COLOUR MIXING THE ECONOMICAL WAY

by

Bill Konrad

Chatham Kent Secondary School
Chatham, Ontario

I am sure that, in the schools of Ontario, the range of equipment presently in place to demonstrate colour mixing varies all the way from ray boxes with colour filters to expensive projectors specifically designed for that topic. Many of these may be effective but frequently one finds that the resulting colour is not exactly what theory predicts. For example, a blue light, a green light, and a red light projected onto the same area of a white screen may produce a "yellow" white or a "greyish" white. The demonstration described below gives excellent results and, in keeping with current budget constraints, is very economical. To carry it out, proceed as follows.

First cut two squares of cardboard from a box (such as a discarded cereal box or shoe box) that are the same size as a 35 mm slide. Now use a paper punch to punch 3 holes in these squares as shown in Fig. 1. (The holes should coincide when the squares are placed back to back.) Now cut a narrow strip from a red filter gel, a green filter gel, and a blue filter gel. These gels should be sandwiched between the pieces of cardboard so that the blue filter gel is in the middle and the green and red are on opposite sides.

This slide, when inserted into a 35 mm projector, will produce the three beams of light that are required, namely, red, blue and green.

To enable colour mixing to occur, these beams must be recombined. Have the carpentry shop in your school create three wooden blocks with top surfaces that are inclined slightly to the horizontal. An additional set of three blocks is required measuring roughly 5 cm x 5 cm x 5 cm. Onto each of this second set of blocks glue a plane mirror that is about the same size as the block (i.e. 5 cm x 5 cm). Now arrange the apparatus as shown in Fig. 2, with each mirrored block on top of an inclined block. The blocks are arranged so that each coloured beam from the projector strikes a different block. The mirrored blocks can then be adjusted so that the colours to be recombined will overlap on the screen behind the projector.

Figure 1

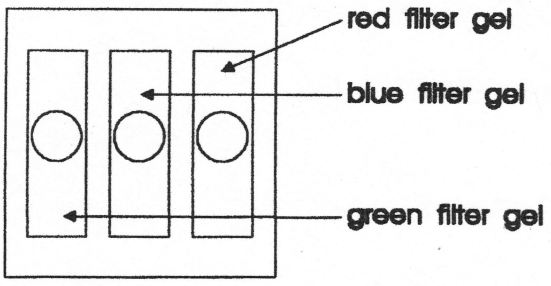
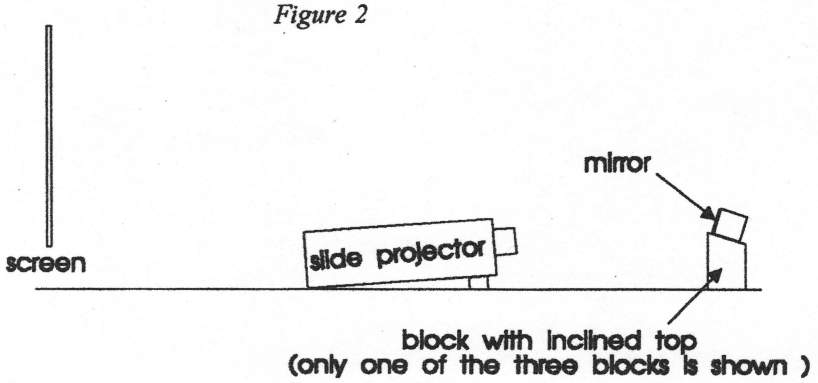


Figure 2



The demonstration works very well. I want to give credit for it to Lorraine Maynard who presented it at the winter meeting in Orlando, Florida, in January of 1992. Lorraine explained that the white resulting from the recombination of the three primary colours is very white because the three colours being recombined all come from the same source and therefore have the correct relative intensity. In many demonstrations where different light sources are used for the three primary colours, the intensity of the sources is not the same, and so the recombined colours do not always live up to expectations.

A second critical factor is to have good quality filter gels in the first place. A good source for these is theatrical supply companies. You may wish to check with your theatre arts teacher. I found an outlet about 2 km away from my school and I am sure that such filters are available in most large towns and small cities. When I tracked down the source, I made an additional discovery. For each of the many filters available, a transmission graph is available. This graph shows percent transmission as a function of wavelength in nanometres. This is a great combination of physics and art, the potential of which I have not yet fully exploited with my classes.

Column Editor: Ernie McFarland, Physics Dept., University of Guelph, Guelph, Ontario, N1G 2W1

Submissions describing demonstrations will be gladly received by the column editor.