Exploring Space

S3 Physics

Lesson Title: The Visible Spectrum

Learning Intention:

Today we are learning about the visible spectrum.

Success Criteria:

✓I can state what is different about different colours of light.

✓I can describe how to split white light into different colours.

✓I can carry out calculations using $v = f\lambda$

Employability skill(s):

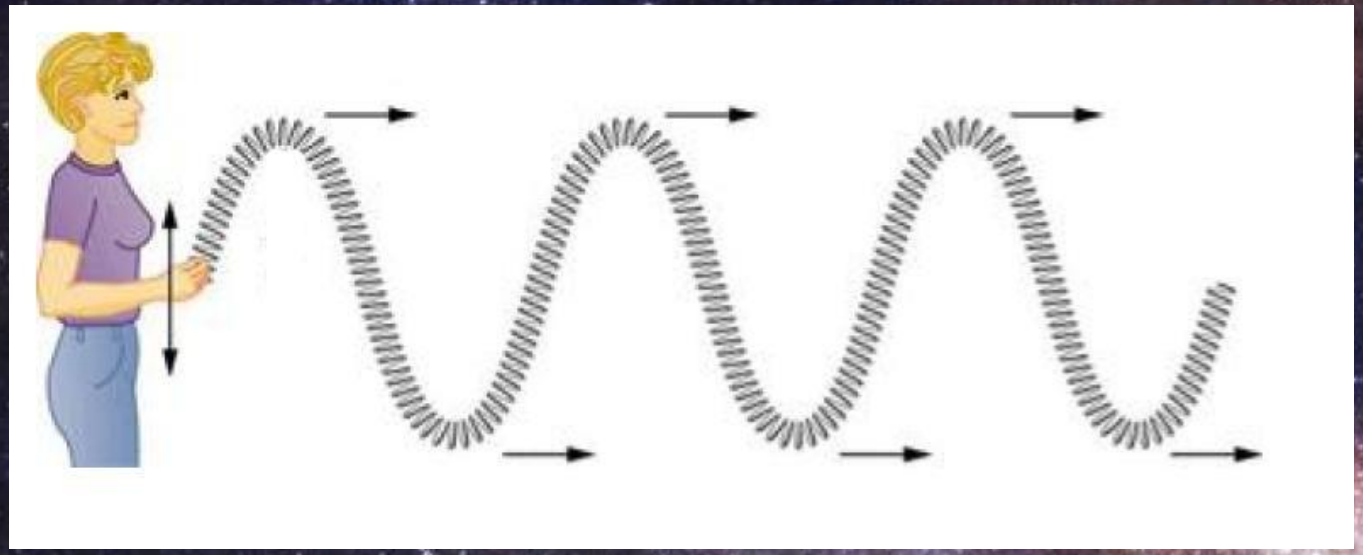
Calculation work

The Visible Spectrum

Visible light is one member of the Electromagnetic Spectrum.

This is a family of waves which have commonalities:

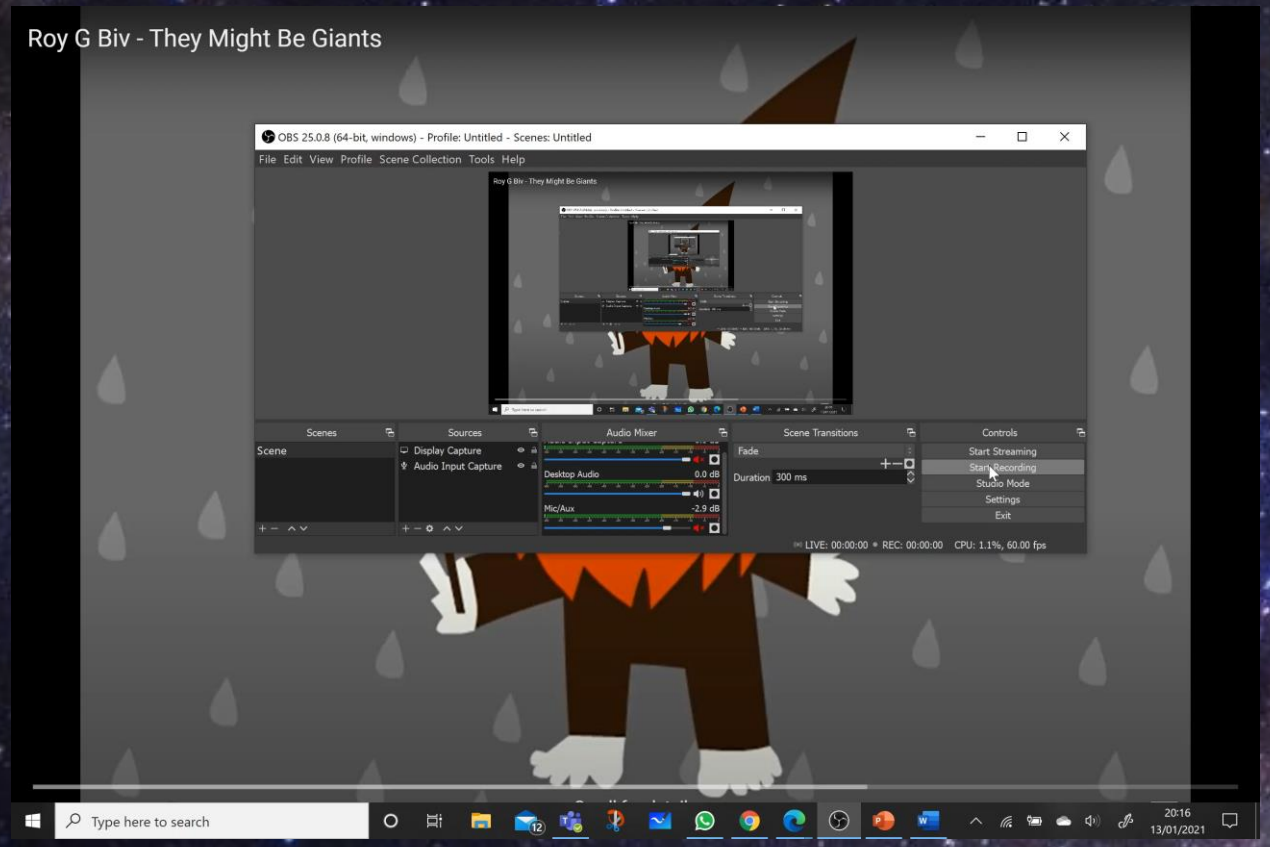
- They all travel through air at 3×10^8 ms^{-1}
- They are all **transverse** waves. This means that the direction of the vibration is at 90º to the direction the waves are travelling in.



White Light

White light is made up of all of the colours in the visible spectrum.

RED **ORANGE** **YELLOW** **GREEN** **BLUE** **INDIGO** **VIOLET**



Each different colour travels at a speed of 3×10^8 ms^{-1} in air.

This is what all the colours have in common.

They have different wavelengths and different frequencies, which makes them appear different colours to our eyes.

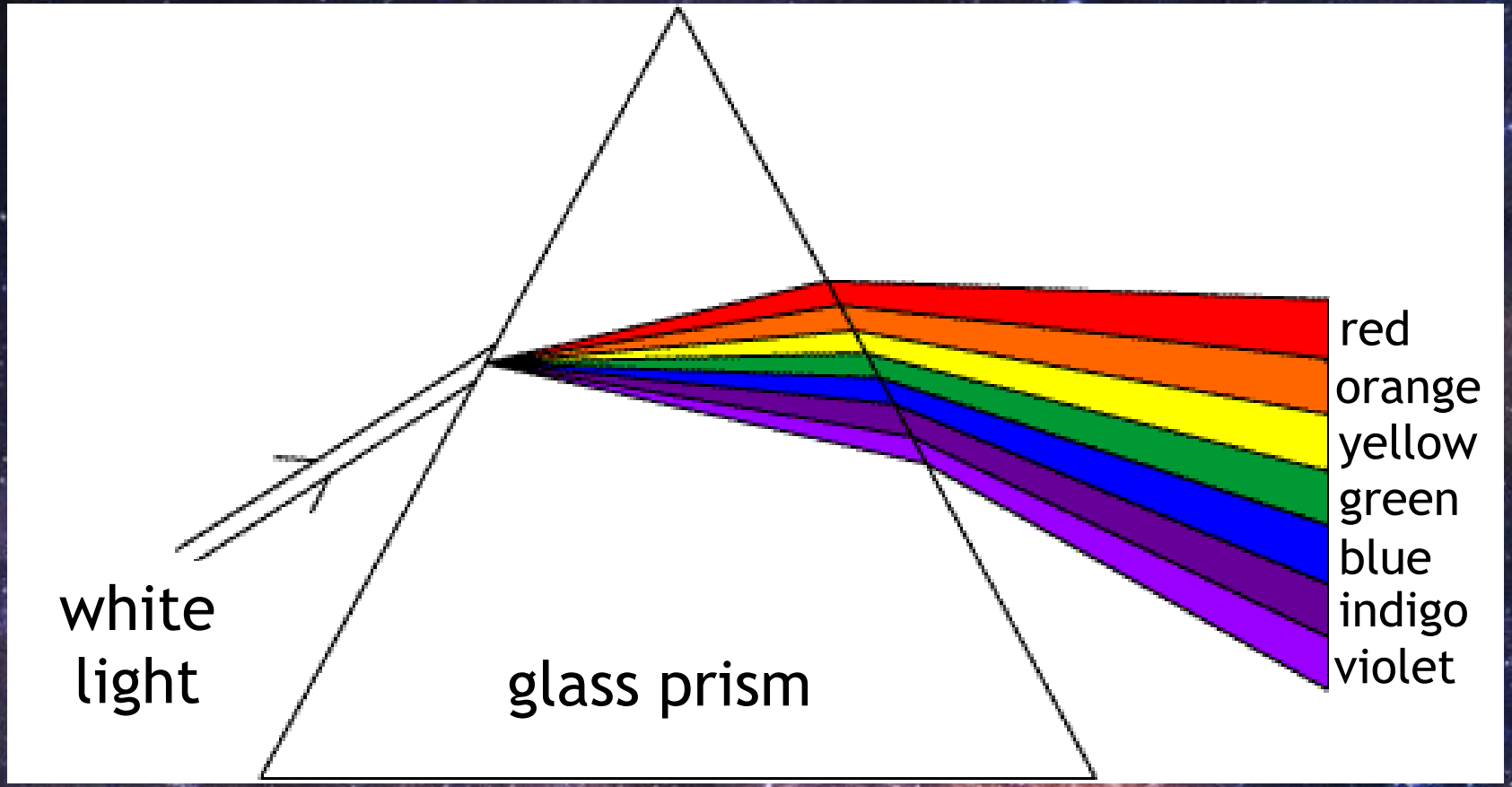
Refraction Through a Prism

White light can be split into its colour spectrum by refraction through a prism.

As the light enters the prism, it slows down. This is known as refraction.

The refraction causes the light to spread out.

Different wavelengths of light refract more than others.



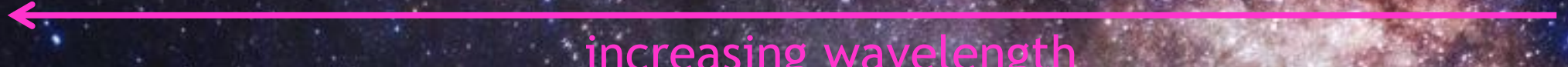
White Light

The order of the colours in the visible spectrum is not random.

The colours, when listed as ROYGBIV, are in order of increasing frequency. This means that they are in order of decreasing wavelength. We can verify this using the equation $v = f\lambda$.

$$v = wave\ speed = 3 \times 10^8\ ms^{-1}$$
$$f = frequency, measured\ in\ hertz, Hz$$
$$\lambda = wavelength, measured\ in\ metres, m$$

RED ORANGE YELLOW GREEN BLUE INDIGO VIOLET



Task: Using $v = f\lambda$

For each of the colours in the table, calculate the missing wavelength or frequency. Remember that all the colours of light travel at a speed of 3×10^8 ms^{-1} in air.

Colour	Frequency (Hz)	Wavelength (m)
Red	4.3×10^{14}	
Orange		6.2×10^{-7}
Yellow	5.2×10^{14}	
Green		5.3×10^{-7}
Blue	6.7×10^{14}	
Indigo		4.5×10^{-7}
Violet	7.5×10^{14}	

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Task: Using $v = f\lambda$

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Colour	Frequency (Hz)	Wavelength (m)
Red	4.3×10^{14}	7.0×10^{-7}

$v = 3 \times 10^8 \, ms^{-1}$

$f = 4.3 \times 10^{14}$ Hz

$\lambda = ?$

$v = f\lambda$

$3.0 \times 10^8 = 4.3 \times 10^{14} \times \lambda$

$\lambda = \frac{3 \times 10^8}{4.3 \times 10^{14}}$

$\lambda = 7.0 \times 10^{-7}$ m

EXP

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$\times 10^{x}$