

FIFTH AND SIXTH - FORCES

Teacher Guidelines:

- Pp. 107-116
- Exemplar 2: A unit of work based on forces p38
- Exemplar 31: p109

Linkage:

- Living Things - Myself
- Materials - Properties and characteristics of materials

Integration:

- Language Development – English and Gaeilge
- Geography – Transport, water, weather and wind
- History – Transport
- Maths – measurement/sorting
- Visual arts
- SPHE
- PE

Content Objective:

IDENTIFY AND EXPLORE HOW OBJECTS AND MATERIALS MAY BE MOVED

by pushing and pulling

by machines using rollers, wheels, axles, gear wheels, chains and belts by pouring and pumping

using trapped air pressure (pneumatics)

using trapped liquid under pressure (hydraulics)

using wind energy

harnessing energy of moving water

design and make a lifting device that uses levers and gears design and make a windmill, water wheel or

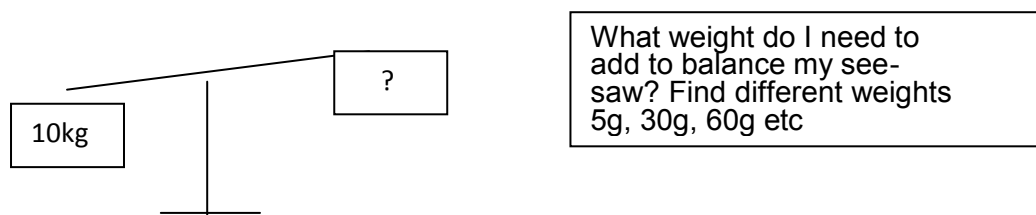
wind turbine to spin a coloured disk or turn a flywheel

Some suggested activities:

- Observe machines in the wider community.
- Taking a toy figure: how many ways can I move it? – sliding down a ramp, floating in a boat, sliding down a rope, travelling in a toy car, blowing on it, using hydraulics (syringes)

and tubing)

- Looking at wheels, axles and chassis on toys, and real life objects – bicycles esp. Chain and gear drives. An upturned bicycle – marking a wheel rim with a sticker and observing how many turns of peddles to turn rear wheel. Change gears – what do you notice. Extend peddle by adding a length of wood/ruler – is it easier to turn peddle?
- Observe bicycle pump and valves.
- Pneumatics and hydraulics: syringes and piping – lift (push) objects – different capacity syringes e.g. 20ml with 5ml. Pneumatic drills to break up concrete and JCB with hydraulics (oil not water in JCB)
- Lifting a book with a ruler and pivot. How can I reduce the work load? The further away from the pivot, the easier the work.
- Using a lever and a known weight can I measure other weights – e.g. if I have a 10g weight, using a lever how will I get a 20g weight? Equipment required: a simple lever or see-saw, pebbles and small plastic bags. A kitchen scales to confirm results. Rather than rest the pebbles on the lever, it would be best to hang them from under the lever.



What weight do I need to add to balance my see-saw? Find different weights 5g, 30g, 60g etc

- Wheel and belt systems – spools on a board with elastic bands – can we turn big spools and smaller spools – what do we observe? – linking to bicycle gear system. Correlation between wheel sizes. Clock wise and anti clockwise movement of wheels.
- Using a slope to reduce the force required to lift an object.
- Moving objects with the help of wheels, rollers etc.
- See Exemplar 3A and 3B – pages 40 □ 41
- See Exemplar 46 pages 138 □ 139

Some suggested investigations:

- Can I reduce the force required to lift a set weight (500g pebbles) using a lever?
- What machines can I use to reduce the force required to do work?
- Does the size of a gear wheel reduce the workload?
- Does the length of hand on my crane make a difference?

Some suggested design and make:

- A lifting device – pulleys, levers, gears
- A wind turbine to spin a coloured disk
- A wind-up toy using elastic bands, levers etc
- A hydraulic/pneumatic machine/toy
- A water wheel to turn a gear system
- A pop-up book/card

Content Objective:

EXPLORE THE EFFECT OF FRICTION ON MOVEMENT AND HOW IT MAY BE USED TO SLOW OR STOP MOVING OBJECTS

a bicycle wheel by a brake, a falling object by a parachute air resistance, streamlining

EXPLORE HOW FRICTION CAN GENERATE HEAT

rubbing hands

Some suggested activities:

- See exemplar 3A page 40
- See exemplar 46 pages 138 □ 139
- Observe how a bicycle brake works – also levers and cables
- Understand that FRICTION makes it difficult for objects to move against each other – shoes on floor; observe that friction is all around us. Difference between chalk on black board and marker on white board or pencil on different papers.
- Rub hands together causing heat
- Pull a block of wood on different surfaces with elastic band or force meter –measuring friction – how to reduce the friction
- Air resistance – throw scrunched up paper of different sizes – parachutes.
- Observe when we need to increase friction and reduce friction – Parachute – increase; aeroplane flying – reduce friction.
- Streamlining – use a hairdryer (wind tunnel!) blow air on different shaped objects and observe air flow by attaching ribbon to shape. Using a light cardboard 3D shape can I make it not move by streamlining it – Ship's bow moving through water, cars and articulated trucks canopies?
- Aeroplane landing – observe smoke from wheels turning on runway. In films why do cars smoke when brakes applied? Rubbing of brake pads on brake disks.
- Ball bearings – a tin of beans with marbles under it and another without.

Some suggested investigations:

- Can I reduce friction between two surfaces/objects?
- Investigate the different ways to move a brick with the least friction across the floor
- Investigate the different ways to move brick with least force AND friction across the floor

Some suggested design and make:

- Vehicles – wheels, axles, chassis and belt drive systems

Content Objective:

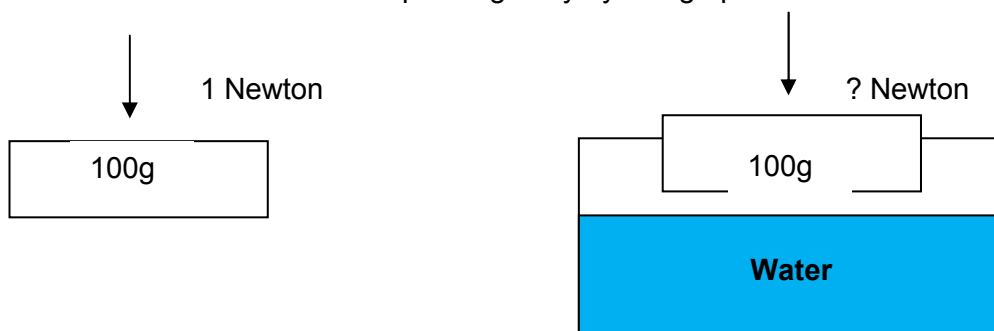
COME TO APPRECIATE THAT GRAVITY IS A FORCE

BECOME AWARE THAT OBJECTS HAVE WEIGHT BECAUSE OF THE PULL OF GRAVITY

design and make a spring balance

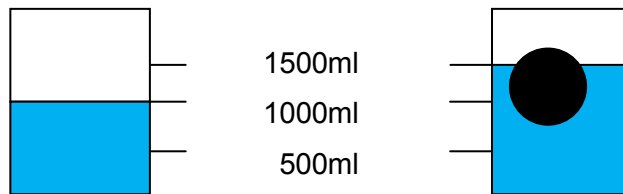
Some suggested activities:

- **REMINDER: Air Resistance gets in the way of explaining that all objects (large and small masses) fall at the same rate.**
- Drop objects of different weights, shapes – predicting which will fall first
- Drop paper flat and scrunched up – what forces are acting on it?
- Observe a feather and a conker falling – understanding and questioning - gravity and air resistance.
- Weight and Mass – looking at video footage of Space travel and moon landing. Moon's gravitational force is 1/6 of Earth's.
- Observe the working of a force metre and elastic band – the greater the pull of gravity the greater the weight. Weight = pull of gravity. The pull of the Earth, which is felt as weight.
- Measure the pull of gravity in Newtons. 1N = 100g
- Observe how we can balance the pull of gravity by using up thrust of water:



- Up thrust: How to measure up thrust (also measured in Newtons) – displacement of floating object - Observe what happens to water level in a glass as a film canister is filled with pebbles one at a time. The weight of the displaced water is equal to the

weight of the canister of marbles.



Rubber ball displaced 50ml of water.

$$50\text{ml} = 50\text{g}$$

Weigh ball using Force metre = .5N

Some suggested investigations:

- Parachute investigation
- Use a slope to redirect the pull of gravity
- Investigate the affects of air resistance on falling objects
- How can I calibrate my force meter with only one known weight?

Some suggested designing and making:

- A spring balance to use in investigations and activities to measure forces – levers, pushing & pulling, friction etc
- A boat/raft

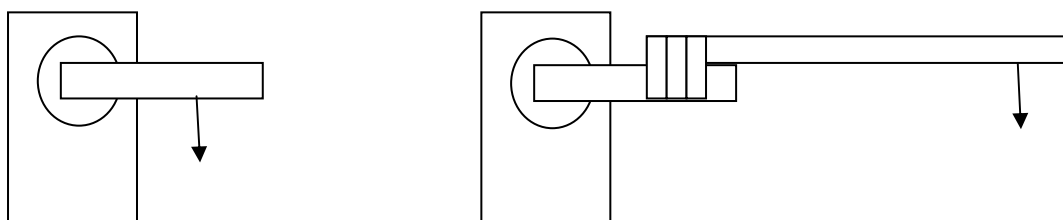
Content Objective:

EXPLORE HOW LEVERS MAY BE USED TO HELP LIFT DIFFERENT OBJECTS

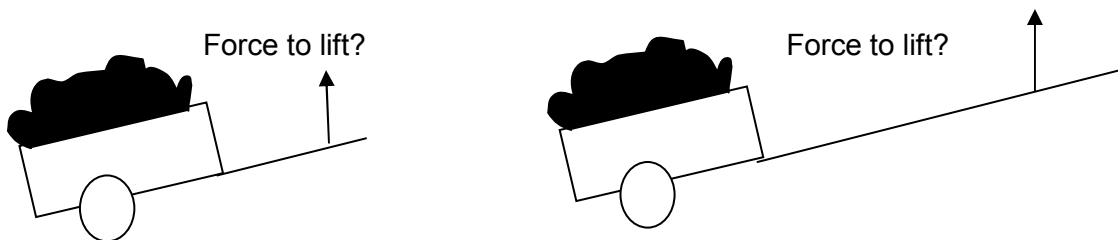
design and make a toy using a lever.

Some suggested activities:

- Observe the use of levers in everyday situations – door handle, hammer handle, in fact ALL HANDLES!
- Lengthen the door handle by adding a piece of timber/ruler to the door handle – is it easier



- Lifting a book with a ruler and pivot. How can I reduce the work load? The further away from the pivot, the easier the work.
- Using a lever and a known weight can I measure other weights – e.g. if I have a 10g weight, using a lever how will I balance a 20g weight? Equipment required: a simple lever or see-saw, pebbles and small plastic bags. A kitchen scales to confirm results. Rather than rest the pebbles on the lever, it would be best to hang them from under the lever.
- Make a “chinese take-away” wheel barrow: Observe the correlation between handle length, amount of pebbles and forces required to lift it.



Some suggested investigations:

- See above – how can I reduce the force required to lift an object
- Investigate the length the handles on a wheel barrow
- Investigate different weights and handle lengths on crane winch gear

Some suggested design and make:

- Crane – lifting device – emphasis on winding handle length