Diffraction of light from LEDs

(Hungary)

Background

Breadboards provide a neat way of setting up electronic circuits. They can be used with a TY class to teach an electronics module.

This simple circuit uses LEDs connected in series to demonstrate how different wavelengths of light behave differently when passed through a diffraction grating.

Multiple colours can be used and the circuit can be set up in series or in parallel.

Red and yellow tend to light whereas the blue, green and white will not. This is because red has a lower forward voltage than blue.

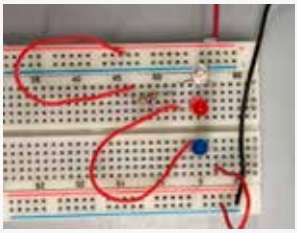
When the LEDs are in parallel each one must have **its own resistor** in series.

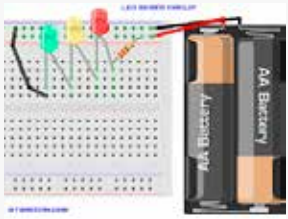
You will need:

- ✓ prototyping breadboard,
- ✓ wires
- ✓ wire stripper
- ✓ LEDs (red, white and blue)
- ✓ resistors (220 Ω)
- ✓ a suitable battery and battery clip
- ✓ diffraction grating (100, 300, 600 lines per mm).

Follow these steps:

1. Use the wire stripper to cut and strip some jumper leads for the breadboard.
2. Connect the LEDs in series with a resistor on the bread board, making sure that you only connect the battery last. The resistor will protect the LEDs from burning out.
3. Arrange the LEDs in a straight line as it is more effective.
4. Place the diffraction grating over the LEDs and observe their spectra. (Placing the diffraction grating over the lens of your camera gives an even better image when observed on your phone).





So what happened?

It can be seen very clearly in that red is diffracted the most and blue the least. The zero order for white light is white whereas the first order is a spectrum.

We can see from the formula $n\lambda = d \sin\theta$ that if λ increases so does θ. Hence, as red light has a longer wavelength than blue it is diffracted the most, i.e. the angle between the zero order and the first order is much larger.