

Engineering Box Project Overview



The Engineering Box Project is a STEM project stored in five easily portable boxes. It demonstrates basic engineering principles and is targeted at the Upper Key Stage 2 (ages 9-11) of the National Curriculum. It has the potential to meet objectives set out in Design & Technology and History (as detailed below) with hands on construction and air powered exercises.

This is a complete kit, with the benefit of not requiring any prior knowledge or expertise from the teacher. Nor does it need extra resources other than those you would normally expect to find in school, such as scissors and paperclips.

There are six linked lessons to be delivered in sequence, each building on the previous one. Throughout the children will be investigating and creating a range of mechanisms which are used in most engines.

Lessons:

1. Investigating different forms of energy including considering the difference between kinetic and potential energy.
2. Creating a store of potential energy using pistons, and ways to release the potential energy using valves. This will be demonstrated by creating a buggy.
3. Considering more efficient ways of creating potential energy through a simple pumping action to a rotating crank to drive the pump piston. An outcome will be the understanding that turning a rotating handle is easier than the pumping action alone.
4. Creating cams as another way of controlling energy. A cam is an essential part of every engine from the very first ever made. It is used to open valves by converting rotary motion into back and forth motion to let in air or steam and then to open another valve to let spent gases escape.
5. Exploring ways in which potential energy is then used in engines in the form of turbines. The simple turbine can be driven by the air pump through a jet of air. Investigating which shape and number of blades is most efficient in a turbine.
6. Looking back in history about the development of steam engines through the ages up to today where steam turbines produce most of our electricity, as an example of places where all these mechanisms are used.

Resources

- You will need to source paperclips & scissors
- Each of five groups has a hand powered pump assembly, which can be operated in two ways and forms the backbone of most lessons.
- Our simple engine displays the use of reciprocal to rotary motion, the use of a cam to open a valve to let air in and out, and how pressure acts on a piston in a cylinder. A further observation can be made as the flywheel provides kinetic energy to return the piston back to its power stroke position, which is when the piston is nearest the air valve supply. The engine can be used to lift a load, providing an opportunity to show how it can be used in a practical application such as lifting a weight.
- CD containing copies of lesson plans and associated printable resources and visual aids.
- Printed and laminated copies of instruction sheets.

National Curriculum Links

Design and Technology

The national curriculum for design and technology aims to ensure that all pupils:

- Develop the creative, technical and practical expertise needed to perform everyday tasks confidently and to participate successfully in an increasingly technological world
- Build and apply a repertoire of knowledge, understanding and skills in order to design and make high-quality prototypes and products for a wide range of users
- Critique, evaluate and test their ideas and products and the work of others

Key Stage 2 Pupils should be taught:

Through a variety of creative and practical activities, be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making. They should work in a range of relevant contexts [for example, the home, school, leisure, culture, enterprise, industry and the wider environment].

Design

3.2 Make, select from and use a wider range of tools and equipment to perform practical tasks [for example, cutting, shaping, joining and finishing] , accurately select from and use a wider range of materials and components, including construction materials, textiles and ingredients, according to their functional properties and aesthetic qualities

3.3 Evaluate, investigate and analyse a range of existing products. Evaluate their ideas and products against their own design criteria and consider the views of others to improve their work. Understand how key events and individuals in design and technology have helped shape the world.

Technical knowledge

3.5 Understand and use mechanical systems in their products [for example, gears, pulleys, cams, levers and linkages].

History

The national curriculum for history aims to ensure that all pupils:

- Know and understand the history of these islands as a coherent, chronological narrative, from the earliest times to the present day: how people's lives have shaped this nation and how Britain has influenced and been influenced by the wider world
- Gain historical perspective by placing their growing knowledge into different contexts, understanding the connections between local, regional, national and international history; between cultural, economic, military, political, religious and social history; and between short and long-term timescales.

Key Stage 2 Pupils should be taught:

To continue to develop a chronologically secure knowledge and understanding of British, local and world history, establishing clear narratives within and across the periods they study. They should note connections, contrasts and trends over time and develop the appropriate use of historical terms. They should regularly address and sometimes devise historically valid questions about change, cause, similarity and difference, and significance. They should construct informed responses that involve thoughtful selection and organisation of relevant historical information. They should understand how our knowledge of the past is constructed from a range of sources.

Pupils should be taught about:

4.6 A study of an aspect or theme in British history that extends pupils' chronological knowledge beyond 1066. A significant turning point in British history, for example, the first railways.



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