10A2: The electromagnetic spectrum

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The human eye has evolved to be sensitive to only a small range of light, all of which can be seen in the spectrum of colours in a rainbow. However, that spectrum is actually a tiny part of a much larger spectrum of types of light, known as the electromagnetic spectrum.

1 Infra-Red

Just beyond the red end of the spectrum lies a non-visible type of light known as infra-red.

In the lesson, we used a webcam which had been modified so that it was only sensitive to infra-red radiation.[1] Firstly, we looked at a message, 'There is not a test today', which read 'There is a test today' when viewed by the infra-red webcam. Where had the 'not' gone? In fact, the 'not' had been written in a different ink, which reflected infra-red light, and so the 'not' appeared white (the same colour as the paper) in the infra-red.

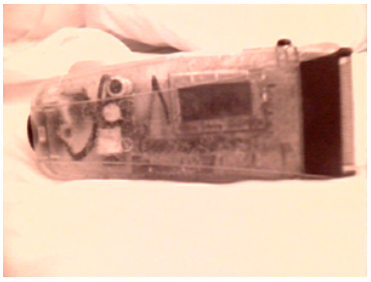
The same idea is used on banknotes as an anti-counterfeit measure. When a modern banknote is viewed in the infra-red, often only part of the printed patternation shows up.

Next, we viewed an older style filament (incandescent) lightbulb and a modern, energy saving (compact fluorescent) lamp with the infra-red camera. We found a huge contrast: in the infra-red the energy saving lamp is fairly dim, and doesn't light up the room much (it isn't wasting energy producing

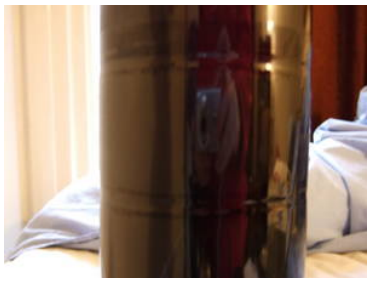
[1] The CCD sensor in a webcam is sensitive to both visible and infra red radiation so the manufacturer adds a filter to stop the infra-red, otherwise it would produce unexpected results when it took photos. So in the camera we used, this filter had been removed, and replaced with one that stops visible light but allows infra-red through.

light you can't see). The conventional filament bulb on the other hand is probably brighter in the infra red than the visible, so it is is not very efficient.[2]

Then we had a look at some objects; plastics that have been coloured with certain pigments become very transparent allowing you to see into this shaver for example.



Similarly, cola is relatively transparent at these wavelengths so you can see right through it. If you look at a light through a glass of cola it looks a very deep red, which tells you it's becoming more transparent at the red end of the spectrum, so we shouldn't be surprised that it transmits infra-red light.



2 Ultra-Violet

Another colour of light which humans can't see lies just beyond the violet end of the rainbow spectrum, and is called ultra-violet (UV) light. You might have seen UV lamps before in discos, or perhaps in banks and shops under the counter. We used such a lamp to investigate how objects behave under UV light.

Paper and white clothes look particularly brilliant when viewed in UV light (usually slightly bluish). This is because when UV hits the paper it gives it some energy, which it can release as blue light, and washing powders also contain substances which take in the energy in the UV light, and release it as light we can see, making clothes appear 'whiter than white'.

[2]So go home and encourage your parents to replace those conventional filament bulbs today! In fact, the newer-style energy saving bulbs are so much more efficient that, even though they are a bit more expensive (around £9 each compared to 45p for a filament bulb), it's worth replacing your old bulbs now rather than waiting until they die naturally – continuing to use an old lightbulb is throwing good money after bad.

3 The electromagnetic spectrum

References

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