TAUNTON SCHOOL

Year 10 Syllabus in a nutshell

PHYSICS

Year 10 Syllabus in a nutshell - Physics

Topic	Spec	Learning Objective
Circuits	4.2.1.1 4.2.1.2	Know the standard symbols used in circuit diagrams Be able to draw and understand simple circuit diagrams Know that the flow of charge in a circuit is electric current Know that the rate of flow of charge gives the size of the current Know and be able to use the equation Q=It Know that at any point in a single closed circuit loop, the current is the same Know that current cannot flow around a circuit without a source of potential difference
Resistance and I-V Characteristics	4.2.1.3 4.2.1.4	Know that the resistance of and potential difference across a component determine the current flowing through it Know and be able to use the equation V=IR Know that an Ohmic conductor has a constant resistance for any current through it Know, and be able to explain examples of, how the resistance of some components varies with current through them Be able to use a circuit to investigate the effect of wire length on the resistance of a circuit Be able to use a circuit to investigate the I-V characteristic of a resistor at a constant temperature, filament lamp and diode Be able to draw , and explain the design and use of, each of the circuits used in RP3 and 4 Know the shape of these I-V characteristics and link it to the properties and function of the component and whether it is linear or non-linear
Topic	**Spec**	**Learning Objective**
Series Circuits	4.2.2	Know that series circuits are one way of connecting electrical components Be able to construct series circuits from circuit diagrams Understand how series circuits can be used to measure quantities and test components Know that the total potential difference from the power supply is shared between all components connected in series Know that the current through each component connected in series is the same Know that the total resistance of the components in series is the sum of the resistances of each component Understand why adding resistors in series increases the total resistance Know how to calculate pd, resistance and current in series circuits
Parallel Circuits	4.2.2	Know that parallel circuits are one way of connecting electrical components Know the difference between series and parallel circuits Be able to construct parallel circuits from circuit diagrams Know that the pd across each component in parallel is the same Know that the total current of a parallel circuit is the sum of the currents through each branch Know that the total resistance of a parallel circuit is less than the resistance of the branch with the smallest resistance Understand why adding resistors in parallel decreases the total resistance

		Know that circuits can contain a combination of components wired in parallel and components wired in series
Investigating Resistance	4.2.1.3	Be able to use a circuit to investigate the effect of connecting resistors in series and in parallel on the resistance of a circuit
LDRs and Thermistors	4.2.1.4	Know that the resistance of an LDR decreases with increasing light intensity Know some applications of LDRs Know that the resistance of a thermistor decreases with increasing temperature Know some applications of thermistors Understand how LDRs and thermistors can be used in circuits, e.g. simple sensor circuits
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Electricity in the Home	4.2.3.1 4.2.3.2	Know how alternating and direct potential differences differ Know that the mains domestic electricity supply of the UK has a frequency of 50Hz and a pd of 230V Know that three core cables are used to connect most electrical appliances to the mains Know the name, colour, function and pd of each wire in three core cable, and why they are colour coded Understand how touching a live wire can result in an electric shock, even when the appliance is switched off Understand why a connection between the live wire and earth can be dangerous
Power and Energy Transfer	4.2.4.1 4.2.4.2	Know that a moving charge transfers energy, and so work is done when it flows in a circuit Know that electrical appliances transfer energy electrically Understand how various different appliances transfer energy from a power source to useful energy stores Know that the energy transferred is determined by the power of an appliance and amount of time it's used for Understand that a higher power means more energy is transferred per second Know that amount of energy transferred is found by E=Pt Know that power is measured in Watts, W Understand the connection between the power rating of a device and the energy transferred between stores when they are used Know the amount of energy transferred by electrical work can be found by E=QV Know that the power of a device is related to the pd across it and current through it by P=VI Know that the power of a device is related to the current through it and its resistance by $P=I^2R$
The National Grid	4.2.4.3	Know that the national grid is a network of cables and transformers Know that it is used to transfer electrical power from power stations to consumers Understand why the national grid is an efficient way of distributing electrical energy Know that step-up transformers are used to increase the pd before transmission, and step-down transformers are used to decrease pd to safe levels for consumers

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Static Electricity	4.2.5.1	Understand how rubbing certain insulators together can lead to them becoming electrically charged Know that an object which loses electrons becomes positively charged, and one which gains electrons becomes equally negatively charged Know that only negative charges (electrons) move Understand that a spark of charge will jump across the gap between a charged object and an earthed conductor if the pd is high enough Know that two electrically charged materials will exert a non-contact force on each other when brought close together Know that objects with opposite types of charge attract each other and objects with the same type of charge repel each other and know examples that are evidence of this
Electric Fields	4.2.5.2	Know that all charged objects have an electric field around them Know how the strength of an electric field at a certain point is related to the distance of that point from the charged sphere Be able to draw electric field lines for an isolated charged sphere Understand that a non-contact force is experienced by a charged object placed inside the electric field of another charged object and how the size of this force depends on the distance between the two charged objects Be able to explain sparking in terms of electric fields
The History of the Atom	4.4.1.3	Know that atoms were originally thought to be tiny balls of matter that could not be split into smaller pieces Know that the discovery of the electron led to the creation of the plum pudding model Know that the plum pudding model describes atoms as a sphere of positive charge with negative electrons inside them Know how the results of the alpha particle scattering experiment suggested mass and positive charge was concentrated at the centre of the atom - leading to the atomic model changing Know that the results of the alpha particle scattering experiment led to the creation of the nuclear model Understand how new experimental evidence leads to old scientific models being changed, or new ones being created
Topic	**Spec**	**Learning Objective**
The Structure of the Atom	4.4.1.1 4.4.1.2 4.4.1.3	Know how the nuclear model has been adapted over time Understand the differences between the nuclear model and the plum pudding model Know that atoms consist of a nucleus, made up of protons and neutrons, orbited by electrons Know the radius of an atom is about 1×10^{-10}m Know that the nucleus contains most of the mass of an atom and is 10 000 smaller than the atom Know that protons and electrons have equal and opposite charges Know that atoms are not charged and contain an equal number of protons and electrons Know that electrons are arranged in energy levels in an atom and move between them when they absorb and emit EM radiation Know all atoms of an element have the same number of protons Know what the mass number and atomic number of an element tell you Be able to use the notation $^{A}_{Z}X$

		Know that an ion is an atom with too few or too many electrons Know that isotopes of an element have atoms with different numbers of neutrons
Topic	**Spec**	**Learning Objective**
Radioactivity	4.4.2.1 4.4.2.2	Know that radioactive decay is where unstable nuclei emit radiation to try and become more stable Know that radioactive substances may emit neutrons, alpha particles, beta particles or gamma rays from their nuclei Know that an alpha particle consists of two protons and two neutrons Know that a beta particle is a high-speed electron Know that beta particles are emitted when a neutron changes into a proton Know that a gamma ray is a high frequency electromagnetic wave Know the penetration, range in air and ionising power of alpha, beta and gamma radiation Understand some of the uses of alpha, beta and gamma radiation and be able to evaluate the best source for a given use Know that alpha decay changes the mass and charge of a nucleus, beta decay changes only the charge and gamma radiation changes neither Know the nuclear equation symbols for alpha and beta particles Be able to construct and balance nuclear equations of alpha and beta decay
Activity and Half-Life	4.4.2.1 4.4.2.3 4.4.3.2	Know that radioactive decay is a random process Know that count rate is the number of radiation counts measured per second by a detector (e.g. a Geiger-Muller tube) Know that you cannot predict when an individual nucleus will decay, but with a large enough sample you can estimate how long it will take for the number of radioactive nuclei to halve Know that the rate at which unstable nuclei decay is the activity, and that it is measured in Bq (becquerels) Know that the half-life of a radioactive isotope is the time for the activity of (or the number of unstable nuclei in) a sample to halve Know that the half-life of radioactive isotopes varies a lot Understand how the risks associated with radioactive substances vary depending on half-life Be able to find the half-life of a given isotope from information provided *Be able to calculate the reduction in activity, count rate or number of nuclei as a ratio of the initial value after a given number of half-lives*
Topic	**Spec**	**Learning Objective**
Irradiation and Contamination	4.4.2.4	Know that exposure to radiation from a radioactive source is known as irradiation Know that the unwanted presence of radioactive atoms on or in another material is known as contamination Know some precautions which can be taken to minimise the risk of irradiation and contamination Understand how the hazards of irradiation and contamination vary depending on the type of radiation Be able to compare the dangers associated with contamination and irradiation Understand the importance of publishing research into the effects of radiation on human health

Background Radiation	4.4.3.1	Know what is meant be radiation dose (in Sieverts, Sv) Know that 1 Sv = 1000 mSv Know that we are always surrounded by background radiation Know that background radiation comes from natural sources (rocks, cosmic rays, etc.) and man-made sources (e.g. the nuclear industry and fallout from nuclear weapons) Know that the amount of background radiation you are exposed to depends on factors such as your location and occupation
Risks and Uses of Radiation	4.4.3.3	Know how radiation can damage the human body Know that ionising radiation has applications in medicine Understand how gamma and beta emitters are used as tracers to investigate the function of internal organs Understand how radiation is used to control or kill cancer cells Be able to assess the risks of using radiation and compare them to the benefits of the treatment
Topic	**Spec**	**Learning Objective**
Nuclear Fission and Fusion	4.4.4.1 4.4.4.2	Know that nuclear fission is a reaction where a large unstable nucleus splits into two smaller ones Know that fission usually has to be started by the nucleus absorbing a neutron Know that fission produces two smaller nuclei and two or three neutrons with energy in their kinetic energy stores, as well as energy in the form of gamma rays Know that the neutrons produced can lead to further fission, and may cause a chain reaction Be able to draw and understand diagrams of nuclear fission and chain reactions Know that chain reactions are controlled in nuclear power plants and used to release energy Know that a nuclear weapon uses an uncontrolled chain reaction to cause an explosion Know that in nuclear fusion, two small nuclei combine to form a heavier nucleus Know that some of the mass of the lighter nuclei is converted to energy and is emitted as radiation
Topic	**Spec**	**Learning Objective**
Density and States of Matter	4.3.1.1	Know and be able to use the equation for the density of a substance, $\rho = m/V$ Know what the three states of matter are, and be able to describe their properties using the particle model Understand how the particle model can explain why substances have different densities Be able to represent the particle model of the three states of matter with simple diagrams Be able to measure the density of a liquid or any shape solid using appropriate apparatus
Internal Energy and Changes of State	4.3.1.2 4.3.2.1 4.3.2.2 4.3.2.3	Know how energy is stored in a system by its particles Know what is meant by the term 'internal energy' Know that heating a system increases the energy of its particles Understand that this heating will either cause an increase in temperature or cause a change of state Know that if there is a temperature increase, its size depends on the material, the mass of the material and the energy supplied Know all the different ways a substance can change state

		Know what is meant by a physical change and how it differs from a chemical change Be able to explain how a change of state is a physical change that conserves mass Understand that when a substance changes state, the energy transferred changes the internal energy - but not the substance's temperature Recognise and understand heating and cooling graphs for a substance undergoing changes of state
Specific Latent Heat	4.3.2.3	Know what is meant by the terms 'latent heat' and 'specific latent heat' Be able to use the equation for specific latent heat, E = mL Know the difference between specific latent heat of fusion and specific latent heat of vaporisation Know how specific heat capacity and specific latent heat differ
Topic	**Spec**	**Learning Objective**
Particle Motion in Gases	4.3.3.1 4.3.3.2 4.3.3.3	Know that gas particles are in constant random motion and understand how temperature is linked to the average energy in the kinetic energy stores of these particles Understand how the motion of gas particles is linked to its temperature and pressure Understand how a change in temperature of a gas at constant volume leads to a change in gas pressure Be able to explain how a change in volume of a gas at constant temperature can lead to a change in pressure Be able to use the formula linking pressure and volume for a gas at constant temperature to make calculations when pressure or volume changes, pV = constant Know that gas pressure produces a net force at right angles to the wall of a container, so a change in gas pressure can cause a change in the volume of a gas *Know that doing work on a gas increases the internal energy and may cause a change in temperature* *Explain how doing work on a gas in a given situation causes the gas to increase in temperature*
Energy Stores and Transfers	4.1.1.1 4.1.2.1	Know that an object or group of objects can be considered a system Know that when a system changes, energy is transferred between stores Be able to describe changes in the way energy is stored when energy is transferred in changing systems Know that energy is transferred between stores when work is done by a force or by a current flowing Know the principle of conservation of energy Be able to calculate the amount of energy transferred to stores in a changing system Know and be able to give examples to show that, whenever energy is transferred, some energy will be transferred to non-useful stores (dissipated). This energy is said to be 'wasted' Be able to describe and give examples of the energy transfers that take place in a closed system, where there is no net change in energy.

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Kinetic and Potential Energy Stores	4.1.1.1 4.1.1.2	Know that all moving objects have energy in their kinetic energy store Know and be able to use $E_K = 1/2\ mv^2$ to calculate the energy in the kinetic energy store of an object Know and be able to use $E_P = mgh$ to calculate the energy transferred to an object's GPE store when it is raised above the ground Be able to make calculations of energy transfers between stores, e.g. between the GPE store and KE store of a falling object Know that a stretched (or compressed) spring has energy in its elastic potential energy store Be able to use $E_e = 1/2\ ke^2$ to calculate the energy in the elastic potential store of a stretched (or compressed) spring
Specific Heat Capacity	4.1.1.1 4.1.1.3	Know that the specific heat capacity of a material is the energy needed to raise the temperature of 1kg of the material by 1°C Be able to use the equation $\Delta E = mc\Delta\Theta$ to calculate the energy transferred to (stored by) or from (released by) the thermal energy store of a substance when its temperature changes Be able to make calculations of energy transfers between energy stores e.g. between the KE store of a car and the thermal energy store of its brakes Be able to find the specific heat capacity of various materials, and to link work done with energy transferred to thermal energy stores in the experiment
Power	4.1.1.4	Know that the rate of energy transfer (or work done) is power Know that power is measured in Watts, W and 1W = 1 J/s Know and be able to use both P = E/t and P = W/t Be able to describe examples which illustrate the definition of power e.g. that the higher the power, the less time it takes to supply a given amount of energy
Conduction and Convection	4.1.2.1	Know that the higher a material's thermal conductivity, the faster energy can be transferred through it by conduction
Reducing Unwanted Energy transfers	4.1.2.1	Be able to describe how a building's rate of cooling is affected by the thermal conductivity and thickness of its walls Be able to explain a number of methods by which unwanted energy transfers can be reduced Be able to investigate the effectiveness of different materials as thermal insulators
Topic	**Spec**	**Learning Objective**
Efficiency	4.1.2.2	Know and be able to use the equations for efficiency in terms of energy transferred and power Be able to express an efficiency as either a decimal or a percentage *Be able to describe ways in which the efficiency of an energy transfer can be improved*
Energy Resources and their Uses	4.1.3	Know the definitions of non-renewable and renewable energy resources and be able to tell which resources are which Know that non-renewable energy resources include fossil fuels (coal, oil and gas) and nuclear fuels (uranium and plutonium) Know that renewable energy sources include wind, water, waves, tides, hydroelectricity, the Sun (solar), geothermal and bio-fuel Know that energy resources are used for electricity generation, transportation and heating Be able to compare how non-renewable and renewable energy resources are used in transport and heating

Wind, Solar and Geothermal	4.1.3	Be able to compare the ways that wind power, solar cells and geothermal power are used for electricity generation Describe the environmental issues that come from using different energy resources Understand why certain energy resources are more reliable than others
Hydroelectric, Waves and Tides	4.1.3	Be able to compare the ways that hydroelectric power stations, wave power and tidal power are used for electricity generation Describe the environmental issues that come from using different energy resources Understand why certain energy resources are more reliable than others
Bio-fuels and Non-Renewables	4.1.3	Be able to compare the ways that bio-fuels, fossil fuels and nuclear fuels are used for electricity generation Describe the environmental issues that come from using different energy resources Understand why certain energy resources are more reliable than others
Trends in Energy Resource Use (by Easter Y10)	4.1.3	Understand how the ways we use energy resources have changed over time Understand that although scientists have identified environmental issues with energy resources, other factors can limit our ability to deal with these issues