Curriculum Plans: Year 11 Physics Separate

Topic	Knowledge: By the end of the unit students will know:	**Skills:** **What skills will students have developed by the end of this unit?**	**Key terms:** **What new key terms and vocabulary will be learnt in this unit?**	**Summative Assessment:** **How will pupils be assessed in this unit?**
Particle Model of atom	Define density and write down its unit. Describe how to measure the density of a solid object or a liquid. Use the density equation to calculate the mass or the volume of an object or a sample. Describe how to tell from its density if an object will float in water. Describe the different properties of solids, liquids, and gases. Describe the arrangement of particles in a solid, a liquid, and a gas. Explain why gases are less dense than solids and liquids. Explain why the mass of a substance that changes state stays the same. Write down what the melting point of and the boiling point of a substance mean. Describe what you need to do to melt a solid or to boil a liquid. Explain the difference between boiling and evaporation. Use a temperature-time graph to find the melting point or the boiling point of a substance. Describe how increasing the temperate of a substance affects its internal energy. Explain the different properties of a solid, a liquid, and a gas. Describe how the energy of the particles of a substance changes when it is heated.	I can use the density equation in a wide variety of calculations. I can use appropriate significant figures in final answers when measuring density. I can evaluate in detail the experimental measurement of density, accounting for errors in measurements. I can describe the forces acting between particles in a solid, liquid, and gas. I can describe the changes in the energy of individual particles during changes of state. I can explain in detail why the density of a material changes during a change of state, using a particle model. I can describe how the melting and boiling points of a substance can be changed.	**Absolute zero: the temperature at which the pressure of a gas drops to zero. It is -273°C or 0 K.** **Boiling point: temperature at which a pure substance boils or condenses.** **Change of state: the changing of matter from one state to another e.g. from solid to liquid.** **Chemical changes: a change that results in the formation of new substances.** **Density: mass per unit volume of a substance.** **Freezing point: the temperature at which a pure substance freezes.** **Gas pressure: the force on a surface caused by the collisions of gas particles with the surface. Gas pressure acts at right angles to a surface.**	HW: Assessed past-paper questions. Kerboodle / Seneca online task(s). Revision: For topic test at end of the topic (PP-style questions, ~40 mins) IS: Textbook spread questions on each topic, to self-assess. Use of online resources including BBC Bitesize, physicandmathstutor.com, Seneca Learning and Kerboodle textbook. Especially check the "Appendices". YouTube channels – Free Science Lessons, Primrose Kitten. S & C: ZigZag AQA GCSE Stretch and Challenge Packs on Teams / SharePoint. BBC Science and Tech news sections

	Explain in terms of particles why a gas exerts pressure. Write down what latent heat means as a substance changes its state. Write down what specific latent heat of fusion and of vaporisation mean. Use specific latent heat in calculations. Describe how to measure the specific heat latent heat of ice and of water. Describe how a gas exerts pressure on a surface. Describe how changing the temperature of a gas in a sealed container affects the pressure of the gas. Explain why raising the temperature of a gas in a sealed container affects the pressure of the gas. Describe how to see evidence of gas molecules moving around at random. Describe how pressure (or volume) changes affect the volume (or pressure) of the gas. Describe why the pressure of a gas changes when its volume is changed at constant temperature. Use the equation pV = constant. Explain why the temperature of a gas increases when it is compressed quickly enough.	I can describe in detail the behaviour of the particles during changes of state. I can evaluate data produced by a heating experiment to discuss the reproducibility of the measurement of a melting point. I can use the concepts of kinetic and potential energy to explain changes in internal energy. I can describe the changes in the size of intermolecular forces during changes of state. I can explain in detail why the pressure of a gas increases as it is heated. I can perform a variety of calculations based on the latent heat equation. I can combine variety of equations to solve problems involving heating. I can evaluate the reproducibility of a measurement of latent heat based on collated data.	**Internal energy: the energy of the particles of a substance due to their individual motion and positions.** **kelvin (K): the unit in the kelvin temperature scale. One kelvin is the same temperature interval as 1°C.** **kelvin temperature scale: a temperature scale that measures temperatures relative to absolute zero.** **Kinetic theory: the model that explains the properties of different states of matter in terms of the movement of particles.** **Latent heat: the energy transferred to or from a substance when it changes its state.** **Melting point: temperature at which a pure substance melts or freezes (solidifies).** **pascal (Pa): a unit of pressure . 1 Pa = 1 N/m2** **Physical change: a change in which no new substances are produced.**	(https://www.bbc.co.uk/news, independent research).

		I can describe the linear relationship between changes in temperatures and pressure for a gas. I can explain Brownian motion in terms of particle behaviour and collisions, relating the speeds of smoke particles and air molecules. I can describe in detail how the relationship between the pressure of a gas and its temperature can be investigated. I can explain in terms of particle behaviour why the pressure of a gas increases when its volume decreases. I can calculate the pressure or volume of a gas. I can solve a variety of problems in which gas pressure or volume changes.	**Specific heat capacity: the energy needed to raise the temperature of 1kg of a substance by 1 °C.** **Specific latent heat of fusion, LF: energy needed to melt 1kg of a substance with no change of temperature.** **Specific latent heat of vaporisation, Lv: energy needed to boil away 1kg of substance with no change of temperature.** **States of matter: there are three different forms that a substance can be in: solid, liquid or gas. These are the three states of matter.** **Sublimation: when a solid changes directly to a gas without becoming a liquid first.** **Temperature: a measure of how hot something is.** **Thermal energy: a term used to describe energy when it is stored in hot objects. The hotter something is, the more thermal**	

			energy it has. It is sometimes called 'heat energy'. **Work done: a measure of the energy transferred when a force acts through a distance.**	
Atomic Structure	Write down what a radioactive substance is. Write down the types of radiation given out from a radioactive substance. Write down what happens when a radioactive source emits radiation (radioactive decay). Write down the different types of radiation emitted by radioactive sources. Describe how the nuclear model of the atom was established. Explain why the 'plum pudding' model of the atom was rejected. Describe what conclusions were made about the atom from experimental evidence. Explain why the nuclear model was accepted. Write down what an isotope is. Describe how the nucleus of an atom changes when it emits an alpha particle or a beta particle.	I can describe in detail the decay of an unstable nucleus. I can explain the similarities and differences between nuclear radiation and visible light. I can describe the relative penetrating powers of the three types of nuclear radiation. I can compare the plum pudding model, Rutherford model, and Bohr model of the atom in terms of the evidence for each model. I can explain how Rutherford and Marsden's experiment caused a	**Activity: the number of unstable atoms that decay per second in a radioactive source.** **Alpha radiation: alpha particles, each composed of two protons and two neutrons, emitted by unstable nuclei.** **Atomic number: the number of protons (which equals the number of electrons) in an atom. It is sometimes called the proton number.**	HW: Assessed past-paper questions. Kerboodle / Seneca online task(s). Revision: For topic test at end of the topic (PP-style questions, ~40 mins) IS: Textbook spread questions on each topic, to self-assess. Use of online resources including BBC Bitesize, physicandmathstutor.com, Seneca Learning and Kerboodle textbook. Especially check the "Appendices". YouTube channels – Free Science Lessons, Primrose Kitten. S & C: ZigZag AQA GCSE Stretch and Challenge Packs on Teams / SharePoint.

	Represent the emission of an alpha particle from the nucleus. Represent the emission of a beta particle from the nucleus. Write down how far each type of radiation can travel in air. Describe how different materials absorb alpha, beta, and gamma radiation. Describe the ionising power of alpha, beta and gamma radiation. Explain why alpha, beta, and gamma radiation are dangerous. Write down what the half-life of a radioactive source means. Write down what the count rate from a radioactive source means. Describe what radioactive isotopes are used for in medicine. Describe how to choose a radioactive isotope for a particular job. Describe what type of nuclear radiation be used for medical imaging. Explain how to use radioactivity to destroy cancer cells. State what nuclear fission is. Explain the difference between spontaneous fission and induced fission. State what a chain reaction is. Describe how a chain reaction in a nuclear reactor is controlled. State what nuclear fusion is.	rejection of the plum pudding model. I can describe how the initial evidence for the nuclear model was processed and how the model came to be accepted. I can explain why particles are ejected from the nucleus during nuclear decay. I can describe the changes in the nucleus that occur during nuclear decay. I can write full decay equations for example nuclear decays. I can describe in detail how the thickness of a material being manufactured can be monitored by using a beta source. I can compare the ionisation caused by different types of nuclear radiation. I can evaluate in some detail the risks	**Background radiation: ionising radiation that is around us all the time from a number of sources. Some background radiation is naturally occurring, but some comes from human activities.** **Beta radiation: beta particles that are high energy electrons created in, and emitted from, unstable nuclei.** **Control rod: a rod that can be lowered into the core of a nuclear reactor, to absorb neutrons and slow down the nuclear chain reaction.** **Cosmic rays: charged particles with a high energy that come from stars, neutron**	BBC Science and Tech news sections (https://www.bbc.co.uk/news, independent research).

	Describe how nuclei can be made to fuse together. Describe where the Sun's energy comes from. Explain why it is difficult to make a nuclear fusion reactor. State what radon gas is and why it is dangerous. Describe how safe nuclear reactors are. Explain why nuclear waste is dangerous. Explain what happens to nuclear waste.	caused by alpha radiation inside and outside the human body. I can compare a physical model of decay with the decay of nuclei, noting the limitations of the model. I can outline how the age of organic material can be determined by using radioactive dating. I can calculate the changes in count rate or nuclei remaining by using an exponential decay function. I can describe the use of radioactive implants and the hazards associated with the technique. I can discuss the factors that need to be taken into account when selecting a medical tracer for a diagnostic test.	**stars, black holes and supernovae.** **Count rate: the number of counts per second detected by a Geiger counter.** **Decay: when a radioactive isotope emits ionising radiation.** **Decommission: dismantle safely.** **Fuel rod: a rod containing the nuclear fuel for a nuclear reactor.** **Atomic Structure Keywords(continued)** **Gamma radiation: electromagnetic radiation emitted**	

		I can explain how a medical tracer is used including the function of a gamma camera. I can explain how a steady-state induced fission reaction can be maintained. I can explain the differences between naturally occurring isotopes and enriched nuclear fuels. I can explain the operation of a nuclear fission reactor, including the choices of appropriate materials. I can explain why it is difficult to carry out controlled nuclear fusion on Earth. I can construct a variety of nuclear equations showing nuclear fusion. I can compare the operation of a nuclear fission reactor and a nuclear fusion reactor.	**from unstable nuclei in radioactive substances.** **Geiger-Muller (GM) tube: a device that can detect ionising radiation and is used to measure the activity of a radioactive source.** **Half-life: average time taken for the number of nuclei of the isotope (or mass of the isotope) in a sample to half.** **Ionisation: any process that in which atoms become charged.** **Irradiated: an object has been exposed to ionising radiation.** **Isotopes: atoms with the same number of protons and different number of neutrons.** **Mass number: the number of protons and neutrons in a nucleus.**	

		I can discuss the risks and benefits of nuclear power compared to other methods of electricity generation. I can describe and explain the safety precautions that need to take place after a large nuclear accident. I can evaluate in detail a variety of storage or disposal solutions for nuclear waste.	**Nuclear equation: an equation representing a change in an atomic nucleus due to radioactive decay.** **The atomic numbers and mass number must balance.** **Random: any process that cannot be predicted and can happen at any time is said to be random.** **Unstable: an unstable nucleus in an atom is one that will decay and give out ionising radiation.**	
Electromagnetism	State the force rule for two magnetic poles near each other. Describe the pattern of magnetic field lines around a bar magnet. Describe what induced magnetism is. Explain why steel, not iron, is used to make permanent magnets. Describe the pattern of the magnetic field around a straight wire carrying a current and in and around a solenoid.	I can describe the regions in a magnetic field where magnetic forces are greatest using the idea of field lines. I can explain in detail how a magnetism can be induced in some materials. I can plan in detail how the strength of a	Alternator: an alternating current generator. Electromagnet: an insulated wire wrapped around an iron bar that becomes magnetic when there is a current in the wire. Electromagnetic induction: the process of inducing a	HW: Assessed past-paper questions. Kerboodle / Seneca online task(s). Revision: For topic test at end of the topic (PP-style questions, ~40 mins) IS: Textbook spread questions on each topic, to self-assess. Use of online resources including BBC Bitesize,

	Describe how the strength and direction of the field varies with position and with the current. Describe what a uniform magnetic field is. Describe what an electromagnet is. State what electromagnets can be used for. Explain how devices that use electromagnets work. Describe how to change the size and reverse the direction of the force on a current-carrying wire in a magnetic field. Explain how a simple electric motor works. Explain what is meant by magnetic flux density. Calculate the force on a current-carrying wire. Explain what the generator effect is. Explain how a potential difference can be induced in a wire. Describe what affects the size of the induced potential difference. Deduce the direction of an induced current. Describe how a simple alternator (alternating-current generator) is constructed and operated. Describe how the induced potential difference of an a.c. generator varies with time.	magnetic field can be investigated. I can determine the polarity of the ends of a solenoid from the direction of the current. I can sketch the shape of the field surrounding a solenoid relating this to the direction of the current through the coil. I can plan a detailed investigation into the factors that affect the strength of the magnetic field around a solenoid. I can explain the effect of an iron core on the strength of an electromagnet in terms of the magnetic field. I can describe in detail the operation of an electric bell. I can evaluate an experiment into the factors which affect	potential difference in a wire by moving the wire so it cuts across the lines of force of a magnetic field. Fleming's left-hand rule: a rule that gives the direction of the force on a current-carrying wire in a magnetic field according to the direction of the current and the field. Generator effect: the production of a potential difference using a magnetic field. Magnetic field: the space around a magnet or a current-carrying wire. Motor effect: when a current is passed along a wire in a magnetic field, and the wire is not parallel to the lines of the magnetic field, a force is exerted on	physicandmathstutor.com, Seneca Learning and Kerboodle textbook. Especially check the "Appendices". YouTube channels – Free Science Lessons, Primrose Kitten. S & C: ZigZag AQA GCSE Stretch and Challenge Packs on Teams / SharePoint. BBC Science and Tech news sections (https://www.bbc.co.uk/news, independent research).

	Explain how a simple dynamo (direct-current generator) is constructed and operated. State what transformers are used for. Describe what step-up and step-down transformers do. Explain why transformers only work with a.c. Describe what a transformer is made up of. Explain how the ratio of the primary potential difference to the secondary potential difference depends on the number of turns on each coil. Explain how the number of turns on the secondary coils relates to the number of coils on the primary coil for a step-down transformer and for a step-up transformer. State what you can say about a transformer that is 100% efficient. Explain why less power is wasted by using high potential difference to transfer power through the grid system.	the strength of an electromagnet. I can describe and explain in detail the operation of a d.c. motor. I can perform calculations involving rearrangements of the equation F = BIl. I can investigate the factors that affect the rotation of an electric motor. I can explain why relative movement of a wire through a magnetic field is required to cause induction. I can independently investigate the magnitude and polarity of a current induced in a solenoid when a magnet is moved in it. I can describe how a changing current in one coil can be used to induce a current in another.	the wire by the magnetic field. Step-down transformer: electrical device that is used to step-down the size of an alternating potential difference. Step-up transformer: electrical device used to step-up the size of an alternating potential difference. Transformer: electrical device used to change a (alternating) voltage.	

		I can describe the output of an alternator, linking this to the position of the coil to the magnetic field and the speed of rotation. I can describe the operation of a direct current generator and its output. I can explain why the peak voltage of an a.c. generator is produced when the coil is parallel to the magnetic field lines. I can justify the choice of materials used to construct a transformer. I can describe and explain the operation of a transformer in terms of induction and changes in magnetic fields. I can investigate the effect that changing the ratio of the input and output loops on a transformer has on the change in voltage.		

		I can apply the transformer equation in a wide variety of situations. I can use the relationship VP × IP = VS × IS to calculate all variables. I can measure the efficiency of a transformer and explain why this may not be 100%.		
Space	Describe how the solar system formed. Describe what is meant by a protostar. Explain how energy is released inside the Sun. Explain why the Sun is stable. Explain why stars eventually become stable. Explain the stages in the life of a star. Describe what will eventually happen to the Sun. Describe what a supernova is. State what forces keep planets and satellites moving along their orbits. Identify the direction of the force on an orbiting body in a circular orbit. Describe how the velocity of a body in a circular orbit changes as the body moves around the orbit.	I can analyse data about the planets to compare them in terms of composition. I can explain why a star in its main sequence maintains a constant radius. I can discuss the methods used to gather evidence for the early solar system and formation of stars. I can describe changes in the wavelength (colour) and quantity (brightness) of light emitted by stars	**Centripetal force: the resultant force towards the centre of a circle acting on an object acting in a circular path.** **Cosmic microwave background radiation (CMBR): electromagnetic radiation that has been travelling through space ever since it was created shortly after the big bang.** **Dark matter: matter in a galaxy that cannot be seen. Its presence is deduced**	HW: Assessed past-paper questions. Kerboodle / Seneca online task(s). Revision: For topic test at end of the topic (PP-style questions, ~40 mins) IS: Textbook spread questions on each topic, to self-assess. Use of online resources including BBC Bitesize, physicandmathstutor.com, Seneca Learning and Kerboodle textbook. Especially check the "Appendices".

	Explain why an orbiting body needs to move at a particular speed for it to stay in a circular orbit. State what is meant by the red-shift of a light source. Explain how red-shift depends on speed. Explain how people know that the distant galaxies are moving away from Earth. Explain why people think the Earth is expanding. Describe what the Big Bang theory of the universe is. Explain why the universe is expanding. Explain what cosmic microwave background radiation is. Explain what evidence there is that the universe was created in a Big Bang.	during various stages of their life-cycle. I can explain, in terms of energy requirements, why elements heavier than iron are produced only in supernovae. I can describe the features of neutron stars and black holes. I can explain why a centripetal force can change the velocity of an object without changing its speed. I can explain why the force acting on an object travelling in a circle must be at right angles to the direction of motion and directed towards the centre of the circle. I can explain why a geostationary satellite must be a specific distance from the centre of the Earth.	**because galaxies would spin much faster if their stars were their only matter.** **Main sequence: the main sequence is the life stage of a star during which it radiates energy because of fusion of hydrogen nuclei in its core.** **Neutron star: the highly compressed core of a massive star that remains after a supernova explosion.** **Red giant: a star that has expanded and cooled, resulting in it becoming red and much larger and cooler than it was before it expanded.** **Red supergiant: a star much more massive than the Sun will swell out after the main sequence stage to become a**	YouTube channels – Free Science Lessons, Primrose Kitten. S & C: ZigZag AQA GCSE Stretch and Challenge Packs on Teams / SharePoint. BBC Science and Tech news sections (https://www.bbc.co.uk/news, independent research).

		I can identify red-shift or blue-shift by comparing emission spectra of objects with those of a non-moving source. I can identify the relationship between the red-shift of a galaxy and its speed of recession from a data set or graph. I can explain how red-shift data is used to show that the universe is expanding. I can outline recent discoveries that have led to changes in the theories of how the universe will develop. I can explain in detail how the CMBR supports the Big Bang model. I can discuss how scientists using new evidence have changed their theories about how the universe has evolved over time	**red supergiant before it collapses.** **Redshift: increase in the wavelength of electromagnetic waves emitted by a star or galaxy due to its motion away from us. The faster the speed of a star or galaxy, the greater the redshift is.** **Protostar: the concentration of dust clouds and gas in space that forms a star.** **Supernova: the explosion of a massive star after fusion in its core ceases and the matter surrounding its core collapses onto the core and rebounds.** **White dwarf: a star that has collapsed from the red giant stage to become much hotter and denser.**	

		and how it will change in the future.		