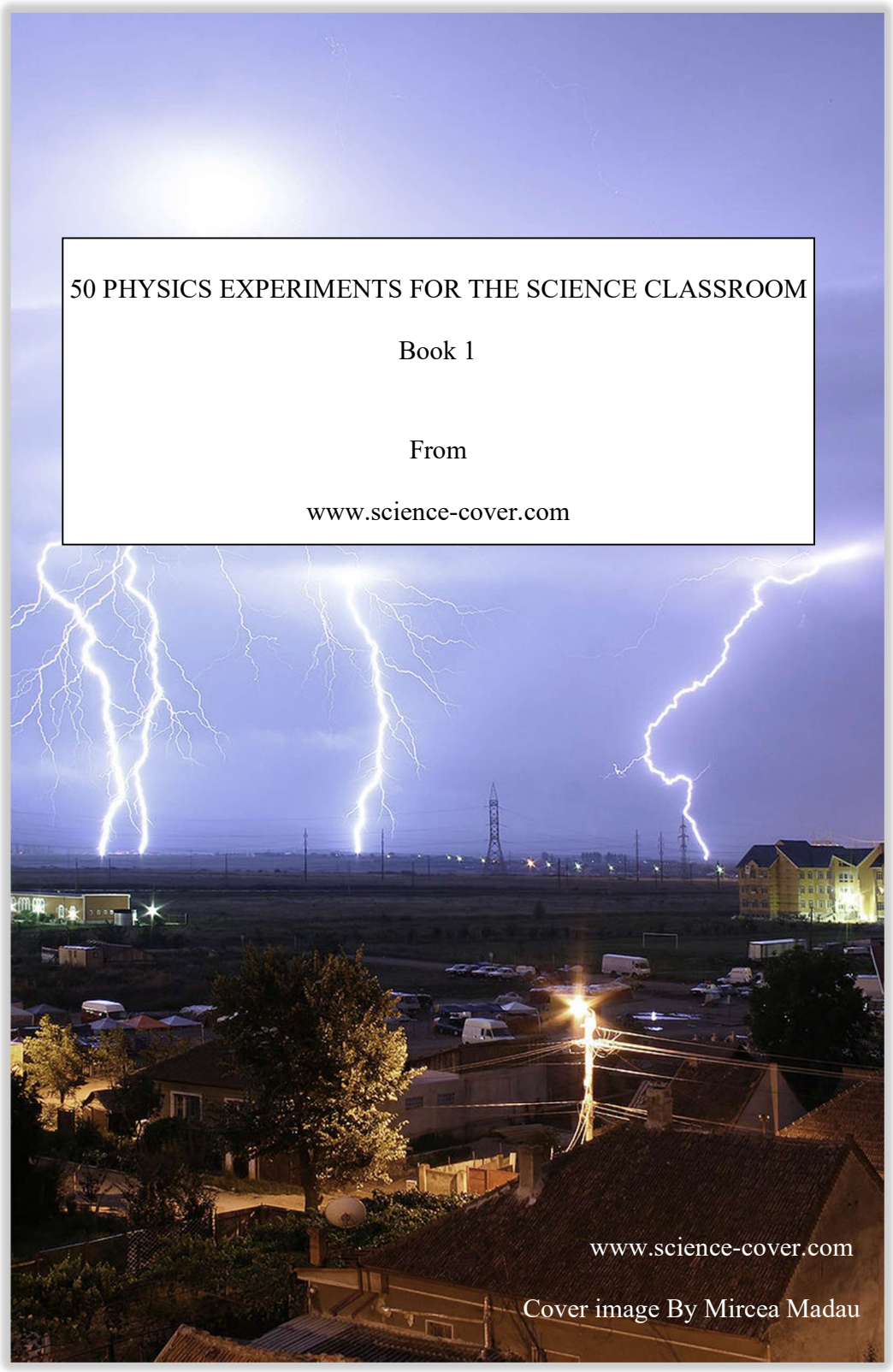

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CHAPTER 1 — INTRODUCTION

After teaching Science in secondary education in schools for thirteen years, I can say it is without doubt the most difficult of subjects to teach in any school. The Science teacher is required to educate their students in Biology, Chemistry and Physics, memorising a never-ending list of facts and diagrams. Teaching their students to write essay quality answers, learn and use the scientific process, master practical skills, use new equipment, develop problem solving, the use of mathematics and equations to prove concepts and master an entirely new vocabulary. We do all this whilst at the same time attempting (Or at least hoping) to be inspirational. Science teachers, I salute you!

This book began its life when I attempted to list all the gimmicks and experiments that I use in my Physics lab to breathe life into my lessons. I will confess I did not invent any of them (If I had, I would probably be living a comfy life in the south of Spain), I have simply learned and adapted them from others over the years.

The experiments are organised by topic in which they could be used, however as with most things in a classroom, they can be switched between upper or lower school depending on the ability of the students.

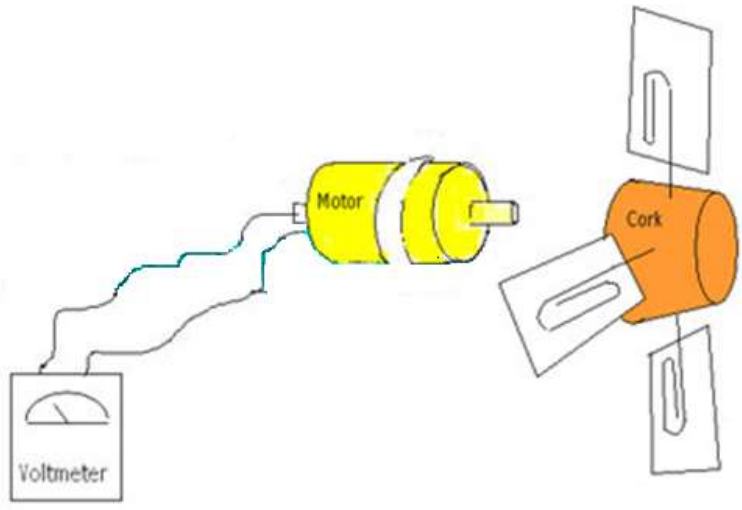
EXPERIMENT 6 – CREATE A WIND TURBINE

Renewable energy is one of the hottest subjects of the moment. With large amounts of public money being invested in renewable resources, this has quite rightly become a key part of almost all Physics curriculums. To the Physics teacher this provides the perfect excuse to dabble in a little bit of engineering, designing, and testing a simple wind turbine.

Aim- To investigate how altering the number of blades on a wind turbine will affect the amount of energy it produces.

Equipment – Motor (Used as a generator), cork, paperclips, card, wire, ruler, hairdryer, voltmeter

Safety – Hairdryer can become very warm after use and students should be careful to avoid being burned. Switch off when not in use.



Method –

1. Place a motor on a clamp stand.

2. Attach a voltmeter to the motor.
3. Place the cork with two blades onto the generator.
4. Blow the blades with a hairdryer.
5. Measure the maximum voltage produced and record this in a table.
6. Repeat step 4 and 5, then calculate the average voltage.
7. Change the number of blades attached to the cork (Between 2 and 8)
8. Repeat steps 4 – 6 for new cork.

EXPERIMENT 11 – THE FLYING TEABAG

This one is a great party trick even if you're not a teacher. Though this experiment drops nicely into any lesson on convection, when you're trying to explain how hot (Less dense) air will rise above colder (More dense) air. This one can be done as a demonstration, but I have also brought in a stash of teabags and done this as a whole class experiment, competing to see whose tea bag can go highest before disappearing.

There is a secret to getting this one to work. Just grabbing teabags from the staffroom and setting them alight is unlikely to produce the desired effect and may result in a rather grumpy looking school staff showing withdrawl symptoms. Avoid using pyramid or plastic teabags, instead use the cheapest square bottom paper bags. When the top is cut away and the bag is unfolded, it will form a cylinder that can be stood upright. When this is lit, it should fly.

Aim- To how warm air will rise above cold air.

Equipment – Teabags (Square bottom, paper bag), scissors, matches, heat mat

Safety – Keep flammable object and hair away from any open flame. Ensure students know what to do in the event of a burn.

Method –

1. Cut the top away from the tea bag. (Marked with the dotted line)
2. Pour out the tea
3. Unfold the bag into a cylinder
4. Stand the cylinder on a heat mat
5. Light the top of the tea bag. (Light both sides, else the bag will tip over.)
6. When the flame reaches the bottom, the bag launches into the air.

EXPERIMENT 17 – MASS AND WEIGHT (PLASTICINE CREATURES)

This experiment works very well with Year 7 and Year 8 student, who are often the classes learning the difference between mass and weight. However, if you find yourself with an older group that struggle with the concepts, they absolutely love it … love it!

Aim- To help students understand the difference between the concepts of mass and weight.

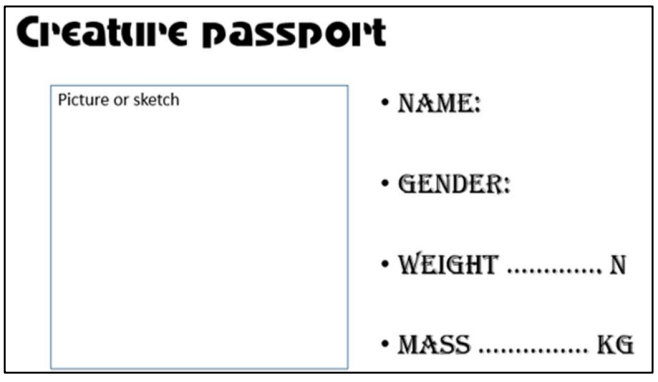
Equipment – Plasticine, play-doe, newton meters, string, balance.

Safety – Don't eat play-doe, it does not taste good.

Method –

1. Students are given 10 minutes to make a creature out of plasticine / play-doe
2. Students create a passport for their creature. Give it a name and sketch what it looks like.

   (It will speed things up if you create a template for the student as shown below)



3. Students place the creature on a balance to measure its mass.

4. Students must then attach the creature to the hook of the newton meter and measure its weight. (This could be done by skewering the creature with the hook, but by this point your class will be invested in their little being and this may start a riot. Therefore, it may be best to connect the creature and newton meter using the string)
5. Once students have the mass and weight, introduce them to the equation:

   Weight = Mass x constant
6. set students the challenge of working out what the constant should be using their creature passport.

EXPERIMENT 34 – SUBMARINE IN A BOTTLE

This is the classic cartesian diver experiment. I used to pretend to be a psychic and tell the kids I was going to move the diver with my mind. Then whilst looking like I was concentrating hard, I'd squeeze the bottle slightly and the diver would sink.

Building the submarines is a great challenge for a class, and there are several ways to make them.

Aim- To create a submarine that will dive to the bottom of the bottle when pressure is applied to the bottle.

Equipment – 2l bottle, tiny test tubes.

Safety – This can be messy. Water spills can be a slipping hazard so have a mop handy for students.

Method –

1. Fill a 2l bottle with water until it is filled right to the top. It is important there is no air even in the neck area.
2. Fill a tiny test tube with water until it is about ¾ full.
3. Invert the tiny test tube and place it in the 2l bottle.

   At this point you want the air trapped in the test tube to be causing it to float, maybe even to the top. If the test tube sinks to the bottom, then start over.
4. Double check the 2l bottle is filled to the top.
5. Place the lid on the bottle.
6. Squeeze the bottle to make the diver sink.

This is without doubt the easiest way to make a simple cartesian diver, but if you wish to make a lesson of it this may go to quickly. Therefore, students can try to make divers out of some other materials as listed below:

Option 1: Use a small amount of plasticine as a weight, then wrap some bubble wrap around the plasticine and tape in place. Use trial and error, popping the bubbles until the diver has the correct buoyancy.

Option 2: Cut a bendy straw about two or three inches below the bend. Roll some plasticine into a snake, then use this to block the short end of the straw, wrapping the rest of your plasticine snake around the straw to hold it in a U shape.

Option 3: Packets of ketchup or soy sauce will also work as a diver.

EXPERIMENT 49 – THE SPINNING NAIL (MAXWELLS HOMOPOLAR MOTOR)

Many students struggle with explaining how a motor work, so building a relatively cheap and simple one can go along way to helping their understanding.

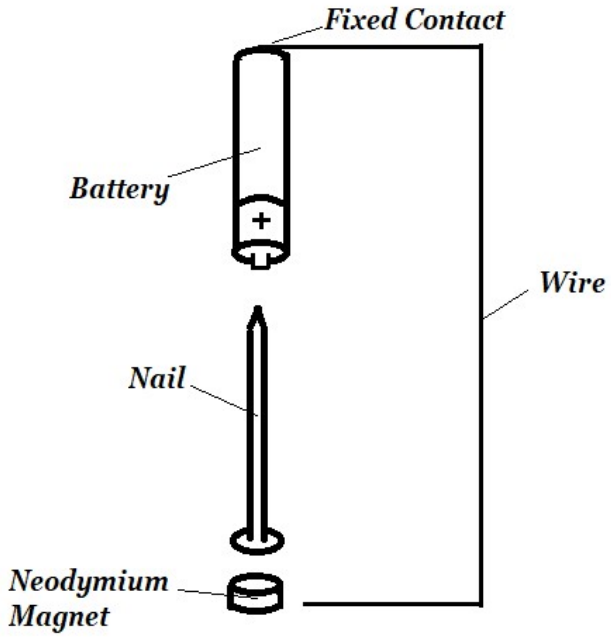
Aim- To produce rotary motion of a nail by using a magnetic field and an electric current.

Equipment – A wire, a nail, a battery, a neodymium magnet

Safety – The magnets are incredibly powerful and can cause a nasty pinch if your finger is caught between two coming together.

Method

1. Connect the neodymium magnet to the head of the pin.
2. Connect the point of the pin to the positive end of a battery (It will stick because the magnet has induced magnetism in the nail).
3. Fix a piece of wire to the negative end of the battery.
4. Bring the opposite side of the wire to the neodymium magnet and make contact.



When the wire makes contact with the neodymium magnet the nail and magnet will spin. The longer they're in contact, the faster they will spin.

THE END