GLASS: MORE THAN MEETS THE EYE

EXPERIMENTAL RESEARCH REPORT

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SHELFORD GIRLS' GRAMMAR

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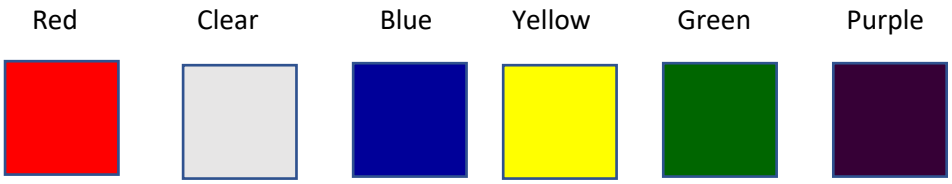
INTRODUCTION

Every time I attend Sunday morning Mass, I always sit near the colour stained-glass windows and watch certain shapes form from the outside. Sometimes I see green coloured branches swaying through the clear coloured glass and other times I can see the shadows of people walking into Church through the dark purple glass. I can also see certain shapes through the yellow and red coloured glass panels, but I find it harder to see through the blue glass. Why is this so? Is there more than meets the eye when it comes to coloured glass? I became quite intrigued by these differences and so I decided to conduct an experiment to find out why such differences existed.

AIM

The aim of this experimental research is to find out which coloured glass panel is easiest to see through when direct sunlight passes through it. A total of 6 coloured glass panels will be tested and will include the following colours:



HYPOTHESIS

My hypothesis will be that the clear coloured glass panel will be the easiest to see through when direct sunlight passes through it. My reason for this is based on my observations during Sunday Mass. During Mass, every time I look at the clear glass panels I can see right through and can see objects clearly such as tree branches. My prediction for the next easiest colour to see through will be yellow, red, green, blue and then purple. Once again, I have based my predictions on the coloured glass panels at Mass. I think it also makes some sense that a

person would be able to see easier through a lighter colour than a darker colour. I'm not very sure how accurate this is but it will be interesting to find out after I finish the experiment.

MATERIALS

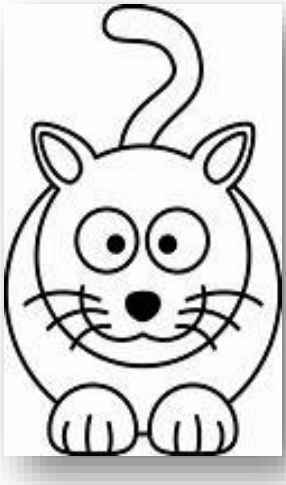
The following materials were used to conduct the experiment at Shelford Grammar:

- Log Sheet
- Folder and pencil
- 6 coloured glass panels (Red, clear, blue, yellow, green and purple, 15cm X 10cm each)
- 6 black and white print outs of a cartoon cat
- 20 Grade 5 Shelford students
- Window

METHOD

The following steps were taken to conduct the experiment:

1. 6 coloured (red, clear, blue, yellow, green and purple) glass panels were bought and a black and white print out of a cartoon cat (pictured below) was attached to each glass panel.



2. A logsheet was then prepared. The logsheet had 11 columns with the following headings: Subjects, Date, Age, Glasses, Contact Lenses, Red, Yellow, Green, Clear, Purple, Blue.

3. The logsheet was placed in a folder.

4. 20 x Grade 5 Shelford students (the "Subjects") between the ages of 10 and 11 were chosen to take part in the experiment – the science teacher assisted with this process.

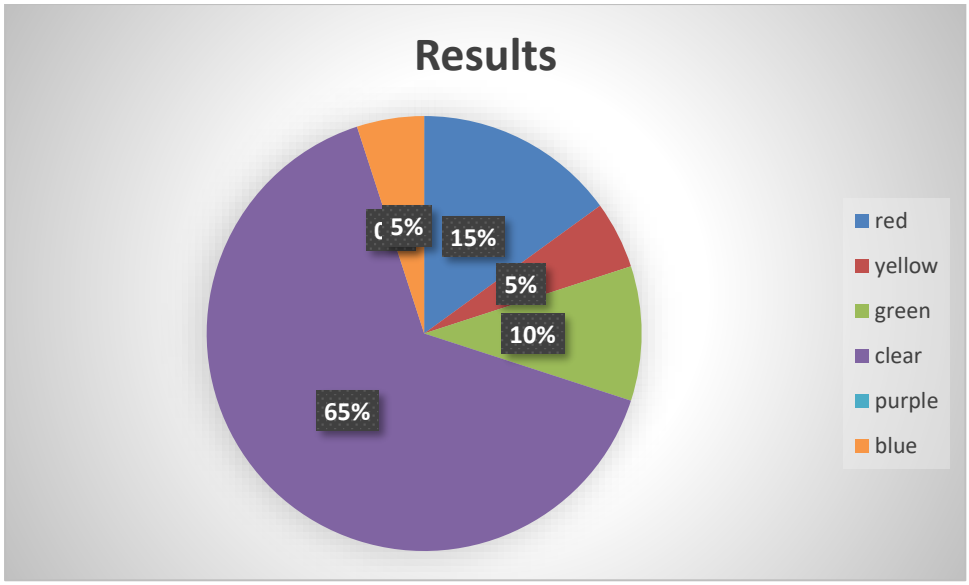
5. The 6 glass panels were securely placed on a glass door in a science laboratory with sunlight shining through each panel. To make sure the glass panels were placed on the door safely and to make sure safety requirements were followed, this step was completed by the science teacher.

6. Each subject was asked to stand around a metre away from the glass panels and then asked to identify which glass panel they could see easiest through in order from 1-6 ("1" being the easiest to see through and "6" being the most difficult).

7. The results of each subject (20 in total) were recorded on the logsheet and then analysed.

RESULTS

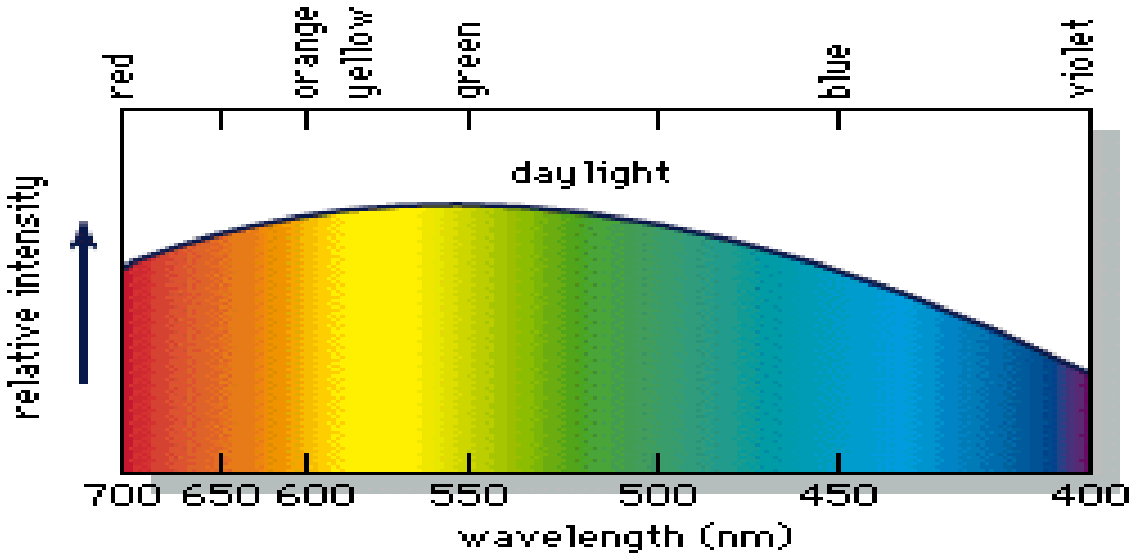
Table A



The results are based on the information recorded on the logsheet. The following results were found:

- 65% of Shelford students could see easiest through the clear coloured glass panel
- 15% of Shelford students could see easiest through the red coloured glass panel
- 10% of Shelford students could see easiest through the green coloured glass panel
- 5% of Shelford students could EQUALLY see easiest through the yellow and blue glass panels
- 0% of Shelford students could see easiest through the purple coloured glass panel.

Energy Distribution in Light Diagram[1]



The above diagram is the energy distribution in light from daylight according to the Encyclopaedia Britannica[2] It is obvious from the above diagram that the wavelength of red colour is greater than blue, violet and green. It means red has the longest wavelength so it will travel faster than blue or any other colour.[3]

[1]Energy distribution in light from daylight (1994)
https://www.britannica.com/science/color#/media/1/126658/1065

[2]Energy distribution in light from daylight (1994)
https://www.britannica.com/science/color#/media/1/126658/1065

[3]McGuire, Raymond (2021) Which Color of Light Red or Blue Travels Faster in Crown Glass? (Scientific Interpretation) (glassbeast.com)

DISCUSSION

After analysing the logsheet, the results showed that most of the subjects (biggest percentage) could see easiest through the 'clear coloured' glass when sunlight passed through. This result did reflect my hypothesis which was that "the clear coloured glass panel will be the easiest to see through when direct sunlight passes through it". Clear glass does not absorb visible light, but it does absorb other wavelengths.[4] This means that clear glass should have been easiest to see through during the experiment as it did not absorb any light and stayed the same. If this is true, then why did only 65% of subjects choose clear coloured glass rather than 100% of subjects?

I am not very sure about what the answer is, but I think I have an idea. One subject (out of the 20) chose blue as the easiest colour to see through when direct sunlight passed through it. This seems quite odd because blue has a wavelength of a round 450nm which means it does not pass through glass as easily as the other colours in the experiment. This particular subject does not wear any glasses or contact lenses (one of the columns on the logsheet) so her eyesight isn't really a problem. The only thing I can really think of is that people see things differently and not everyone will see the same exact thing. I guess when it comes to glass, there is more than meets the eye?

The next part of my hypothesis was to predict that the next easiest coloured glass panels to see through were "yellow, red, green, blue and purple" – in that exact order. The results show that I was wrong because it was "red" that was next as easiest to see through, followed by green and then equally by yellow and blue. No one put down purple as easiest to see through and I am not surprised as purple has the lowest wavelength. Given that red has the longest wavelength, I am not surprised that it was next highest. I am surprised that green came before yellow and even more surprised that yellow and blue were seen as equally easy to see through since they have very different wavelengths. There were 3 out of 20 subjects who wore glasses and/or contact lenses so that could have some kind of effect on the way they see things especially colours.

[4] https://www.popsci.com/scitech/article/2002-04/glass solid how can we see through it? Why can't we see through wood-/? Wikipedia 2002

During the experiment, I had to change my subject group because the first group was not available to help. My first group was aged between 8 - 10 years old but I ended up using a 10-11 years old group instead. I don't really think that would have made a big difference to my results because I think that both groups would have found the clear glass to be the easiest to see through. The results for the remaining coloured glass panels may have been different though.

One way I could improve on my experiment is to use a different age group of subjects to see if it makes any difference on the results or findings. The reason I used a younger group of subjects was because lots of older people wear glasses or have bad eyesight but I think it would be a good idea to compare these age groups in the future. Another way to improve my experiment would be to increase the number of subjects tested from 20 to 200 or even 2000. This experiment has taught me that eyesight and the way we see things are very personal and different so it would be a good idea to test many subjects from different age groups and then compare the results. One more way which I could improve my experiment and test my hypothesis is to repeat the experiment many times so that I can compare results and minimise errors along the way and also improve the processes I have used.

CONCLUSION

In conclusion, clear coloured glass panels are easiest to see through when sunlight shines through them. This conclusion is not only supported by science (cited earlier), but it is supported by the research experiment I carried out. My initial hypothesis that "the clear coloured glass panel will be the easiest to see through when direct sunlight passes through it", also supports this conclusion. However, when it comes to other coloured glass panels, there seems to be more than meets the eye and this is something I would like to investigate in more detail in the future.

ACKNOWLEDGEMENTS AND REFERENCES

1. Energy distribution in light from daylight (1994) https://www.britannica.com/science/color#/media/1/126658/1065 (Accessed: 17-07-2022)

2. https://www.popsci.com/scitech/article/2002-04/glass solid how can we see through it? Why can't we see through wood-/? Wikipedia 2002

3. I would like to acknowledge my dad who helped me draw a pie chart using the Excel spreadsheet

4. I would like to acknowledge my mum for showing me how to cut and paste diagrams from one document to another

5. I would like to acknowledge my mum for helping explain the meaning of scientific words and phrases from the Encyclopaedia Britannica so that I could better understand my topic and my experiment (my mum is not a scientist).

6. I would like to thank my Junior School Teacher, Miss Jacqueline Sidaway, for helping to organise the 20 subjects used in the experiment and for helping attach the glass on the windows safely in the science laboratory so that no one got hurt during the experiment.