A **scene** is the **background** of a play or a puppet show.

The puppet-theater company wants us to **create a picture on the wall using light** for a scene in their puppet show.

What do you think this scene is showing for the story?

Think about **how light is being used** in this scene.

Puppet Scene Design Goals

- The scene should have a <u>bright</u> area.

- The scene should have a <u>dark</u> area.

- The scene should have a <u>medium bright</u> area, between bright and dark.

This list shows our **design goals**.

The puppet-theater company asked us to make scenes that create **three different areas** on the wall.

By making these **three areas**, the puppet-theater company will be able to include many different things in their scenes.

Engineers who **study light** try to answer questions about **how to make brighter and darker areas**.

We will think about this question as we help the puppet-theater company solve its problem:

Unit Question

How do we make different parts of a surface brighter or darker?

Glossary

block: to stop something from passing through
bloquear: no permitir que algo pase

design: to try to make something new that people want or need
diseñar: intentar crear algo nuevo que las personas quieren o necesitan

engineer: a person who makes something to solve a problem
ingeniero/a: una persona que crea algo para solucionar un problema

material: what something is made of
material: lo que constituye algo

observe: to use any of the five senses (sight, hearing, smell, taste, touch) to learn more about something
observar: usar cualquiera de los cinco sentidos (vista, oído, olfato, gusto, tacto) para aprender más sobre algo

source: the place where something comes from
fuente: el lugar desde donde viene algo

surface: the outside part of something
superficie: la parte exterior de algo

vibrate: to move back and forth quickly
vibrar: mover hacia adelante y hacia atrás rapidamente

Light and Sound @Home Lesson 1

You have a **Glossary** you can use if you need to find definitions for science words we are using.

Light and Sound @Home Lesson 1
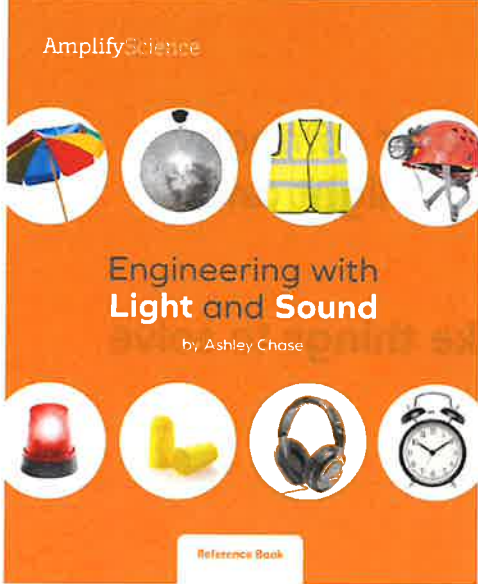
Now is a good time to take a break.

In order to help the puppet-theater company solve its problem, we will work as **light and sound engineers**.

Engineers are people who **make things** to solve problems.

Now, we will read a **book** to find out more about **what engineers do**.

Check with your teacher about how you will access books in this @Home Unit.

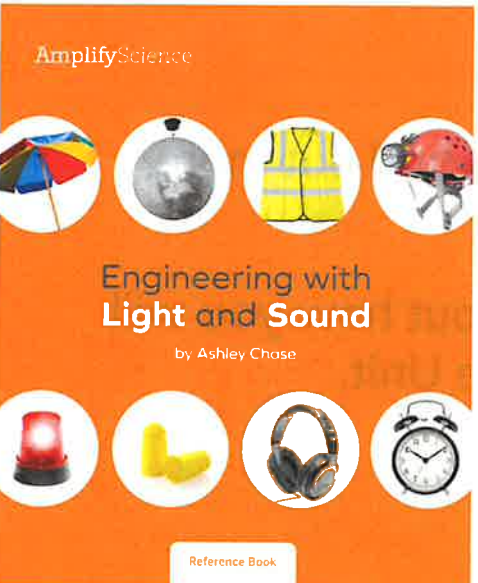This is a special type of book called a **reference book**.

Instead of reading the book from beginning to end, we can read **specific parts** of the book to **gather information**.

Find someone to **read** out loud to you.

Contents

3

Turn to **page 3**. This is the **Contents** page.

It lists the different sections where we can find out more about **what engineers do**.

Turn to **pages 4 and 5** and read them.

What Is an Engineer?

Engineers make things to solve problems. They call this **designing**. Engineers design **solutions** to problems.

This man is an engineer.

These engineers are designing solutions.

First, engineers learn all they can about a problem. Next they plan how to solve the problem. Once they have finished planning, they make their solutions. Then engineers **test** their solutions to see if they work. They may need to change their solutions or try new solutions.
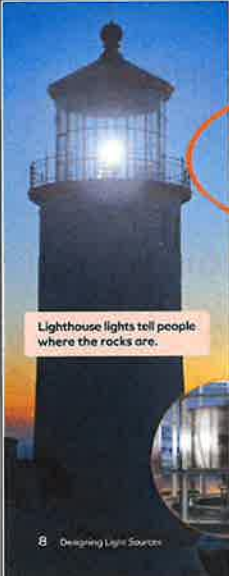
What Is an Engineer? 5

What have you learned from these pages?

Let's explore this book more.

Each section has the same two headings:

"**The Problem**" and "**The Solution**"

Lighthouse Lights

The Problem
Boats may sink if they run into a rock. Rocks are hard to see at night. People in boats need a way to stay safe from rocks at night.

The Solution
Engineers designed bright lights to warn people in boats. The lights tell people where the rocks are.

Lighthouse lights tell people where the rocks are.

This photo shows a lighthouse light up close.

8 Designing Light Sources

Turn to **page 8**.

"**The Problem**" section describes something that people wanted or needed to do but could not.

Lighthouse Lights

The Problem
Boats may sink if they run into a rock. Rocks are hard to see at night. People in boats need a way to stay safe from rocks at night.

The Solution
Engineers designed bright lights to warn people in boats. The lights tell people where the rocks are.
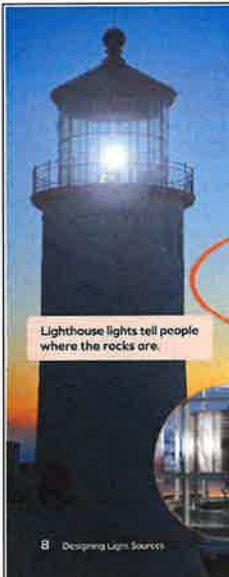
Lighthouse lights tell people where the rocks are.

This photo shows a lighthouse light up close.

8 Designing Light Sources

"**The Solution**" section describes what the engineers made to solve that problem and help people do what they wanted or needed to do.

AmplifyScience

Engineering with
Light and **Sound**
by Ashley Chase

Reference Book

Now you will look at the **solutions** in the book to get ideas about what **light and sound engineers** do and make.

Look for a page you think is **interesting**.

Think about the **problem** and the **solution**.

Engineers plan, make, and test lots of solutions. They try to make their solutions better and better.

These engineers are testing the rover they made. They want to find out how well it can drive on slippery sand.

Designing Light Sources

All light comes from a **source**. **Engineers design** light sources for all kinds of uses. They design light sources for reading. They design light sources for safety. They even design light sources for fun!

When engineers design a light source, they think about how much light should come from the source. They also think about the **surfaces** they want the light to get to, and how bright they want these surfaces to be.

Lighthouse Lights

The Problem
Boats may sink if they run into a rock. Rocks are hard to see at night. People in boats need a way to stay safe from rocks at night.

The Solution
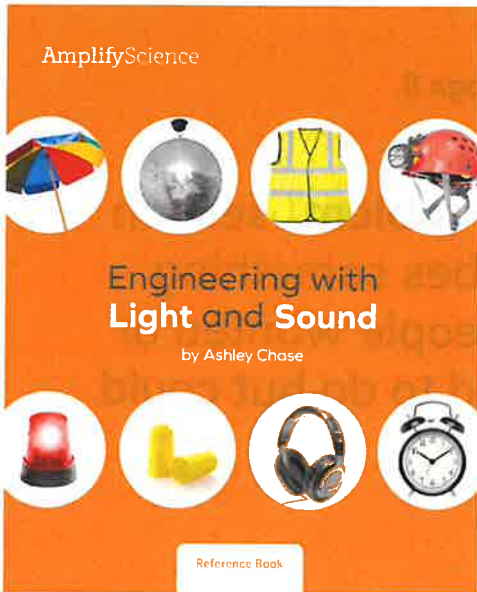Engineers designed bright lights to warn people in boats. The lights tell people where the rocks are.

Lighthouse lights tell people where the rocks are.

This photo shows a lighthouse light up close.

Headlamps

The Problem
People like to climb in dark caves. They cannot hold lights, because they need their hands for climbing.

The Solution
Engineers designed helmets with lights on them. These are called headlamps.

This woman is wearing a headlamp in a dark cave.

A headlamp has a light on the front.

Signal Lamps

The Problem
Sometimes, sailors want to send secret messages from one boat to another. They don't want to use a phone or a radio because somebody might hear them.

The Solution
Engineers designed signal lamps. Sailors use these lamps to flash light at another boat far away. They flash the lamp on and off in a **pattern**. The pattern is a code. Sailors on the other boat see the flashes and understand the secret message.

This sailor is sending a message with light.

Glow Sticks

Glow sticks come in different colors.

The Problem
When people are outside at night, it is hard to see them.

The Solution
Engineers designed sticks that glow in the dark. Holding a glow stick helps people see you at night. Glow sticks are also fun.

This girl is holding a glow stick.

Night Lights

The Problem
Some people want just a little bit of light when they are going to bed.

The Solution
Engineers designed night lights. This night light has a bulb that is not very bright. It sends out just a little bit of light.

A night light only sends out a little bit of light.

Some people like a little bit of light at night.

Designing Things That Block Light or Let Light Pass Through

Sometimes, **engineers** need to **block** light. Light comes from **sources**, and it gets to different **surfaces**. To block light, engineers put **material** between the light source and the surface that they want to make darker.

Different materials block different amounts of light. An engineer may want to block all the light, some of the light, or none of the light. Light that is not blocked passes through the material to the other side. Engineers think about what materials to use when they are **designing solutions**.

Welding Helmets

The Problem
Some tools make very bright light. Workers need to protect their eyes from the light, but they still need to be able to see.

The Solution
Engineers designed welding helmets. A welding helmet has a window made of a special material. The material blocks most of the light, but it lets a little bit of light through. You can see through the window to do your work.

This man is wearing a welding helmet.

A welding helmet has a window in the middle. It blocks most of the light.

Window Blinds

The Problem
Sometimes, people want light coming in through the window. At other times, they don't want any light coming in through the window.

The Solution
Engineers designed window blinds. The blinds are made of material that doesn't let any light go through. You can open the blinds or close them. When the blinds are closed, they block the light.

Window blinds block sunlight.

Beach Umbrellas

The Problem
People like to sit on the beach on sunny days, but it can be hot in the sunlight. People want to sit in the shade.

The Solution
Engineers designed beach umbrellas. These large umbrellas have thick cloth that blocks most of the light and lets almost no light through. A beach umbrella makes a shadow on the beach where people can sit down.

Beach umbrellas block sunlight to make shade.

Insulated Windows

The Problem
When it's very cold outside, people spend most of their time inside warm buildings. Still, people want to be in the sunlight. People want to let the sunlight into buildings, but keep cold air out.

The Solution
Engineers designed insulated windows. These windows keep it warm inside because they block cold air from coming in. The windows block air, but they don't block much light at all. They are clear, and they let almost all the light go through them.

Insulated windows block cold air from coming in, but they don't block much sunlight.

Many insulated windows have two layers of glass.

Swim Shirts

The Problem
People like to go swimming on sunny days. Too much sunlight can give you a sunburn. People need to protect their skin.

The Solution
Engineers designed swim shirts. A swim shirt covers your skin. It blocks the sunlight from getting to your skin. A swim shirt lets you play in the sunlight without getting a sunburn.

This boy is wearing a swim shirt.

Swim shirts are made of material that blocks light.

Shadow Puppets

The Problem
People like to tell stories with **shadows**. They want to make shadows that look like characters from stories.

The Solution
Artists design shadow puppets. Artists sometimes design solutions like engineers do. Shadow puppet artists shine a light on a screen. They make a puppet to block some of the light. The puppet is in the shape of a character. It makes a shadow in the same shape.

Shadow puppets block light in the shape of a character.

Display Cases

The Problem

Museums have lots of things from long ago. These things are rare, and they break easily. Museums want people to be able to look at things, but not touch them.

The Solution

Engineers designed display cases. A display case keeps the things in a museum safe. The display case blocks people's hands from touching, but it doesn't block much light. The display case lets almost all the light go through, so people can see the things inside.

A display case keeps people's hands out, but lets light go through.

Tinted Windows

This photo shows part of a tinted window. The glass blocks some light, and lets some light go through.

The Problem

People want light inside a building, but they don't want too much light.

The Solution

Engineers designed tinted windows. The windows let some light through. They block the rest of the light.

This building has tinted windows.

Designing Things That Reflect Light

Sometimes **engineers** need to **reflect** light. When light reflects, it bounces off a **surface**. A mirror reflects lots of light. Engineers often use shiny **materials** to reflect light.

22-23

Emergency Signal Mirror

The Problem

Sometimes, hikers become lost in the woods. Rescuers send planes to try to find them, but from a plane it is hard to see a person in the woods. Hikers need a way to send a signal to a search plane flying high overhead.

The Solution

Engineers designed signal mirrors. A lost hiker can use the mirror to reflect sunlight in flashes. People in search planes can see the flashes of light. The reflected light sends a signal. It tells the people in the plane that the lost hiker is below.

This mirror reflects light to send a signal.

Safety Vests

The Problem
When people are outside at night, it is hard to see them.

The Solution
Engineers designed safety vests. The vests are made of shiny material that reflects lots of light. They look bright. Wearing a safety vest helps people see you at night.

This boy is wearing a safety vest.

Safety vests reflect light.

Disco Balls

The Problem
People wanted a new way to have fun.

The Solution
Engineers designed disco balls. People shine a light on the ball. The ball spins and reflects light in all directions. Disco balls are just for fun.

This disco ball is reflecting dots of light on the wall.

A disco ball has little mirrors all over it.

Designing Sound Sources

Just like light, every sound comes from a **source**. When **engineers design** sound sources, they think about what needs to **vibrate** to make a sound. They think about how loud or soft the sound should be and what they want it to sound like.

Speakers

The Problem
When a rock star sings on stage, big crowds come to listen. People have to be able to hear the music from far away.

The Solution
Engineers designed speakers. Big speakers make powerful vibrations. They make the music louder. The loud sound gets to everyone's ears.

Lots of people came to hear the rock star sing.

These are big speakers. They make the music louder.

Lithotripter

The Problem
Sometimes, pieces of hard material form inside a person's body. The hard material can cause pain and other problems in the body. Doctors need a way to break up the pieces of hard material.

This person is sick. Doctors are using a lithotripter to help her get better.

The Solution
Engineers designed the lithotripter. (The name sounds like "LIH-tho-trip-ter.") This machine sends sounds into a person's body. The sounds make the pieces of hard material vibrate. The vibrations break up the pieces so that they are small enough not to hurt the person anymore.

This siren uses sound to warn people a tornado is coming.

Tornado Siren

The Problem
Tornadoes are dangerous storms that can happen suddenly. When a tornado is coming, weather scientists need a way to warn everybody quickly.

The Solution
Engineers designed tornado sirens. These sirens have speakers that vibrate to make very loud sounds. The sounds can be heard over long distances. In places where tornadoes happen, people listen for the sound of the tornado siren. When they hear the siren, they know a tornado is coming. Everybody gets to safety.

Keytar

The Problem
People like the sound of a piano, but a piano is too big to carry around.

The Solution
Engineers designed keytars (KEE-tars). A keytar has keys like a piano. It sounds like a piano, but it is small enough to carry around.

This man is playing a keytar.

A keytar has keys like a piano.

This kid is wearing headphones.

Headphones

The Problem
People like to listen to music, but the sound might bother somebody else. People want to listen to music without bothering anybody.

The Solution
Engineers designed headphones. Headphones play music close to a person's ears. The vibrations go straight to that person's ears. Only the person wearing the headphones can hear the music.

Headphones play music.

Hydraulophone

The Problem
People want new ways to make music.

The Solution
Engineers designed the hydraulophone. (The name sounds like "hi-DRAW-la-fone.") Water squirts through pipes and holes to make sounds. The water vibrates! The sounds can be higher and lower. They make a new kind of music.

A hydraulophone uses water to make music.

Designing Things That Block Sound

Sometimes, **engineers** need to **block** sound. To block a sound, an engineer needs to stop the **vibrations** from getting from a **source** to people's ears.

Ear Plugs

The Problem
Sometimes, it's too noisy. People need something to block the sound.

The Solution
Engineers designed ear plugs that block sound. They stop vibrations from coming into the ear.

People put ear plugs into their ears.

Ear plugs block sound.

The walls of this room block sound. No sound can come in from outside.

Soundproof Room

The Problem
Musicians like to record their music. When they record, they only want the sound of the music. They want to block any sound from outside.

The Solution
Engineers designed soundproof rooms. A soundproof room has walls that stop vibrations. The walls block almost all the sound from outside.

This material is good for blocking sound. People often use material like this to make soundproof rooms.

Designing Things That Use Both Light and Sound

To solve some problems, **engineers** need to use what they know about light AND sound! Sound and light are different in many ways, but they have important things in common. For example, sound and light both come from a **source**, and they can both be **blocked**.

Fire trucks are loud. They have bright lights.

Sirens and Flashing Lights

The Problem
Firefighters drive fast on the way to a fire. They need a way to warn people to get out of the way.

The Solution
Engineers **designed** sirens and flashing lights. Sirens use loud sound to warn people. Flashing lights warn people, too.

Fire trucks have lights like this one. It flashes to warn people.

Fire trucks have sirens like this one. It makes a loud sound.

Alarm Clocks

The Problem
People sometimes need to get up early in the morning. They need something to wake them up.

The Solution
Engineers designed alarm clocks. Many alarm clocks make loud sounds to wake people up. Other alarm clocks use light to wake people up instead of sound. Some people are deaf, and they can't hear sounds. They need an alarm clock with a light.

This alarm clock lights up.

This alarm clock makes a loud sound.

Glossary

block: to stop something from passing through

design: to try to make something new that people want or need

engineer: a person who makes something to solve a problem

material: what something is made of

pattern: something we observe to be similar over and over again

reflect: to cause light to bounce off a material

shadow: a part of a surface that is darker because less light is getting to it

solution: something that helps people do what they want or need to do

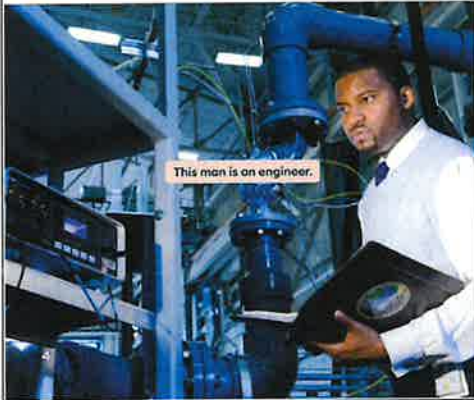**source:** the place where something comes from

surface: the outside part of something

test: to try something and find out what happens

vibrate: to move back and forth quickly

What Is an Engineer?

Engineers make things to solve problems. They call this **designing**. Engineers design **solutions** to problems.

This man is an engineer.

What did you learn about what **engineers** do?

What **problems** and **solutions** did you look at?

People depend on the **solutions** engineers make, like the examples we saw today. Engineers are people who use what they know to make things to solve **problems**.

We will work like **engineers** as we help the puppet-theater company solve their problem.

When engineers hear about a **problem**, they try to make a **solution**.

What do you think the puppet-theater company needs you to do?

We will be learning new **science words** to help with our investigations.

Now we will think more about **one** of the new words we are learning.

An **engineer** is a person who makes something to solve a problem.

1. Practice saying the word to yourself: **engineer**
2. Practice saying the word to someone at home: **engineer**
3. Practice whispering the word: **engineer**

End of @Home Lesson

Name: _____   Date: _____

Thinking About Brighter and Darker Areas

Directions:

1. Think about what you know about how brighter and darker areas on a surface might be made.
2. Look carefully at the picture.
3. In the box, draw to show how you think someone made the brighter and darker areas on the wall.
4. Label your drawing.

Glossary

block: to stop something from passing through
bloquear: no permitir que algo pase

design: to try to make something new that people want or need
diseñar: intentar crear algo nuevo que las personas quieren o necesitan

engineer: a person who makes something to solve a problem
ingeniero/a: una persona que crea algo para solucionar un problema

material: what something is made of
material: lo que constituye algo

observe: to use any of the five senses (sight, hearing, smell, taste, touch) to learn more about something
observar: usar cualquiera de los cinco sentidos (vista, oído, olfato, gusto, tacto) para aprender más sobre algo

source: the place where something comes from
fuente: el lugar desde donde viene algo
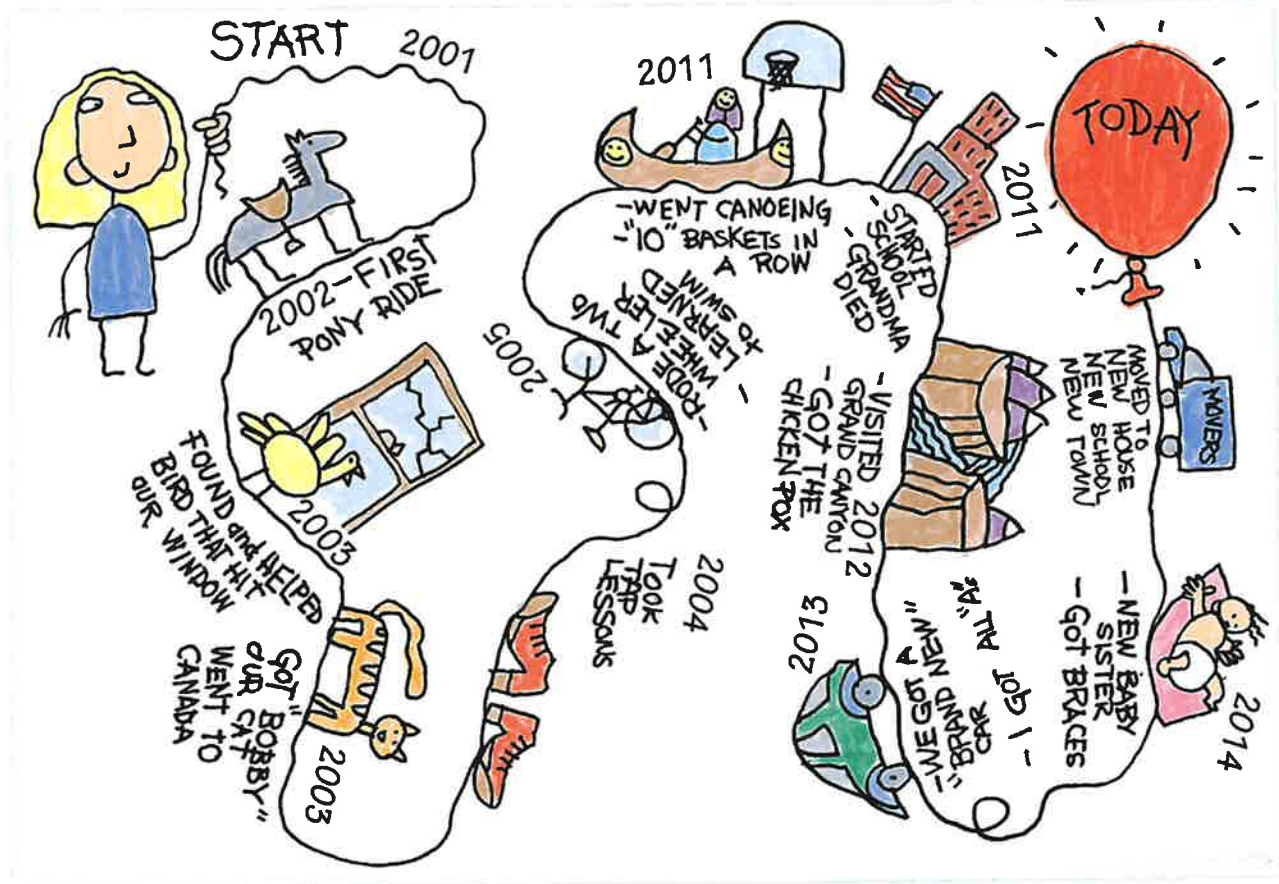
surface: the outside part of something
superficie: la parte exterior de algo

vibrate: to move back and forth quickly
vibrar: mover hacia adelante y hacia atrás rápidamente

Minilesson

Drawing a Life Map

A life map is a visual time line. It traces key moments in your life from the time you were born until the present day. The events and experiences you draw in your life map can make great starting points for writing topics, particularly for personal writing.

↺ **Your Turn** Create your own life map.

1. Start your life map with the day you were born.
2. Record the dates of key moments in your life in time order.
3. Draw each event to help you remember it.
4. End your life map with the present day.