FAULKES TELESCOPE

Light and Optics

Colours and Filters

Answer Sheet (Advanced)

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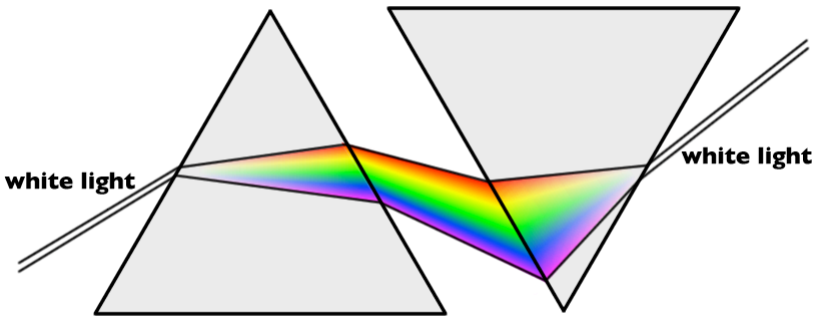
Splitting light

1. Draw the path of the light as it travels through the two prisms in the diagram below. Explain what is happening.



As the white light passes through the first prism, it is dispersed into seven separate colours, or a spectrum. As it then enters the second prism, the separate colours are refracted once more, together, and pass back into the air as white light.

2. The prism experiment described above, is comparable to the formation of rainbows after a rainstorm.

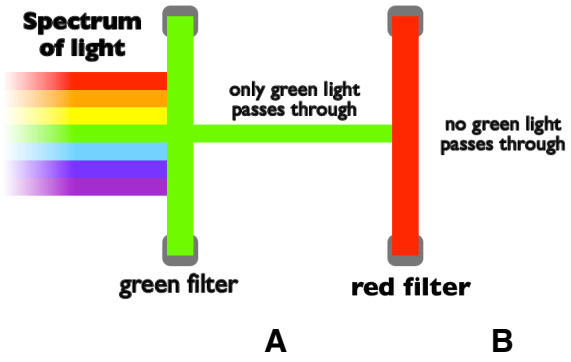
a). In your own words describe how a rainbow forms.

Light from the sun is basically white light, and consists of the spectrum of seven colours. When this light hits a raindrop, it is dispersed into its separate colours. This results in a rainbow being formed. This is similar to the glass prsim experiment, but instead of glass prisms dispersing the light, the raindrops disperse the light.

Blocking light

Filters can be used to block particular colours and only allow one colour of light through. For example, if you shone white light on a red filter, only the red part of the light would get through the filter. 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 would you see at point B? Explain your answer.

Point B is where the red filter is placed. When the green light shines on the red filter, it is absorbed by the filter, thus no light would pass through. So, no light at all would be seen after point B.

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

If blue light was shone onto a red filter, it would all be absorbed. No light would pass through the filter.

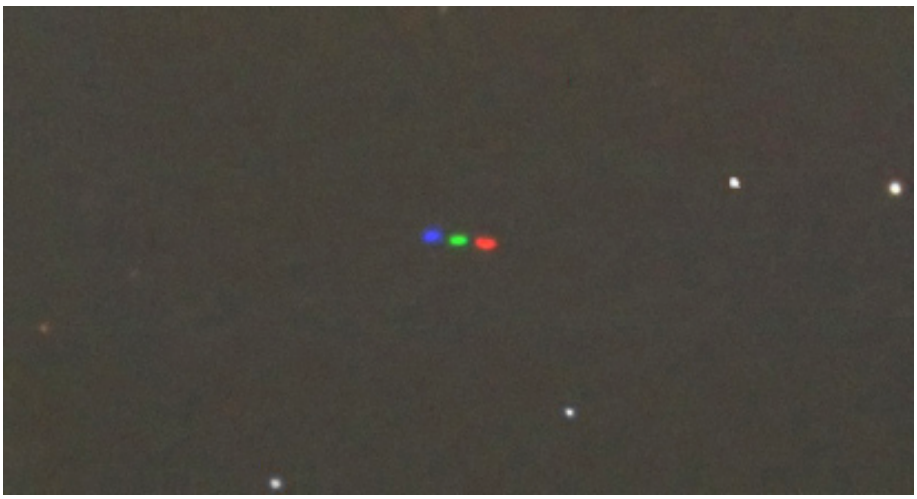
3. a). What filter would you use on the Faulkes Telescopes if you wanted to look at star formation regions in a galaxy?

Star forming regions in galaxies emit more strongly in the blue part of the electromagnetic spectrum, therefore they would be brighter and more apparent in an image taken through the blue filter.

b). What filter would you use if you were interested in finding regions which had a lot of older stars?

Regions which contain older stars emit more red light, so a red filter would be best to use to find these regions.

3. The Faulkes Telescope image below shows an asteroid moving across the sky whilst a colour image exposure was being taken.



a) why does the asteroid appear as a streak of red, green and blue?

The telescope takes a colour image as a series of images, taken firstly with the red filter, then an image with the green filter and a final image with the blue filter. These three images are then added together to make one colour image. If there is a moving object in the image, it will move between each exposure, and therefore appear as 3 coloured streaks.

b) why are the stars white in this colour image?

The stars are stationary during the red, green and blue filter exposure, thus when the 3 images are added to make a colour image, these 3 colours make white.

c) from the information above, and looking at this image, can you say which way the asteroid is moving? Explain your answer.

The asteroid is moving from the right to the left. The telescope takes a colour image with the red filter first, then the green, then the blue. If we follow this order, we can see that it is moving right to left.

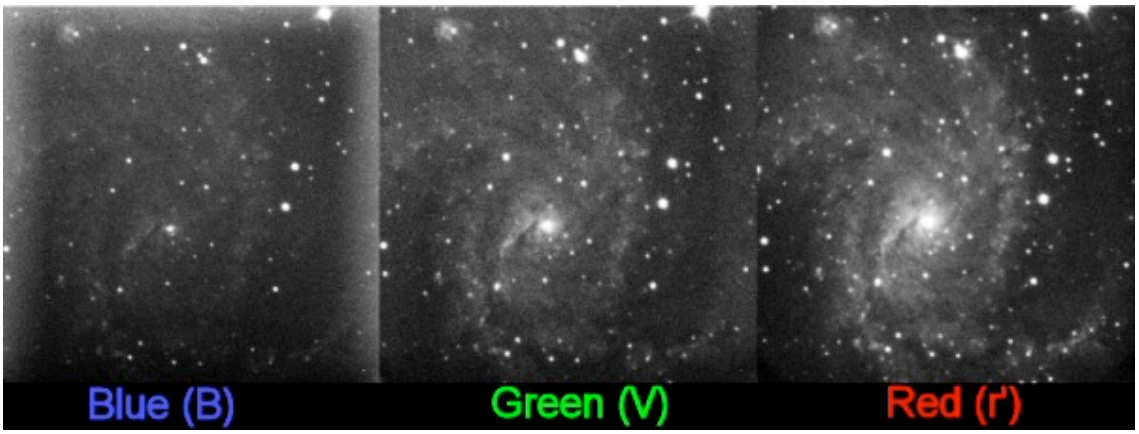
4. Below is a colour image of spiral galaxy NGC 6946, taken with the Faulkes Telescope North in Hawaii during a time when the moon was full.

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

The Moon does not produce its own light - we see the Moon because it reflects light from the Sun towards us on Earth. Therefore, the Moon is 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). Why is the image taken through the Blue filter, so faint?

When the Moon is full, it reflects a lot of blue light from the Sun. This stray blue light then enters any image which is taken with a telescope, making the Blue image appear 'washed out', as seen above.

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?

Images taken with the Red filter are least affected by the bright moonlight, as also shown above, thus it would be best to use the red filter at full moon when observing faint objects.

e). When would be the best time of the month to observe faint objects with the Faulkes Telescopes?

It would be best to observe faint objects with the Faulkes Telescopes when the Moon is new (i.e. when there is no stray moonlight in the sky).

5. Fill the crossword below by answering the clues.

Across	Down
1. White light is made up of several of these.	1. This light is made up of several wavelengths.
2. Light passing from one medium to another is _____.	2. This wavelength of light is refracted the least as it passes through a glass prism.
3. The Sun _____ light.	3. Objects which produce their own light are known as _____ of light.
4. The splitting of light as it passes through, for example, a glass prism.	4. A piece of apparatus which absorbs some wavelengths but lets particular ones through.
5. A green filter does this to red light.	5. Nature's result of splitting light.
	6. As the Moon does this to sunlight, we can see the Moon.