KESTEVEN AND SLEAFORD HIGH SCHOOL

Physics Scheme of Learning

Year 11 – Term 2/P13 Electromagnetic Spectrum/P14 Light

Intent – Rationale

This topic follows on, and is almost intertwined with, the previous topic of waves. Students come across the electromagnetic spectrum on a daily basis, through seeing light, communications with their mobile phones, using infrared to cook food and so on – they are a crucial part of society. Students will also develop their mathematical skills by continuing to apply the wave equations to a wider range of situations and scenarios.

How light interacts with different surfaces, such as mirrors and glass, is studies through the use of ray diagrams and models. Students will build on previous knowledge or reflection and refraction to apply their understanding to a greater range of circumstances.

Sequencing – what prior learning does this topic build upon?	Sequencing – what subsequent learning does this topic feed into?
Topic 8 Phys Waves and Sound **Topic 9 Phys Light** **GCSE P12 - Waves**	• A level – Year 12 topic Waves
What are the links with other subjects in the curriculum?	**What are the links to SMSC, British Values and Careers?**
• Prefixes and standard form are used commonly in Maths	P13.2 The Electromagnetic Spectrum BV2 P13.3 Communications GB4a, GB4e, GB4f P13.5 Medical Uses of short waves SP2 SO3 R.Prac 9 Investigating Refraction of Light GB4e
What are the opportunities for developing literacy skills and developing learner confidence and enjoyment in reading?	**What are the opportunities for developing mathematical skills?**
FROM THE LIBRARY *Dictionary Of Physics*-530.03	• Development of mathematical skills through use of the three wave equations. • Prefixes and standard form are used commonly in these calculations

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Intent – Concepts

What knowledge will students gain and what skills will they develop as a consequence of this topic?

Know

State that electromagnetic waves transfer energy from one place to an absorber of that energy.
State the seven types of electromagnetic wave, in the correct order from longest to shortest wavelength.
State that the only part of the electromagnetic spectrum that our eyes can detect is visible light.
State the define transparent and translucent.
State situations where real images and virtual images are produced.

Apply

Plan and carry out an experiment to investigate the best surface for the emission of infra-red
Describe how radio waves can be produced in electrical circuits and also the effect that radio waves may have on electrical circuits.
Describe how ultraviolet radiation from the sun can affect the body and in particular the skin.
Describe gamma radiation as being a type of electromagnetic radiation emitted from the nucleus of an unstable atom.
Describe and explain the effects that gamma, X-rays and ultraviolet radiation have on the body.
Describe the key features of a ray diagram where light passes through a lens. Students should be able to identify the, Principal axis, Principal focus, Focal length.
Construct ray diagrams to show how light travels through concave and convex lenses.
Construct ray diagrams for a camera, a projector and a magnifying glass using a convex lens.
Calculate the magnification of a lens using the magnification equation.
Construct a ray diagram showing the refraction of light at a boundary
Draw conclusions from given data about the risks and consequences of exposure to radiation.
Draw rays diagrams to illustrate specular reflection by a smooth surface and scattering of light by a rough surface.
Describe uses of each wave in the electromagnetic spectrum.
Describe dangers of each wave in the electromagnetic spectrum.
Describe the properties common to all electromagnetic waves.

Extend

Explain how the colour of an opaque object is related to the wavelengths of light that are reflected and the wavelengths of light that are absorbed.
Explain how the colour an object looks depends on the absorption, transmission and reflection of different wavelengths of light.
Explain why a red jacket appears red under white light or red light and black under blue light
Explain why objects appear black when placed under a light source.
Explain what dispersion is.
Explain the difference between real and virtual images.
Explain the suitability of each wave for its practical application.
Explain the precautions taken in a hospital when carrying out an X-ray. Precautions should include steps taken to reduce the risks for the patient and the radiographer.

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What subject specific language will be used and developed in this topic?	What opportunities are available for assessing the progress of students?
angle of incidence angle between the incident ray and the normal **angle of reflection** angle between the reflected ray and the normal **concave (diverging) lens** a lens that makes parallel rays diverge (spread out) **convex (converging) lens** a lens that makes light rays parallel to the principal axis converge (meet) at a point **diffuse reflection** reflection from a rough surface - the light rays are scattered in different directions **focal length** the distance from the centre of a lens to the point where light rays parallel to the principal axis are focused (or, in the case of a diverging lens, appear to diverge from) **magnification** the image height ÷ the object height **magnifying glass** a converging lens used to magnify a small object which must be placed between the lens and its focal point **normal** straight line through a surface or boundary perpendicular to the surface or boundary **opaque object** an object that light cannot pass through **principal focus** the point where light rays parallel to the principal axis of a lens are focused (or, in the case of a diverging lens, appear to diverge from) **real image** an image formed by a lens that can be projected on a screen **refraction** the change of direction of a light ray when it passes across a boundary between two transparent substances (including air) **specular reflection** reflection from a smooth surface. Each light ray is reflected in a single direction **translucent object** an object that allows light to pass through, but the light is scattered or refracted **transparent object** an object that transmits all the incident light that enters the object **virtual image** an image, seen in a lens or a mirror, from which light rays appear to come after being refracted by a lens or reflected by a mirror **carrier waves** waves used to carry any type of signal **charge-coupled device (CCD)** an electronic device that creates an electronic signal from an optical image formed on the CCD's array of pixels **contrast medium** an X-ray absorbing substance used to fill a body organ so the organ can be seen on a radiograph **electromagnetic spectrum** the continuous spectrum of electromagnetic waves **ionisation** any process in which atoms become charged **microwaves**	

electromagnetic waves between infrared radiation and radio waves in the electromagnetic spectrum **optical fibre** thin glass fibre used to transmit light signals **radiation dose** amount of ionising radiation a person receives **radio waves** electromagnetic waves of wavelengths greater than 0.10m **ultraviolet radiation (UV)** electromagnetic waves between visible light and X-rays in the electromagnetic spectrum **wave speed** the distance travelled per second by a wave crest or trough **white light** light that includes all the colours of the spectrum	

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Intent – Concepts

Lesson title	Learning challenge	Higher level challenge	Suggested activities and resources
P13.1 The Electromagnetic Spectrum	Can I state that electromagnetic waves transfer energy from one place to an absorber of that energy? Can I name the seven types of electromagnetic wave, in the correct order from longest to shortest wavelength? Can I state that the only part of the electromagnetic spectrum that our eyes can detect is visible light?	Can I describe the properties common to all electromagnetic waves?	
P13.2 The Electromagnetic Spectrum	Can I describe uses of each wave in the electromagnetic spectrum? Can I describe dangers of each wave in the electromagnetic spectrum?	Can I explain the suitability of each wave for its practical application?	
R.Prac 10 Absorption and emission of infrared radiation required practical	Can I plan and carry out an experiment to investigate the best surface for the emission of infra-red?	Can I evaluate a practical and explain the best way to present data?	
P13.3 Communications	Can I describe how radio waves can be produced in electrical circuits and also the effect that radio waves may have on electrical circuits?	Can I explain what a carrier wave is?	
P13.4 Ultraviolet, X-rays and gamma rays	Can I describe how ultraviolet radiation from the sun can affect the body and in particular the skin? Can I describe gamma radiation as being a type of electromagnetic radiation emitted from the nucleus of an unstable atom?	Can I describe and explain the effects that gamma, X-rays and ultraviolet radiation have on the body?	
P13.5 Medical Uses of short waves	Can I draw conclusions from given data about the risks and consequences of exposure to radiation?	Can I explain the precautions taken in a hospital when carrying out an X-ray?	

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P14.1 Reflection of light	Can I draw rays diagrams to illustrate specular reflection by a smooth surface and scattering of light by a rough surface?	Can I explain why a wave will display specular or scattering reflection?	
R.Prac 9 Investigating Refraction of Light	Can I construct a ray diagram showing the refraction of light at a boundary?	Can I analyse a ray diagram?	
P14.3 Light and Colour	Can I define transparent and translucent? Can I explain what dispersion is?	Can I explain how the colour of an opaque object is related to the wavelengths of light that are reflected and the wavelengths of light that are absorbed? Can I explain how the colour an object looks depends on the absorption, transmission and reflection of different wavelengths of light? Can I explain why a red jacket appears red under white light or red light and black under blue light Can I explain why objects appear black when placed under a light source?	
P14.4 Lenses	Can I describe the key features of a ray diagram where light passes through a lens? Can I Identify the: • Principal axis • Principal focus • Focal length Can I state situations where real images and virtual images are produced?	Can I explain the difference between real and virtual images?	
P14.5 Using Lenses	Can I construct ray diagrams to show how light travels through concave and convex lenses? Can I calculate the magnification of a lens using the magnification equation?	Can I construct ray diagrams for a camera, a projector and a magnifying glass using a convex lens?	