KS3 Science Independent Learning Booklets

Variation

If you have internet at home, you can use bitesize to help you with some of the activities.

Try your hardest to work through the booklets

What is variation?

All people are human. They belong to the same species. Your friends and classmates may have different eye colour and hair colour. Some will be boys and some will be girls. Some will be tall and some will be shorter. The presence of differences between living things of the same species is called variation.

Variation between different species is usually greater than the variation within a species.

Inherited and environmental variation

Some variation within a species is inherited, and some variation is due to the environment.
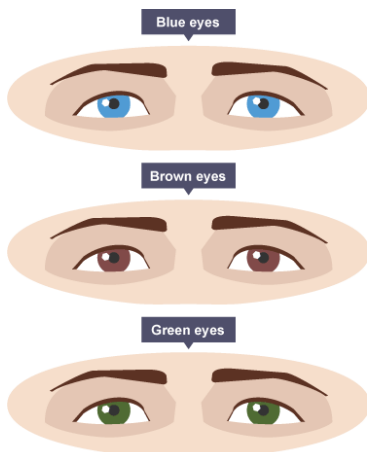
Inherited causes of variation

Variation in a characteristic that is a result of genetic information from the parents is called inherited variation.

Children usually look a little like their father, and a little like their mother, but they will not be identical to either of their parents. This is because they get half of their DNA and inherited features from each parent.

Each egg cell and each sperm cell contains half of the genetic information needed for an individual. When these join at fertilisation a new cell is formed with all the genetic information needed for an individual.

Here are some examples of inherited variation in humans:

- eye colour
- hair colour
- skin colour
- lobed or lobeless ears
- ability to roll your tongue

Eye colour is an example of inherited variation.

Having lobed or lobeless ears is an example of inherited variation

Gender is inherited variation too, because whether you are male or female is a result of the genes you inherited from your parents.

<u>Environmental causes of variation</u>

Characteristics of animal and plant species can be affected by factors such as:

- climate
- diet
- accidents
- culture
- lifestyle

For example, you will become heavier if you eat too much food, and you will become lighter if you eat too little. A plant in the shade of a big tree will grow taller as it tries to reach more light.

Variation caused by the surroundings is called environmental variation. Here are some other examples of features that show environmental variation:

- your language
- your religion
- flower colour in hydrangeas (these plants produce blue flowers in acidic soil and pink flowers in alkaline soil)

Inherited and environmental causes

Some features vary because of a mixture of inherited causes and environmental causes. For example, identical twins inherit exactly the same features from their parents. However, if you take a pair of twins, and twin 'A' is given more to eat than twin 'B', twin 'A' is likely to end up heavier. Weight and height are common examples of characteristics that are influenced by both genetic and environmental factors.

Continuous and discontinuous variation

Some of the features of the different organisms in a species show continuous variation, and some features show discontinuous variation.
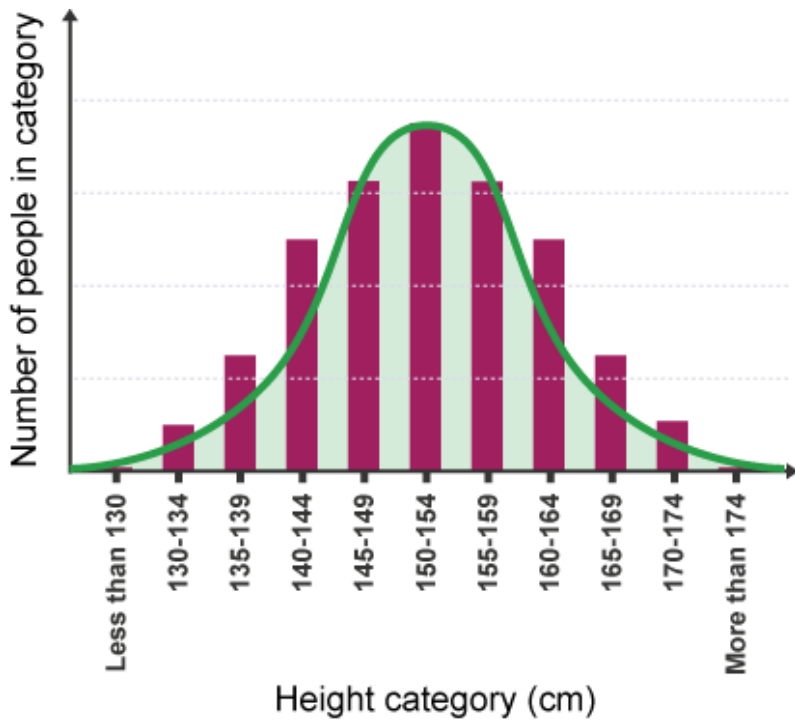
<u>Continuous variation</u>

Human height is an example of continuous variation. It ranges from that of the shortest person in the world to that of the tallest person. Any height is possible between these values. So it is continuous variation.

For any species a characteristic that changes gradually over a range of values shows continuous variation. Examples of such characteristics are:

- height
- weight

If you record the heights of a group of people and draw a graph of your results, it usually looks something like this:
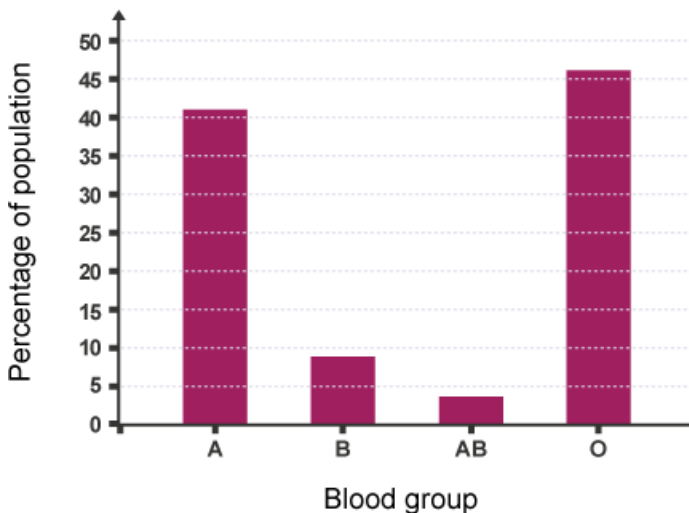
A bar chart to represent variation in height

The more people you measure, and the smaller the categories you use, the closer the results will be to the curved line. This shape of graph is typical of a feature with continuous variation. Weight would give a graph similar in shape to this.

Discontinuous variation

A characteristic of any species with only a limited number of possible values shows discontinuous variation. Human blood group is an example of discontinuous variation. In the ABO blood group system, only four blood groups are possible (A, B, AB or O). There are no values in between, so this is discontinuous variation.

Here are some examples:

- blood group
- sex (male or female)
- eye colour

A Bar chart to represent the frequency of each blood group in the population

What is classification?

Animal groups
Animals can be divided into groups or 'classified' by looking at the similarities and differences between them.

Animals are divided into two main groups. Animals that have a backbone are called vertebrates. Animals that don't have a backbone are called invertebrates.

Vertebrates and invertebrates are divided into smaller groups. Vertebrates, for example, are divided into fish, amphibians, reptiles, birds and mammals.

There are many different groups of invertebrates too. They include invertebrates which have soft bodies such as jellyfish, worms and molluscs (like slugs and squids). There are also groups of invertebrates with hard bodies, such as insects, crustaceans and spiders.

Key's can play a vital part in helping to classify animals and objects, in the activities section you will see examples of keys and how to use them and even get to make your own.

Species

A species is a group of similar organisms that can breed with one another to produce fertile offspring. For example, humans are one species and dogs are another species.

Individuals of the same species can reproduce to make more individuals of the same species. Two individuals belonging to different species cannot normally reproduce together. If they do, their offspring is often infertile and unable to reproduce.

These penguins belong to the same species

Sometimes individuals from two different species can reproduce. For example, animals called ligers are produced when a male lion and a female tiger reproduce. Tigons are produced when a female lion and male tiger have cubs. Unlike many young from different species, ligers and tigons can have offspring.

A liger looks like a lion but has stripes like a tiger

Selective breeding

Pedigree dogs come in lots of different varieties. They may be different colours and sizes, but they are all still dogs. They are all still the same species. The different varieties of dog have been produced through deliberate selective breeding by dog-owners.

Five very different breeds of dog

These are the steps taken to select a particular feature in an organism:

1. choose individuals with the desired feature
2. let only these individuals reproduce
3. choose the offspring that have the desired feature
4. let only these individuals reproduce
5. repeat steps 3 and 4 until you have produced a variety in which all the individuals show the desired feature

For example, suppose you wanted a variety of cow that produced a lot of milk. This is what you could do:

1. select the cows in your herd that produce the most milk
2. let only these cows reproduce
3. select the offspring that produce the most milk
4. let only these individuals reproduce
5. keep repeating the process of selection and breeding until you produce a breed that consistently produces a lot of milk

Other examples of selective breeding

The key to success is to identify the feature you want, only breed from the individuals that have that feature, and do not allow individuals with undesirable features to breed. Here are some examples of what selective breeding can produce:

- hens that lay big eggs of a particular colour
- cattle that produce lots of meat
- tomato plants that produce lots of tomatoes
- crops that are resistant to certain plant diseases

What is natural selection?

-     - Natural selection is known as 'the survival of the fittest'. The best adapted organisms are able to survive.
-      - The most desirable characteristics get passed down from parents to their offspring.
-      - Scientists have used fossils to look at how organisms have evolved over time.

Natural selection

Natural selection is a process by which a species changes over time in response to changes in the environment, or competition between organisms, in order for the species to survive.

The members of the species with the most desirable characteristics are able to produce the best-adapted offspring. If a species is unable to adapt then it is at risk of becoming extinct.
Evolution
Charles Darwin's theory of evolution suggested that different species have evolved from simpler life forms and that the organisms able to survive are those that have adapted best to their environment.

Evolution is a slow process that can take many thousands, even millions, of years to happen. Scientists have used fossil evidence to look at how organisms have adapted over millions of years and how their characteristics have changed.

If a species is unable to adapt quickly enough to its environment, then it is at risk of becoming extinct. This can happen for many reasons:

- New predators
- New diseases
- Destruction of habitats
- Changes to the environment
- Increased competition for resources

Tasks and Activities
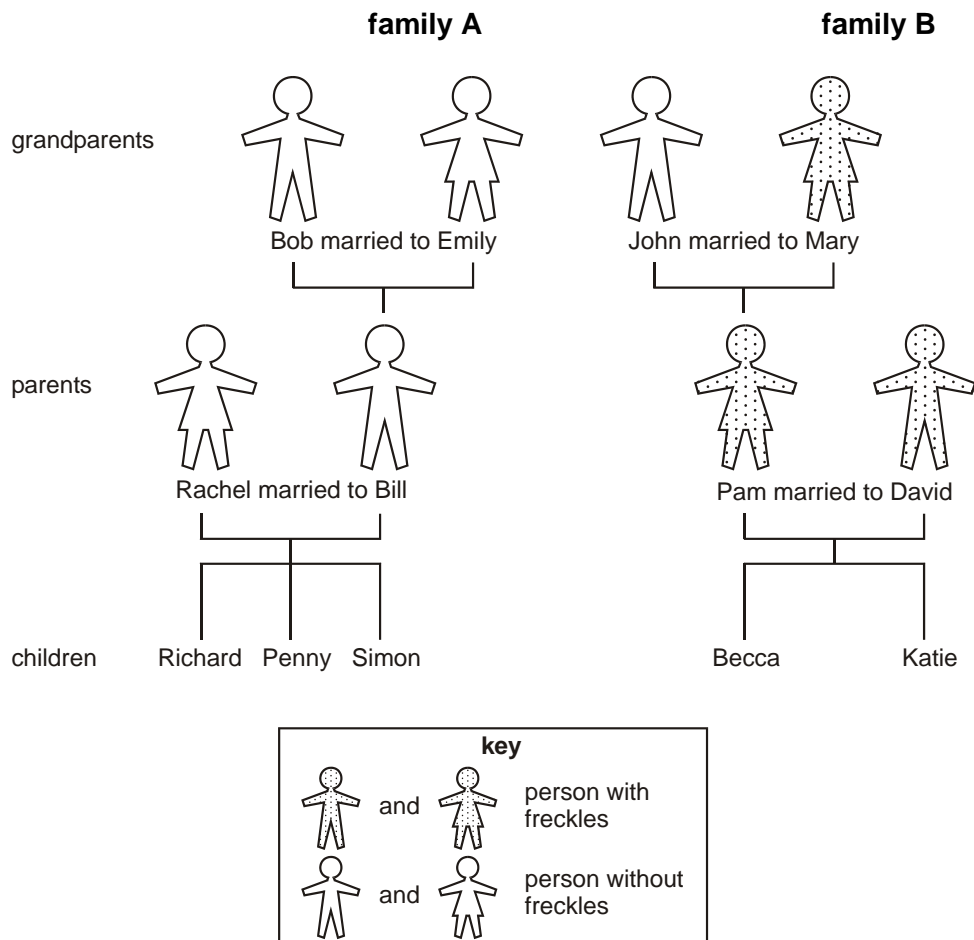
Task 1 Wordsearch

Variation Wordsearch

t	a	e	y	e	c	o	l	o	u	r	a	e	b	s
o	c	i	e	o	s	t	w	l	e	a	s	o	s	c
n	a	e	s	t	r	h	e	i	g	h	t	e	y	a
g	a	d	i	s	a	g	i	e	a	s	n	m	u	r
u	o	i	a	t	a	n	g	p	t	d	a	d	a	s
e	c	e	b	u	i	e	h	a	n	i	s	w	c	r
r	e	f	g	i	h	k	t	i	l	m	a	t	b	u
o	d	n	u	d	e	l	l	p	r	p	u	a	t	o
l	a	a	e	t	e	b	s	f	e	l	d	g	q	l
l	w	o	x	r	r	t	d	o	m	e	e	n	u	o
i	n	e	t	u	l	e	s	a	e	s	i	d	o	c
n	b	f	o	g	o	p	w	a	m	l	r	t	e	r
g	b	l	o	o	d	g	r	o	u	p	r	g	e	i
a	o	v	a	m	t	h	s	v	s	o	e	t	m	a
c	l	o	e	n	h	t	g	n	e	l	r	i	a	h

Find twelve different traits in the wordsearch above. Classify these as either environmental or inherited (genetic), or a mixture of inheritance and environmental factors.
Extension: decide whether each of these is continuous or discontinuous.

_____   _____

_____   _____

_____   _____

_____   _____

_____   _____

Task 2 Memory recall and new learning exam question

1. The diagram shows two families. Some of the people in the diagram have freckles.

(a) (i) Which children are most likely to have freckles? Tick the correct boxes.

Richard	Simon	Katie	Penny	Becca
☐	☐	☐	☐	☐

1 mark

(ii) How did you decide?

....

.... 1 mark

(iii) Suggest why Bill does **not** have freckles.

.... 1 Mark

(b) (i) Which **two** cells pass on information from parents to their children?
         Tick the **two** correct boxes.

bone cell	☐	cheek cell	☐
egg cell	☐	muscle cell	☐
red blood cell	☐	sperm cell	☐

1 mark

(ii) Which organ system produces these two cells?
      Tick the correct box.

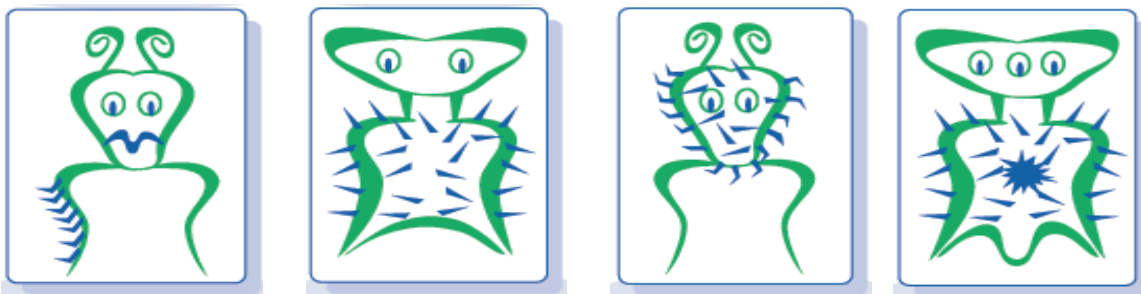|			
circulatory system	☐	digestive system	☐
reproductive system	☐	respiratory system	☐

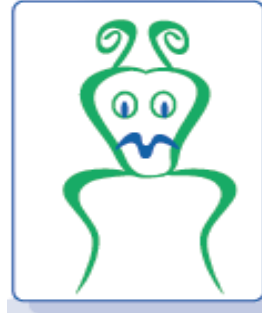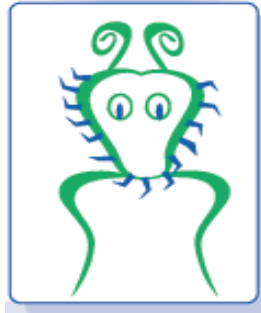1 mark

Task 3 Using a statement key to classify aliens

These aliens have lost their way, and arrived on Earth. They have forgotten their names! Can you use the key to help them remember their names?

1_____ 2_____ 3_____ 4_____

5_____ 6_____ 7_____ 8_____

9_____ 10_____ 11_____ 12_____
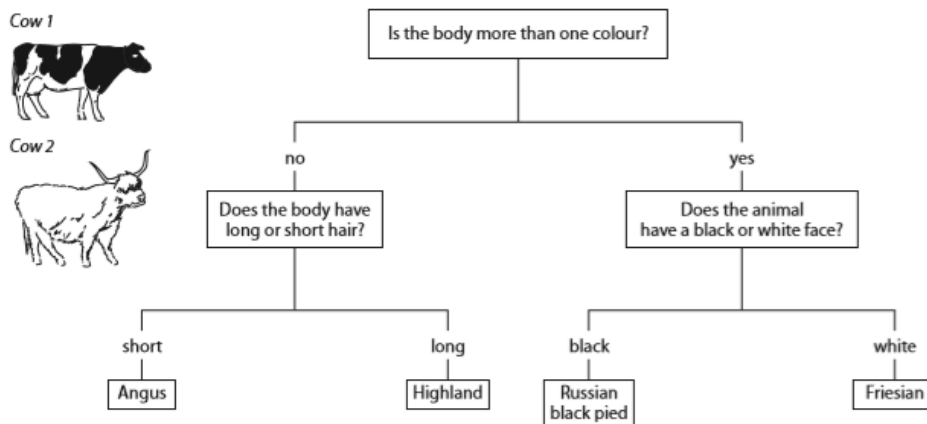
Key:

1. Does it have *one eye*?   If yes it is **Alan**
                                        If no go to step **2**

2. Does it have *two eyes*?   If yes go to step **3**
                                        If no go to step **4**

3. Does it have a *flat head*?   If yes go to step **5**
                                        If no go to step **6**

4. Does it have a *spiky body*?   If yes it is **Rob**
                                        If no it is **Mark**

5. Does it have a *star on its   If yes it is **Victor**
    tummy?*   If no it is **Paul**

6. Does it have *antennae?*   If yes go to step **7**
                                        If no go to step **8**

7. Does it have a *mouth?*   If yes go to step **9**
                                        If no go to step **10**

8. Does it have a *spiky arm?*   If yes it is **Bob**
                                        If no it is **Carl**

9. Does it have a *spiky arm?*   If yes it is **Hal**
                                        If no it is **Eric**

10. Does it have a *spiky face?*   If yes go to step **11**
                                        If no it is **Dave**

11. Does it have *spikes all over   If yes it is **Tom**
    its face?*   If no it is **Felix**
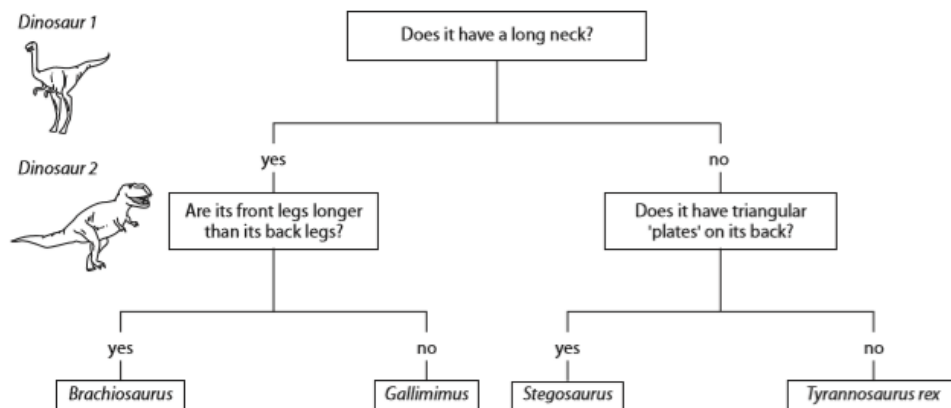
Task 4 Using classification Keys

- We can use keys to help us put organisms into groups.
- Dichotomous or branching keys let you make a choice at each question.

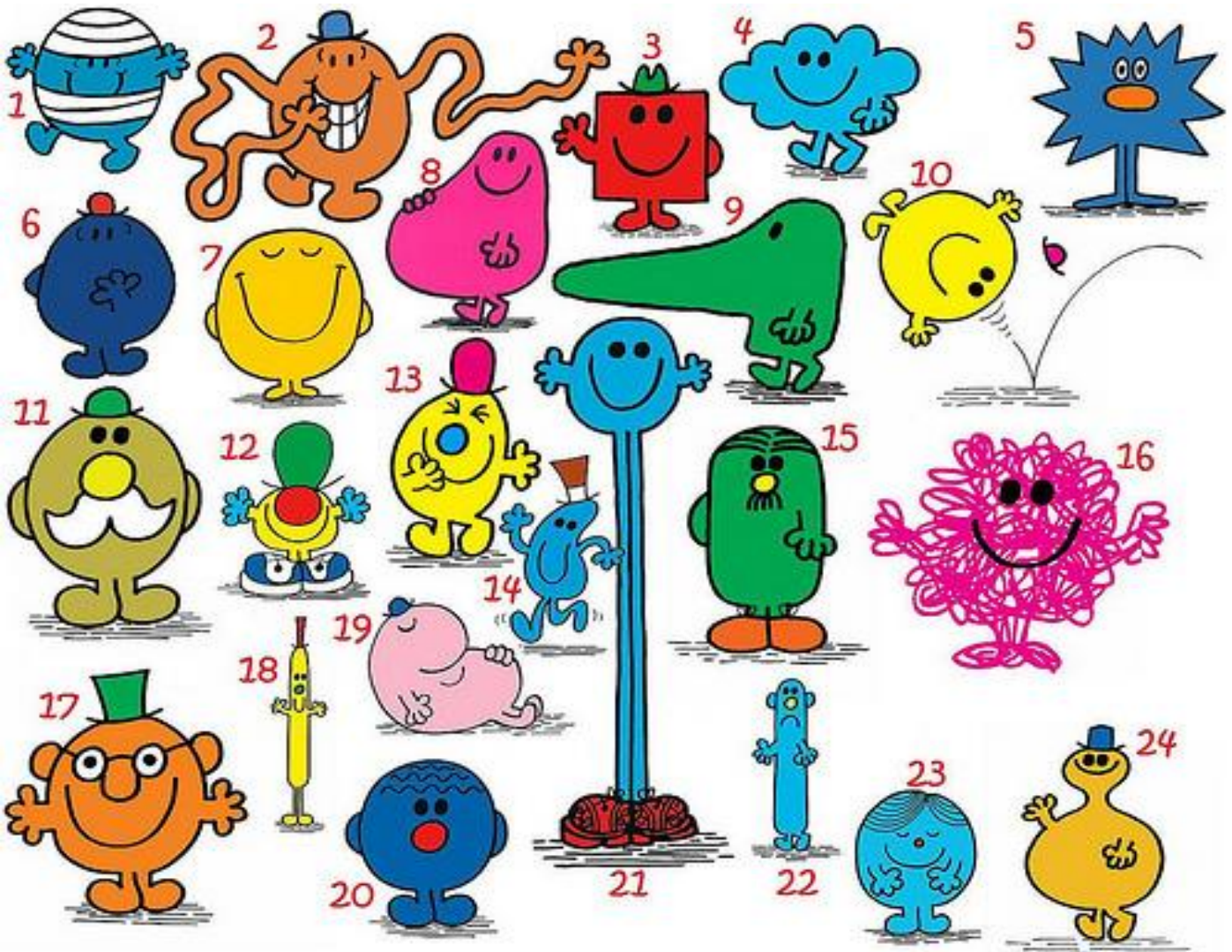**1** Use this branching key to identify these two breeds of cow.

Cow 1

Cow 2

Is the body more than one colour?

no

yes

Does the body have
long or short hair?

Does the animal
have a black or white face?

short

long

black

white

Angus

Highland

Russian
black pied

Friesian

Cow 1 is _____. Cow 2 is _____.

2 Use this branching key to identify these two dinosaurs.

Dinosaur 1

Dinosaur 2

Does it have a long neck?

yes

no

Are its front legs longer
than its back legs?

Does it have triangular
'plates' on its back?

yes

no

yes

no

Brachiosaurus

Gallimimus

Stegosaurus

Tyrannosaurus rex

Dinosaur 1 is _____. Dinosaur 2 is _____.

Each Mr Man has a unique characteristic that you could use to identify them. Make a branching key on the next page to identify at least 8 Mr Men.

1. Mr Bump	8. Mr Greedy	15. Mr Fussy	22. Mr Mean
2. Mr Tickle	9. Mr Nosey	16. Mr Messy	23. Mr Perfect
3. Mr Strong	10. Mr Bounce	17. Mr Clever	24. Mr Dizzy
4. Mr Daydream	11. Mr Slow	18. Mr Skinny	
5. Mr Sneeze	12. Mr Nonsense	19. Mr Lazy	
6. Mr Forgetful	13. Mr Mischief	20. Mr Worry	
7. Mr Happy	14. Mr Busy	21. Mr Tall	

Start with a template