

SCIENCE EDUTAINMENT II: GUARANTEED ENGAGEMENT IN PHYSICS

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Globally students show less interest in the physical sciences due to a lack of engagement, relevance and connection with their interests. So that is our challenge! In this session we will cover simple, practical chemical activities and demonstrations that will engage and connect!

1. The Fun Fly Stick

The World's first portable and inexpensive Van de Graaff Generator has arrived. All teachers can now teach electrostatics without worrying about being zapped or the unreliable temperament of the Van de Graaff generator. (See complete instructions in attached document or under Downloads on website.)

2. A Bottle Jet Drag Racer

A vivid demonstration of Newton's first, second & third Laws in action. A jet of air is expelled through a small pinhole at the back of the car. This is sufficient to propel the car. Many variations are possible.

3. Singing rods & Standing waves

Most objects have a natural frequency of vibration, eg a stretched string, an organ pipe full of air, etc. When the energy source's frequency matches the natural frequency of vibration then the object will "resonate". A solid rod & Dhorje bell will be used to demonstrate the position of nodal and anti-nodal points in a wave.

4. Luminescence & LED lights

Max Planck determined the relationship between the photon energy of light and light's frequency: $E = hf$ and $v = f \lambda$

This indicates that a UV source at 405 nm will have a higher energy value than red light at 630 nm. Thus:

- high-frequency electromagnetic waves have a short wavelength and high energy;
- low-frequency waves have a long wavelength and low energy.

Prepare a phosphorescent screen using photo luminescent pigment and white glue. (1:3). See 'Downloads' at Prof Bunsen Science website for more details.

5. A real virtual image!

The human vision system retains an image for a fraction of a second (about 1/30 th of a second). If a new image is formed on the retina before the previous one fades, then the two consecutive images will merge. This is known as persistence of vision. When a wand is waved up and down, many "slices" are merged together in the brain to create a continuous image. A movie is simply a series of still pictures projected onto a screen in fast succession and our brain does the merging.

6. A super sized spectrum on an OHP

When light rays pass through a narrow gap, they bend outwards from the edges of the gap so that the light spreads out. This is known as diffraction. The gap has to be of the same size order as the wavelength of the light. A diffraction grating contains rows of very narrow slits. Typical gratings have 500 lines (slits) per mm.

A large spectrum can easily be produced in a darkened classroom using a diffraction grating in stead of a prism. (See Downloads on website for detailed instructions).

To observe:

- Compare the **colour sequence** of the diffracted light to that of light refracted by a prism.
- Addition to form **white light**: Recombine the spectrum colours using a large fresnel lens between the grating and the screen. The colours should converge to form a white spot.
- **Primary colours**. Cover half of the slit in succession with the red, green and blue coloured solutions or coloured gels / filters. Place a white poster board behind the spectrum and each time mark which region of the spectrum is produced by the colour. The students should be able to deduce that the full spectrum is a combination of only three additive primary colours.

7. The Singing Flashlight: A Light Modulator

Amplitude modulation can easily and dramatically be demonstrated using a simple flashlight, solar panel and simple amplifier circuits.

8. Amazing magnetic toys

8.1 A Magnetic Accelerator (or 'rail gun')

A steel ball rolls towards a magnet and three steel balls on a track. As it approaches the magnet, it accelerates towards the magnet and amazingly shoots off the steel ball at the other end at a high velocity! This ball once again activates the second group and the last ball flies off at a fantastic speed. Be warned – this is known as a Gaussian rail gun too! But how about the Conservation of Energy?

8.2 A really simple electric motor

This idea I got from a video on YouTube!

Try it. A wire, a magnet, a nail and a battery produce a simple electric motor in seconds! It would be hard to beat this one on simplicity.

9. A cheap DIY laser show

A great laser toy to engage the older boys in the class. It simply proves that sound = vibrations.

Full photo instructions and a video are available under Downloads on our website.

10. Nitinol memory wire

Nitinol (pronounced "night-in-all") is a generic trade name for NiTi alloys, which stands for Nickel (Ni), Titanium (Ti) and US Naval Ordinance Laboratory (NOL) where the alloy was discovered in the early 1960s by William Beuhler.

Nitinol belongs to a class of materials called Shape Memory Alloys (SMA). It has interesting mechanical properties:

- When heated, it will magically return to a predefined shape that it has been “trained” to remember.
- The contraction resembles biological muscle and it exerts a substantial force. Ten muscle wires the thickness of a human hair can lift 1.5 kg!

11. A Sand Hand

When sand is put under pressure, its characteristics change dramatically. Or is this an Alien hand? Instructions under Downloads on the website.

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