



FAULKES TELESCOPE

Light and Optics

Colours and Filters Student Question Sheet (Introductory)

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Light and Optics

Introduction

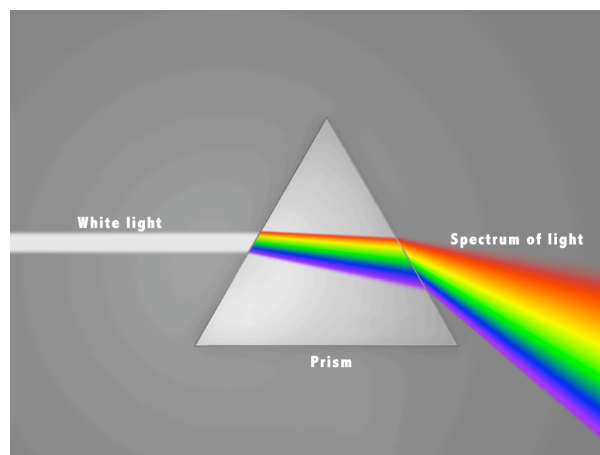
This worksheet contains questions and activities which will test your knowledge and understanding of the project, 'Light and Optics'. It is assumed that you have carried out the project as given in the document, 'Light and Optics- Activity Instructions' before completing this worksheet.

Colour and Filters

If you have ever seen a rainbow in the sky, you will have seen nature splitting the white light from the Sun into a colourful arrangement in the sky. White light is made up of a range of colours (or spectrum) - red, orange, yellow, green, blue, indigo and violet. However, these different parts of the light are only visible to us if we either split the white light somehow, or block parts of the light to only allow certain colours through.

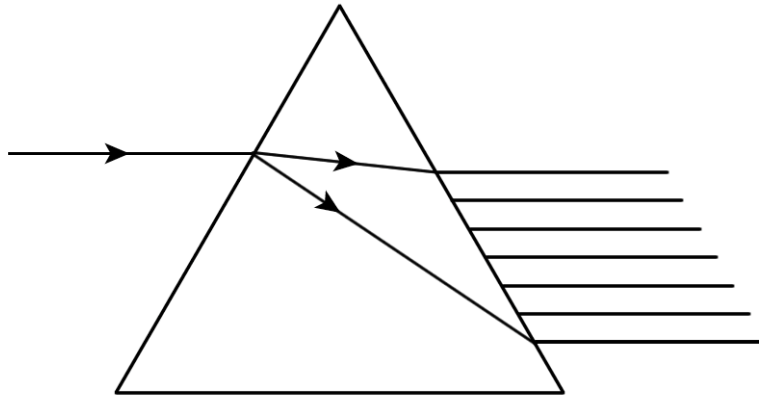
Splitting light

White light can be split into its different coloured parts by using a prism (a triangular piece of transparent, material such as glass or perspex), as shown in the diagram below.



The white light which shines on one side of the prism is split into its separate colours by the prism - the white light has been spread out or *dispersed* into the visible spectrum of colours. This happens because each colour is bent by different amounts as they pass from the air into the glass, and back into the air again. The red light is bent the least, whilst the violet light is bent the most. This results in a clear view of each separate colour once the light has passed into and back out of, the glass prism.

1. In the diagram below, label the colours which the white light is split into.



2. Rainbows are formed when light from the Sun is dispersed in the sky by drops of rain. This is nature's demonstration of the prism experiment described above. Using this information, fill in the blanks in the following sentences using the words below:

refracted

dispersed

seven

bent

raindrops

smoke

cloud

nine

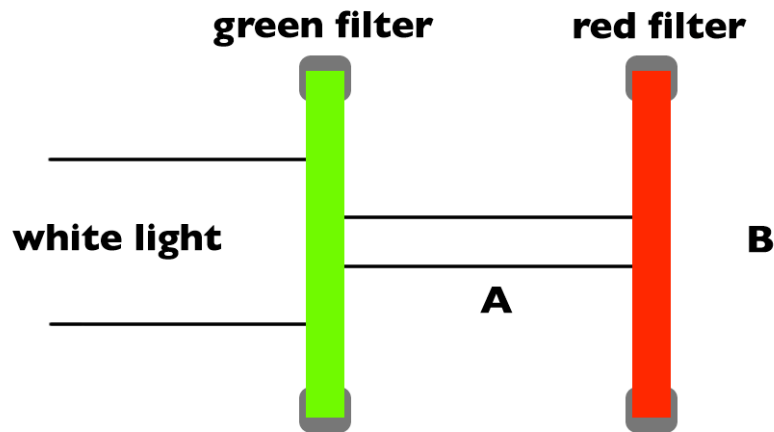
rainbow

When white light shines on the side of a prism, the light is _____ into _____ separate colours. The same effect can be seen when light from the Sun shines on _____ in the air. Different colours are seen because each separate colour is _____ by different amounts as they travel through the prism or raindrop. In the sky, this results in a _____.

Blocking light

As explained above, white light is made up of several different colours - red, orange, yellow, green, blue, indigo and violet. Filters can be used to block particular colours from white light and only allow one colour of light through. For example, if you shone white light onto a red filter, only the red part of the light would pass through the filter. The other colours would be absorbed. Similarly, if you shone white light on a blue filter, only the blue part of the white light would get through.

1. a). The diagram below shows white light shining onto a green filter, followed by a red filter. Label the colour of light which passes through the green filter at point A.



- b). What colour light, if any, would be seen at point B? Explain your answer.

2. What would happen if you shone blue light onto a red filter? Explain your answer.

The Faulkes Telescopes have many different filters which can be used when imaging objects in an observing session.

IT OPPORTUNITY

1. A Flash demonstration of the filters in the Faulkes Telescopes and the CCD can be viewed from the colour imaging project at:

Education > Activities & Projects > Astronomical Imaging > Basic Imaging > CCD & Filters.swf

One of the filters which can be used to produce a colour image of an object is the 'Colour' filter. However, this is not a single filter which makes a colour image - it works by first taking an image of your chosen object through the red filter on the CCD camera, then taking a second image through the green filter, then a third image through the blue filter. These 3 red, green and blue images are then combined to make a colour image. Between taking the 3 images there is a gap of a couple of seconds whilst the wheel of filters on the telescope moves to put the next filter in place.

3. In a galaxy, the regions where stars form tend to be bluer than average, and the regions which contain older stars are redder than average.

a). Is a galaxy a source of light or a reflector of light?

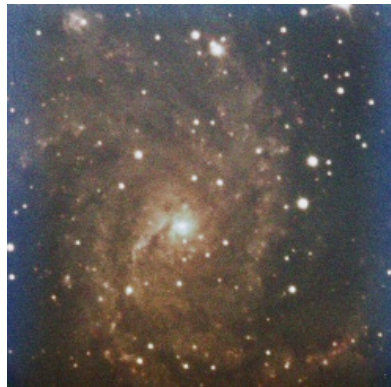
b). If you wanted to look at star formation regions in a galaxy with the Faulkes Telescope, which filter would be best to use, red, green or blue?

c). If you wanted to look for regions which had a lot of older stars, which filter would be best to use, red, green or blue?

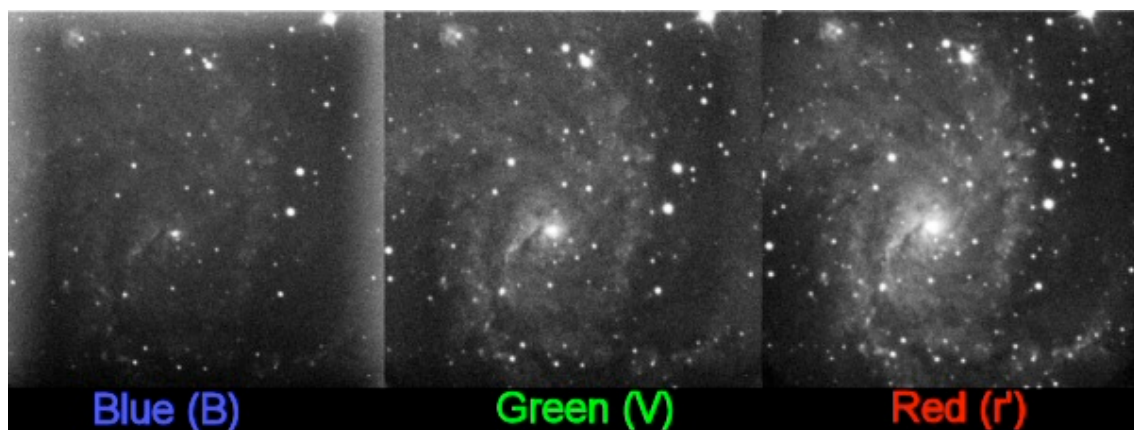
4. Below is a colour image of spiral galaxy NGC 6946, taken with the Faulkes Telescope North in Hawaii during a time when the moon was full.

a). Is the Moon a source of, or a reflector of light?

The Moon, when full, reflects a lot of the blue light from the Sun. As a result, any images of faint objects taken with the Faulkes Telescopes around this time have a lot of stray blue light in them. This can be seen in the image below as a blue border.



Also shown below are the three separate red, green and blue images which make up the colour image above.



b). In which filter is the galaxy the faintest? Red, green or blue?

c). In which filter is the galaxy the brightest?

d). If you were planning on observing a faint object when the moon is full, which filter would be best to use to make sure you get the most detail?

5. Fill in the blanks below and find the words in the wordsearch.

1. The range of colours in a rainbow is known as a _____.
2. A _____ is formed when sunlight is dispersed off raindrops.
3. White light passing through a prism is _____ into different colours.
4. _____ light is dispersed the most by a glass prism.
5. _____ light is dispersed the least by a glass prism.
6. The bending of light is known as _____.
7. A piece of apparatus which absorbs some colours of light but allows particular colours through is called a _____.
8. When green light hits a blue filter, it is _____.
9. A full moon _____ sunlight, particularly _____ coloured light.

n	c	s	j	d	u	n	t	m	w	r
v	e	d	b	a	e	d	u	r	a	e
i	z	a	b	s	o	r	b	e	d	f
o	t	p	n	o	t	m	o	f	g	r
l	w	s	b	c	h	b	r	l	k	a
e	c	r	e	t	l	i	f	e	a	c
t	a	p	o	u	r	t	p	c	l	t
u	s	f	e	a	s	b	y	t	p	i
r	a	i	n	b	o	w	r	s	w	o
i	d	e	s	r	e	p	s	i	d	n