Everything around us is made of atoms. Atoms do not have any electrical charge, however, atoms contain even smaller particles called electrons which have a negative charge. If an atom gains electrons it becomes negatively charged and if it loses any electrons, it becomes positively charged.

Electrons are able to move from one object to another. When objects are rubbed together, some electrons are stripped from one object and are left on the other. This leaves one object with extra electrons and therefore a negative charge and the other with fewer electrons and a positive charge.

When an object is positively or negatively charged, an electric field is created. This is an area around the object in which its electric charge exerts a force. If another charged object moves into this electric field a force acts upon it. This means that two objects do not have to touch for a force to act between them. If the two objects both have the same electric charge (both positive or both negative), they will repel each other. If one object is negatively charged and one is positively charged, they will attract one another.

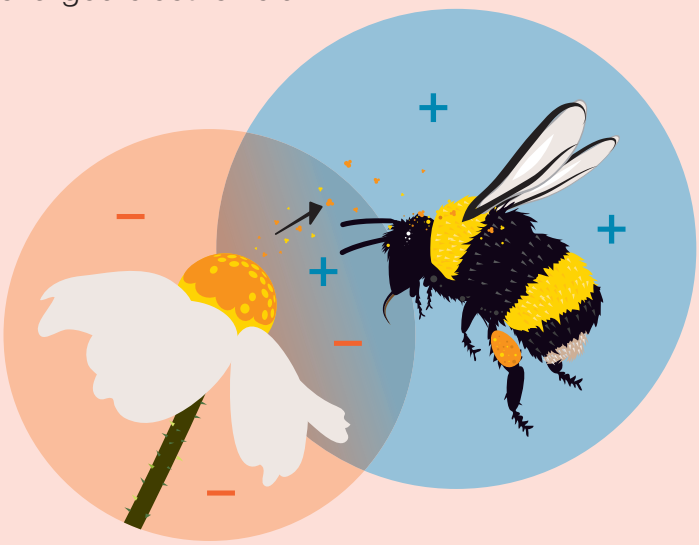
Objects with the same electric charge will repel (push away from) each other.

Objects with opposite electric charges will attract (pull towards) each other.

Bumblebees use static electricity to collect pollen

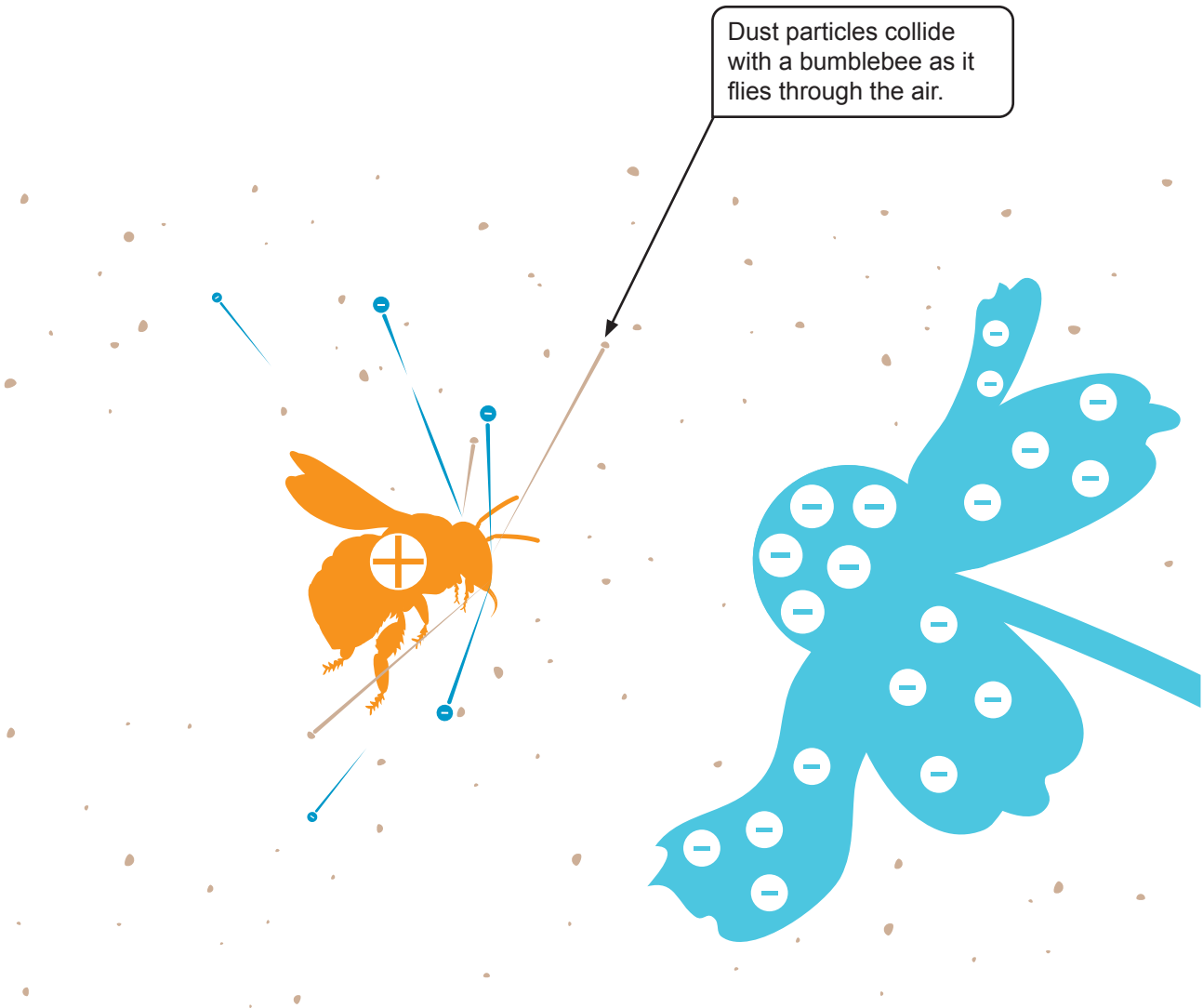
When a bumblebee flies through the air, it can beat its wings up to 200 times per second. This extremely rapid movement means that the bumblebee frequently collides with tiny particles in the air. These collisions strip negatively charged electrons from the bumblebee. This leaves a bumblebee with a positively charged electric field.

Flowers and therefore the pollen within them have a negatively charged electric field. As a positively charged bumblebee approaches a flower, their electric fields overlap and there is a force of attraction between them. This force causes the negatively charged pollen grains, that are not anchored to the flower, to 'leap' from the flower onto the bumblebee, without the two even needing to touch.



HERITAGE FUND

Task 1: Using the information from worksheet 1, annotate the diagram below to explain how a bumblebee becomes positively charged and why a negatively charged flower is pulled towards it. Aim for at least **four annotations** with good explanations.



HERITAGE FUND

Task 2: Use the information from worksheet 1 and your annotations from task 1 to create a storyboard, outlining how static electricity helps bumblebees collect pollen.

When a bumblebee flies through the air, it can beat its wings up to 200 times per second.	This extremely rapid movement means that the bumblebee frequently collides with tiny particles in the air.	These collisions strip negatively charged electrons from the bumblebee. This leaves a bumblebee with a positively charged electric field.
Flowers and therefore the pollen within them have a negatively charged electric field.	As a positively charged bumblebee approaches a flower, their electric fields overlap and there is a force of attraction between them.	This force causes the negatively charged pollen grains, that are not anchored to the flower, to 'leap' from the flower onto the bumblebee, without the two even needing to touch.

HERITAGE FUND

Task 2: Use the information from worksheet 1 and your annotations from task 1 to create a storyboard, outlining how static electricity helps bumblebees collect pollen.

Overview

This lesson explains how the movement of electrons between objects creates positive and negative charges and explores how these objects interact. Bumblebees are used as a case study to show how these principles can occur in the natural world.

Task 1

In this task, students need to apply the information from worksheet 1 to the image. They should try to identify key areas in the image and explain what is happening.

e.g. *An arrow pointing to a negative electron coming off of the bumblebee would have an annotation saying; Dust particles colliding with the fast moving bumblebee knock negative electrons off of the bee.*

Task 2

Students use their annotations from task 1 and the bumblebee case study from worksheet 1 to create a storyboard, explaining how static electricity helps bumblebees to collect pollen. Students should aim to split the case study up into logical steps and create an appropriate image for each step that supplements the text. Images could also include some annotations to add detail and context.

Note: There is a differentiated version of the storyboard (worksheet 3a), which has all of the text included.

Example of Storyboard Steps

Step 1: *When a bumblebee flies through the air, it can beat its wings up to 200 times per second.*

Step 2: *This extremely rapid movement means that the bumblebee frequently collides with tiny particles in the air.*

Step 3: *These collisions strip negatively charged electrons from the bumblebee. This leaves a bumblebee with a positively charged electric field.*

Step 4: *Flowers and therefore the pollen within them have a negatively charged electric field.*

Step 5: *As a positively charged bumblebee approaches a flower, their electric fields overlap and there is a force of attraction between them.*

Step 6: *This force causes the negatively charged pollen grains, that are not anchored to the flower, to 'leap' from the flower onto the bumblebee, without the two even needing to touch.*