



Lesson Plan – Fairground Rides



Level – Years 5-6

Time taken – 6 hours (including about 1 hour's design time)

Pupils to work individually or in pairs

Additional adult help is recommended

Expectations – to complete working model fairground rides

Associated resources:

PowerPoint

Design sheet

Pupil worksheet

Suggested answers to worksheet

Blog 'How to make a chair-o-plane'

Blog 'How to make a merry-go-round'

STEM Links

- Science: electrical circuits, air resistance and friction, pulleys
- Technology: design products, use tools, mechanical systems, electrical systems
- Engineering: designing rotating machinery, designing for safety
- Mathematics: drawing 2D shapes, measurement, speed, converting units

Curriculum Learning Objectives – it is recommended to cover as many of these topics as possible prior to the exercise so that the pupils are reinforcing their knowledge and understanding, rather than meeting the topics for the first time.

Science: Electricity

Pupils should be taught to:

- construct a simple series electrical circuit, identifying and naming its basic parts
- recognise that a switch opens and closes a circuit
- recognise some common conductors and insulators, and associate metals with being good conductors
- use their circuits to create simple devices
- represent a simple circuit in a diagram using recognised symbols
- pupils should be taught about precautions for working safely with electricity

Science: Forces

Pupils should be taught to:

- identify the effects of air resistance and friction that act between moving surfaces
- recognize that some mechanisms including pulleys allow a smaller force to have a greater effect

Design and Technology

Through a variety of creative and practical activities, pupils should be taught the knowledge, understanding and skills needed to engage in an iterative process of designing and making.

When designing and making, pupils should be taught to:

Design and Technology: Design

- design innovative, functional, appealing products that are fit for purpose

Design and Technology: Make

- use a range of tools and equipment to perform practical tasks (for example cutting, shaping, joining and finishing) accurately
- select from and use a range of materials and components according to their functional properties and aesthetic qualities

Design and Technology: Technical knowledge

- understand and use mechanical systems in their products
- understand and use electrical systems in their products (for example series circuits incorporating switches and motors)

Mathematics: Measurement

Pupils should be taught to:

- draw 2D shapes using given dimensions and angles
- record and compare time
- name parts of circles including radius, diameter and circumference
- convert between standard units of length and time

Vocabulary list

Pulley – a grooved wheel over which a drive belt can run

Drive belt – the belt which connects and transfers movement between two pulleys

Shaft – a rotating rod

Bearing – this holds the shaft in position whilst allowing it to rotate

Series circuit – a circuit with only one possible path for the current

Short circuit – an incorrect route in a circuit which misses out certain components and can cause the circuit to fail

Parts included in class kit:

- 30 cardboard task boxes
- 100 54mm diameter wheels with 6mm hole
- 100 mixed diameter wheels with 5mm hole
- 1 pack of corrugated plastic (10 coloured sheets 500mm x 500mm)
- 30 motors
- 30 motor mounts
- 30 battery holders
- 30 toggle switches
- 90 crocodile leads
- 120 plastic pulleys
- 100 cotton reels
- 50 lengths of 8mm square wood
- 40 lengths of 5mm diameter wooden rod
- 500 jumbo coloured lolly sticks
- 245g box of rubber bands

Check you have received the correct contents in your class kit. Try pushing the mixed diameter wheels and the pulleys onto the wooden rod to check they fit tightly. (There can be a slight variation in the diameter of the dowel due to the wood's moisture content. If the wheels and pulleys are difficult to fit you can sandpaper down the end of the dowel slightly, and if they are slightly loose on the dowel you can glue them on.) Check that the 54mm diameter wheels with the 6mm hole are very loose on the rod. Please let TTS know if there are any problems as soon as possible.

Tools and consumables needed:

- Plenty of lightweight passengers, e.g. small soft toys, plastic figures, furry bugs, pine cones with googly eyes, or the pupils can make figures out of cardboard
- Rulers
- Pencils
- Pencil sharpeners
- Blu Tack
- Calculators
- Pairs of compasses
- Protractors
- Large scissors
- Low melt glue guns and glue sticks. **Note: High melt temperature glue guns should not be used by pupils, as they can cause nasty burns.**
- Junior hacksaw
- Vice or bench hook
- Sandpaper
- Stop watch
- Secateurs (optional – to be used by adults only)

Preparation needed

Build a sample chair-o-plane to help the pupils understand how a rotating fairground works, and to explore any pitfalls. Instructions for building the chair-o-plane are given in the blog 'How to make a chair-o-plane'.

It is recommended that at least half the class make 'chair-o-plane' type of rides, because they are easier and require less material than other rides.

You could pre-cut two of the sheets of Corriflute into roughly 17 cm x 17 cm squares to use for chair-o-planes. You should get 9 squares from each sheet. This will prevent pupils wasting a lot of material by cutting from the middle instead of the edge of the sheet.

You could also pre-cut 18 shafts from the 5 mm wooden rod using secateurs to use for the chair-o-planes.

If making merry-go-rounds as shown in the blog, you can only get two merry-go-rounds (i.e. four squares) per sheet of Corriflute (again it is better to pre-cut the squares to minimise wastage). Similarly you would only expect to get two Ferris wheels per sheet. You could make much smaller merry-go-rounds using 17 cm x 17 cm squares if you need to save on material.

If you are making a lot of merry-go-round type rides you could use garden cane or wooden skewers for the outer poles to save on 5 mm wooden rod.

The pulleys can be a very tight fit on the 5 mm rod. You could use a 5 mm reamer or drill to open up the holes so that they go on more easily. Alternatively pupils can clamp the rod in the vice and use their weight to force the pulley down the rod. They need to remember to sharpen the end of the rod slightly to get the pulley to start going on. Also they must clamp the rod near to the end where they are fitting the pulley; if they clamp it at the opposite end they are likely to break the rod!

Risk assessment

Conduct a risk assessment before undertaking the activity. Some suggestions for inclusion are given below:

Hazard: Pupils burning themselves with the glue guns.

Ways to reduce the risk: Warn the pupils of the dangers; don't switch them on until after the safety briefing; have a responsible adult supervising the glue guns; only use low melt temperature glue guns.

Hazard: Pupils cutting themselves with the junior hacksaws.

Ways to reduce the risk: Explain how to use the hacksaws safely; warn the pupils of the dangers; use only in combination with a vice or bench hook.

Hazard: Pupils cutting themselves with the scissors.

Ways to reduce the risk: make the pupils aware of the dangers; explain how to use the scissors safely.

Hazard: Pupils short circuiting their batteries and burning their fingers.

Ways to reduce the risk: explain how to avoid short circuiting the battery; use zinc chloride batteries (not alkaline or rechargeable ones) so they don't get so hot; if the batteries get hot ask an adult to disconnect them immediately.

Hazard: Passengers flying off the rides and hitting someone.

Ways to reduce the risk: use lightweight passengers such as small soft toys and furry bugs; make sure the passengers are wearing seat belts!

Extension activity

You could connect up the Crumble Controller (not included in the kit) and use it to programme your fairground rides, so that you can run them forwards and backwards, at different speeds and for a specified ride time. This controller is particularly useful because you can run motors directly from it without needing a separate circuit. It can be programmed using a very simple drag and drop language. You could also add some Sparkles (LED lights) to the rides and programme different colours and flashing sequences.