity of species both living and extinct.
- 3 A **species** is a group of organisms that are capable of reproducing to produce fertile offspring. For example, a male lion and a female tiger can reproduce to produce a liger. However ligers are infertile, thus lions and tigers are different species.
- 4 **Speciation** is the term used to describe the formation of new and distinct species in the course of evolution.
- 5
 - a) True - The theory of evolution assumes that all species share a common ancestor.
 - b) True - Geographical isolation is one way by which new species occur.
 - c) True - The second name in *Homo sapiens* identifies the species (The first name indicates the genus).
- 6 Which of the following is the better description of natural selection?
 - c) Natural selection is the process by which individuals better suited to their environment tend to survive and produce more offspring.
- 7 Charles Darwin based the process of natural selection on his observation of the following key points:

More offspring are produced than can possibly survive.

Variation - The individuals in a species have a wide range of variation.

Selection - The individuals in a species with characteristics that most suit the environment are more likely to survive and reproduce.

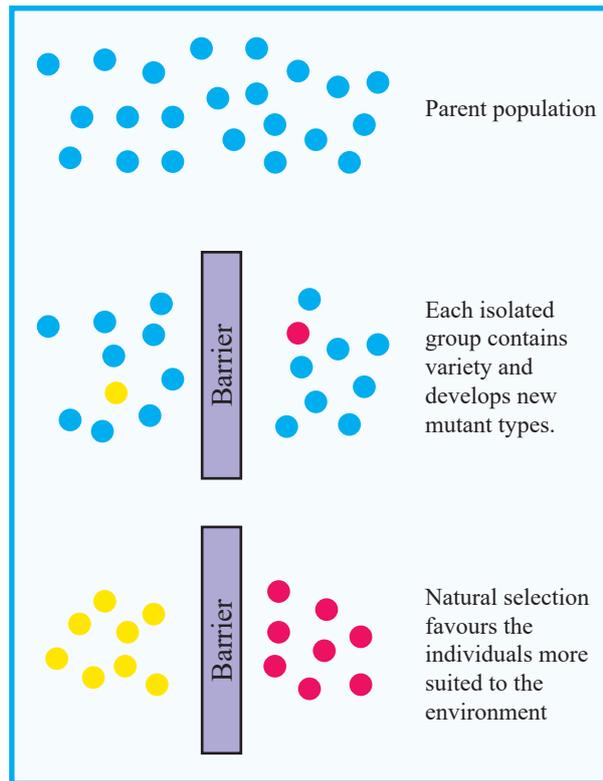
Adaptation - The genetic traits that aid the individuals to survive are passed onto their offspring.

p61

- 1

Beak shape	Suitable for
large powerful	larger harder seeds
small	small seeds in low vegetation
long pointed	pollen and nectar in cactus lowers
sharper	grasping insects
- 2 A single migration suggests that a single freakish weather condition allowed a group of finches to migrate from South America.
- 3 The Galapagos Islands are relatively newly formed and predators haven't been present on the islands during the evolution of the finches.
- 4 **Speciation** is the term used to describe the formation of new and distinct species in the course of evolution.
- 5 What are thought to be the two major factors in the process of speciation?
 - **Isolation.** A group of organisms may evolve into a new species if it is isolated from the parent population.
 - **Adaptation by natural selection.** An isolated population will have adaptations which increase its survival in the local environment. This natural selection modifies the population to the extent that it becomes a new species.

- 6 Draw a labelled sketch showing how, over many generations through isolation and natural selection, a parent population can be split into two separate species.



- 7 Isolation of groups of individuals from the parent population is considered a major factor in the formation of new species. Describe three different ways in which groups can be isolated from their parent population.
- **Geographical barriers** such as mountain ranges, rivers, and seas can separate a group from its parent population.
 - **Ecological barriers** such as different habitats, breeding areas, salinity, and pH can separate a group from its parent population.
 - **Reproductive barriers** such as different physical appeal, mating ritual, and mating times can separate a group from its parent population.
- 8 **Island speciation** proposes that:
- Plants and animals migrate to geographically isolated islands from a nearby mainland.
 - The geographically isolated group develops new mutant types and natural selection favours the individuals more suited to the environment.
 - Over many generations, and as groups migrate from island to island, speciation occurs.

- 1 Complete the hypothesis 'If all organisms have a common ancestor **then**'.

If all organisms have a shared ancestry, **then** all living things should have certain characteristics in common.

- 2 A human has 23 pairs of chromosomes and chimpanzees have 24 pairs of chromosomes. What is the explanation for this difference given that humans and chimpanzees are assumed to have a common ancestor?

The human chromosome 2 is an almost exact match for two separate chimpanzee chromosomes if they were fused together. This suggests a common ancestor for humans and chimpanzees.

- 3 **Artificial selection** or **selective breeding** has been used by farmers for thousands of years to 'select' desirable characteristics from their plants and animals.
- 4 Which two varieties of fruit plant would you choose to cross to produce a plant with abundant disease resistant fruit?

Either variety 3 and variety 2 or variety 3 and variety 4

p63

- 2 Grandmother on her father's side.
- 3 The crossed out numbers are replaced by zeros
011
000
009
sum = 20

4



p64

- 1 Complete the following hypothesis: 'Evolutionary theory predicts that, **if** all organisms have a shared ancestry, **then** the fossil record

If all organisms have a shared ancestry, **then** the fossil record should show a succession of species.
- 2 The fossil record contains evidence of around 25,000 species of past life. Why is it thought that this is only a small fraction of the variety of past life?

The fossil record of evolutionary history is incomplete because soft-bodied species are unlikely to be fossilised, fossilisation will only happen in specific conditions, and many fossils are destroyed by weathering and earth movements. The conclusion is that the fossil record shows only a very small fraction of the variety of past life.
- 3 Does the fossil evidence support the theory that all organisms have a shared ancestry?

While the fossil record provides some evidence, the fossil record doesn't show a continuous transition from a common ancestor through to the massive diversity of later species.
- 4 Complete the hypothesis '**If** all organisms have a common ancestor **then**'.

If all organisms have a shared ancestry, **then** all living things should have certain characteristics in common.
- 5 **Biogeography** is the study of the distribution of species and ecosystems both geographically and over time.
- 6 Explain why marsupials are found in both Australia and South America.

Continental drift provides an explanation for the geographical isolation of marsupials and other species. It is generally thought that marsupials originated in Asia, diversified and dispersed through Gondwanaland around 65 million years ago. It is theorised that marsupials moved from South America to Antarctica to Australia about 50 million years ago before Australia was separated by continental drift.

<p>p64</p>	<p>7 Provide two biogeographical examples supporting the theory of a common ancestor and continental drift.</p> <p>Support for the theory of a common ancestor and continental drift is provided by:</p> <ul style="list-style-type: none"> • The protea family of plants are found only in southern South America, southern South Africa, Australia, and New Zealand. • There are about 40 species of southern beech distributed across Australia, South America, and New Zealand. • Platypus fossils have been found in South America. • The <i>Fitzroya tasmanensis</i> conifer grows only in South America. Fossils of this conifer are found in Tasmania. <p>8 If marsupials were dispersed throughout Gondwana then marsupial fossils should exist in southern South Africa. Why would it be expected that marsupials once lived in southern South Africa?</p> <p>Gondwana is a supercontinent that is theorised to have existed from about 500 to 180 million years ago. Gondwana included South America, Africa, India, Antarctica, and Australia. The existence of Gondwana suggests that If marsupials were dispersed throughout Gondwana then marsupial fossils should exist in southern South Africa.</p>
<p>p65</p>	<p>1 C - The original plate A is washed with the same antibiotic and the same colony survives. b) the genetic variety of bacteria includes antibiotic resistant bacteria.</p> <p>2 d)</p>
<p>p66</p>	<p>1 Gondwana is a supercontinent that is theorised to have existed from about 500 to 180 million years ago. Gondwana included South America, Africa, India, Antarctica, and Australia. The existence of Gondwana suggests that if the Nothofagus plant was dispersed throughout Gondwana then evidence of the Nothofagus plant may exist in Australia, New Zealand, New Caledonia, South America, and in Antarctica.</p> <p>2 Variety 4 and variety 3.</p> <p>3 c) Selective breeding.</p> <p>4 b) Some giraffes have short necks, some giraffes have longer necks. The longer necked giraffes had higher survival rates and reproduced more young with longer necks.</p> <p>5 Island speciation proposes that:</p> <ul style="list-style-type: none"> • Plants and animals migrate to geographically isolated islands from a nearby mainland. • The geographically isolated group develops new mutant types and natural selection favours the individuals more suited to the environment. • Over many generations, and as groups migrate from island to island, speciation occurs.