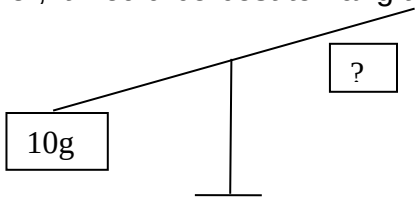
FIFTH AND SIXTH CLASSES – FORCES
Teacher Guidelines: ○ Pp. 107-116 ○ Exemplar 2: A unit of work based on forces p38 ○ Exemplar 31 p109
Linkages: ○ Living Things - Myself ○ Materials - Properties and characteristics of materials
Integration: ○ Language Development – English and Gaeilge ○ Geography – Transport, water, weather and wind ○ History – Transport ○ Maths – measurement/sorting ○ Visual arts ○ SPHE ○ PE

FIFTH AND SIXTH CLASSES – FORCES
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 designing and making:

- 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

FIFTH AND SIXTH CLASSES – FORCES

Content Objective:

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

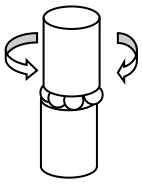
a bicycle wheel by a brake
a falling object by a parachute
air resistance, streamlining

- **EXPLORE HOW FRICTION CAN GENERATE HEAT**

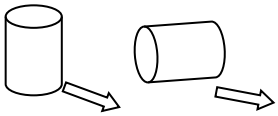
rubbing hands

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 –



Bearings help the tins move easily



Which tin moves more easily – why?

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 designing and making:

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

FIFTH AND SIXTH CLASSES – FORCES

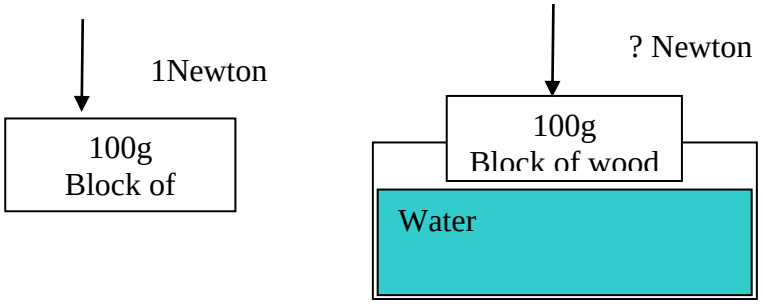
Content Objective:

- **COME TO APPRECIATE THAT GRAVITY IS A FORCE**
- **BECOME AWARE THAT OBJECTS HAVE WEIGHT BECAUSE OF THE PULL OF GRAVITY**

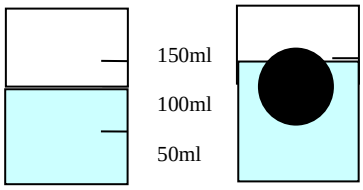
design and make a spring balance

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.
50ml = 50g
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? (see levers!)

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

FIFTH AND SIXTH CLASSES – FORCES

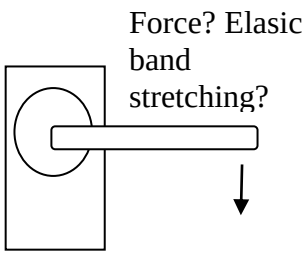
Content Objective:

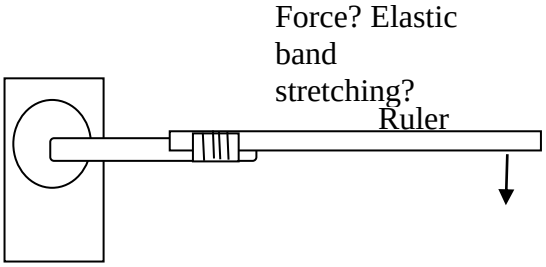
- **EXPLORE HOW LEVERS MAY BE USED TO HELP LIFT DIFFERENT OBJECTS**

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!
- Lenghten the door handle by adding a piece of timber/ruler to the door handle – is it easier?





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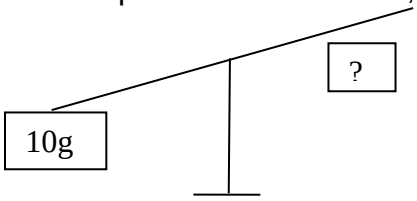
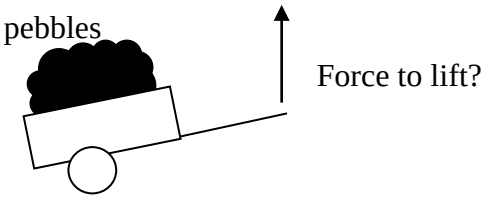
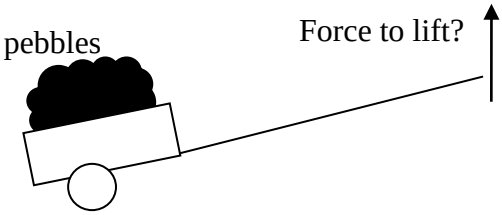


What weight do I need to add to balance my see-saw? Find different weights 5g, 30g, 60g etc

- Make a "chinese take-away" wheel barrow: Observe the correlation between handle length, amount of pebbles and forces required to lift it.



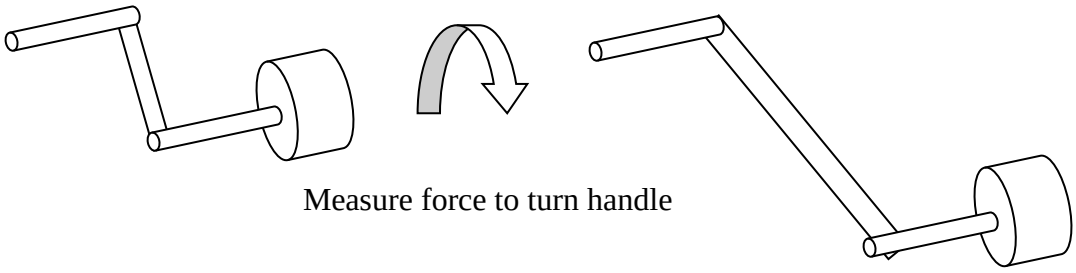


Some suggested investigations:

- 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 designing and making:

- Crane – lifting device – emphasis on winding handle length



- A wheel barrow – see investigation