

Is an Object Always the Same Colour

Colour filters

You have been given a set of safety spectacles and some sheets of coloured film. Hold up the coloured film to the light. You can see through the coloured film: it is transparent. Write down what the word *transparent* means:

An object is transparent if:

It allows light to pass through.

NB: *Translucent* objects allow light to pass through, but as there is some scattering within the object, you generally cannot resolve an image.

Using tape, carefully stick some film over each of the lenses in the safety spectacles. Make sure that the tape is only on the edges of the film.

You can use the same colour on each side, or different colours. If you use different colours over the two lenses, then remember to only have one eye open at a time when you wear them!

In the lab there should be some different-coloured lights (not so bright as to hurt your eyes).

Look at the different-coloured lights while wearing your safety spectacles with the film covering. What do you notice? Fill out the table below with your observations. Some rows have been left blank for you to fill in with different observations. You may need to swap spectacles with other students, so that you can try all the colours of film.

Colour of light	Colour of film	What I see
Red	Red	Red
Blue	Red	No light gets through
Red	Blue	No light gets through
Green	Red	No light gets through
Green	Blue	No light gets through
White		As white is a combination of all colours, any film should let some light through, corresponding to the colour of the film

What conclusion can you come to at the end of your observations? Write some thoughts in the spaces below:

Red film looks red as it only lets through **red** light.

If you look at a white light through a blue film, it will look **blue**.

If you look at a white light through a green film, it will look **green**.

Some light gets through when you hold a red film in front of white light as **white light contains all colours, including red**.

You cannot see a blue light through a red film as **blue light does not have any red light / blue film will not let red light through**.

Reflecting light

You have been provided with some different coloured pieces of card. Do they look the same colour when you view them through your spectacles? Fill in the table with your observations. Make sure that the pieces of card are well illuminated with white light before you look at them through your spectacles.

Colour of card	Colour of film	What I see
White	Red	Red
White	Blue	Blue
White	Green	Green
Green	Red	Black
Green	Blue	Black
Green	Green	Green
Red	Red	Red
Red	Blue	Black
Red	Green	Black
Blue	Red	Black
Blue	Blue	Blue
Blue	Green	Black
Black	Red	Black
Black	Blue	Black
Black	Green	Black

Last lesson, we learned that:

An object is white if it **reflects all** colours.

An object is black if it **does not reflect any** colours.

Fill in the following:

An object is red if it reflects **red** light.

An object is blue if it reflects **blue** light.

An object is green if it reflects **green** light.

The spectacles with the coloured films only allow some of the light through. So, by looking at coloured objects through the spectacles, we can start to figure out what colours of light are being reflected by the objects.

Using these ideas, explain your observations:

Students should note that the spectacles only allow certain colours through, i.e. the colour of the film. So, if the card reflects that colour, it will be seen through the film. If the card does not reflect that colour, it will look black through the spectacles. The spectacles then act as 'detectors' allowing us to figure out what colours are being reflected by a certain object.

Independent observations

In science, it is always important to check your observations by doing an independent experiment. Sometimes this is done by different people to check your observations, but it can also be a different way of making the same observations.

In this experiment, we are going to try lighting up the coloured cards with different colours of light. Before, each card was lit up with white light and we used the coloured films on the spectacles to view the colours being reflected.

The different colours of light have been made by putting coloured films in front of white light. Can you explain why this works?

Now, we are not going to wear the spectacles to look at the cards, but we are going to turn off all the white lights in the lab and view the cards in different-coloured lights.

Once again, write your observations in the table below:

Colour of card	Colour of film	What I see
White	Red	Red
White	Blue	Blue
White	Green	Green
Green	Red	Black
Green	Blue	Black
Green	Green	Green
Red	Red	Red
Red	Blue	Black
Red	Green	Black
Blue	Red	Black
Blue	Blue	Blue
Blue	Green	Black

Notice that the colour of an object that reflects light depends on the colour of light that is being used to illuminate it. Generally, we see things in white light, which is why we say that they have certain colours.

Conclusions so far

A red card is red because it reflects **red** light.

If we light up a red card with red light it will look **red**.

If we light up a red card with blue light it will look **black** as there is **no red light** for it to reflect.

One more colour

The cards that you have been using so far have been white, black, red, green and blue. You may know that the last three are called the *primary colours of light* (there are different primary colours for pigments as we will see next lesson).

Now, you have been given some yellow card. Using white light, view the yellow card through the different-coloured films. Record your results:

Colour of card in white light	Colour of film	What I see
Yellow	Red	Red
Yellow	Green	Green
Yellow	Blue	Black

In practice, depending on the shade of the card and that of the film, slightly different results might be obtained, e.g. not full black in the case of a blue film.

Now try illuminating the yellow card with different-coloured lights and record the results:

Colour of card in white light	Colour of light	What I see
Yellow	Red	Red
Yellow	Green	Green
Yellow	Blue	Black

In practice, depending on the shade of the card and that of the film, slightly different results might be obtained, e.g. not full black in the case of a blue film.

What does this suggest about the colour yellow on the card?

Yellow reflects both red and green.