

Radio waves absorbed by metal and cause oscillations in electrical circuits connected to the aerial.

Metal can be used as an aerial to receive radio waves.

Radio waves made by oscillations in electrical circuits.

Radio	Transmitted.
Microwave	Absorbed.
Infrared	Mostly reflected or absorbed.
Visible	
Ultra violet	Absorbed.
X-ray	Absorbed by deep tissue.
Gamma	

Different substances absorb, transmit, refract and reflect EM waves depending upon wavelength.

EM waves transfer energy from source to observer e.g. infrared waves transfer energy from heater to person

**Core Practical**  
*Investigate surface s affecting thermal energy radiation or absorption*  
Different surfaces, temperature at start and end, thermal energy gained or lost

Temperature of Earth is controlled by the amount absorbed = amount radiated.

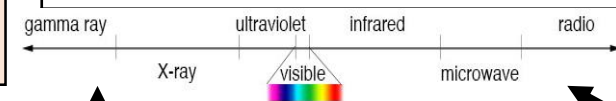
More absorbed, temperature increases.

For a body to be at constant temperature, the amount absorbed = amount radiated.

**PHYSICS HIGHER ONLY**  
Different EM wavelengths travel at different velocities through different materials.

**HIGHER ONLY**

Electromagnetic wave  
*Continuous spectrum of transverse waves*  
Travel at the same speed in a vacuum ( $3 \times 10^8$  m/s).



Short wavelengths, high frequency and high energy.

Our eyes only detect a small part of spectrum e.g. visible light.

Long wavelengths, low frequency and less energy.

e.g. changes in the nucleus of an atom creates gamma rays. Visible light is often produced by changes in an electron's energy level.

Herschel 1738-1822  
*Discovered infra-red*  
He used different coloured filters to observe the sun.

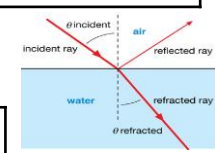
Infra-red  
*EM waves with frequencies slight lower than visible light*  
Objects emit infra-red. The hotter the object is, the more infra-red is emitted.

**PHYSICS ONLY**

**Electromagnetic Spectrum**

**EDEXCEL TOPIC 5 LIGHT AND EMS**

**Core Practical**  
*Investigate refraction*  
Light passing through a glass block.

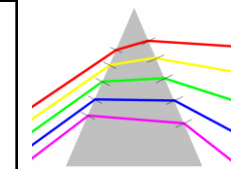


Light refracts as it slows down in a denser substance.  
*When a wave hits a surface and is reflected back into the material*  
Only happens when a wave travels through a denser material.  
Angle of incidence is larger than the critical angle, no light leaves all light internally reflected.  
Angle of incidence is equal to the critical angle, most light leaves along the surface boundary (some internally reflected).  
Angle of incidence is less than the critical angle, most light is refracted (some internally reflected).

Angle of incidence = angle of reflection (i) = (r)

**PHYSICS ONLY**  
Specular reflection  
Diffuse reflection  
*Very smooth surface reflects light evenly*  
*Rough surfaces reflect light by scattering in all directions*

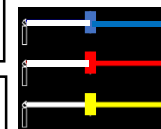
**PHYSICS ONLY**  
White light  
*A mixture of different colours of light*  
Can be split up into the colours of the visible spectrum by using a prism.



The more powerful the lens, the more the rays of light refract so the shorter the focal length.

Focal length is linked to the power of lens.

Power of lens increases with its curvature.



**Seeing colours**  
When white light hits a coloured surface, some of the visible spectrum is absorbed and some is reflected.  
When white light passes through a filter, some colours are absorbed and some colours are transmitted.

Diverging lens	<i>Thinner in the middle</i>	Focal point is the point from which the rays seem to be coming from after passing through the lens.	Only virtual images.
Converging lens	<i>Fatter in the middle</i>	Parallel rays of light converge at focal point.	Real or virtual images.

Object close to a converging lens will form a virtual image The image appears to be on the same side as the object.

2F	Image same size, upside down, real.
2F - F	Image larger, upside down, real.
< F	Image bigger, right way, virtual.

EM wave	Use	Danger
Radio	Broadcasting TV, radio, communications, satellite transmissions.	Safe.
Microwave	Cooking, communication and satellites transmissions (mobile phones).	Internal heating of cells.
Infrared	Cooking, thermal imaging, short range communications, optical fibres, TV remote controls, security systems.	Skin burns.
Visible	Vision, illumination, photography.	Damage to eyes.
Ultra violet	Security marking, disinfecting water, fluorescent lamps, detecting forged bank notes.	Damage to eyes, surface cells, sunburn, cancer.
X-ray	Observing internal structure of objects, broken bones, airport security.	Cell destruction, mutation, cancer.
Gamma	Sterilising food and medical equipment, detecting and treating cancer.	

Frequency increases.

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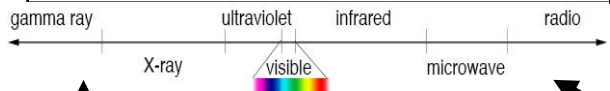
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**HIGHER ONLY**

**Continuous spectrum of transverse waves**

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e.g. changes in the nucleus of an atom creates gamma rays. Visible light is often produced by changes in an electron's energy level.

He found the red end was hot but just beyond the red end was even hotter.

He split sunlight into a spectrum using a prism. He put a thermometer in each temperature and measured the temperature just beyond the red end of the spectrum

**Discovered infra-red**

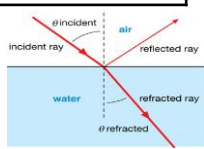
He used different coloured filters to observe the sun.

**EM waves with frequencies slight lower than visible light**

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**Investigate refraction**

Light passing through a glass block.



Light refracts as it slows down in a denser substance.

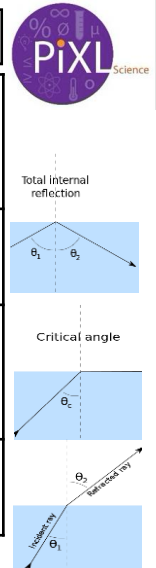
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**PHYSICS ONLY**

**Electromagnetic Spectrum**

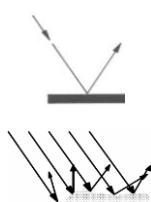
**EDEXCEL TOPIC 5 LIGHT AND EMS**

**PHYSICS ONLY**

**Light**

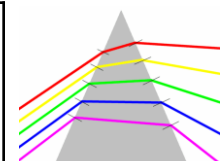
**PHYSICS ONLY**

Angle of incidence = angle of reflection (i) = (r)



**Very smooth surface reflects light evenly**

**Rough surfaces reflect light by scattering in all directions**



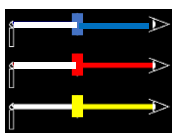
**A mixture of different colours of light**

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The more powerful the lens, the more the rays of light refract so the shorter the focal length.

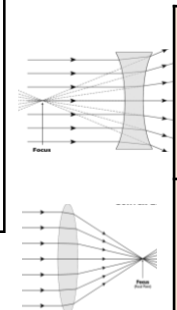
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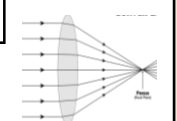
When white light passes through a filter, some colours are absorbed and some colours are transmitted.



**Thinner in the middle**

Focal point is the point from which the rays seem to be coming from after passing through the lens.

Only virtual images.



**Fatter in the middle**

Parallel rays of light converge at focal point.

Real or virtual images.

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	Sterilising food and medical equipment, detecting and treating cancer.	

Frequency increases.

Radio waves absorbed

Radio waves

Radio	
Microwave	
Infrared	
Visible	
Ultra violet	
X-ray	
Gamma	

Different substances

EM waves

EM wave	Use	Danger
Radio		
Microwave		
Infrared		
Visible		
Ultra violet		
X-ray		
Gamma		

**Core Practical**

Temperature of Earth

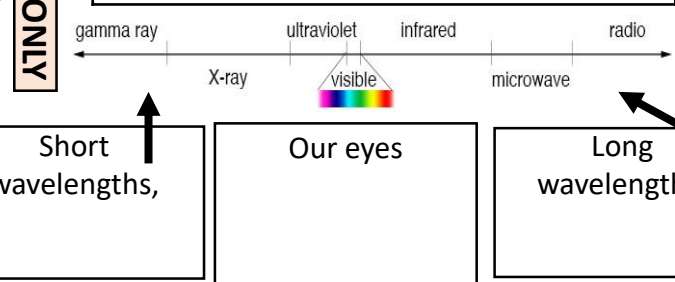
More absorbed,

For a body to be at constant temperature,

**PHYSICS HIGHER ONLY**

Different EM wavelengths

Electromagnetic wave



He found

He split sunlight

Herschel 1738-1822

Infra-red

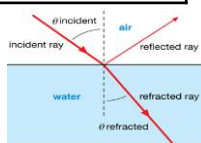
**PHYSICS ONLY**

**Electromagnetic Spectrum**

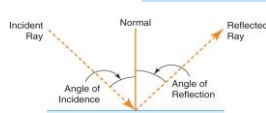
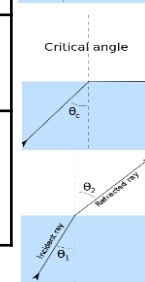
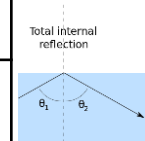
EM waves

e.g. changes in the nucleus of an atom

**Core Practical**



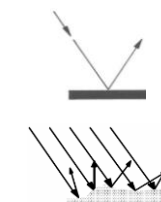
**Total internal reflection**



**PHYSICS ONLY**

**Light**

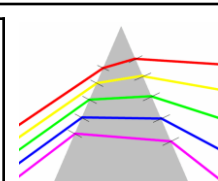
**PHYSICS ONLY**



Specular reflection

Diffuse reflection

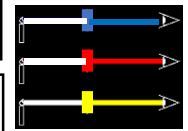
White light



The more powerful the lens,

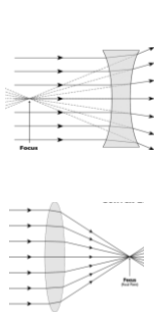
Focal length

Power of lens



**Seeing colours**

Diverging lens			
Converging lens			

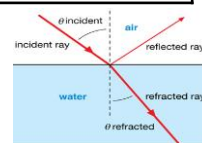


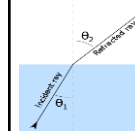
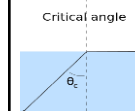
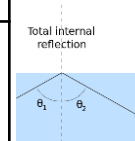
2F	
2F - F	
< F	



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**PHYSICS ONLY**

**PHYSICS HIGHER ONLY**

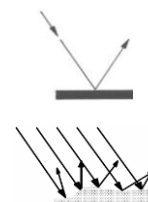
**Electromagnetic Spectrum**

**EDEXCEL TOPIC 5 LIGHT AND EMS**

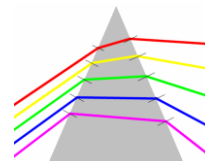
**PHYSICS ONLY**

**Light**

**PHYSICS ONLY**









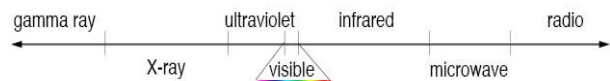
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**HIGHER ONLY**



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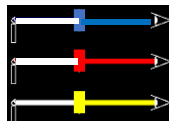
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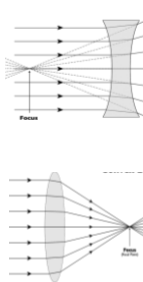
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Frequency increases.


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