

In This Unit

Theme This unit is about the evolution of flight.

Content Objectives

Students will

- examine the world of animal and human flight.
- read about the development of the first powered aeroplane.
- consider how childhood interests can influence career choices.

Language Objectives

Students will

- talk about the evolution of flying animals and machines.
- use phrases to argue, counterargue and concede.
- use the past perfect to distinguish the first of two actions in the past.
- use the past perfect continuous to describe the first of two actions in the past.
- write a classification essay describing two types of animal flight.

Vocabulary

pages 78–79 *adaptation, capability, early, evolve, feature, flap, flight, glide, hollow, limited, soar, weight, wingspan*

page 80 *allow, powered, skilled, support*

page 83 *ascend, descend, force, parachute, prove, stable*

page 84 *engine, fuel, to land, pilot, to take off*

Vocabulary Strategies Root words (*port*); Using a dictionary

Speaking Strategy Arguing and conceding

Grammar

Grammar 1 Use the past perfect to distinguish the first of two actions in the past

Grammar 2 Use the past perfect continuous to describe the first of two actions in the past

Reading *Reaching for the Sky*

Reading Strategy Identify sequence of events

Video Scene 5.1: *Flight of the RoboBee*;
Scene 5.2: Meet Ryan Carney

Writing Classification essay

National Geographic

Mission Explore Your Interests

Project

- Flying machine model
- Poster
- Advertisement

Pronunciation Relaxed pronunciation:
Past perfect

Pacing Guides 3.5.1, 3.5.2, 3.5.3



Jetmen flying over the city of Dubai, United Arab Emirates

TO START

1. We all know that birds fly. What other living things fly? Make a list of as many as you can.
2. Why do you think humans have always wanted to fly?
3. Would you like to be able to fly? Why or why not?

76

Introduce the Unit

- **Build background** Say *The next unit is about flying. Many of us have flown in an aeroplane, but has anyone ever flown in a glider? What's the difference between an aeroplane and a glider?* Explain that, unlike aeroplanes, gliders don't need engines to fly; they are carried along 'rivers' of air, called air currents, in the atmosphere. Ask *Which way of flying do you think is more like the way a bird flies?* If possible, display photos of gliders. Discuss. (Planes are bigger; they go faster. Gliders are small and quiet; they have to be towed into the sky by an aeroplane.)
- Tell students to open their books at pages 76–77. Ask *Are those real people? What are they doing? How are they doing it?* Read aloud the caption. Tell students the men are flying with jetpacks, consisting of a carbon fibre wing and four tiny engines.
- Ask questions such as the following to encourage discussion:
 - What country are the men flying above?* (the United Arab Emirates)
 - What is Dubai?* (a city in the United Arab Emirates)
 - How do you think the men are feeling?*

'From flying dinosaurs to jet packs, the ability to soar among the clouds has always captivated our imagination.'

Ryan Carney

Flying High



77

- **TO START** Ask a student to read aloud Question 1 on page 76. Write some responses on the board. (some insects, bats) Explain that only birds, insects and bats can truly fly. Other animals, such as lemurs and flying squirrels, glide or leap, which is not real flight.
- Read aloud the quote on page 77. Ask students what they think *captivated our imagination* means. (fascinated us, made us wonder) Ask another student to read Question 2 aloud. Discuss as a class.
- Ask a student to read Question 3 aloud. Ask students what they know about paragliding, parasailing, bungee jumping or riding a zip line. Ask *Might these activities feel like flying?* Invite students to share any experiences they've had with these or similar activities.

Extend

- Hand out **Worksheet 3.5.1**. Put students into pairs. Explain that students will be thinking and writing about the appeal of human flight.

Objectives

Students will

- describe and discuss a photo.
- discuss why people are fascinated by flight.

Content vocabulary *soar*

Resources Worksheet 3.5.1 (Teacher's Resource CD-ROM/Website);
CPT: Unit Opener

Materials photos of gliders (*optional*)

BE THE EXPERT

About the Photo

The photo shows Yves Rossy and Vince Reffet flying with experimental jetpacks invented by Rossy, a Swiss military pilot and aviation enthusiast. In recent years, Rossy has exhibited versions of his jetpacks in high-profile events staged around the world, including the United Arab Emirates, the English Channel and the Grand Canyon. The jetpack's four engines are mounted beneath the wing, and eight gallons of jet fuel provide about ten minutes of thrust. Rossy performs loops, rolls and other manoeuvres using body movements.

Teaching Tip

There may be times during a lesson when you need to provide a long explanation or multiple examples. Make sure students still have a chance to speak. It can be helpful to pause during your explanation and ask students to repeat the concept that you just presented. This will keep students engaged and allow them to practise the language.

Objectives

Students will

- use vocabulary related to animal flight.
- use new vocabulary to read about and discuss the evolution of flight in animals.

Target Vocabulary *adaptation, capability, early, evolve, feature, flap, flight, glide, hollow, limited, soar, weight, wingspan*

Content Vocabulary *ancestors, clawed, reptiles, theory*

Resources Worksheet 3.5.2 (Teacher's Resource CD-ROM/Website); Tracks 058–059 (Audio CD/Website/CPT); CPT: Vocabulary

- 1 Which animal do you think was the first to fly? Why? Discuss. Then listen and read. 058

350 million years ago

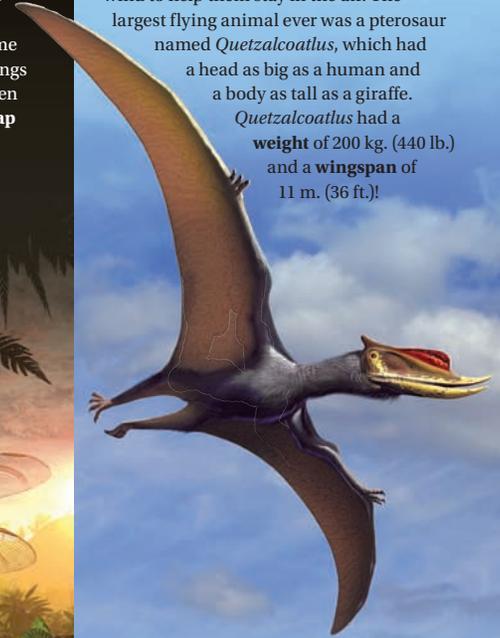
Today it's hard to imagine an empty sky, but many millions of years ago, there was no **flight** of any kind. All life was **limited** to water or land. This included very **early** insects, which were the first animals to develop wings around 350 million years ago. How did wings **evolve**? The most accepted theory is that wings developed from structures that originally supported insects' ancestors as they moved in the water. Over time, these structures became larger and stronger. They turned into wings that first allowed insects to jump and then **glide**. Eventually, insects were able to **flap** their wings and fly.



78 VOCABULARY

229 million years ago

By 229 million years ago, flight had also developed in pterosaurs, large flying reptiles. These animals were not dinosaurs, but were closely related to them. They were good fliers because they had strong flight muscles, skin-covered wings and strong but **hollow** bones. They could glide, flap their wings and even **soar**, using the wind to help them stay in the air. The largest flying animal ever was a pterosaur named *Quetzalcoatlus*, which had a head as big as a human and a body as tall as a giraffe. *Quetzalcoatlus* had a **weight** of 200 kg. (440 lb.) and a **wingspan** of 11 m. (36 ft.)!



Warm Up

- **Build background** Write *evolution* on the board. Say *We're going to read about the process by which the ability to fly developed in animals over millions of years.* Point to the board and ask if anyone can read aloud the word. Explain that *evolution* is the noun that names the process by which physical changes happen over time.
- Then write *evolve* on the board and tell students it's the verb that describes the action of changing, as in *Bats evolved from gliding animals to flying animals.*

Present 1 2

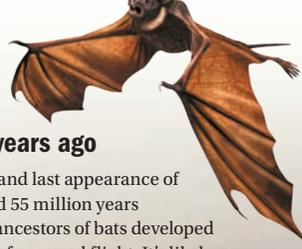
- **1** Ask students to open their books at pages 78–79. Read the Activity 1 questions. Remind students that only birds, insects and bats can fly.

- **Revisit** Say *Remember in Unit 2 we read that cockroaches have been on Earth longer than humans have. We also learnt about Jenny Daltry and her work with snakes and other reptiles, which are another group of animals that have been around for millions of years. What other kinds of animals were around before humans? Let's list some on the board.* Brainstorm a list like the one below.

cockroaches, other insects	dinosaurs
fish	birds
frogs	apes, other mammals
crocodiles, snakes, other reptiles	

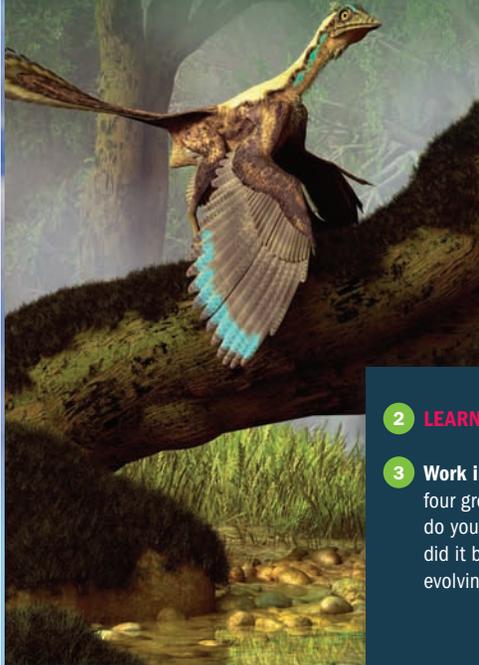
150 million years ago

Today's birds are actually living dinosaurs! The earliest known dinosaur that is generally considered to be the first bird is *Archaeopteryx*. It had feathered wings like modern birds, but also shared **features** with reptiles, such as teeth, clawed fingers and a bony tail. It could fly, but not very well. Later, birds became more skilled fliers due to better flight **adaptations**.



55 million years ago

The fourth and last appearance of flight happened 55 million years ago, when the ancestors of bats developed the **capability** of powered flight. It's likely that these mammals lived in trees and first became gliders. Over time, their bodies formed wings, making bats the only mammals that have evolved to fly.



2 LEARN NEW WORDS Listen and repeat. 🎧 059

3 Work in pairs. The capability of flight has evolved in four groups: insects, pterosaurs, birds and bats. Why do you think each of these animals evolved to fly? How did it benefit them? Do you imagine any other animals evolving this way in the future? Explain.

VOCABULARY 79

Our World in Context

It was not until the 1990s that most scientists agreed that birds evolved from dinosaurs. The many recent fossils of early birds and their predecessors that have been collected worldwide reveal that features previously thought to belong exclusively to birds – from feathers to a wishbone – were present in birds' dinosaur predecessors. Today, the consensus is that birds evolved from a group of small meat-eating dinosaurs that included *Velociraptor* of *Jurassic Park* fame.

Teaching Tip

When you introduce new vocabulary, ask the entire class to repeat each word. Then ask individual students to repeat the same word aloud. Correct any pronunciation errors. This allows you to monitor pronunciation quickly and fix any errors before students begin to use the words on their own.

- Say *Now we're going to hear and read about how some animals evolved to be able to fly.* Play **Track 058** and tell students to listen and read. Then discuss the photos and the reading with students. Ask questions such as:

How did wings develop in insects? (from structures that originally supported insects' ancestors as they moved in water)

What do birds have that no other animals have? (feathers)

What do you think is meant by powered flight? (flight that requires a source of energy)

How do wings get the power to lift an animal off the ground? (they need to be flapped)

- **2 LEARN NEW WORDS** Play **Track 059**. Ask students to listen and repeat. Then put students into pairs. Tell partners to take turns saying each word. Display the

vocabulary words. Assign two or three to each pair. Say *Work together to write a new sentence for each of your words.*

- Model an example for students. Point to *adaptation*. Write on the board *Dinosaurs underwent adaptations that allowed them to fly.* When students have finished, ask pairs to read their sentences to the class.

Practise 3 4 5

- **3** Put students into pairs. Read aloud the Activity 3 questions on page 79. Say *Review the reading. Then think about modern animals – on land, in the sea, in the air.* Ask *What do they eat? What eats them? What threatens their habitats? Why might modern animals evolve to fly? Which ones might benefit most?* Tell partners to discuss. When they have finished, ask pairs to share their ideas.

Objectives

Students will

- practise using vocabulary related to the evolution of flight in animals.
- use a vocabulary strategy to learn new vocabulary.

Target Vocabulary *allow, powered, skilled, support*

Vocabulary Strategy Root words (*port*)

Content Vocabulary *descendants*

Resources Online Workbook/Workbook pages 46–47; Tracks 060–061 (Audio CD/Website/CPT); CPT: Vocabulary

4 **Read and write the words from the list.** Make any necessary changes.

adaptation	capability	evolve	flight
glide	hollow	limited	weight

As an evolutionary biologist and palaeontologist, Ryan Carney studies the history of dinosaurs and their modern-day descendants: birds. From a single feather, he was inspired to research the adaptations that species made over time in order to fly. He is interested in *Archaeopteryx* because it was the earliest known dinosaur. *Archaeopteryx* was also the earliest species to evolve the capability of powered flight. Ryan investigates the theory that flight in birds originated from 'the ground up' (from ancestors that first ran on the ground), and not from 'the trees down' (from ancestors who lived in trees and then learnt to glide, before eventually flying).



Archaeopteryx feather fossil



Ryan Carney

5 **LEARN NEW WORDS** Listen to these words and match them to their definitions. Then listen and repeat. [060](#) [061](#)

allow	powered	skilled	support
-------	---------	---------	---------

- | | |
|----------------|---|
| <u>allow</u> | 1. to provide the capability to do something |
| <u>skilled</u> | 2. having the capability to do something well |
| <u>support</u> | 3. to carry the weight of something |
| <u>powered</u> | 4. having energy to produce movement |

6 **YOU DECIDE** Choose an activity. Work in pairs.

1. List three insects that fly and three that don't. Compare the insects on the two lists. What are the advantages of flying for insects?
2. With around 10,000 species in existence, birds have developed a wide variety of adaptations for flight. Compare and contrast two very different-looking birds. How is their flight similar? How is it different?
3. Why do you think bats developed flight to use mainly at night? How are bats' flight adaptations different from those of other fliers?

80 VOCABULARY

- 4 Ask students to turn to page 80. Point out the photos of the fossil and Ryan Carney. Say *Ryan is a palaeontologist, a scientist who studies fossils to learn about life on Earth*. Ask students to read the words in the word box aloud. Tell them to choose a word and use it in a sentence. Then tell students to complete Activity 4 independently. Ask a student read the completed paragraph aloud.
- 5 **LEARN NEW WORDS** Read aloud the words in the box. Tell students to listen for the words as you play **Track 060**. Then replay the track and ask students to match each of the four words to its definition. Play **Track 061** and tell students to listen and repeat. Ask *Did you match the words to the right definitions?* Review the word meanings. Tell students to correct any mistakes.
- **Vocabulary Strategy** Write *support* on the board. Circle *port* and say *Port is a word part called a root. Like prefixes and suffixes, roots have meaning*. Explain that a word root is usually part of another word, and if you know its meaning, it can help you work out the meaning of an unfamiliar word. Say *Port means 'to carry'. If you didn't know the meaning of support, recognising the root would*

help you work out that support has something to do with holding, carrying or keeping something from falling.

Apply 6

- **6** Say *Let's list some familiar insects. I'll start with cockroaches. What are some others?* Add students' suggestions to the list. (bees, wasps, ants, butterflies, mosquitoes, termites) Say *Now, let's name some birds.* Start another list and add students' suggestions. (eagles, gulls, parrots, canaries, turkeys, hummingbirds)
- **YOU DECIDE** Ask students to read Activity 6. Explain that students who choose option 1 will compare and contrast two categories of insects – those that fly and those that don't. Students who choose option 2 will compare and contrast two birds with very different physical characteristics – and the way they fly. Say *After you compare and contrast, you'll need to analyse the information.*
- **Think aloud** Model thinking about the third activity option. Say *I think bats are fascinating because they're the only flying mammal. I'm going to do option 3. I'll need to contrast the physical features that allow bats to fly with those of insects and birds. First, I'll go back and re-read the section about bats on page 79. Bats' wings look very different to those of insects and birds. I'll start with that.*
- Put students who are interested in the same option into pairs. Ask them to re-read the instructions and complete the activity. Tell students to make notes. Then review their work as a class.

Extend

- Point out that the ancestors of bats appeared 95 million years after Archaeopteryx. Say *Evolution is a very, very slow process. Bats are the only flying mammal now, but what other mammals might be slowly evolving the capability of flight as we speak?* Put students into small groups to discuss. Say *Give reasons for your conclusions. Try to use the new vocabulary in your discussion.*
- If time allows, hand out **Worksheet 3.5.2**.

Consolidate

- Write on the board: *evolve, feature, flap, flight, glide, hollow, limited, soar, weight, wingspan.* Say *Write a paragraph about the mammal you think will be the next to evolve the capability of flight. Describe its features and how it flies. Use as many of the vocabulary words on the board as you can. Include a drawing of what the animal might look like.*

Vocabulary Strategy

Root words (port) The word root *port* comes from the Latin word for 'to carry'. Other words that contain the Latin root *port* are *transportation* ('system for carrying people or things from one place to another'), *transport* ('to carry from one place to another'), *portable* ('able to be carried easily'), *porter* ('a person who carries baggage') and *portfolio* ('a case for carrying materials').

Teaching Tip

Graphic organisers help students organise and categorise information, show cause-and-effect relationships, and compare and contrast ideas. Tables and diagrams can help visual learners understand complex ideas. Additionally, when students return to a lesson to review material, graphic organisers help them quickly locate important ideas.

Formative Assessment

Can students

- use vocabulary related to animal flight?
Ask *Many animals glide or jump, but what capability sets insects, birds and bats apart from these other animals?*
- use new vocabulary to discuss the evolution of flight in animals?
Ask students to name some features of pterosaurs that allowed them to fly.

Workbook For additional practice, assign Workbook pages 46–47.

Online Workbook Vocabulary

SPEAKING STRATEGY

Objective

- Students will
- use expressions to argue and concede points.

Speaking Strategy

Arguing and conceding

Academic Language

argue, concede

Content Vocabulary

logical

Resources Online Workbook; Worksheet 3.5.3 (Teacher's Resource CD-ROM/Website); Tracks 062–063 (Audio CD/Website/CPT); CPT: Speaking Strategy

SPEAKING STRATEGY 062

Arguing

I'm sure you agree that _____ .
Well, I think that _____ .
Most people support _____ .
Yes, but what about _____ ?

Conceding

I guess you have a point.
Well, maybe you're right.

- 1 **Listen.** How do the speakers argue their points and concede? Write the phrases you hear. 063

- 2 **Read and complete the dialogue.** Possible answers:

Ann: You know, we still don't know much about the ancestors of bats. There just isn't much evidence.

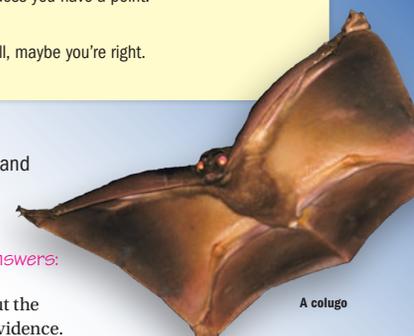
Alan: Maybe, but *most people support* the idea that bats are closely related to a group of mammals that also includes the colugo.

Ann: Yes, *but what about* the fact that the colugo glides? It doesn't flap its wings and fly.

Alan: Well, I *think that* bats and colugos probably had an ancestor in common at some point. Think about it. I'm

sure you agree that they share characteristics. Their wings look very similar. And both species eat insects. So it's logical that their ancestor would be a nocturnal glider who lived in trees.

Ann: I *guess you have a point* there.



A colugo

- 3 **Work in groups.** Cut out the cards. Take turns reading them aloud. Group members argue and concede each point.



Go to page 163.

- 4 **Work in pairs.** What affects your own life? What do you want to change? Take turns arguing and conceding.

Most students support the idea of less homework. I do, too.

Yes, but what about preparing for tests? Homework can be useful for that.

Well, maybe you're right.

Warm Up

- **Activate prior knowledge** Ask *What do you call it when you and a friend are talking about something but you don't agree about it?* (arguing) Model arguing with a student. Write a sentence frame on the board and ask the student to complete it aloud: *I think that _____ is the best singer today.* Respond by saying *I think you're wrong. I'm sure _____ is the best singer today.*
- Say *(Student's name) and I stated our opinions – and that was that. End of conversation.* Explain that neither of you offered a reason for your opinion, nor did you admit that there are probably other people who would agree with each of you. Say *There are better, more polite and more helpful ways of arguing.*
- Add to the board *You might be right* and *But what about the fact that _____?* Then tell partners to use the language on the board to have a conversation in which they disagree about something.

Present 1

- Ask *How did your conversations go? Were you polite? Did you admit to one another that others may agree with both of you?* Say *When you do that, it's called conceding. Let's hear some other ways of arguing and conceding.* Tell students to turn to page 81. Play **Track 062**.
- 1 Say *Now listen as two people argue and concede. Pay attention to how they respond. Write the phrases they use.* Play **Track 063**. When students have finished, ask them to share what they wrote. Then tell partners to use the expressions they wrote to practise arguing and conceding. Provide other prompts such as:

What do you think about _____?

You have a point, but I think that _____.

Yes, but don't you agree that _____?

Many experts say that _____.

Practise 2

- **2** Once students seem comfortable using the language of arguing and conceding, ask them to complete the activity independently. Before they begin, point out the photo of the colugo and tell students it's a small mammal that lives in Southeast Asia. Say *It's also called a flying lemur, despite the fact that it's not a lemur and it doesn't fly. It glides.* When they have finished, ask students to read aloud their completed dialogues.

Apply 3 4

- **3** Tell students to cut out the cards on page 163. Point out that the cards contain information related to Units 1–5. Then put students into small groups and read the instructions. Ask each group member to choose a card. Say *Decide whether you agree with the statement on the card or not, and then argue your point with the other group members, who must then concede.* Circulate as students interact, and provide assistance as needed. Say *Be polite. Only one student speaks at a time.*
- **4** Read the Activity 4 instructions aloud. Put students into pairs and ask them to read the model dialogue. Say *Let's brainstorm situations partners might argue about.* You might suggest topics such as following fashion trends, bringing mobile phones to class, whether flash mobs serve any good purpose or the best way to raise students' awareness of environmental issues. When students have completed their discussions, ask them to share any phrases they used to argue and concede. Write them on the board.

Extend

- Tell the Activity 4 partners to work together to write a dialogue based on their discussion. Tell them to include the expressions they used to argue and concede or use ones from the board. Then ask pairs to read their dialogues aloud to the class.
- If time allows, hand out **Worksheet 3.5.3**. Partners can use the worksheet for further practice in arguing and conceding.

Consolidate

- Use one of the topics students brainstormed for Activity 4. Write a statement about the topic on the board. For example, *I think the school should ban mobile phones in class.* Below that, display expressions of argument and concession.
- Tell students to stand in a circle. Explain that you'll begin a conversation by reading aloud the statement on the board to a student in the circle. That student will continue the conversation by conceding a point. Then the next student will argue a different point about the topic, to which the next student will concede, and so on, until everyone has had a chance to speak. Say *Let's see how long we can keep the conversation going!*

Strategy in Depth

Arguing and conceding are common conversation techniques. Tell students that learning to politely argue and concede will improve their conversational skills while also showing that they're actively listening to what someone is saying. Other expressions used to argue and concede include the following:

To introduce an issue: *Some people feel / insist / believe that*

To concede a point: *While it's true / sensible / evident that*

To argue your own point: *It's also true / It's more important / The bigger issue is that*

To sum up: *It's clear / I believe that*

Formative Assessment

Can students

- use expressions to concede points?

Say *Imagine someone told you they don't believe that birds are descended from dinosaurs because they're smaller than dinosaurs and covered with feathers. How would you concede a point?*

- use expressions to argue points?

Ask *Now, how would you argue a different point?*

Objectives

Students will

- identify the form, meaning and use of the past perfect tense.
- use the past perfect to distinguish the first of two actions in the past.
- use words associated with human flight.

Grammar Past perfect: Talking about the first of two actions in the past

Target Vocabulary *ascend, descend, force, parachute, prove, stable*

Academic Language *past perfect, timeline*

Content Vocabulary *BCE, CE, experimented, gravity, kites, signalling, transport*

Pronunciation Relaxed pronunciation: Past perfect

Resources Online Workbook/Workbook pages 48–49; Tracks 064–067, 123–125 (Audio CD/Website/CPT); CPT: Grammar 1 and Pronunciation; Pronunciation Answer Key (Teacher's Resource CD-ROM/Website)

Materials pieces of card

GRAMMAR 064

Past perfect: Talking about the first of two actions in the past

Pterosaurs disappeared.
Modern birds evolved.

Pterosaurs **had** already **disappeared** by the time modern birds evolved.

The capability of flight developed four times in animals.

By the time humans tried to fly, the capability of flight **had developed** in four groups of animals.

Humans tried to fly.

1 Listen. Which of the two actions in the past happened first? Tick the box. 065

- | | |
|--|--|
| 1. <input type="checkbox"/> kite flight | <input checked="" type="checkbox"/> animal flight |
| 2. <input checked="" type="checkbox"/> running, arm flapping | <input type="checkbox"/> kite flight |
| 3. <input checked="" type="checkbox"/> measuring, signalling | <input type="checkbox"/> human transport |
| 4. <input type="checkbox"/> fun and entertainment | <input checked="" type="checkbox"/> military use |
| 5. <input type="checkbox"/> kites made of paper | <input checked="" type="checkbox"/> kites made of silk |

2 Read and complete the sentences. Use past perfect forms of the verbs in the box.

design draw forget jump run try

Jumping from towers, walls and cliffs was among many ways humans tried to fly. Many men had tried to fly like the birds before success was achieved in 875 CE. In that year, a man named Abdul Qasim Abbas Ibn Firnas jumped from a high wall built over a valley in Cordoba, Spain. Before his experiment, he had designed wings covered in feathers. He planned to wear them on his arms and legs. Also, he had drawn on paper a series of wing movements to use in flight. According to the people who saw his experiment, he began to fall after he had jumped. Afterwards, he climbed even higher than his starting point. He glided for several hundred feet, turned and came back to the wall. He hurt his back in the experiment, possibly because he had forgotten to include a tail in his design.

1000 BCE

The Chinese invent kites.



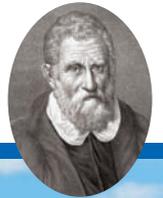
875 CE

Abbas Ibn Firnas wants to **prove** that man can fly. He tries flying by jumping with feathered wings.



1295

Marco Polo describes man-carrying kites.



82 GRAMMAR

Warm Up

- **Activate prior knowledge** Say *You know that we use the past form of a verb to talk about things that happened in the past, as in Last night, I recycled all my old shoes.* Then say *Sometimes, we talk about more than one past event at the same time. When we do, it's helpful to let the listener know which thing happened first.*
- Write on the board *By the time I went to bed, everyone else had been asleep for hours.* Read aloud the sentence and underline *went to bed* and *had been asleep*. Ask *Who went to bed first, me or everyone else?* (everyone else) Say *The word had helps you know which action happened first.*
- Write on the board:

When I arrived home yesterday, I got a big surprise.
The cat had knocked over the birdcage.
The bird had got out.
It had flown to the top of the window.
The cat had ripped the curtains trying to get it.

- 3 **LEARN NEW WORDS Listen.** Learn about Leonardo da Vinci and the history of human flight. Then listen and repeat. 066 067



- 4 **Read the sentences.** Tick T for true or F for false.

- Gravity is one of the forces that acts on flying and falling objects. T F
- Leonardo da Vinci designed his parachute in 1595. T F
- A stable flying object does not move from side to side. T F
- Da Vinci created a helicopter that ascended into the sky at an angle. T F
- A parachute can be used to help people descend safely from the sky. T F
- Experts proved that da Vinci's glider was almost the same as Cayley's. T F

- 5 **Work in groups.** Use the timeline and new words to make four true sentences about flight. Use the past perfect.

- _____
- _____
- _____
- _____

1485

Leonardo da Vinci studies **forces** that affect objects in the air in order to design flying machines.



1595

Fausto Veranzio designs a **parachute**.

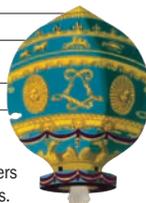
1670

Francesco Lana de Terzi designs an **airship**.



1783

The Montgolfier brothers launch hot-air balloons. These balloons **ascend** when the air inside is hot and **descend** when it cools.



1800

George Cayley designs the first **stable** glider to carry a human.



GRAMMAR 83

- Ask students to read the sentences silently. Say *Pay attention to the underlined verbs.* Ask *What things happened first? Did they happen before or after I arrived home?* (before) Ask *Which word helped you know what things happened first?* (had) Then ask questions such as *Did the cat rip the curtains before or after the bird got out?*

Present

- Ask students to open their books at page 82 and look at the grammar box. Read aloud the grammar skill at the top of the box. Point out the past perfect verbs on the right side of the box. Say *When you use had and the past participle of a verb to talk about something that happened before something else in the past, it's called the past perfect form. Let's listen to sentences with past perfect verbs.* Play **Track 064** as students listen.

BE THE EXPERT

Grammar in Depth

There are three perfect tenses: the present perfect, past perfect and future perfect. The past perfect is formed with the past form of *have* (*had*) plus the past participle of the verb.

Use the ...	to talk about ...
present perfect	something that took place in the past and may still be going on: <i>I have read about the history of flight.</i>
past perfect	something that took place before something else in the past: <i>I had read about da Vinci before you told me about him.</i>
future perfect	something that will take place before something else in the future: <i>I will have read all I can by the time the test is given.</i>

Another use of the past perfect is in an *if*-clause, to express an imaginary situation, as in *If I had been better in maths, I could have been an astronaut.* This use will be covered in more depth in Unit 6.

Pronunciation

Go to Student's Book page 146. Use Audio Tracks 123–125.

Relaxed pronunciation: Past perfect

Students learn about contractions with *had* in writing, usually with pronouns (*I'd, we'd, ...*), where *had* is reduced to /d/, but they may not realise that in speaking, *had* is also reduced after nouns (*Julie'd /d/, Jim'd /əd/ or /həd/*) as well as question words (*When'd /əd/ or /həd/; Who'd /d/, /əd/ or /həd/*).

It's not necessary for students to attempt to speak this way, but it is important for them to listen for it and be aware of the slight differences between how the past perfect sounds compared to the simple past. That small sound carries meaning.

GRAMMAR 066
Past perfect: Talking about the first of two actions in the past
 Promoters **disappeared**.
 Modern kites **evolved**.

The **ability of flight** developed **long** in animals.
 Humans **tried to fly**.

In the 19th century, the **possibility of flight** had **developed** in bird groups of animals.

1 Listen. Which of the two actions in the past happened first? Tick the box. **065**

Kites flight animal flight
 running, sea flapping kite flight
 measuring, signalling human transport
 fun and entertainment military use
 kites made of paper kites made of silk

2 Read and complete the sentences. Use past perfect forms of the verbs in the box.

evolve draw forget jump see try

Jumping from towers, walls and cliffs was among many ways humans tried to fly. Many men **had tried** to fly like the birds before success was achieved in 875 CE. In that year, a man named Abul Qasim Abbas Ibn Firnas jumped from a high wall built over a valley in Cordoba, Spain. Before his experiment, he **had designed** wings covered in feathers. He planned to wear them on his arms and legs. Also, he **had drawn** on paper a series of wing movements to use in flight. According to the people who saw his experiment, he began to fall after he **had tried** several hours, he climbed even higher than his starting point. The glider for several hundred feet, turned and came back to the wall. He hurt his back in the experiment, possibly because he **had forgotten** to include a tail in his design.

1000 BCE The Chinese invent kites.
875 CE Abbas Ibn Firnas wants to prove that man can fly. He tries flying by jumping with his own wings.
1289 Marco Polo describes man-carrying kites.

1483 Leonardo da Vinci studies birds that affect objects in the air in order to design flying machines.
1490 Fausto Veranzio designs a parachute.
1490 Francesco Lana da Vinci designs an airship.
1783 The Montgolfier brothers launch hot air balloons. These balloons ascend when the air inside is hot and descend when it cools.
1800 George Cayley designs the first stable glider to carry a human.

- Ask a student to read aloud the first two sentences on the left side of the grammar box. Ask *What are the verbs in these sentences? (disappeared, evolved) What form are they? (simple past) Then ask How can you combine these two sentences and say which event happened first?* Ask a student to read aloud the first sentence on the right side of the grammar box. Repeat the process with the second group of sentences.
- Tell pairs to read the sentences to each other. One partner reads the two sentences on the left. The other partner then reads the sentence on the right. Then they swap roles. Circulate as pairs read to each other. Stop occasionally and ask partners *Which event happened first?*

Practise 1 2

- 1** Say *Now we'll hear sentences about the history of kites. Listen for the past perfect verbs. Write down as many as you can.* Play **Track 065** once and tell students to listen.
- Read the Activity 1 instructions. Say *Let's go over item 1 together.* Ask *Which past action happened first – people experimented with kite flight or flight existed in animals?* (flight existed in animals) Say *Look at the verbs you wrote. What past perfect verb helped you work out the answer?* (*had existed*) Replay **Track 065** and ask students to complete the activity. Review the answers and the past perfect verbs as a class.

- 2** Read the activity instructions and verbs aloud. Ask *How do you write the past perfect form of a verb?* Remind students that to form the past perfect you use *had* and the past participle of the verb. Then review that the past participles of some verbs are not written with the ending *-ed*. Instead, the past participles of these 'irregular' verbs have to be memorised.
- Point out that *draw* and *forget* are irregular verbs. Write the past perfect forms of the verbs in the box: *had designed, had drawn, had forgotten, had jumped, had tried.* Remind students that when a verb, such as *try*, ends in a consonant + *y*, we replace *y* with *ied* to write the past form.
- Read the first two sentences. Say *I have to fill in the blank with the past perfect verb form of a verb in the box. Ask Which verb makes the most sense here? (had tried)* You may wish to pair less proficient readers of English with more proficient students to complete the activity. When students have finished, ask individuals to read each sentence.

Apply 3 4 5

- 3 LEARN NEW WORDS** Point out the image of Leonardo da Vinci on page 83. Ask *Does anyone know anything about Leonardo da Vinci?* Some students may know he was a famous artist. Then say *In addition to da Vinci's many artistic achievements, he was one of the first people to consider the science of powered flight. Let's listen and learn some new words.* Play **Track 066** and tell students to listen. Then play **Track 067**. Ask students to listen and repeat.
- 4** Read aloud the activity instructions. Ask students to read the sentences. Then say *Before you decide which statements are true and which are false, we'll listen to the audio tracks again.* Replay **Track 066** and **Track 067**. Review the answers as a class.
- Draw students' attention to the image across the bottom of pages 82–83. Ask *Does anyone know what type of diagram this is?* Explain that it's a timeline showing important events in the early history of human flight. Say *You've heard some of these events already. Others will be new to you.* Ask students to read aloud each section of the timeline, including the year. Provide assistance as necessary.

- 5 Put students into small groups. Read the Activity 5 instructions. Provide a sample sentence, such as *Long before da Vinci designed flying machines, Abbas Ibn Firnas had glided with wings.* Say *Listen to one another's suggestions for sentences. Encourage all group members to share their ideas. Come to a consensus, and remember to use the new vocabulary words in your sentences.* Help groups as necessary. Ask each student to write down his or her group's sentences. When they have finished, ask groups to share some sentences. Write a few on the board as models.

Extend

- Put students into pairs with someone from a different group, if possible. Ask partners to take turns reading their four sentences to each other. Tell them to peer-review the sentences. Say *Check the facts against the timeline. Make sure vocabulary words and past perfect verbs are correct. See if you can add other vocabulary words.* Then challenge partners to work together to improve the sentences, correcting any errors in vocabulary or in the use of past perfect verbs. Then ask them to choose two of the sentences to rewrite on a sheet of paper to display in the classroom.

Consolidate

- Choose verbs from the target vocabulary to write on pieces of card, one to a card: *allow, ascend, descend, evolve, flap, glide, soar, support.* Give each student a card. Then display the following list:

adaptation	capability	flight	parachute
bats	colugo	helicopter	pterosaurs
birds	feature	insects	wingspan

- Tell students to sit in a circle. Say *We're going to practise verb forms. I'll call out a name.* Point to and say (*Billy*). Prompt (*Billy*) to stand and read aloud the word on his card, for example, *ascend*. Say *Then I'll say either simple past or past perfect.* Look at (*Billy*) and say *Past perfect.*
- Explain that (*Billy*) must use the past perfect form of the verb on his card and a word from the board in a sentence. Tell (*Billy*) to sit down. Then say (*Billy*) *might say The helicopter had already ascended by the time we got to the airport.* Ask *What's the past perfect verb? (had ascended)* Give students a few minutes to think of sentence ideas. Then say *OK, let's begin!*

Our World in Context

The abbreviations CE (Common Era) and BCE (Before Common Era) refer to a method of numbering years based on the birth of Jesus Christ. Despite the obvious connection, the terms were conceived as neutral chronological indicators that are not specifically related to Christianity, and therefore sensitive to all religions. The terms are, nevertheless, tied to the Gregorian calendar, introduced in 1582 by Pope Gregory XIII, and used worldwide.

Formative Assessment

Can students

- identify the form, meaning and use of the past perfect tense?

Ask students to identify which sentence has a past perfect verb:

Da Vinci made diagrams of flying machines in the 15th century.

Long before the modern helicopter was developed, da Vinci had designed an 'aerial screw'.

- use the past perfect to distinguish the first of two actions in the past?

Ask students which action came first:

By the time reptiles evolved the capability of flight, insects had already flown for millions of years.

- use words associated with human flight?

Ask students to use at least two of the following words in a sentence about a past action: *ascend, descend, force, parachute, prove, stable.*

Sample: *The pilot descended to the ground in a parachute.*

Workbook For additional practice, assign Workbook pages 48–49.

Online Workbook Grammar 1

Objectives

Students will

- summarise events that led to the Wright brothers' development of the first powered aeroplane.
- use new words from the reading.
- put events in sequential order.

Reading Strategy Identify sequence of events

Target Vocabulary *engine, fuel, to land, pilot, to take off*

Vocabulary Strategy Using a dictionary

Academic Language *sequence of events, syllables*

Content Vocabulary *contribution, engineers, generated, horsepower, mechanics, perfecting, phonetic, reality, rubber bands, wind tunnel*

Resources Online Workbook/Workbook pages 50–51; Worksheet 3.5.4 (Teacher's Resource CD-ROM/Website); Tracks 068–069 (Audio CD/Website/CPT); CPT: Reading

Materials set of classroom dictionaries

1 BEFORE YOU READ Discuss in pairs.

What do you know about the Wright brothers and flight? Make a list. What are three facts you expect to find in the reading?

2 LEARN NEW WORDS Find the words in the reading.

What do you think they mean? Then find the words *land, fuel* and *pilot* in a dictionary. Look at the different ways these words can be used. Then listen and repeat all of the new words. **068**

engine fuel to land pilot to take off

3 WHILE YOU READ Notice the order in which events happened. **069**

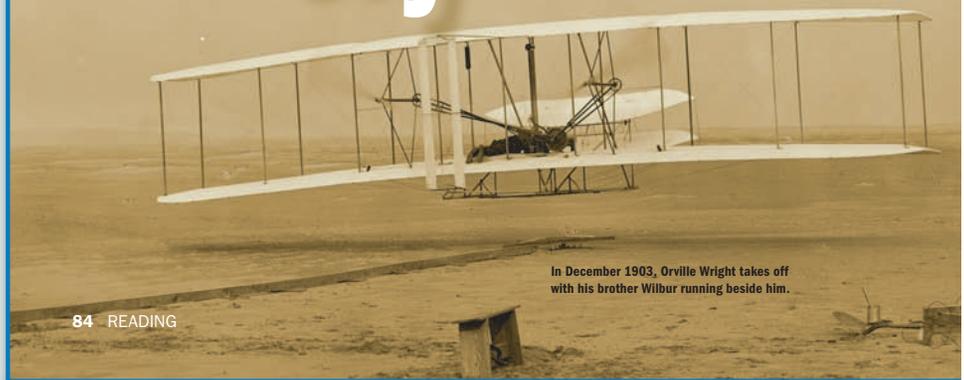
The Dream of Human Flight

One day while travelling, Milton Wright saw a small toy helicopter that was powered by rubber bands. He bought this toy for his two young sons, Orville and Wilbur. Mr Wright surely had no idea this simple act would lead to the creation of the world's first powered aeroplane. The toy gave the brothers a strong interest in flight. They soon began trying to build similar models themselves.

When they were older, the Wright brothers decided they wanted to make a 'small contribution' to the field of flight. At that time, most attention on flight focused on hot-air balloons and gliders. However, the brothers were more interested in a heavier flying machine, powered by an engine and controlled by a pilot. They first read all the books they could on the early mechanics of flight. Then they used kites to better understand the forces that controlled objects in the air.

Over the next three years, the Wright brothers worked on designs and shapes for different types of gliders. During this time, they worked with engineers Otto Lilienthal and Octave Chanute, both authors of books on flight. These men were important influences on the brothers' work.

Reaching FOR THE Sky



In December 1903, Orville Wright takes off with his brother Wilbur running beside him.

84 READING

Warm Up

- **Activate prior knowledge** Say *We've read and talked about the evolution of flight in animals and also humans' early attempts to fly. We've heard about aerial screws, parachutes, hot-air balloons and gliders. What important development in the history of human flight haven't we read about yet?* (the invention of the aeroplane) Ask *What's the main difference between gliders and aeroplanes?* Discuss with students the idea that aeroplanes are powered by engines that require fuel.

Before You Read **1** **2**

- Say *Now open your books at pages 84 and 85. Read the title. Look at the photos and read the captions.* Point out that the photos and captions on page 85 are actually a timeline. Say *Take a minute to skim the text.* When students are ready, ask them to predict what they think the reading will be about.
- **1** Read aloud Activity 1. Put students into pairs. Remind them that they can use a three-column table to list what they know, what they expect to find out and what they learnt from the reading.

The brothers had built a wind tunnel to test different shapes of wings and tails for their gliders. Then they began to think about how to get a flying machine weighing 272 kg. (600 lb.) into the air and keep it there. They designed a 12-horsepower engine that generated enough force to allow the Flyer to take off from the ground in December 1903. It ascended about 3 m. (10 ft.) into the air and continued to fly 36 m. (120 ft.) in about 12 seconds. The first heavier-than-air flight became a reality!

The second, third and fourth flights followed on the same day. But the Wright brothers observed that the Flyer was not stable enough and was hard to control. They spent two more years perfecting their aeroplane. Finally, on the 5th of October 1905, Flyer III flew about 39 km. (24 mi.) in 39 minutes. The plane landed only because it ran out of fuel. The dream of human flight had finally become true.



1891 Otto Lilienthal builds a glider.



1894 Octave Chanute's book on flying machines is published.



1891 Samuel Langley creates his aerodrome model.



1901 Alberto Santos-Dumont circles the Eiffel Tower.



1905 The Wright brothers fly for 39 minutes in Flyer III.

4 AFTER YOU READ Work in pairs to answer the questions.

1. What is the main idea of the reading?
2. How did the Wright brothers prepare for their project?
3. Whose ideas on flight influenced the Wright brothers?
4. The Wright brothers worked on their flight project for years. What personality characteristics do you think they had that helped them reach their goals?

5 Put the events in order.

- 3 The Wright brothers built a wind tunnel to test the wings and tails of their gliders.
- 2 They read everything they could about flight.
- 6 They flew Flyer III about 39 km. (24 mi.) before it ran out of fuel.
- 4 They designed a 12-horsepower engine to power the Flyer.
- 1 They used kites to learn more about how things fly.
- 5 They worked for two years to make the Flyer more stable.

6 Discuss in groups.

1. How do you think the Wright brothers' work helped shape the 20th century? What aspects of life changed?
2. Is just one person ever truly responsible for a great idea or invention? Do all ideas and inventions build on the work of previous generations? What do you think? Why?

READING 85

Reading Strategy

Identify sequence of events The sequence of events refers to the order in which events happen in a story or an informational text. It can also refer to the order of steps to follow in a process or set of instructions on how to make or do something. Certain words and phrases signal when a text is organised in sequential order. These words and phrases include *first*, *next*, *then*, *finally*, *later on*, *in the meantime*, and so on, as well as dates, times and other phrases that indicate the passage of time.

In *Reaching for the Sky*, these phrases include *when they were older* and *over the next three years*. Recognising these signal words and phrases and understanding the sequence of events in a text will help students better understand and remember what they read.

Teaching Tip

It's easy for students to become overwhelmed when listening to long sentences and paragraphs in English. Try to keep listening activities brief so students have time to process and ask questions about what they've heard. Tell them to focus on and listen for key words. Pause longer audio recordings whenever necessary to check for comprehension. Encourage students to practise their listening skills outside of class by listening to English-language television, radio and Internet programmes.

Answer Key

Comprehension 4

1. The Wright brothers took years to perfect their aeroplane, which was a major achievement in the history of human flight.
2. They read the work of other flight researchers, and they experimented with kites and gliders.
3. Otto Lilienthal and Octave Chanute
4. Answers will vary. Traits might include curiosity, determination, ambition, creativity and persistence.

Display a table like this one for students to copy. Tell them to fill in the first two columns as they discuss the activity questions.

Topic: The Wright Brothers and Flight		
What I know	What I expect to find out	What I learnt

- **2 LEARN NEW WORDS** Read aloud the words in the word box. Encourage students to share what they think the words mean. Tell them they can act out the words or use gestures to show the meanings.

4 BEFORE YOU READ Discuss in pairs. What do you know about the Wright brothers and flight? Make a list. What are three facts you expect to find in the reading?

5 LEARN NEW WORDS Find the words in the reading. What do you think they mean? Then find the words (and their part) in a dictionary. List all the different ways these words can be used. Then listen and repeat all of the new words. **RECI**

6 WHILE YOU READ Notice the order in which events happened. **RECI**

7 DISCUSS IN GROUPS

1 How do you think the Wright brothers' work helped shape the 20th century? What aspects of life changed?

2 Is just one person ever truly responsible for a great idea or invention? Do all ideas and inventions build on the work of previous generations? What do you think? Why?

READING 85

- Call on a volunteer to come up and rewrite *reality* to show its syllables and stress mark. Then ask the student to point to each syllable as he/she says the word aloud. (re · 'al · i · ty) Tell students that online dictionaries usually include a symbol that looks like a tiny speaker after each word. They can click on the symbol to hear the word pronounced correctly.

While You Read 3

- **3** Say *Now we're going to listen to Reaching for the Sky and learn more about the Wright brothers and their contribution to the field of flight.* Play **Track 069** and tell students to follow along.

- Say *Now find the words in the reading.* Then ask *Does the text confirm what you thought the words meant?* Explain that several of the words have more than one meaning, and some can be used as nouns or verbs. Say *When you're not sure how a word is being used in a text, look it up in a dictionary and try to work out which definition best fits the context of what you're reading.*

- Ask students to look up *fuel*, *land* and *pilot* in a dictionary. Ask *Did anything you found in the entries for these words surprise you?* Discuss what students learnt. Finally, play **Track 068**. Tell students to listen and repeat.

- **Vocabulary Strategy** Remind students that in addition to word definitions, a dictionary also shows how to properly pronounce, or say, a word. Explain that, in English, there can be several different ways to pronounce a single letter, so it's important to become familiar with how your dictionary shows pronunciation.

- Without saying it, write the word *reality* on the board. Ask partners or small groups to work together to look up the word in a dictionary. Say *The entry word is broken up into syllables, or word parts.* Then point out the phonetic respelling that follows each entry word.

- Say *Stress marks show the syllable or syllables to emphasize, or stress, when you say the word out loud.* Ask *How many syllables does the word have?* (four) *How many stress marks do you see?* (one)

- Say *Find the pronunciation key in your dictionary.* Tell students that it explains the different phonetic symbols that show the sound each letter makes. It also include examples of the sounds shown in the respelling.

- Say *Now read again. This time, pay attention to the sequence of events, or the order in which the events happened. Note the words, phrases and dates the writer uses to show that time has passed. Underline them.*

- You may want to suggest that students create their own timelines for the development of the Wright brothers' aeroplane. Tell them to use the timeline on page 85 as a model. Tell them to record only the four or five most important events. Play **Track 069** again or allow students to read in silence.

After You Read 4 5 6

- **4** Put students into pairs to answer the Activity 4 questions. If partners disagree on an answer, tell them to read the text again and find information that supports their answers. Review the answers as a class.
- **5** Read aloud the Activity 5 instructions. Point out the list of events and explain to students that they're all things that the Wright brothers did. Tell students to read the list. Ask *Are the events listed in the order in which they happened?* (no) Then say *Read the events again and think about the order in which they happened. The first event is numbered for you. Number the rest in the correct order.*
- Tell students if they're not sure, they can review the reading and check the sections where they underlined sequence words and phrases.
- Ask students to read the events in the correct order. Make sure everyone agrees. Finally, tell students to fill in the tables they started before reading *Reaching for the Sky*. Ask *Did you find out what you expected to? What new information did you learn? Write the most interesting facts in the table.*

- **6** Read the Activity 6 questions. Put students into small groups. Appoint a secretary for each group to write down notes from the discussion. Say *The group secretary will decide when the first question has been discussed enough and it's time to move on to question 2.* You may wish to set a time limit for the activity.
- Provide prompts if necessary: *What impact has aeroplane travel had on the world? How much of that impact is due to the Wright brothers? Did they benefit from the work of others? How? Besides engineering – the design of engines and machinery – what other sciences do you think the Wright brothers had to be familiar with to make their planes fly?*

Extend

- Ask secretaries to share some of their group's ideas with the class. Then tell students to imagine they are one of the brothers. Tell them to write a diary entry about one of the developments described in *Reaching for the Sky*. Say *Write about the event. Say how you felt about what happened. Was it a breakthrough? Was it a disappointment? Think of the personality traits the brothers probably had. How would they react to success? to failure? Use your imaginations!* When they have finished, ask a few students to read their entries to the class.
- **Worksheet** If time allows, you may want to hand out **Worksheet 3.5.4** in class. Students will use the worksheet to practise new vocabulary words.

Consolidate

- Write on the board: *allow, ascend, capability, descend, engine, flight, fuel, glide, land, limited, pilot, powered, soar, stable, take off.* Put students into pairs and tell them to exchange diary entries. Say *Now see if you can suggest places where your partner's diary entry could include more vocabulary words.* When students have finished, tell them to swap diaries again and discuss their suggestions. Ask the original writers to write final versions and read them to the class.

Vocabulary Strategy

Using a dictionary Students should scan the entire entry to see if any of the definitions pertain to the word's use as another part of speech. For example, *fuel* can be used as a noun or a verb. No two dictionaries are the same, and sometimes, there's a separate entry for each part of speech. Other times, two parts of speech are embedded in the same entry.

Note that parts of speech are often abbreviated: *n.* (noun), *v.* (verb), *adj.* (adjective) and *adv.* (adverb), to name a few. Most dictionaries also include sample phrases or sentences for each part of speech. Different dictionaries also use different phonetic symbols, so students need to check the pronunciation guide when using a new dictionary.

Teaching Tip

Display a table of the phonetic symbols used in the classroom dictionary, and include sample words that students will be familiar with for each sound. Practise sounds regularly with students, and periodically tell them to use the phonetic respellings in the dictionary to learn the pronunciation of new words.

Formative Assessment

Can students

- summarise events that led to the Wright brothers' development of the first powered aeroplane?

Ask students to describe two events that led to the Wright brothers' invention of the powered aeroplane.

- use new words from the reading?

Ask students to use at least two of the following words in a sentence about human flight: *engine, fuel, to land, pilot, to take off.*

- put events in sequential order?

Ask students to put these events in order:

The Flyer proved to be hard to control.

The Wright brothers tested different gliders.

They wanted to build a flying machine with an engine.

Workbook For additional practice, assign Workbook pages 50–51.

Online Workbook Reading

Objectives

Students will

- discuss the development of robotic bees and their potential uses.
- apply the message of the video to their personal lives.

Content Vocabulary *autonomous, pioneers, pollen, pollinate*

Resources Video scene 5.1 (DVD/Website/CPT); Online Workbook; CPT: Video

Materials drawing materials, poster board

1 BEFORE YOU WATCH Discuss in pairs. What makes bees different from other insects? Why are bees important?

2 Work in pairs. You're going to watch a video called *Flight of the RoboBee*. Based on the title and the photo, predict what the video is about.

3 WHILE YOU WATCH List three benefits that robotic bees will have. Watch scene 5.1.

1. _____
2. _____
3. _____



Robotic bees developed by Robert Wood, Electrical Engineer/National Geographic Explorer

86 VIDEO

Before You Watch **1** **2**

- Ask *What do you know about robots? I'm not talking about made-up robots, like those from the Star Wars, Transformers and Terminator movies, but robots that are used in real life.* Students may know something about factory robots that do dangerous jobs or about robotic body parts that perform some of the functions of missing or damaged human limbs. Discuss the usefulness to society of these devices.
- **1** Ask students to open their books at pages 86–87. Read Activity 1 aloud. Say *Even though bees can sting, they're usually thought of in a positive way, unlike wasps and other stinging insects. Why is that?* Put students into pairs and tell them to discuss the questions.
- After they discuss, ask partners to share their ideas. Make sure students know that bees perform an important function for farmers by pollinating, or

fertilising, various food crops. Without the pollen delivered by bees as they travel from plant to plant, the plants would not be able to produce the seeds that grow into the fruit and other foods we eat.

- **2** Ask a student to read aloud Activity 2. Say *Look at the photo.* Read the caption aloud. Tell students they'll learn about Robert Wood in the video. Ask *Are these robotic bees big or small? How do you know?* Then ask *What do you think the word robobee comes from?* Finally, ask students to share their predictions.

While You Watch **3**

- **3** Ask a student to read the Activity 3 instructions. Say *Listen carefully as you watch Flight of the RoboBee. Write three potential benefits of these robotic insects.* Play **Video scene 5.1**. Say *Write down other things that you find interesting.*

4 AFTER YOU WATCH Work in pairs to decide if each sentence is true or false. Tick the correct answer.

- Robert Wood says that most new robots are large, powerful and dangerous. T F
- Robert's robots are inspired by nature. T F
- Robert looks at real insects to work out how to construct his robotic bees. T F
- Robotic bees haven't got the supports necessary to fly independently. T F
- Robert doesn't plan to send robotic bees into dangerous areas because they could break. T F
- Getting the robots to fly was a long, difficult process for Robert and his team. T F

5 Discuss in groups. In the video, Robert says, 'If you don't fail, you don't learn enough.' Explain what you think he means by this.

6 Work in groups. You learnt about man's early attempts at flying. Compare and contrast the process of getting the robotic bee to fly with the processes of the flight pioneers you learnt about.

7 YOU DECIDE Choose an activity.

- Work independently.** Research other robotic insects that are being developed. Choose one and create a short presentation on it. Explain what it's used for. Compare it with the robotic bee.
- Work in pairs.** Robert says that robotics is 'the next big thing to impact our lives'. Find an example of a robot that is making an impact on people's lives. Write an article about this robot and the impact it's having.
- Work in groups.** Create a poster to advertise robotic bees. Use illustrations and text to describe them, and explain why they are useful.

VIDEO 87

Teaching Tip

Whenever students identify a false statement in a true or false activity, ask them to think about how to make the statement true. Point out that there's often more than one way to correct a false statement. Whenever possible, challenge students to think of different ways to restate a false statement so that it's true.

Formative Assessment

Can students

- discuss the development of robotic bees and their potential uses?

Ask *What's one way you know, or can imagine, how robotic bees could be helpful to you or someone you know?*

Online Workbook Video

After You Watch 4 5 6 7

- 4** Put students into pairs. Remind them to use information from the video to determine their answers.
- 5** Put students into small groups. Read aloud the quote. Ask *Do you agree? How can you learn by failing at something?* Tell groups to discuss times in their own lives when they learnt a lesson by failing.
- 6** Put students into small groups. Remind students of *Reaching for the Sky* and the years-long process of research and experimentation the Wright brothers went through before achieving success. Say *You may want to use a Venn diagram to compare and contrast the Wright brothers' and Robert Wood's experiences.*
- 7 YOU DECIDE** Ask students to choose an activity. Guide students who choose option 1 to find websites where they can research robotic insects. Be advised that there are websites for robotic insect toys and for robotic insects being developed for military use, in addition to websites related to the work of Robert Wood and others on medical, agricultural, and search and rescue applications. Say *Remember, your purpose is to compare another robotic insect to Wood's robobee.*
- Put students who choose the second option into pairs. Replay the video. Tell partners they are not limited to robotic insects. Say *Remember that at the beginning of this lesson we discussed robots that do dangerous factory work or that perform the functions of missing or damaged human limbs. Research a robot that has changed people's lives in a good way.*
- Put students who choose the third option into small groups. Replay the video for them. Suggest that they consider situations in which robobees can work as individuals, as well as situations where collective behaviour can solve problems a single bee cannot.

Objectives

Students will

- identify the form, meaning and use of the past perfect continuous tense.
- use the past perfect continuous to describe the first of two actions in the past.

Grammar Past perfect continuous:

Talking about the first of two actions in the past

Academic Language *past perfect continuous*

Resources Online Workbook/Workbook pages 52–53; Worksheet 3.5.5 (Teacher's Resource CD-ROM/Website); Track 070 (Audio CD/Website/CPT); CPT: Grammar 2

GRAMMAR 070

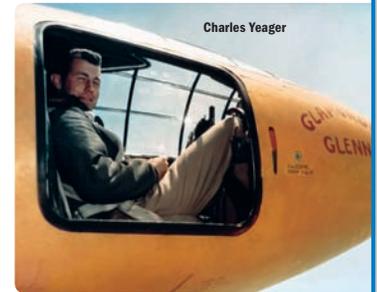
Past perfect continuous: Talking about the first of two actions in the past

The Wright brothers **had been working** on powered flight for several years before Wilbur Wright flew for 2 hours and 19 minutes in 1908.

Before Louis Bleriot first crossed the English Channel in an aeroplane in 1909, pilots **had been using** hot-air balloons.

1 Read. Complete the sentences with past perfect continuous forms of the verbs in brackets.

- Otto Lilienthal had been using (use) gliders for around five years before he crashed in one in 1896.
- Before Samuel Langley's large Aerodrome A crashed while taking off, he had been building (build) smaller machines that flew successfully.
- Before Alberto Santos-Dumont made the first successful powered flight in Europe, he had been winning (win) awards for his flights in balloons.
- Engineer Frank Whittle had been working (work) on his theories for nine years before he tested his first jet engine in 1937.
- Before Charles Yeager became the first pilot to travel faster than the speed of sound in 1947, he had been flying (fly) for about five years.



Charles Yeager

2 Work in pairs. Take turns throwing the cube. Ask and answer questions. Use the past perfect continuous.



Before you became part of the team, how long had you been playing basketball?

I had been playing basketball for six years.

Go to page 165.

88 GRAMMAR

Warm Up

- **Activate prior knowledge** Write *Long before the Wright brothers invented the aeroplane, da Vinci had designed flying machines. Underline had designed. Say We've learnt about using the past perfect to talk about something that happened* (point to *da Vinci had designed flying machines*) *before something else* (point to *the Wright brothers invented the aeroplane*) *in the past.*

Present

- Say *Now, we're going to learn a verb form used to talk about something in the past that was still happening when something else happened. It's called the past perfect continuous.* Write on the board:

The pilot **had been waiting** to take off for an hour when we finally arrived.

- Read aloud the sentence. Point to the verbs and say *Both events took place in the past, but the -ing ending (point to it) shows that this event was still going on when the second event – we arrived – happened.* Then say *Just as you form the past perfect with the word had and a past participle, you form the past perfect continuous with the words had been (point to the boxed words) and a verb ending in -ing.*
- Ask students to open their books at page 88. Say *Read along silently. You'll hear other past perfect continuous verbs.* Play **Track 070**. Ask *In the first sentence, what event started first?* (the Wright brothers had been working on powered flight) *And in the second sentence, what started first?* (pilots had been using hot-air balloons) Ask *How do you know?* (*had been* and a verb ending in *-ing*) Ask students to read the two sentences aloud.

Practise 1

- **1** Say *Now you're going to read sentences about some of the other pioneers of human flight. Some names will be familiar to you.* Tell students to turn back to page 85 and look at the timeline and the photos of Langley's and Santos-Dumont's flying machines. Then point out the photo of Charles ('Chuck') Yeager on page 88.
- Read the Activity 1 instructions aloud. Ask students to work independently. Review the answers as a class.

Apply 2

- **2** Tell partners to cut out and assemble the cube on page 165. Ask two students to model the game by reading the model dialogue. Say *When you answer your partner, repeat the past perfect continuous verb from the question.*

Extend

- Ask students to look up aviation timelines on the Internet. Say *Work with a partner to look up facts about aviation history. Note the dates of important events. Then write one or more sentences about the events, using past perfect continuous verbs.* Display a sample: *By the time Chuck Yeager made his historic flight in 1947, Frank Whittle had been working on jet engines for many years.* Ask students to share their sentences.
- Hand out **Worksheet 3.5.5** for further practice with past perfect continuous verbs.

Consolidate

- Use these verbs to play a game, but don't display them for the class to see: *ascend, descend, evolve, flap, glide, land, soar, support, test, try* and the irregular verbs *buy (bought), draw (drawn), fly (flown), prove (proved or proven), take off (taken off), win (won)*. Divide the class into two teams.
- Say *Here's a game we'll call Form That Verb. I'll alternate asking a student from each team to say either the past perfect or past perfect continuous form of a verb. Each correct verb earns the team one point. For example, I might say Form the past perfect of soar or Form the past perfect continuous of soar.*
- Say *If I give you an irregular verb, such as fly, and you get the form right, your team earns two points! Don't call out anything unless it's your turn. The team with the most points at the end wins.* Explain that students may not know some of the irregular verb forms. Say *Make your best guess! Let's see how fast you can form that verb!*

Grammar in Depth

All the continuous verb forms show a continuing action. The continuous form of a verb is the present participle combined with a form of *be*. The main uses of the past perfect continuous are

- to refer to an action that was taking place over a period of time in the past before another event in the past, as in *I had been studying very hard, so my mum told me I could have a break and go to the cinema.*
- to refer to an action in the past that was in progress but was interrupted by another action, as in *I had been thinking about my grandmother when she suddenly called me.*

Teaching Tip

Keep students focused during games by setting a time limit, for example, five minutes, for playing the game. When there are two minutes left to play, ring a bell to let students know their time is almost up.

Formative Assessment

Can students

- identify the form, meaning and use of the past perfect continuous tense?

Ask students to identify which sentence has a past perfect continuous verb:

*Chuck Yeager had flown for many years before he broke the sound barrier.
He had been flying experimental aircraft before he became the first person to fly faster than the speed of sound.*

- use the past perfect continuous to describe the first of two actions in the past?

Ask students to use a past perfect continuous verb to describe which of these actions came first: Otto Lillenthal flew gliders; the Wright brothers flew the Flyer.

Workbook For additional practice, assign Workbook pages 52–53.

Online Workbook Grammar 2

Objectives

- Students will
- apply elements of classification writing.
 - use categories.
 - analyse a model of classification writing.
 - produce a paragraph of classification writing.

Writing Classification essay

Academic Language *category, classification, classify*

Content Vocabulary *dairy, produce, steer, World War II*

Resources Online Workbook/Workbook page 54; Process Writing Worksheets 1–5, Genre Writing Worksheet: Classification (Teacher’s Resource CD-ROM/Website); CPT: Writing

WRITING

When we classify, we organise our ideas into categories. First, we introduce the topic. Then we divide it into categories. Each category gets its own paragraph in the essay. In each paragraph, we describe shared characteristics that make up that category. A classification essay ends with a conclusion. In the conclusion, we bring the categories back together to talk about the main topic.

1 Read the model. Work in pairs to identify the categories and details.

Long before we had aeroplanes, people had been experimenting with different flying machines. We still use some of those flying machines today. Some depend on air for movement, while others use engines.

Hot-air balloons and gliders use air currents for movement. Hot-air balloon pilots steer their aircraft by ascending or descending into air currents that move the balloon. The pilot controls the balloon’s movement by heating the air inside the balloon, or by allowing it to cool naturally.

A glider also uses air currents to soar and glide. Small planes pull gliders along a runway to help them take off. But once in the air, gliders use the currents, not an engine, to move. Their long wingspan and strong body give riders a safe, smooth flight. Hot-air balloons and gliders are most often used for fun and adventure.

Helicopters first appeared during World War II. A helicopter hasn’t got wings, but, like an aeroplane, it’s got an engine that makes its blades spin at high speeds. This allows the helicopter to ascend into the sky. Unlike an aeroplane, which has to keep moving, helicopters can stay in one place in the sky for a long time. Today, helicopters are mostly used by medical teams and the military. But you can also take a helicopter ride for fun. Many tourist destinations offer helicopter rides for sightseeing.

So before your next plane ride, remember that planes aren’t the only way to fly.

2 Work in pairs. What does the writer classify? How many categories are there? What details are mentioned in each part?

3 Write. Write a classification essay to describe two types of animal flight.

WRITING 89

Warm Up

- **Activate prior knowledge** Say *Think about how you make a list of things to buy at a shop or market. Ask Do you list items randomly as you think of them? Or do you organise the list by grouping together similar items, or items you’ll find in the same part of the shop? Ask Do you think one way makes more sense than another? Why?* Elicit responses from students. Discuss.
- Write grocery items, such as the following, on the board:

bananas	eggs	peppers
beans	pasta	rice
canned tuna	mangoes	sausages
chicken	milk	yoghurt

Ask *How could you group these items in a logical way? For example, which ones do you often find in the dairy section of the shop? Which do you find in the canned or packaged goods section?* Ask a few students to come to the board and rewrite the items in groups of similar things. Explain that there’s no one right way to group the items, as long as it makes sense. Say *When you’ve grouped the items, write a name for each group. It should be a name that describes the group in some way, such as dairy or vegetables.*

- When the students have finished, say *What you’ve just done is to classify the items into categories.*

Present

- Say *Open your books at page 89.* Read aloud the text in the green box. Then write the steps in classification writing on the board. Ask students to explain what happens in each step. Say *Let’s explain what you do in each step.* Add the explanations to the board.

Classification Writing

- | | |
|--|--------------|
| 1. Introduce: state the topic in a sentence | 3. Describe: |
| 2. Classify: organise ideas into categories; write a paragraph on each one | 4. Conclude: |

Read the Model 1 2

- Say *Now we're going to read a model of a classification essay. First, skim the essay to get an idea of what it's about.* Remind students that when you skim a text, you read the title and look at any photos and captions. Then you quickly read the first and last paragraphs and the first sentence of each of the other paragraphs. Give students a minute or two to skim the essay. Then ask *What is the topic of the essay?* (different flying machines)
- 1 Put students into pairs. Say *Now you'll work with your partner to read and analyse, or examine, the essay to see how it's put together.* Tell students to read the Activity 1 instructions. Ask *What do you do when you classify a topic?* (divide the topic into groups, or categories) Say *As you read, underline words you think identify the categories.* Tell students to read the essay.
- 2 When pairs have finished, ask students to name the categories they identified. Don't correct students if they name hot-air balloons and gliders as separate categories. Ask *What's the third thing to look for in a classification essay?* (a description of each category) Say *Now read the text again to see what the shared characteristics of the things in each category are.*
- When partners have finished, ask students to answer the Activity 2 questions. Say *We know the writer is classifying different kinds of aircraft.* Ask *How many categories does he or she divide aircraft into?* (two) *What are they?* (hot-air balloons / gliders and helicopters)
- If students think hot-air balloons and gliders are separate categories because they're described in separate paragraphs, tell them that that's true, but point out that the writer groups them together at the beginning of the second paragraph and the end of the third paragraph. Then ask *What characteristics do hot-air balloons and gliders share?* (They both use air currents to move; they're both used mostly for fun and adventure.)
- Ask *What does the writer do to help you understand the characteristics of helicopters?* (The writer compares and contrasts them with aeroplanes.)
- **Worksheet** If your students need a reminder of the elements of the Classification Writing genre, you may want to hand out **Genre Writing Worksheet 12 (Classification)** and review it together.

Writing Support

Potential classification problems

Students should think about whether a topic can actually be divided into categories. A topic should not have too few categories, or too many. Too few categories don't provide enough information. Too many categories weaken the focus and confuse the reader. Similarly, when a category has fewer examples or details than the other categories, it will seem weaker or less credible as a category.

Students should try to describe each category in a separate paragraph. However, sometimes they'll need more than one paragraph. That's fine. The important thing is to make sure each category is clearly defined and relates to the organising principle. In other words, if the organising principle is types of aircraft, for example, students shouldn't veer off into describing the characteristics of the people who developed each type of aircraft.

Teaching Tip

Let students know in advance how much time they will have to complete an activity so that they can manage their time efficiently. For instance, if students are writing, make sure you tell them how much time you will give them to complete the task. If students have difficulty completing a task in the time allotted, tell them to finish the rest of the assignment at home or during the next class.

Related Word

rotor blades

Workbook For scaffolded Writing support, assign Workbook page 54.

Online Workbook Writing

WRITING

When we classify, we organise our ideas into categories. First, we introduce the topic. Then we divide it into categories. Each category gets its own paragraph in the essay. In each paragraph, we describe shared characteristics that make up that category. A classification essay ends with a conclusion. In the conclusion, we bring the categories back together to talk about the main topic.

1 Read the model. Work in pairs to identify the categories and details.

Long before we had aeroplanes, people had been experimenting with different flying machines. We still use some of those flying machines today. Some depend on air for movement, while others use engines.

Hot-air balloons and gliders use air currents for movement. Hot-air balloon pilots steer their aircraft by ascending or descending into air currents that move the balloon. The pilot controls the balloon's movement by heating the air inside the balloon, or by allowing it to cool naturally.

A glider also uses air currents to soar and glide. Small planes pull gliders along a runway to help them take off. But once in the air, gliders use the currents, not an engine, to move. Their long wingspan and strong body give riders a safe, smooth flight. Hot-air balloons and gliders are most often used for fun and adventure.

Helicopters first appeared during World War II. A helicopter hasn't got wings, but, like an aeroplane, it's got an engine that makes its blades spin at high speeds. This allows the helicopter to ascend into the sky. Unlike an aeroplane, which has to keep moving, helicopters can stay in one place in the sky for a long time. Today, helicopters are mostly used by medical teams and the military. But you can also take a helicopter ride for fun. Many tourist destinations offer helicopter rides for sightseeing.

So before your next plane ride, remember that planes aren't the only way to fly.

2 Work in pairs. What does the writer classify? How many categories are there? What details are mentioned in each part?

3 Write. Write a classification essay to describe two types of animal flight.

WRITING 89

Plan 3

- **3** Say *It's time to plan your own writing. Read the Activity 3 instructions.* Then say *Your topic is two types of animal flight.* Say *You'll need to go back and review the information about the evolution of animal flight on pages 78 to 81.*
- Say *Your next step is pre-writing. Let's review. What are some ways we do pre-writing?* (brainstorm, freewrite, make lists, use a graphic organiser, use sentence starters) Say *Now decide what you want to use for pre-writing.* If you have time in class, allow students to work on this step. If not, assign it as homework. If students have Workbooks, remind them to use Workbook page 54 for writing support.

- **Worksheets** If your students need a reminder of any of the steps of process writing, you may want to hand out **Process Writing Worksheets 1–5** and review them together.
- **Workbook** Refer students to Workbook page 54 to help them organise and plan their writing.

Write

- After students have finished their pre-writing, tell them to work on their first drafts. If you haven't got enough time in class, assign the first draft as homework.

Revise

- After students have finished their first drafts, tell them to review their writing and think about their ideas and organisation. Ask them to quietly read their drafts aloud to themselves. Tell each student to consider the following: *Did I cover all four of the steps of classification writing: Introduce, Classify, Describe, Conclude? Are the characteristics of each category clearly described? What seems good? What needs more work?* If time permits, students could read their drafts to a classmate for feedback.

Edit and Proofread

- Encourage students to consider elements of style, such as sentence variety, parallelism and word choice. Then ask them to proofread for mistakes in grammar, punctuation, capitalisation and spelling.

Publish

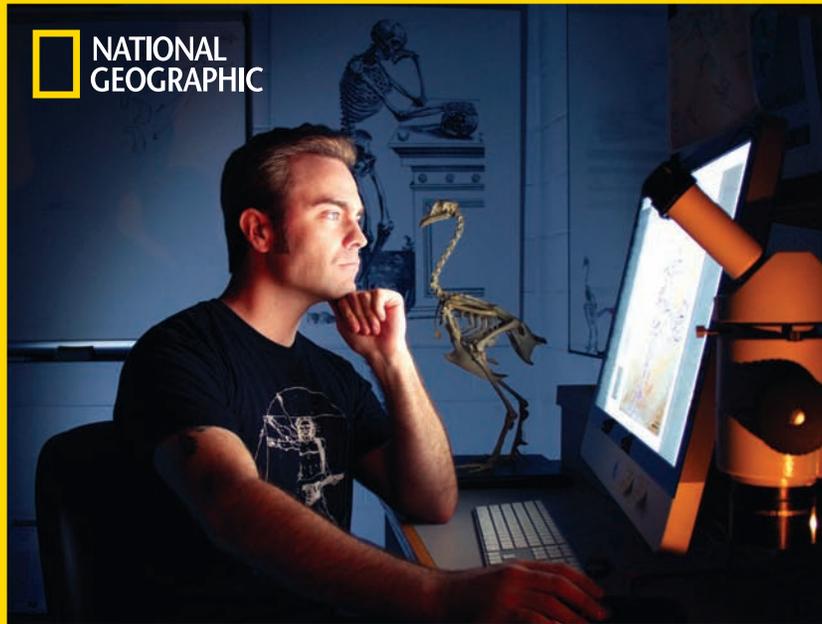
- Publishing includes handing in pieces of writing to the teacher, sharing work with classmates, adding pieces to a class book, displaying pieces on a classroom wall or in a hallway, and posting on the Internet.

Writing Assessment

Use these guidelines to assess students' writing. You can add other aspects of their writing you'd like to assess at the bottom of the table.

- 4 = Excellent
- 3 = Good
- 2 = Needs improvement
- 1 = Re-do

	1	2	3	4
Writing Student organises the classification essay in a way that makes sense and uses enough details to describe each category.				
Grammar Student uses past perfect and past perfect continuous verbs correctly.				
Vocabulary Student uses a variety of word choices, including words taught in this unit.				



Explore Your Interests

'As an evolutionary biologist, I get to combine both childhood interests into my research: dinosaurs and animation!'

Ryan Carney

National Geographic Explorer, Palaeontologist/Evolutionary Biologist

1. **Watch scene 5.2.**
2. What are your interests? How have they changed over the years? Is there anything that you were interested in as a child that you are still learning about? What is it?
3. The people you read about in this unit, from Leonardo da Vinci to Ryan Carney, made their interests their life's work. How could you turn your own interests into a career? What would you need to do?

MISSION

Objective

Students will

- discuss using the things that interest them to work out what career to pursue.

Resources Video scene 5.2 (DVD/Website/CPT); Worksheet 3.5.6 (Teacher's Resource CD-ROM/Website); Online Workbook: Meet the Explorer; CPT: Mission

BE THE EXPERT

Teaching Tip

Encourage students to be active listeners when they work in pairs or groups. As classmates discuss, encourage them to take notes on what their classmates say, to ask for clarification or to repeat something that was said. Circulate during partner discussions and occasionally stop and ask students to repeat what their partners just said.

Online Workbook Meet the Explorer

Mission

- Say *Turn to page 90*. Read aloud the Mission and the quote from Ryan Carney. Ask *Does anyone know what animation is?* (a process of making films in which drawings of characters, puppets or models move) Point out the model next to Ryan's computer in the photo. Ask *What do you think it's a model of?* (some kind of bird, *Archaeopteryx*)
- Ask *Do you think it's easy to find a job or career that allows you to do things you're very interested in?* Explain that a career like Ryan's, evolutionary biologist, requires planning and years of study.
- **Activity 1** Say *Now let's watch a video about Ryan Carney*. Play **Video scene 5.2**. Tell them to pay attention to what Ryan has to say about his childhood fascination and also to notice the animation at the end of the video.
- **Activity 2** Put students into pairs. Tell them to discuss one question at a time. If students need help recalling childhood interests, tell them to think of experiences they had as a child – long trips, visits to outdoor places, visits to theatres, museums, aquariums or a live concert. Tell them to think also of school subjects that sparked an interest in them.
- **Activity 3** Say *Now discuss what you would need to do to make that interest your life's work*. Ask *What are some of the subject areas the people in this unit had to study to be able to accomplish what they did?* (science, maths, drawing, engineering, aerodynamics [the study of the properties of moving air], computer science) Then ask *Do any of these subjects involve anything that interests you?*
- **Worksheet** Hand out **Worksheet 3.5.6**. Explain that students will use the worksheet to think and write about Ryan Carney and his ideas about evolution.

Make an Impact

Objective

Students will

- choose and complete a project related to flying animals and machines.

Content Vocabulary *benefits, evolution, flying machine, risks*

Resources Assessment: Unit 5 Quiz; Workbook pages 55 and 94; Worksheet 3.5.7 (Teacher's Resource CD-ROM/Website); CPT: Make an Impact and Review Games

Materials drawing materials, poster board

YOU DECIDE Choose a project.

1 Design a flying machine.

- Plan and design a flying machine.
- Use your plans to create a model of the machine.
- Present your machine to the class. Explain how it works.

2 Make an evolution poster.

- Choose an animal that has evolved the capability of flight.
- Research how this animal has evolved over time. Draw and label at least four steps in its evolution.
- Arrange your drawings in order on a poster. Display the poster in class.

3 Advertise a flying machine.

- Choose a flying machine that you learnt about.
- Think about the benefits and risks of using that machine.
- Make an advertisement for the machine. Try to persuade your audience to fly in it.

Assessment Go to page 259.

Unit Review Assign Worksheet 3.5.7

Workbook Assign pages 55 and 94.

Online Workbook Now I can



A pilot guiding a home-made machine during a flying competition in Moscow, Russia

PROJECT 91

Prepare

- **YOU DECIDE** Ask students to choose a project.
- **Activity 1** Point out the photo of the flying machine on page 91. Ask *How do you think it's staying up in the air?* Tell students that now they have the opportunity to design and build their own flying machine. Explain that they have to create a model of it and be able to show how it works. Suggest that they start by drawing different designs. You may want to arrange for these students to meet with a science teacher or mechanical engineer to help them identify reasonable designs.
- **Activity 2** Tell students to choose a flying insect, bird or mammal and research how it evolved the capability of flight. They'll need to make drawings to show the animal's development over time and label the body parts that eventually became wings.
- **Activity 3** Tell students to go back and review the different flying machines they learnt about in the

unit – parachutes, balloons, gliders, aerodromes and others. Tell them to choose one to advertise. Say *Remember, when you advertise a product, you want people to try it. How will you get people's attention?*

Share

- Schedule time for students to present their final projects to the class. Encourage students to ask questions and provide feedback on their classmates' work. You can ask students to vote for their favourite flying machine, poster and advert.
- **Modify** Help students simplify a project by eliminating one of the options or steps. For example, you could provide students with the names of age-appropriate websites that explain the evolution of flight in animals. For students writing adverts, you might research and display vintage airshow or exhibition posters or adverts for early flying machines.

Track 058 1 **Listen and read.** See Student's Book pages 78–79.

Track 059 2 **LEARN NEW WORDS** **adaptation** / Physical adaptations helped birds become better fliers. **capability** / Bats are the only mammals with flight capability. **early** / Early insects were the first animals to fly. **evolve** / All species evolve over time. **feature** / Ancient birds had some of the same features as dinosaurs. **flap** / Animals flap their wings to fly. **flight** / Flight developed first in insects. **glide** / Many species developed the ability to glide. **hollow** / Birds have light, hollow bones that allow them to fly. **limited** / Millions of years ago, all life was limited to land and water. **soar** / Large birds can soar when they spread their wings. **weight** / An animal's weight can affect how it flies. **wingspan** / The wingspan of the largest pterosaur was over ten metres.

Track 060 5 How did flight happen? Physical adaptations have taken place in species such as birds and bats, allowing them to become skilled fliers. Both are capable of true powered flight. One example of these adaptations is wing structure. Birds gradually lost the claws their ancestors had. Bats still have all their long clawed fingers, which support the membranes of their wings.

Track 061 5 **LEARN NEW WORDS** **allow** / Their hollow bones and light bodies allow birds to fly. **powered** / Bats are the only mammals capable of powered flight. **skilled** / Both birds and bats are skilled fliers. **support** / Insects' wing structures support them when they fly.

Track 062 **SPEAKING STRATEGY** See Student's Book page 81.

Track 063 1 **S1:** Hi, Alex. **S2:** Hey, Jacob. How did your presentation on birds go?

S1: Quite well, though not everybody believed me when I said that birds evolved from dinosaurs. **S2:** What makes you think that it's true?

S1: Well, I've done a lot of research, and most scientists support the idea that birds evolved from dinosaurs. The first birds shared a lot of features with them. **S2:** Yes, but what about modern birds? Most of them live in trees, but dinosaurs didn't. I think that birds had to come from ancestors who lived in trees.

S1: But look at how much time has passed between the earliest birds and modern birds! 150 million years! They live in trees now, but that doesn't mean they always did. I'm sure you agree that a lot of small adaptations happen as a species evolves. It doesn't happen all at once! **S2:** Well, maybe you're right.

Track 064 **GRAMMAR** See Student's Book page 82.

Track 065 1 1. By the time the Chinese experimented with the first kites more than 2,500 years ago, flight in animals had existed for many millions of years.

2. Long before the Chinese turned to flying kites, it's likely that early humans had tried to imitate birds by running and flapping their arms.

3. The Chinese had already used kites for measuring and signalling by the time people tried to use kites for transport.

4. Though the Chinese later used kites for fun and entertainment, they had originally designed them for military uses, such as spying.

5. Only the Chinese royal family and rich people had enjoyed flying silk kites before the invention of paper, which made kites cheaper and available to the public.

Track 066 3 Many people consider Leonardo da Vinci to be one of the first people to really experiment with flight. He produced over 6,000 pages and 500 drawings related to the flight of birds and bats. He also studied the forces that affect objects in the air and worked on flying machines. Long before Veranzio designed his parachute in 1595, da Vinci had drawn a sketch of one. Long before Cayley flew his gliders in the 1800s, da Vinci had designed one. In order to fly, it needed only a small change to make the glider's movement stable, as was proved later. And long before modern helicopters existed, da Vinci had drawn several versions. His 'aerial screw' allowed his machine to ascend into the air and descend to the ground the same way modern helicopters do.

Track 067 3 **LEARN NEW WORDS** **ascend** / An aeroplane ascends into the air at an angle. **descend** / A helicopter descends slowly when it lands. **force** / Gravity is the force that keeps objects from staying in the air. **parachute** / Skydivers use parachutes when they jump out of planes. **prove** / Scientists examine theories and look for ways to prove them. **stable** / A stable glider or aeroplane does not move from side to side as it flies.

Track 068 2 **LEARN NEW WORDS** **engine** / Modern aeroplanes have powerful engines. **fuel** / An aeroplane loses power when it runs out of fuel. **to land** / When the plane lands, you arrive at the airport. **pilot** / A pilot controls an aeroplane. **to take off** / You have to be seated before the plane will take off.

Track 069 3 **WHILE YOU READ** See Student's Book pages 84–85.

Track 070 **GRAMMAR** See Student's Book page 88.