

Name _____ Class _____ Date _____

1 Look at the picture of the family.



Kushi



Ranya



Jivraj



Sandeep

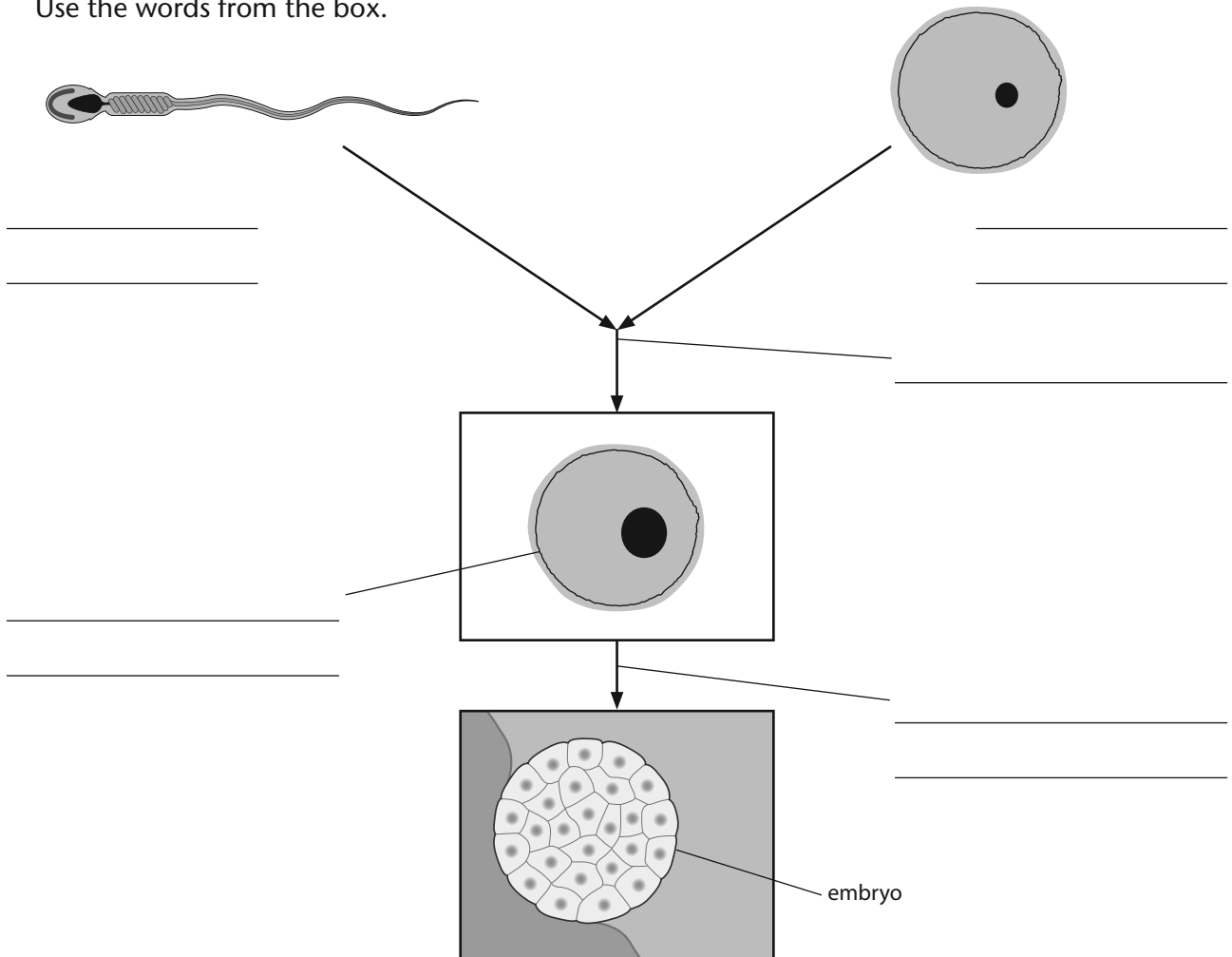
a What characteristics has Jivraj inherited from his mother? Tick the correct boxes.

- chin shape ear shape face shape hair type

b What characteristics has Ranya inherited from her father? Tick the correct boxes.

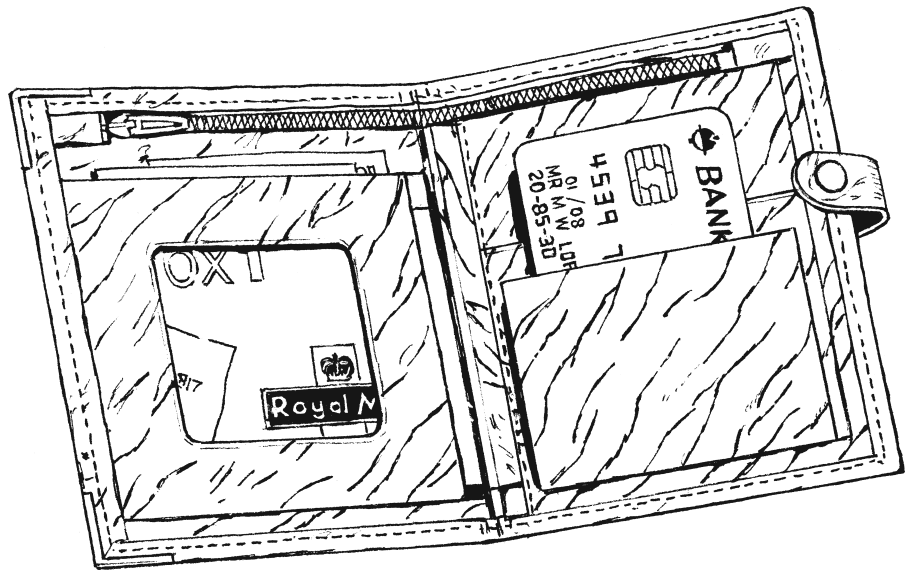
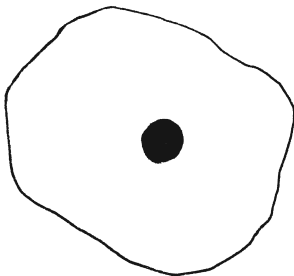
- chin shape ear shape face shape hair type

2 The diagram shows what happens before and after fertilisation. Fill in the labels on the diagram. Use the words from the box.



cell division egg cell fertilisation fertilised egg cell sperm cell

- 3 The drawing on the left shows a cell. The credit card on the right can be used to help explain how a cell works.



Complete the sentences by crossing out the wrong words in the brackets.

- a** The cell is like the (*wallet/credit card/chip*).
- b** The cell contains a (*nucleus/credit card/sperm cell*) which is like the wallet containing the (*wallet/credit card/chip*).
- c** The nucleus contains a store of (*genetic information/personal information/essential information*) just like the credit card contains a store of information on its (*wallet/credit card/chip*).

I CAN...

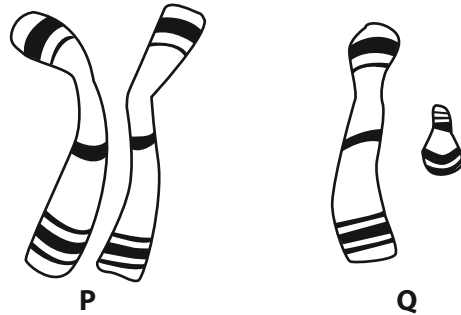
- identify inherited features
- recall what happens during fertilisation
- use everyday things to help explain how more complicated things work.

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1 How many chromosomes in total are there in one of your muscle cells? Tick the correct box.

- 0 12 23 46 92

2 The drawings show the sex chromosomes for two people.



- a Which person is male? _____
 b Which person is female? _____

3 Bharat has these alleles.



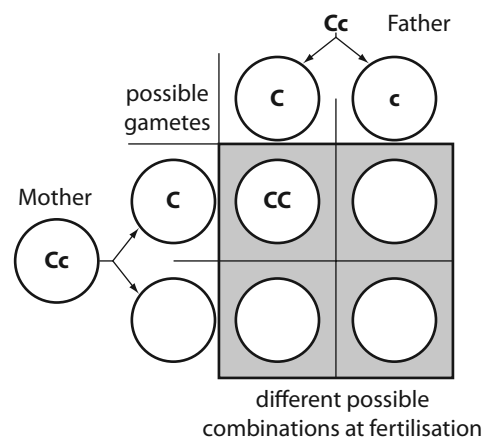
a Which of these is the best description of an allele? Tick the correct box.

- A gene that does not work.
 A gene that carries very slightly different instructions to another.
 A gene that can only work if there is another allele in the nucleus.
 A piece of DNA that gets into genes during fertilisation.

- b How many of the alleles shown for Bharat are recessive? _____
 c How do you know? _____

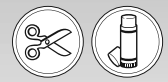
4 a Complete this Punnett square to show the possible combination of alleles for Ben and Belinda's children.

b Allele **C** is normal and allele **c** causes cystic fibrosis. What percentage of their children would have cystic fibrosis?



I CAN...

- explain that sex is determined in humans by chromosomes
- explain how dominant and recessive alleles cause their effects.



- 1 Cut out the chromosomes, match the pairs and stick them in your book.
- 2 Are these chromosomes from a boy or a girl?

I CAN... • explain how sex is determined in humans.

9
A
a

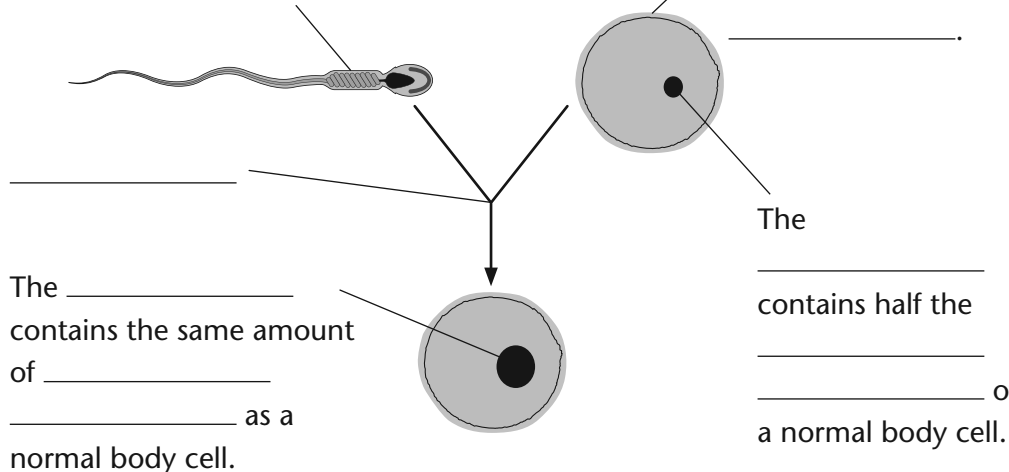
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1 Label the diagram using words from the box. You can use each word more than once.

- egg cell
- female sex cell
- fertilisation
- fertilised egg cell
- cell
- genetic information
- male
- nucleus
- sperm cell

The _____ sex cell is called the _____.

The _____ is called the _____.



2 Write down two ways in which a sperm cell is adapted to its function.

- i _____
- ii _____

3 The drawing shows an average family of superheroes.



a What characteristics has Terrific Tony inherited from Glider Man? Tick the correct boxes.

- chin shape ear shape hair type nose shape

b What characteristics has Lightning Liam inherited from Thunder Woman? Tick the correct boxes.

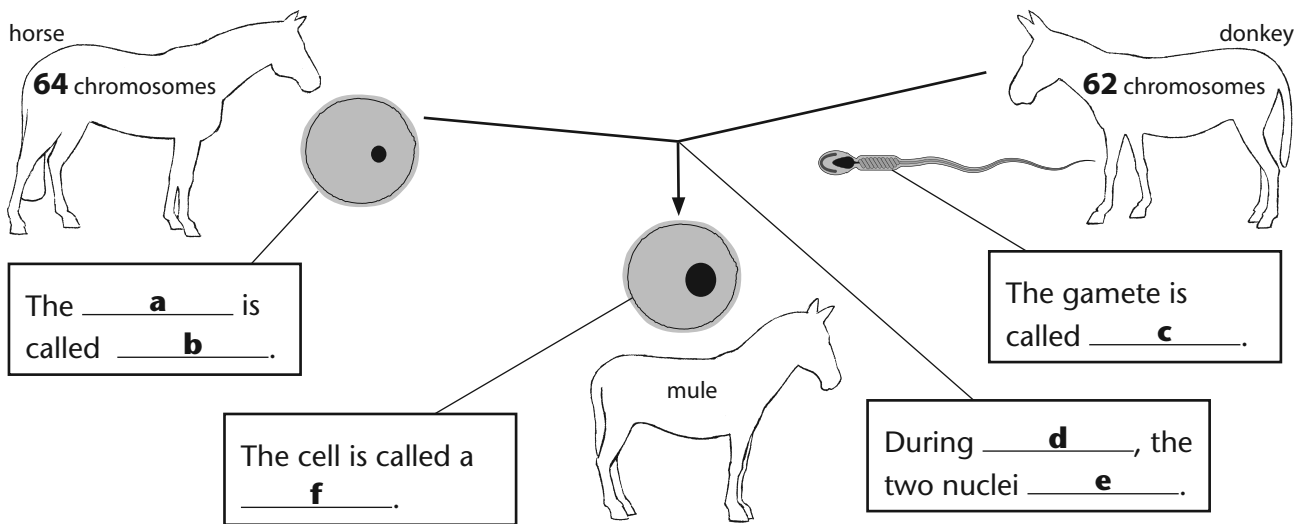
- chin shape ear shape hair type nose shape

c Explain why Lightning Liam and Terrific Tony do not look the same.

I CAN...

- recall how characteristics are inherited
- identify inherited features
- explain why offspring are not identical to their parents.

1 This diagram shows what happens during fertilisation when a horse and a donkey mate and produce a hybrid called a mule.



Write down the missing words shown by **a-f**. Each letter may represent several words.

- 2 **a** Which was the male animal – the horse or the donkey?
 - b** How do you know?
 - c** Horses and donkeys are different species. What does this mean?
 - d** The hybrid mule that is produced is said to be 'infertile'. What do you think this means?
 - e** How many chromosomes would you expect to find in the nucleus of a donkey gamete?
 - f** Explain your answer to part **e**.
 - g** Suggest how many chromosomes you would find in the nucleus of a mule body cell.
- 3 **a** List the following in order of size, starting with the largest.

cell chromosome gene nucleus organ tissue

b Genes contain genetic information. What does this mean?

4 The drawing shows an average family of superheroes.



- a** What characteristics has Terrific Tony inherited from Glider Man?
- b** What characteristics has Lightning Liam inherited from Thunder Woman?
- c** Explain why Lightning Liam and Terrific Tony do not look the same.

I CAN...

- describe how mixing of genes occurs during fertilisation
- identify inherited features
- describe how hybrids are produced.

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1 Draw lines to match each word with its correct meaning.

breed

Something in the surroundings that can cause variation.

environmental factor

A group of plants with characteristics that make them look different to other plants of that species.

environmental variation

Characteristics caused by something in the surroundings.

variety

A group of animals with characteristics that make them look different to other animals of that species.

2 For each variation listed in the table below tick the boxes to say how it can be caused and how useful it is to the animal or plant. The first one has been done for you.

Variation of life process	Can be caused by genes	Can be caused by environmental factors	Is useful	Is not useful
arthritis	✓	✓		✓
a liger cannot reproduce				
large and small potatoes from the same variety				
hydrogen cyanide stops respiration in animals				
animals from different species sweat at different temperatures				
fireblight kills the leaves on pear trees				

3 Write down one of your own characteristics that has been caused by environmental factors.

I CAN...

- recall what breeds and varieties are
- describe variations caused by environmental factors
- identify variations that are helpful or harmful.

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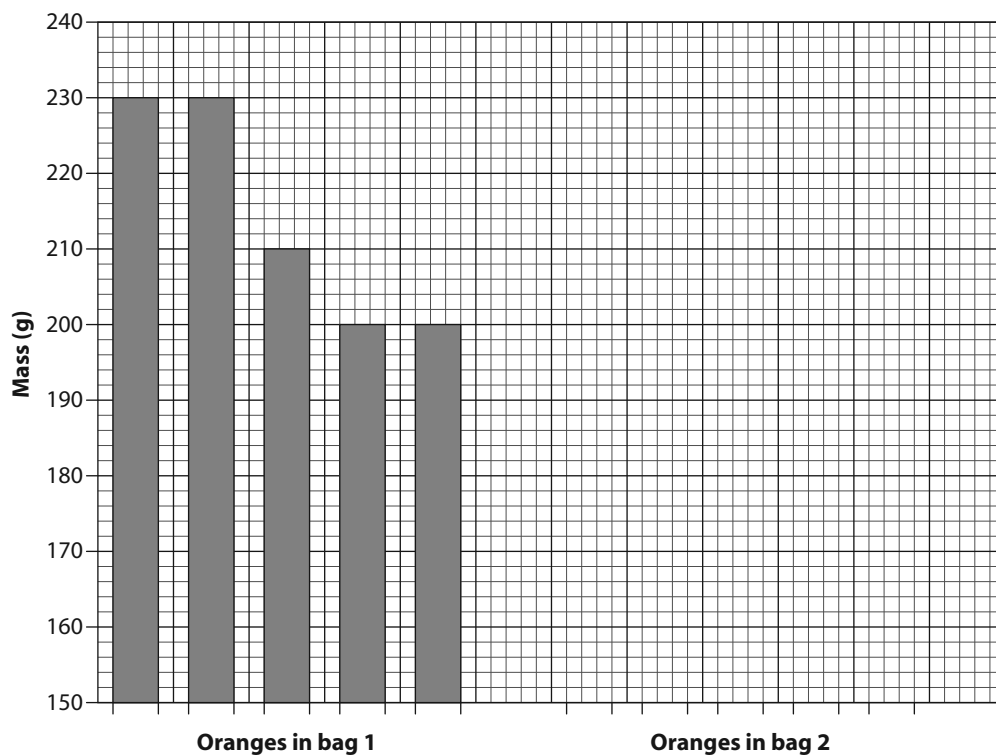
Callie bought two bags of oranges. When she got home she thought that those in one bag looked a little smaller than those in the other. There were no labels so she measured the mass of each orange to see if they could be two different types of orange.

Mass of oranges in bag 1 (g)	Mass of oranges in bag 2 (g)
230	195
230	195
210	220
200	230
200	230

1 a Which bag do you *think* contains oranges with the bigger mean (average) mass?

b Explain your answer.

2 a Complete the bar chart of Callie's results.



b How does using a bar chart help you to see if one bag contains bigger oranges than the other?

3 Calculate the mean mass of oranges in each bag.

Oranges in bag 1 have a mean mass of _____.

Oranges in bag 2 have a mean mass of _____.

4 a Which method (glancing at data, looking at data or doing calculations) is the best way to see if oranges from each bag are different? _____

b Why is this way 'best'? _____

5 What are different types of oranges called? Tick the correct box.

breeds species varieties

6 Do you think that Callie's oranges are of different types? Explain your answer.

7 What other characteristics could Callie look at to find out if the oranges were different types? List one characteristic that can be seen and one that can not.

8 If the oranges are all of the same type, what can cause the differences between them? Tick the correct box.

environmental factors genes variety

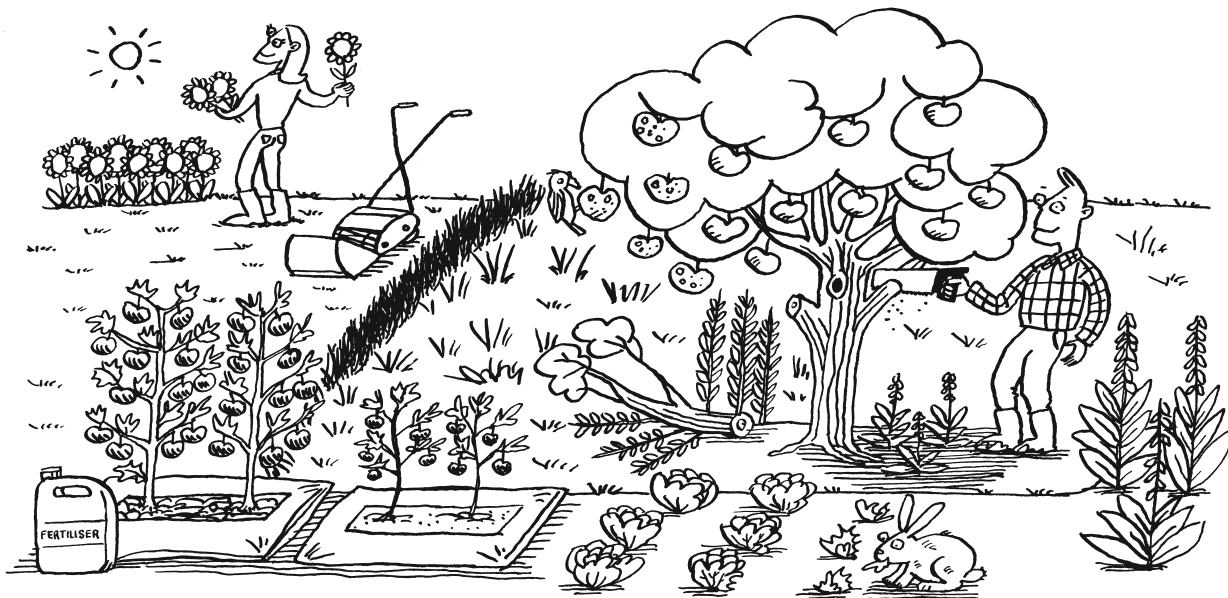
I CAN...

- recall what breeds and varieties are
- comment on different ways of drawing a conclusion.

Name _____ Class _____ Date _____

1 Look at the picture of the garden. Find the different variations caused by environmental factors in the garden.

Circle each variation and fill in the table to show which environmental factor you think caused it. The first one has been done for you.



Variation	Environmental factor that caused it
flattened plants	fallen tree branch

2 From your list of environmental factors, write down the names of one factor that is helpful and one that is unhelpful.

Helpful factor	Unhelpful factor

I CAN...

- describe variations caused by environmental factors
- identify factors that are helpful or harmful.

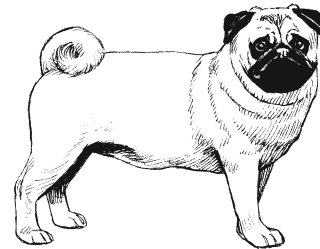
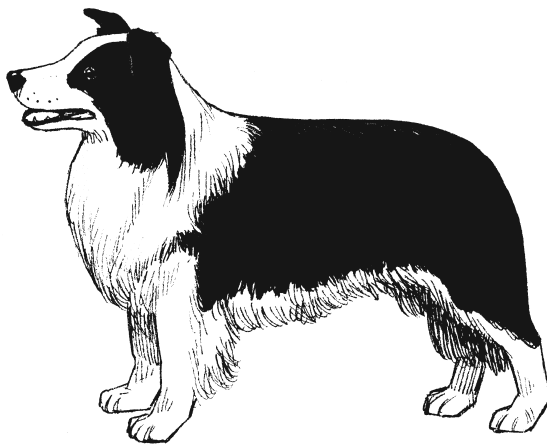
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1 Look at the dogs in photograph A on page 14 of your text book.

a Which breed do you think was bred to look like a lion?

b Which breed do you think was bred to jump into cold water to haul in fishing nets?

2 The drawings show a border collie and a pug.



a State two differences between border collies and pugs.

b State two similarities between border collies and pugs.

3 Tick the boxes in the table to show which characteristics a farmer would want to select for each of the different animals.

Animal	Characteristics			
	Produces lots of milk	Produces lots of hair	Produces lots of muscle	Produces lots of eggs
cow				
hen				
sheep				
pig				

I CAN...

- explain why humans may want to breed animals
- identify useful characteristics of breeds.

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For each statement, say if it is true or false. For each false statement, write out a correct version.

True **False**





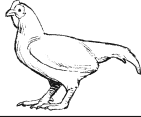
- | | | | |
|-------|---|-----------------------|-----------------------|
| 1 | The colour of your eyes is a characteristic that is inherited. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 2 | You inherit characteristics from your mother only. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 3 | Your brothers or sisters inherit exactly the same characteristics as you. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 4 | All animals inherit some characteristics from their parents. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 5 | Not all characteristics are inherited. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 6 | The environment has no effect on your characteristics. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 7 | Genes carry genetic information and are found inside every cell. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 8 | There are half as many genes in gametes (sex cells) as there are in normal body cells. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 9 | A fertilised egg cell only contains half the genetic information of a normal body cell. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 10 | Identical twins form from a single egg cell and a single sperm cell. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 11 | A breed is a set of plants of the same species that share certain characteristics. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |
| 12 | Variations in some characteristics are caused by genes <i>and</i> by the environment. | <input type="radio"/> | <input type="radio"/> |
| <hr/> | | | |

I CAN...

- recall how characteristics are inherited
- recall what happens during fertilisation
- identify inherited features
- recall what breeds and varieties are.

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The table shows some information about different breeds of chicken.

Breed	Sultan	Hamburg	Sussex	ISA brown	Cornish
					
eggs per week	1	3	4	6	1
egg size	small	medium	large	medium	small
egg colour	white	white	light brown	brown	light brown
meat	poor	poor	good	average	good
behaviour	very calm	aggressive	calm	calm	calm
copers with cold	no	yes	yes	no	yes

- 1 a** Which breed would you choose if you wanted to get eggs? _____
- b** Which breed would be least suitable if you wanted egg-laying chickens that could live outside all year? _____
- c** Explain your choice in part **b**.

- d** How many eggs could a farmer expect to get from a Hamburg hen each year?

- e** Suggest one environmental factor that might reduce the number of eggs laid.

- f** Which breed of chicken do you think would be least able to cope with being confined in cages with other chickens? _____
- g** Explain your choice for part **e**.

- h** Imagine you are a chicken seller! You have lots of Sussex chickens that you need to sell to a farmer who wants fresh eggs. How would you alter the table above to convince the farmer to buy your chickens?

2 Why would a farmer want to breed chickens that grow fast?

3 Which of these ways of creating new breeds has been invented in the last 30 years?

cross-breeding genetic modification selective breeding

I CAN...

- explain why humans may want to breed animals
- identify useful characteristics of breeds.

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1 a Draw lines to match the words with the correct labels.

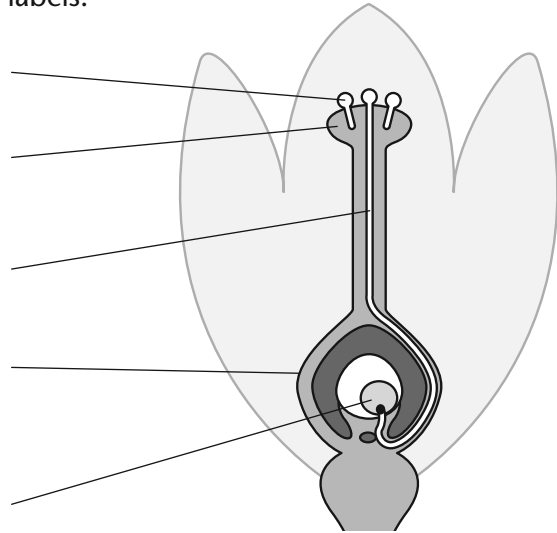
egg cell

ovary

pollen grain

pollen tube

stigma

**b** How do pollen grains naturally get from one flower to another?
_____**c** What is this process called? Tick the correct box.
 fertilisation pollination polling reproduction
d What process is happening in the drawing? Tick the correct box.
 fertilisation pollination polling reproduction
2 a Write down the name of a plant. _____**b** Suggest one characteristic that a breeder might want this plant to have.

3 In the space on the right, draw a plant that a mad scientist might create in a book or a film. Before you start, think about the interesting characteristics it might have. Label these on your drawing.

I CAN...

- recall what pollination and fertilisation are
- describe useful characteristics for plants.

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The Quick Quiz is to see how much you already know about a subject. It also gives you some idea of the things you will soon be learning about. Record your answers in the answers column. Shade in or tick the ones you get right.

Topic		Answers		I can already...
9Aa	1			Recall what variation is.
	2			Describe some examples of inherited characteristics.
	3			Describe what happens during fertilisation in animals.
	4			Explain how characteristics are inherited during fertilisation.
9Ab	1			Recall what breeds and varieties are.
	2			Describe some examples of characteristics that cannot be seen.
	3			Describe how natural variations in a characteristic can affect animals and plants in both useful and harmful ways.
	4			Identify variation caused by environmental factors and/or genes.
9Ac	1			Identify the characteristics of some animal breeds that are useful to us.
	2			Describe what selective breeding is.
	3			Describe what cross-breeding is.
	4			Recall what cloning and genetic modification are.
9Ad	1			Identify the characteristics of some plant varieties that are useful to us.
	2			Recall what happens in plants during fertilisation.
	3			Recall what happens in pollination.
	4			Describe the different methods that plant breeders can use to breed plants.

Quick Quiz:	/16	At the start: 0–4 = I didn't know much; 5–9 = I knew something 10–12 = I knew a fair bit; 13–16 = I already knew a lot
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Inherited variation

The features of organisms are called their **characteristics** (e.g. blue eyes). Offspring normally share some characteristics with their parents and brothers and/or sisters. Offspring can **inherit** characteristics from their parents. Characteristics can be different and this is known as **variation** (e.g. brown eyes and blue eyes). Variation occurs in both plants and animals.

An organism's characteristics are controlled by **genetic information**, which is carried on **genes**. Genes are sections of **chromosomes** which are found inside the **nucleus** of almost all of an organism's cells. Genetic information is passed from parents to offspring during reproduction.

In sexual reproduction, two **gametes** (sex cells) **fuse**; one from the male and one from the female. In animals, the male gamete is the **sperm cell** and the female gamete is the **ovum** (egg cell). This fusing produces a **fertilised egg cell**, which then splits in two, by a process called **cell division**, to form an embryo. The cells of the embryo continue to divide to form a ball of cells, which then grows into a new organism.

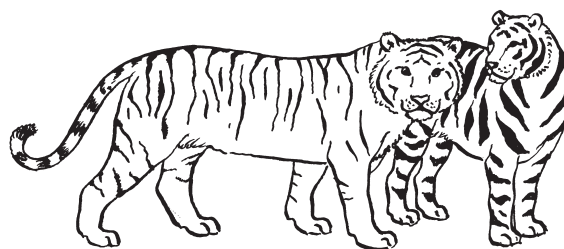
Each gamete contains half the amount of genetic information that a normal body cell has. So the fertilised egg cell gets half its genetic information from the male and half from the female.

In many animals, when two egg cells are each fertilised by different sperm cells, non-identical twins are born. Sometimes a fertilised egg cell splits into two and identical twins form.

Species, breeds and varieties

A **species** is a group of organisms that are able to produce offspring that are also able to reproduce. Members of the same species have very similar characteristics, but there is some variation in these characteristics. Some members of a species may have **mutations** in their genes, giving them very different characteristics compared with other members of the species.

A group of animals may have special differences in their inherited characteristics from the rest of their species. A group like this is called a **breed** (e.g. different breeds of dog). There are also breeds of plants and these are called **varieties**.



All tigers have stripes but there is variation in the stripes between each tiger.

Selective breeding

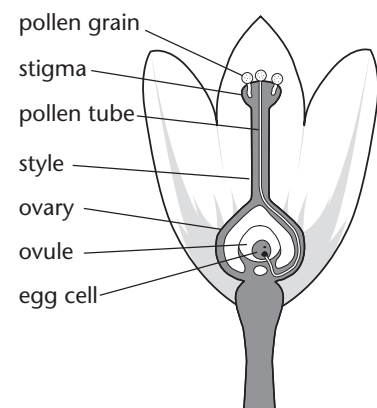
Farmers and plant breeders may choose or 'select' an animal or plant with certain characteristics (e.g. good milk production in cows). This animal or plant is then used to breed from. The offspring that have the best of these characteristics are then bred from again. This is called **selective breeding** and is how many new breeds and varieties are created. Sometimes two different breeds or varieties are bred together to produce offspring with characteristics from both breeds/varieties. This is called **cross-breeding**.

Plant breeding

Pollen grains (the male gametes) are carried by the wind or insects to the **stigma** of another flower. This is called **pollination**. Plant breeders can transfer the pollen that they want to the stigma that they choose, sometimes using a paintbrush.

A pollen grain grows a **pollen tube** down through the **style** and into the **ovary**, where it meets an **ovule**. It grows into the ovule and meets an ovum (egg cell). The nucleus from the pollen grain goes into the ovum and fuses with its nucleus. This is **fertilisation**.

Many of the characteristics that plant breeders choose are visible (e.g. fruit size, **yield**) but some are not visible (e.g. **disease resistance**).



Genetic modification

Scientists can insert a **gene** from one organism into another to create new **breeds** and **varieties** quickly.

Variation caused by the environment

Some characteristics vary due to an organism's surroundings (**environment**). This is called **environmental variation**. For example, plants growing in different areas of a field may be different heights depending on the amount of light, water and mineral salts that they get. These things are all physical **environmental factors**.

Cloning

Many plants can use **asexual reproduction**, which is reproduction that needs only one parent. All the offspring are **clones**. Taking a cutting is a form of **cloning**. Scientists now have ways in which they can clone animals. Cloning allows the numbers of an organism to be increased quickly.

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A dog-breeding company of the future wants an advertising leaflet to show its range of services, which include selective breeding, cloning and genetic modification. The leaflet is designed to be given to people who are thinking about getting a dog (which might include people who are after a working dog such as a Border Collie).

You should have made a set of notes or produced a leaflet to answer this challenge.

Level	I have...	Yes
Working towards level 4	stated that there are many different breeds of dog.	
	explained that dogs are bred by mating them.	
	described or named a range of different dog breeds.	
Level 4	described how sexual reproduction needs a male and a female.	
	explained that members of an animal breed share a set of similar characteristics.	
	explained why people might want to have a dog (e.g. for company, for working with).	
	explained that the offspring of two parents have a mixture of characteristics from the two parents, which you can often see.	
	described how dogs with certain characteristics are used for breeding.	
Level 5	described how the reproductive organs of animals allow sexual reproduction to occur.	
	used a Venn diagram or spider diagram to show how dog breeds are from the same species but are a different species from other mammals that may share some characteristics.	
	described a breed of dog, indicating which characteristics have been bred into it.	
	explained that different breeds are all members of the same species and can breed together, whereas members of different species usually cannot.	
	explained why different breeds of dogs are bred, including why certain characteristics may be important.	
Level 6	described the role of gametes in sexual reproduction.	
	described how certain dogs with certain characteristics will be matched to a certain environment or way of life.	
	described some evidence for the causes of variation, for example dogs may have short tails because they have inherited them or because their tails have been docked (cut off).	
	described how selective breeding is carried out.	

Level	I have...	Yes
Level 7	explained that cloning is a form of asexual reproduction, which is quite common in plants.	
	explained why cloning dogs can be useful, but why some people object to the idea.	
	explained that many variations in characteristics are due to genes and to the environment, and explained how an example, like height, is affected by both.	
	explained that a clone is an exact genetic copy of an organism.	
	explained what genetic modification is and how adding genes to organisms alters their characteristics.	
	described how some breeds of dog can suffer from genetic problems caused by breeding.	
Level 8	described how genetic modification is carried out.	
	described what controls would need to be taken to stop the new genes in genetically modified dogs being passed to other dogs.	
	described how Mendel developed his ideas of how genes were inherited and how some alleles are dominant and others are recessive.	
	described some of the objections people have to genetic modification of dogs.	