Crewe Engineering & Design UTC

Curriculum Summary - Physics (Year 11)

Autumn

P8: Forces in action

In this chapter students will compare vectors and scalars using the examples of distance and displacement along with the nature of forces. Representations of vectors using scale diagrams led to descriptions of the forces acting in a wide variety of situations and the identification of Newton's third law. The concept of balanced and unbalanced forces was used to determine the behaviour of objects and the application of Newton's first law of motion. Higher tier students will produce free body diagrams demonstrating the forces acting on an isolated object. All students will determine the centre of mass of an object experimentally.

All higher tier students will analyse the forces acting on an object in additional depth using a parallelogram of forces approach to determine the resultant force or a missing force' when an object is in equilibrium. In addition, the students will resolve forces at right angles to analyse systems and determine if a system is in equilibrium.

P9: Motion

In this chapter the students will analyse the motion of objects in depth starting from a recap of the concept of speed and the relationship to distance travelled and time taken. The representation of motion using distance-time graphs representing single and multiple objects will be analysed to give detailed descriptions of the movement of the objects.

The students will define acceleration in terms of changes in velocity and analyse it graphically and mathematically. Higher tier students will describe circular motion in terms of constant acceleration but with constant angular speed. All students will investigate acceleration caused by an unbalanced force on a ramp, linking acceleration to the gradient of a line on a velocity-time graph.

Students will continue to analyse graphs representing motion by looking at the area beneath the line on a velocity-time graph and its relationship to the distance travelled by an object. Students will use the gradient of a distance-time graph to determine the speed of an object. In addition, higher tier students will use the tangent of a line on a distance-time graph to determine the speed. All students will apply these techniques to analyse a range of graphs to extract all possible information from them.

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Curriculum Summary - Physics (Year 11)

Spring

P10: Forces and motion

Students began this chapter by experimentally determining the relationships between a force acting on an object and the acceleration, and the mass of the object and acceleration. The results lead to the formulation for Newton's second law of motion and its application. Higher-tier students will define the inertial mass of an object.

The students will compare the concepts of mass and weight, linking them through the idea of a gravitational field before looking at the forces acting on an object as it falls through a fluid and the resulting terminal velocity. The forces acting during stopping a car will be analysed; identifying two phases of the motion; thinking and braking distance. The effects of a wide range of factors on both distances will be considered. Students will calculate the size of the accelerations experienced during braking with higher tier students deriving an appropriate equation involving the stopping distance.

Finally, all the students will investigate the effect of forces on the stretching of a range of materials identifying both linear and non-linear relationships between the force and extension. Students will apply Hooke's law as appropriate.

P12: Wave properties

In this chapter the students will observe and describe the properties of mechanical and electromagnetic waves in terms of energy transfer with or without the need for a transfer medium. They will compare transverse waves and longitudinal waves by examining the relationship between the direction of propagation and the direction of the oscillations.

The students will analyse wave properties such as wavelength, amplitude, and period leading to the relationships between period, frequency and wave speed, frequency, and wavelength. They will also measure the speed of sound in air and the speed of ripples on water. Higher-tier students will investigate and describe both the reflection and refraction of waves describing these effects in terms of wave fronts. The processes of absorption, transmission, and reflection of waves in terms of energy will also be described.

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Curriculum Summary - Physics (Year 11)

Summer

P13: Electromagnetic waves

In this chapter the students will describe the electromagnetic spectrum in terms of different regions related to wavelength. The speed of electromagnetic waves in a vacuum will be described as constant allowing the use of the wave equation to link wavelength and frequency, which will be tied to the energy carried by the wave.

Each of the regions of the electromagnetic spectrum will be described along with associated uses and students will investigate the relationship between surface colour, temperature, and the rate of emission of infra-red radiation. The use of radio waves in communications for television and mobile phones will be described along with outlining transmissions of signals through optical fibres. Higher tier students will also describe the process of modulation of carrier waves to give a more complex picture of how information can be transmitted using waves.

All students will describe the application of ultraviolet waves in phosphorescence and the damage these waves can cause to skin and eyes before describing the uses of X-rays and gamma rays in medical applications. The process of ionisation will be outlined as the cause of tissue damage and as a useful technique in killing bacteria or cancerous cells. Further details of the use of X-rays will be described including contrast media and detection devices such as the CCD and the concept of radiation dose. Higher tier students will compare the intensity of imaging and therapeutic X-rays.

P15: Electromagnetism

Students begin this chapter by reinforcing their knowledge of magnetism by looking at the magnetic fields around permanent magnets and the concept of induced magnetism in some materials. The students will be reminded of the techniques used to plot a magnetic field and the shape of the Earth's field.

Students will move on to examine the magnetic field produced by a current and investigate the factors that affect the direction and strength of this field. They will compare the field shape of a solenoid to that produced by a simple bar magnet.

All higher-tier students will describe how a current carrying wire placed in a magnetic field would experience the motor effect before going on to explain how this effect could be used to create an electric motor. The force produced on the motor will be linked mathematically to the magnetic flux density of the magnetic field.