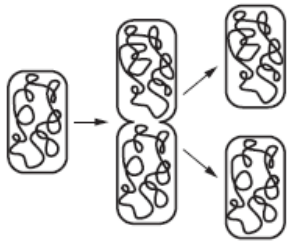
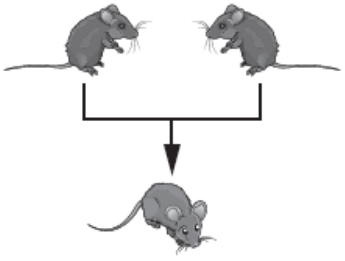
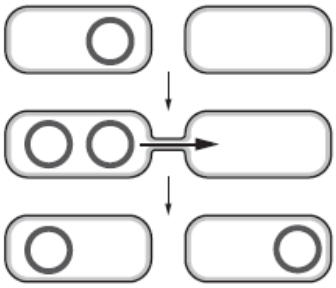
CfE Higher Biology

1. ## *Unit 1 DNA and the Genome*

The table shows three examples of gene transfer.

.

1	2	3
Asexual reproduction by bacteria	Sexual reproduction by mice	Plasmid transfer by bacteria
		

Which of these examples illustrate horizontal gene transfer?

A 2 only

B 3 only

C 1 and 2 only

D 1 and 3 only

2. The following are events in the evolution of life on Earth.

1 Animals appear
2 Vertebrates appear
3 Land plants appear

In which order are these events thought to have occurred?

A 1 2 3

B 1 3 2

C 3 1 2

D 3 2 1

3. New species have evolved when two populations have become

A isolated by a behavioural barrier

B unable to interbreed to produce fertile offspring

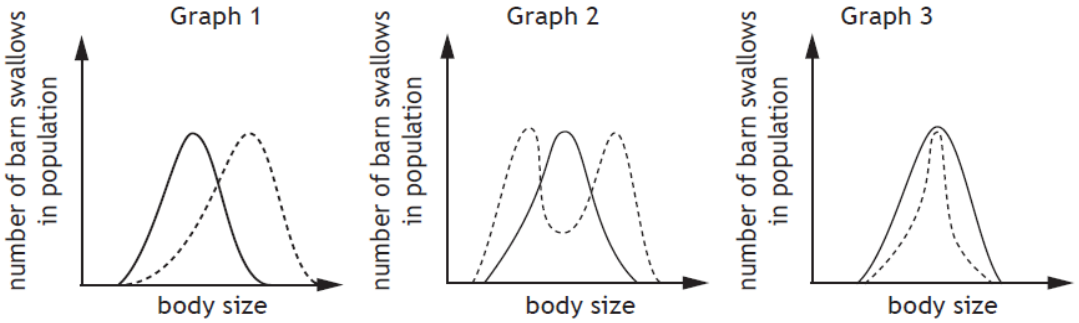
C very different due to directional selection

D very different due to disruptive selection.

4. The graphs below show possible changes in the body size of a population of barn swallows, *Hirudino rusticana*, in response to a selection pressure.

——— original population

---------- population after selection

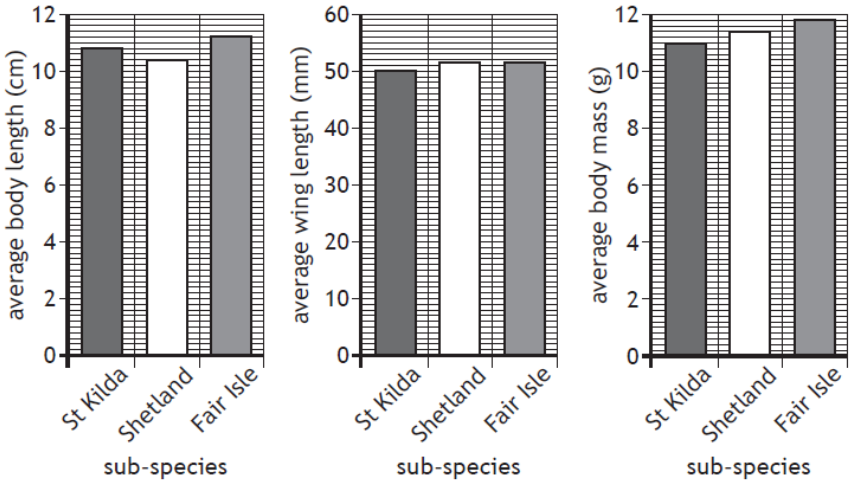


Which row in the table below matches each graph with the type of selection taking place?

	Graph		
	1	*2*	*3*
A	disruptive	directional	stabilising
B	directional	disruptive	stabilising
C	stabilising	disruptive	directional
D	directional	stabilising	disruptive

5. Subspecies of the wren (*Troglodytes troglodytes*) have evolved in different island areas in Scotland.

The graphs show averages of body length, wing length and body mass for wrens from the islands of St Kilda, Shetland and Fair Isle.



Which of the following conclusions can be drawn from this data?

A Shetland and Fair Isle wrens have a greater average wing length and body mass than St Kilda wrens

B St Kilda and Fair Isle wrens have a greater average body length and wing length than Shetland wrens

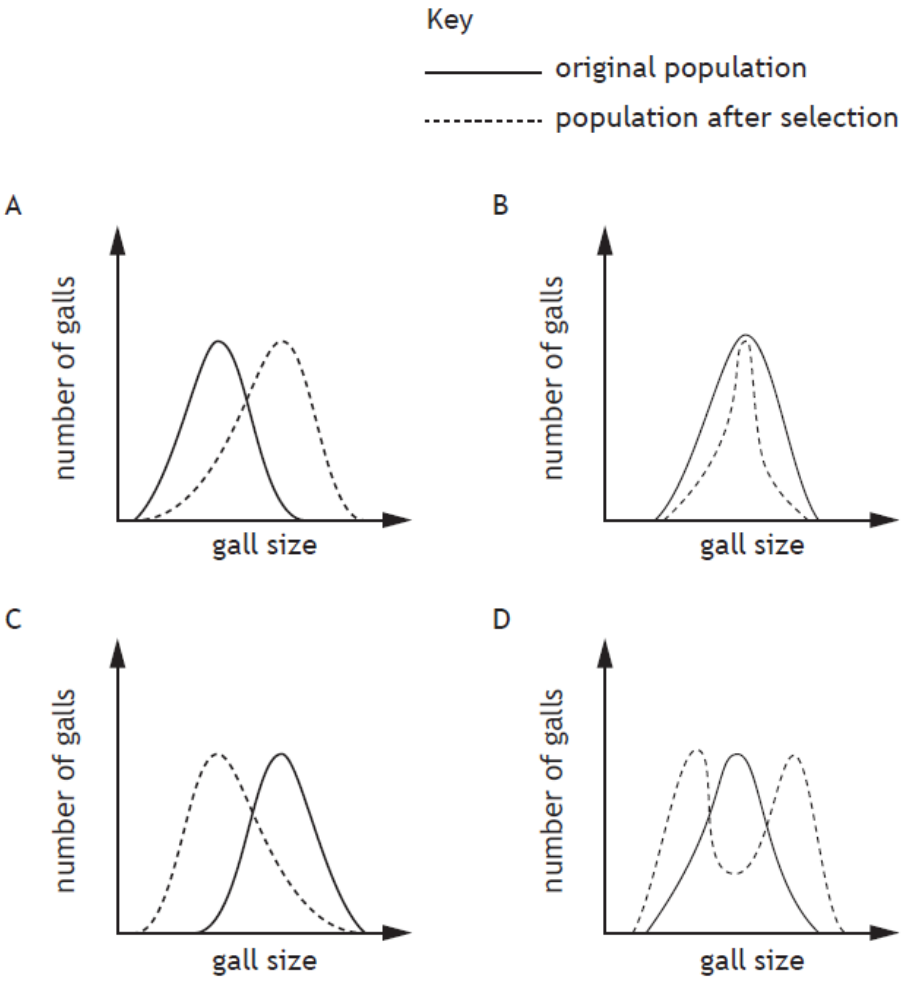
C St Kilda wrens are smaller in each characteristic than the other two subspecies

D Fair Isle wrens are larger in each characteristic than the other two subspecies

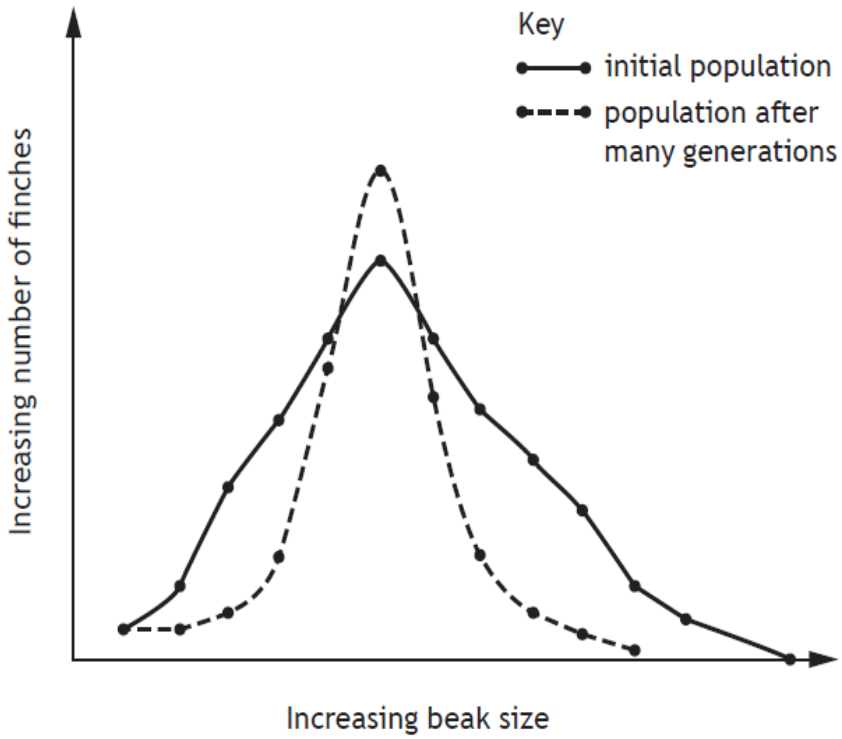
6. Goldenrod gall flies (*Eurosta solidaginis*) lay eggs on the stems of several plant species. The newly hatched larvae then burrow into the plant, causing the growth of a mass of plant tissue (gall) around them. The larvae live and feed inside the gall.

The size of gall is affected by two different selection pressures. Larvae in smaller galls are more likely to be predated by wasps, while larvae in larger galls are more likely to be predated by birds.

Which diagram represents the type of selection affecting gall size?



7. A population of finches became isolated on an island. The graph shows the range of beak sizes within the initial population at the time of isolation and in the population after many generations.



Which row in the table shows the type of selection pressure and the type of speciation which might be expected to occur in this example?

	Selection pressure	*Speciation*
A	directional	allopatric
B	directional	sympatric
C	stabilising	allopatric
D	stabilising	sympatric

8. In the North Pacific Ocean there are two different populations of killer whales *Orcinus orca*. One population feeds mainly on fish while the other feeds mainly on sea mammals.

This behavioural barrier has led to considerable genetic variation between these populations.

(a) (i) Name the type of speciation which could occur as a result of this barrier. 1

_____

(ii) State the importance of isolation barriers in speciation. 1

_____

_____

(iii) Scientists believe that these two populations are still the same species.

Suggest how they could confirm this. 1

_____

_____

9.

The herbicide glyphosate is used to control the annual weed charlock (*Sinapis arvensis*) in cereal fields.

An investigation was carried out into the effect of glyphosate on the development of glyphosate resistance in charlock plants in a cereal plot.

The charlock plants were treated with glyphosate from 2009 to 2016 and the percentage of glyphosate resistant plants in the plot was recorded every year.

The results are shown in the table.

Year	*Charlock plants resistant to glyphosate* (%)
2009	10
2010	18
2011	32
2012	42
2013	53
2014	58
2015	66
2016	66

(a) Using values from the table describe the change in glyphosate resistance over the time of investigation. **2**

(b) Explain how natural selection resulted in the change in glyphosate resistance. **2**

(c) Another investigation was carried out into the development of antibiotic resistance in bacteria. It was observed to be more rapid than the development of glyphosate resistance in charlock.

Explain this observation in terms of gene transfer. **1**

10. *Staphylococcus aureus* (*S.aureus*) is a species of bacteria that lives on human skin. This species of bacteria can cause infections if it enters the body through a wound. *S.aureus* infections can be treated with antibiotics such as methicillin and penicillin.

Infections can be caused by a strain of *S.aureus* called MRSA which is resistant to methicillin and penicillin and is becoming more common.

(a) The MRSA strain has developed resistance to antibiotics by gene transfer from another organism.

Identify the correct statement(s) relating to MRSA antibiotic resistance.

Tick (✓) the correct box(es). **2**

MRSA has developed antibiotic resistance through **horizontal** gene transfer from another organism.	
MRSA has developed antibiotic resistance through **vertical** gene transfer from another organism.	
This type of gene transfer in bacteria brings about a **rapid** evolutionary change.	
This type of gene transfer in bacteria brings about a **slow** evolutionary change.	

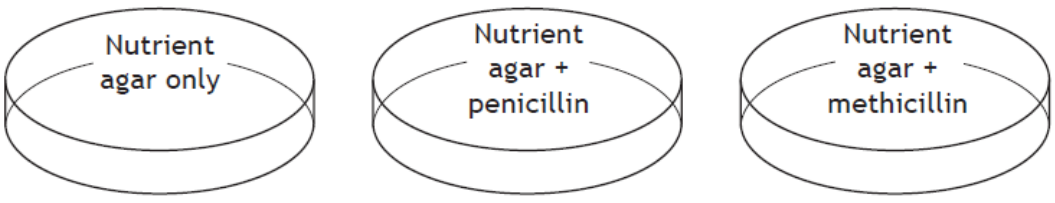
(b) Explain how the overuse of antibiotics has led to the increase in the population of MRSA. **2**

_____

_____

_____

(c) Samples were taken from a patient suspected of having a bacterial infection. The samples were used to inoculate plates of agar as shown in the diagram below.



(i) Predict the results if the cause of the bacterial infection was MRSA. **1**

_____

(ii) The nutrient agar contained specific amino acids required for protein synthesis. Suggest **one other** type of complex compound that the nutrient agar may have contained. **1**

_____

11. The Galapagos are a group of islands 600 to 800 miles off the coast of South America. Less than three million years ago some finches of a single ancestral species reached these islands from South America and bred successfully.

The number of islands has increased over time, further isolating groups of finches.

(a) Use this information to name the type of isolation barrier involved in the speciation of these finches and explain its role. **2**

Name _____

Explanation _____

_____

(b) The table shows the estimated number of islands and finch species in the Galapagos over the last 2·8 million years.

Time (millions of years ago)	Estimated number of islands in the group	Estimated number of finch species present
2·8	4	0
1·0	6	5
0·5	18	9
0·0	18	14

(i) Calculate the average increase in the number of finch species per million years over this entire period. **1**

Space for calculation

(ii) Suggest what could have caused the change in the number of finch species over the last 0·5 million years. **1**

_____

_____