The Origin of Species Year 6 Packet

THE ORIGIN OF SPECIES

BY MEANS OF NATURAL SELECTION

OR

THE PRESERVATION OF FAVOURED RACES
IN THE STRUGGLE FOR LIFE

CHARLES DARWIN

ADAPTED BY BEN ROGERS

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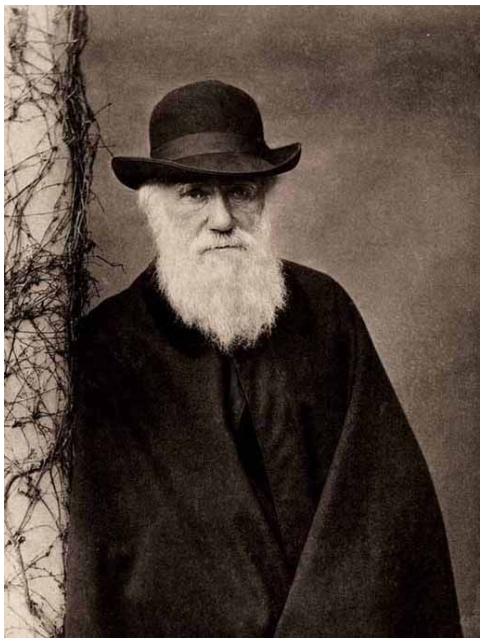


INTRODUCTION

WHEN on board the H.M.S. *Beagle*, as a naturalist, I was much struck with certain facts about the inhabitants of South America. These facts seemed to me to throw some light on the origin of species - that mystery of mysteries. It occurred to me, in 1837, that something might perhaps be made of this question by patiently collecting and reflecting on all sorts of facts which could have any bearing on it.

My work is now nearly finished. Although much remains obscure, and will long remain obscure, I have no doubt that the view I used to hold - that each species has been independently created - is wrong. I am fully convinced that species can change. Furthermore, I am convinced that Natural Selection has been the main means of change.

CHAPTER I

VARIATION UNDER DOMESTICATION

Causes of Variability - Inheritance - Principle of Selection

WHEN we look at individual domesticated animals, for example dogs, one of the first things we notice is how much they differ from each other: far more than individuals of any non-domesticated, natural or wild species. For example, there is much more variation between dogs (compare greyhounds, bloodhounds, terriers, spaniels and bull-dogs) than between species of wild fox. Dogs have a wider range of size, colour, build and even temperament. Fox species, on the other hand, show very little variation.

I strongly suspect that the most frequent cause of these differences, or variations, is due to characteristics inherited from the parents. The young from the same litter of pups sometimes differ considerably from each other, even though they have been exposed to the same conditions. This shows how important inheritance of characteristics from parents is compared to the influence of living conditions. If living conditions directly influenced individuals, all of the litter would probably have varied in the same way. My impression is that heat, moisture, light, food, &c. have very little effect, whereas, inheritance from parents is of great importance.

Believing that it is always best to study some special group, I now keep domestic pigeons. I have kept every breed I could obtain and have been most kindly presented with skins from several quarters of the world. The diversity of breeds is astonishing. Compare the English carrier pigeon and the short faced tumbler, and see the wonderful difference in their beaks. The male carrier is remarkable with its wonderful development of the carunculated skin about the head, accompanied by the greatly elongated eyelids and wide gape of mouth. The tumbler has the unusual habit of tumbling in the air head over heels. The pouter pigeon has an enormously developed crop, which it glories in inflating. The fantail has thirty or even forty tail-feathers, instead of the usual twelve or fourteen. The differences between the breeds of pigeons are great, yet I am fully convinced that all of them have descended from one wild species, the rock-pigeon.

We cannot suppose that all breeds were suddenly produced as perfect and as useful as we now see them. The key is man's power of gradual and accumulative selection. This selection results from generations of breeders choosing the best individual animals. It is certain that animal breeders even within a single lifetime have significantly modified some breeds of cattle and sheep. This selection has been carried out since antiquity leading to the breeds we see today.

To sum up on the origin of our Domesticated Races of animal and plants. The differences between the breeds of domesticated plants and animals is very great. I am convinced that the cause of Change is mankind’s use of Selection.

Chapter 1

Questions:

1. Do foxes or dogs vary the most? **dogs / foxes**
2. Do domesticated or wild animals vary the most? **domesticated / wild**
3. What does Darwin believe causes variations between animals?

   Characteristics inherited from parents / the conditions the individual lives in
4. Does Darwin believe that the characteristics of domesticated animals have changed over generations? **yes / no**
5. Why did Darwin keep domestic pigeons?

   _____

   _____

   _____

   _____
6.
   a. Domestic animals, such as dogs, differ from one another, but _____

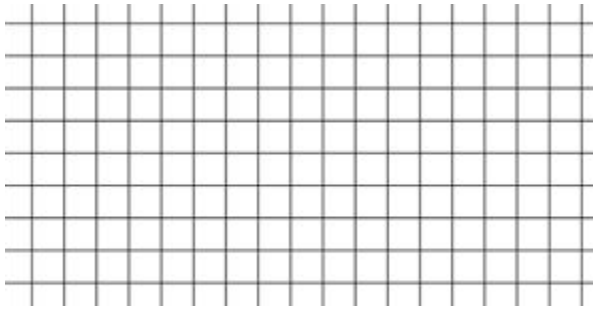
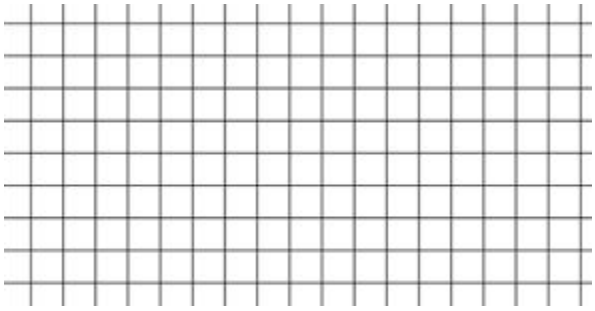
      _____
   b. Domestic animals, such as dogs, differ from one another, because

      _____
   c. Domestic animals, such as dogs, differ from one another, so _____

      _____

Write: What does Darwin believe caused the breeds of animals to change over generations?

Discuss:

Ideas that support my answer:	Ideas that differ from my answer:
	

Rewrite:

CHAPTER II

VARIATION UNDER NATURE

Variability - Individual differences - Doubtful species

BEFORE applying the principles arrived at in the last chapter to living things in the wild, we must discuss whether wild individuals vary. To treat this subject at all properly, a long catalogue of dry facts should be given; but I shall reserve this for my future work.

We know that living things have many slight differences which we may call individual differences. They often appear in the offspring from the same parents. No one supposes that all the individuals of the same species are cast in the very same mould. These individual differences are highly important for us; they allow nature to select the characteristics most suited to an environment.

Every naturalist knows what he means when he speaks of a species, yet no single definition has yet satisfied all naturalists. The term "variety" is almost as difficult to define. Variety suggests the individuals descended from a common ancestor, though this can be rarely proved.

Many years ago, when comparing the birds from the separate islands of the Galapagos Archipelago, I noticed how vague and arbitrary is the distinction between species and varieties. Who can say that the dwarfed shells in the salty waters of the Baltic, or dwarfed plants on Alpine summits, or the thicker fur of an animal from far northwards, are varieties rather than species?

Understanding the distinction between varieties and species is of great importance if we are to understand the origin of species. If all species previously existed as varieties, we can explain how varieties evolve into new species. However, if each species has been individually created, the similarities between species and varieties cannot be understood.

Chapter 2

Question:

1. Find and copy a phrase which shows that Darwin knew that individual wild animals vary.

_____

_____

Write: Why did Darwin think that the differences between species and varieties are important?

Discuss:

Ideas that support my answer:	Ideas that differ from my answer:

Rewrite:

CHAPTER III

STRUGGLE FOR EXISTENCE

Bears on natural selection - The term used in a wide sense - Geometrical powers of increase - Nature of the checks to increase

BEFORE entering on the subject of this chapter, I must make a few remarks, to show how the struggle for existence causes Natural Selection. Living things in the wild have individual variability. But how have all those exquisite adaptations been perfected? We see beautiful adaptations plainly in the woodpecker and mistletoe; and only a little less plainly in a humble parasite which clings to the feathers of a bird; in the structure of the beetle which dives through the water; in the plumed seed which is wafted by the gentlest breeze; in short, we see beautiful adaptations everywhere and in every part of the natural world.

We may ask, how do varieties change into good and distinct species? All changes are caused by the struggle for life. Because of this struggle for life, any useful change, however small, will help that individual survive, and will be inherited by its offspring.

We have seen that man can make great changes to living things through selection. But Natural Selection is always ready for action, and is far superior to man's feeble efforts.

I use the term Struggle for Existence to include not only the life of the individual, but success in leaving offspring. Two dogs in a time of hunger will struggle with each other to get food and live. But a plant on the edge of a desert is said to struggle for life against the drought. A plant which annually produces a thousand seeds, of which on an average only one survives, struggles with the plants which already cover the ground.

There is no exception to the rule that every living thing naturally increases at so high a rate that if not destroyed, the earth would soon be covered by the offspring of a single pair. Think of how many seeds a dandelion produces, or the number of eggs laid by a frog. The majority of these seeds and eggs must be destroyed otherwise the numbers of frogs and dandelions would grow at such a huge rate that no country could support them. As more individuals are produced than could ever survive, there must be a great struggle for existence, either one individual with another of the same species, or with the individuals of another species, or with the physical conditions of life. Although some species may be now increasing, more or less rapidly, in numbers, all cannot do so, for the world would not hold them.

Chapter 3

Questions:

1. Find and copy a word or phrase which shows that Darwin considers each plant and animal well adapted to its environment?

   _____

   _____

2. Which two things does Darwin mean by "struggle for existence"?

   a. _____

   b. _____

3. If the majority of the seeds of a dandelion were not destroyed, what would happen?

   _____

   _____

4. Read the line below:

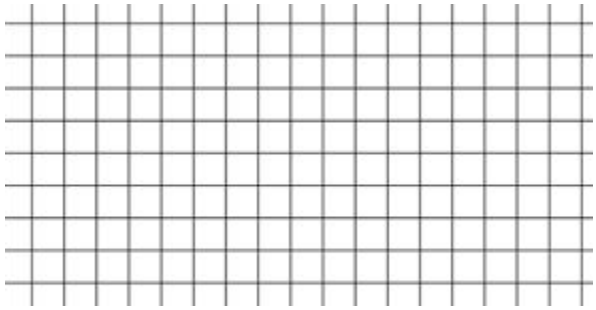
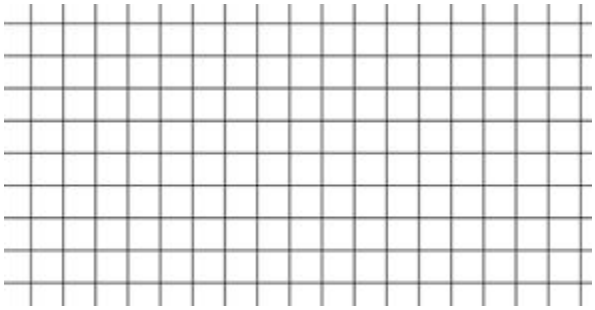
   "There is no exception to the rule that every living thing naturally increases at so high a rate that if not destroyed, the earth would soon be covered by the offspring of a single pair.

   Which is the best explanation of this line?

   - ❑ Every living thing reproduces much faster than it needs to.
   - ❑ If every offspring survived, the population would grow too large.
   - ❑ The Earth will be destroyed by offspring.

Write: Why makes Darwin think that all living things experience a "struggle for existence"?

Discuss:

Ideas that support my answer:	Ideas that differ from my answer:
	

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CHAPTER IV

NATURAL SELECTION

Natural Selection - its power compared with man's selection - its power on characters of trifling importance - Slow action

How will the struggle for existence, discussed too briefly in the last chapter, act on the variation found between individuals of a species? Can the principle of selection, which we have seen is so powerful in the hands of man, apply in nature? I think we shall see that it can act most effectually.

Can it be thought improbable, seeing that variations useful to man have undoubtedly occurred, that other variations useful in some way to each being in the battle of life, should sometimes occur in the course of thousands of generations? If so, can we doubt (remembering that many more individuals are born than can possibly survive) that individuals having any advantage, however slight, over others, would have the best chance of surviving and of reproducing? And we may feel sure that any damaging variation would be destroyed. This preservation of favourable variations and the rejection of damaging variations, I call Natural Selection.

We can understand the course of natural selection by imagining a country experiencing a physical change, for example, of climate. The numbers of its inhabitants would almost immediately change, and some species might become extinct. In addition, any change in the numbers of some of the inhabitants would affect many of the others. If the country were open on its borders, new forms would move in, further disturbing the former inhabitants.

But in the case of an island, habitats would be better occupied if some of the original inhabitants were modified. Every slight modification which in any way favoured the individuals of any of the species, by better adapting them to their altered conditions, would tend to be preserved; and natural selection would thus have free scope for the work of improvement.

Man can certainly produce great results by adding up individual differences. So could Nature, but far more easily; she has far longer at her disposal. In addition, no climate change is actually necessary to produce new and unoccupied places for natural selection to fill up by modifying and improving some of the varying inhabitants. As all the inhabitants struggle together with nicely balanced forces, any slight modification to the habit of one inhabitant could give it an advantage over others; and still further modifications of the same kind would often still further increase the advantage. No country can be named in which all the native inhabitants are now so perfectly adapted that none of them could be improved.

If man can produce a great result by methodical means of selection, what more can nature achieve? Man can act only on external and visible characters: nature cares nothing for appearances, unless useful to the being. She can act on every internal organ, on every shade of difference, on the whole machinery of life. Man selects only for his own good; Nature only for that of the being which she tends.

It may be said that natural selection is daily and hourly scrutinising, throughout the world, every variation, even the slightest; rejecting that which is bad, preserving and adding up all that is good; silently and invisibly working, whenever and wherever opportunity offers, at the improvement of each living thing. We see nothing of these slow changes in progress, until the hand of time has marked the long passing of ages, and even then our view is so imperfect that we only see that the forms of life are now different from what they were.

Slow though the process of selection may be, if feeble man can do much by his powers of artificial selection, I can see no limit to the amount of change, to the beauty and infinite complexity of the co-adaptations between all organic beings, one with another and their physical conditions of life, which may be effected in the long course of time by nature's power of selection.

Chapter 4

Questions:

1. What example does Darwin give for a physical change to an environment?

   _____

   _____

2. What does Darwin say will happen if there is a physical change in the environment?

   _____

   _____

3. Read the section below:

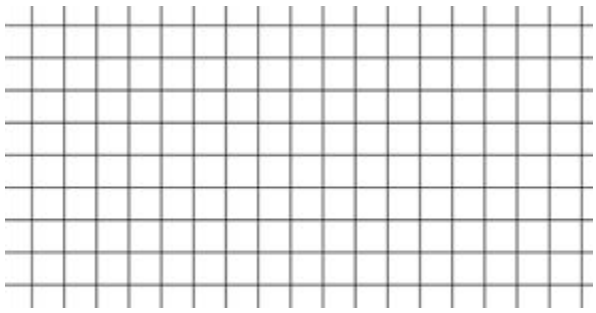
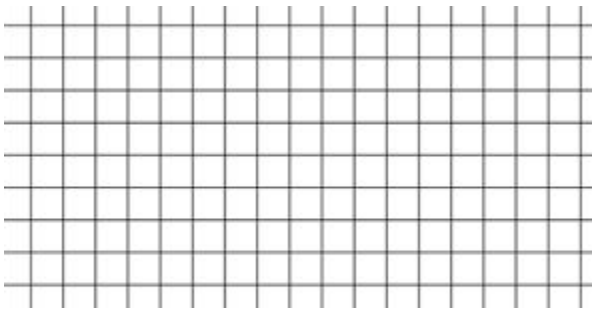
   > "Man can act only on external and visible characters: nature cares nothing for appearances, unless useful to the being. She can act on every internal organ, on every shade of difference, on the whole machinery of life."

   Which is the best explanation of this line?

   - ❑ Nature is more careful about the animals and plants it selects.
   - ❑ Humans care more about external characteristics than about how living things work.
   - ❑ Farmers and breeders can only select visible characteristics, but nature can select important characteristics which we can't see.

Write: Why does Darwin believe that Natural Selection is more effective than artificial selection?

Discuss:

Ideas that support my answer:	Ideas that differ from my answer:
	

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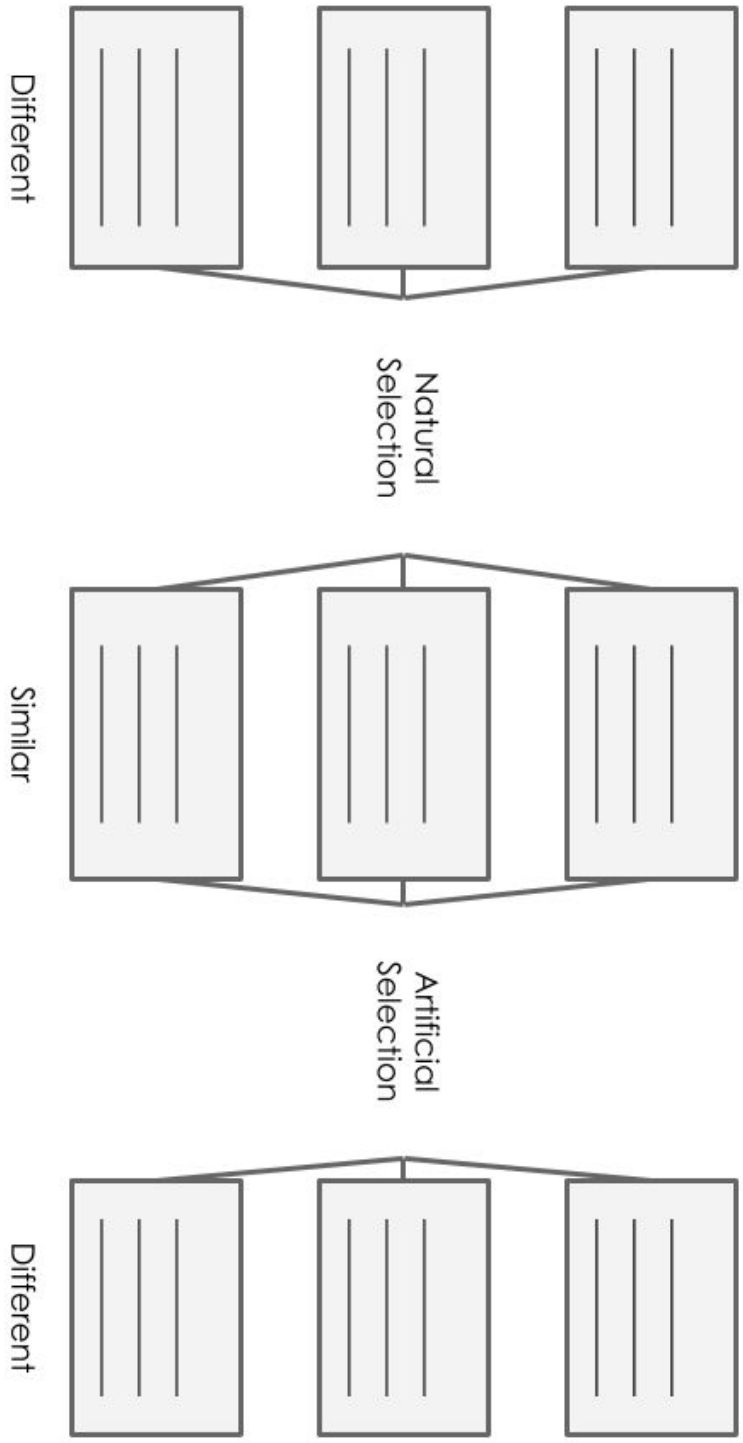
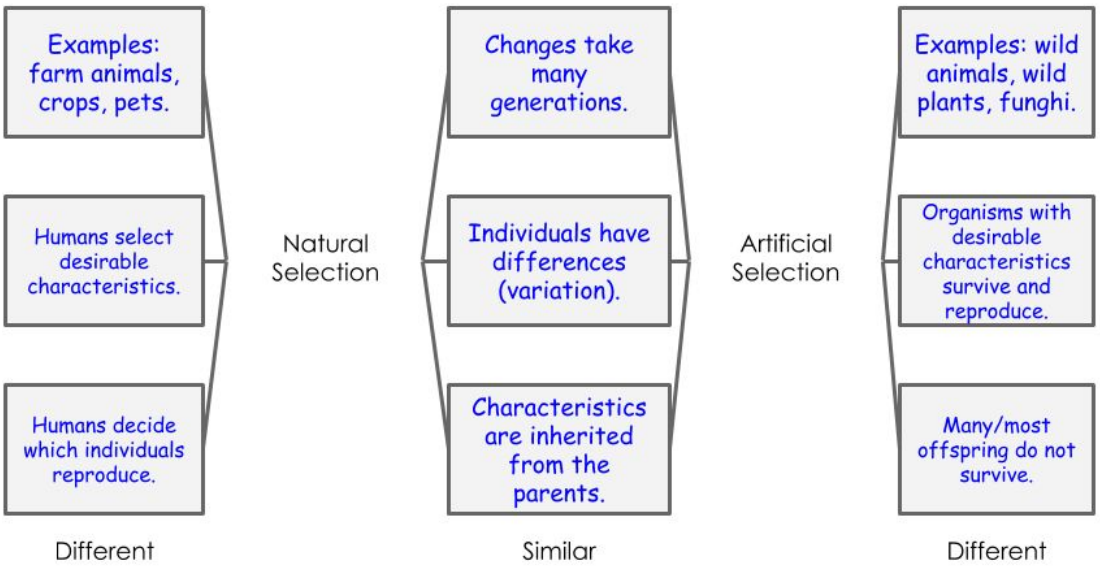

Different
Natural Selection
Similar
Artificial Selection
Different


Examples: farm animals, crops, pets.
Humans select desirable characteristics.
Humans decide which individuals reproduce.
Different
Natural Selection
Changes take many generations.
Individuals have differences (variation).
Characteristics are inherited from the parents.
Similar
Artificial Selection
Examples: wild animals, wild plants, funghi.
Organisms with desirable characteristics survive and reproduce.
Many/most offspring do not survive.
Different

Notes for Teachers

Reading this adaptation of *The Origin of Species* should be the finale of a sequence of study. Reading it is the equivalent of a performance after much rehearsal. For a modern reader, a significant amount of background knowledge is required. These lesson notes offer a sequence of learning activities to prepare the reader for the final text.

INTRODUCTION

The introduction is a brief text, but it gives the reader and teacher the opportunity to explore the social and scientific context of the book when it was published.

ACTIVITY 1: There are many videos available on the internet to support this text. An example from the BBC is https://www.youtube.com/watch?v=TSVsXrAJEuc. This could be watched at home.

ACTIVITY 2: Discussion. Was Darwin's idea dangerous? I recommed using Philosophy for Children techniques (e.g. http://www.sapere.org.uk/default.aspx?tabid=162) to discuss this with the class.

ACTIVITY 3: Writing is an effective way to ensure children think carefully about an idea. I suggest they write an answer to the question: Was Darwin's Idea Dangerous? Even a short answer (1 paragraph) will support effective reasoning.

ACTIVITY 4: Read the INTRODUCTION. The teacher should judge whether students read this independently, in small groups to each other, or whether the teacher should read it aloud to the class.

Example session to lead up to the reading of Chapter 1

CHAPTER 1: VARIATION UNDER DOMESTICATION

This chapter is Darwin's gentle introduction to a controversial idea. Darwin uses examples familiar to the reader to describe how breeds have changed over time by selection by man. These ideas introduce the reader to the idea that species change: they are not immutable.

Task 1: How selective breeding works.

Part 1: Which plants and animals have been bred? Use examples (with images) of domestic animals including dogs, and domesticated plants, for example varieties of apple.

Part 2: How are they bred? The breeder chooses individuals with the characteristics she wants to develop in the next generation. She breeds the parents together so that the offspring inherit the chosen characteristics.

Task 2: Vocabulary. Key terms needed to understand the text are:

Inherit:	When the offspring have characteristics from their parents.
Selection:	Choosing the individuals with chosen characteristics to breed together.
Variation:	When individuals have different characteristics, for example colour differences, size differences and behaviour differences.
Breeding:	Choosing parents with identified characteristics to breed together to produce offspring with the desired characteristics.

Task 3: Complete these tables.

Give examples of domesticated species.

Domesticated Animals	**Domesticated Plants**
Dogs	Apples

Identify useful characteristics a breeder might want to develop.

Useful Characteristics of Dogs	**Useful Characteristics of Apples**
Good sense of smell	Taste

Task 4: Text version 1. Use this extremely simplified version to introduce chapter 1.

1. Domesticated animals vary more than wild animals. Give the example of dogs and foxes.
2. Characteristics are inherited from the parents. Give the example of breeding two different varieties of dog together: e.g. dalmations and greyhounds. Ask the pupils to predict the characteristics the puppies will inherit.
3. Darwin studies pigeons to get a better understanding of selection. Show images of types of pigeons. (Fantail, pouter, tumbler, carrier and the original rock-pigeon).
4. Breeders have chosen the best animals and plants to breed together over thousands of years to produce varieties.
5. Breeders need individuals that vary so that they can make choices.

Task 5: Sentence starters - complete these sentences:

Domestication is the process of taking a wild plant or animal and…

Breeders choose individuals with the best characteristics so that…

Breeders need a large group of individuals to choose from because…

Breeders need the individuals to vary so that….