Personalised Learning Checklist

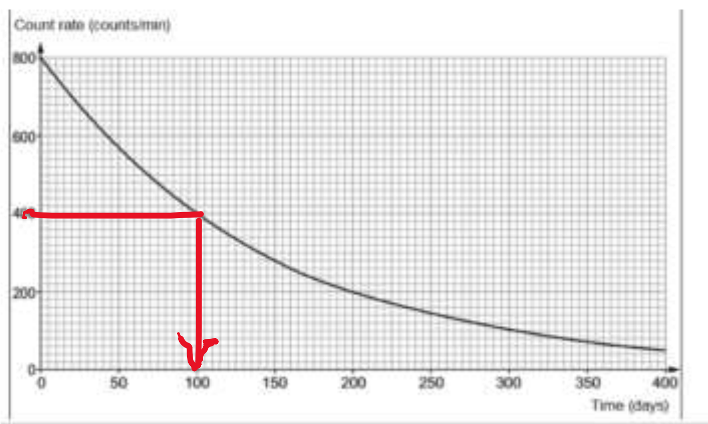
WJEC (Triple Award) Physics 2

Unit 2: Topics 2.1 -2.9

Topic	Student Checklist	R	A	G
Topic 2.1 Distance Speed and Time	Use the equation: speed = distance ÷ time Know the unit of speed to be m/s			
	Know the difference between speed and velocity			
	Use the equation: acceleration = change in velocity ÷ time Know the unit of acceleration to be m/s^2			
	Interpret distance –time graphs: ➢ An object that is not moving has a horizontal line ➢ An object that is moving at a steady velocity shows a straight diagonal line ➢ An object that is accelerating or decelerating shows a curved line ➢ A positive gradient/slope is an object moving forwards and a negative one is moving backwards			
	Interpret speed (velocity) –time graphs : ➢ An object that is accelerating has an upward sloping straight diagonal line. ➢ An object that is decelerating has a downward sloping straight diagonal line. ➢ An object that is moving at a constant velocity shows a horizontal line ➢ Lines below the x-axis are negative velocities (moving backwards) ➢ Curved lines shows non-uniform acceleration/deceleration			
	The gradient of a straight line on a distance –time graph gives the velocity or speed The gradient of a straight line on a velocity –time graphs gives the acceleration			
	HT only : The area under a velocity-time graph gives the distance travelled.			
	Know that : ➢ Total stopping distance of a car = Thinking distance + Braking distance. ➢ Know the difference between stopping, thinking and braking distance. ➢ Know that reaction time affects Thinking distance and therefore total stopping distance as well but **not** braking distance ➢ Know the effect of alcohol on reaction time. ➢ Know that speed affects thinking and braking distance ➢ Know that friction and therefore brakes, brake pads, road conditions, tyres affect braking distance and therefore total stopping distance **but not thinking distance.**			
	Understand the need for speed limits and traffic control measures such as speed humps and cameras.			
Topic 2.2 Newton's Laws	Understand that inertia is a property of a mass that makes it difficult to start or stop moving			
	Know and **state** Newton's 1st Law: An object will remain at rest or continue at a constant velocity unless a resultant force acts on it.			
	Know that an unbalanced force will cause an object to accelerate or decelerate.			
	Know and **state** Newton's 2nd law:			

	Resultant force is proportional to the acceleration and inversely proportional to the mass. Or stated mathematically: F (resultant force in newtons) = m (mass in kilograms) x acceleration (m/s^2)			
	Know that weight is the force of gravity acting on a mass and depends on the gravitational field strength of a planet and the mass of an object. Know that mass is the amount of matter in an object and is measured in kilograms			
	Use the equation: *W* (weight in newtons (N)) = *m* (mass in kilograms(kg)) x *g* (gravitational field strength (N/kg))			
	Explain the velocity – time graphs of bodies such as skydivers who as a result of increasing air resistance accelerate with a decreasing rate until they reach a terminal velocity. Understand the use of parachutes to reach a new lower terminal speed.			
	Know and **state** Newton 3rd Law: When body A exerts a force on body B, body B will exert an equal and opposite force (of the same type) back on A. Examples: A book on a table pushes against a table and the reaction force from the table pushes back with an **equal and opposite force**. One force cannot exist without the other. The Earth pulls the Moon with the force of gravity acting on its mass and the Moon pulls the Earth with an equal and opposite force of gravity. One force cannot exist without the other. On force diagrams the reaction force is normally omitted as we are only interested in the force acting ON an object and not the force the object has on everything else.			
	Specified practical work : terminal speed of falling object using paper cases			
Topic 2.3 Work and Energy Work	Know that: Work is done when a force acts on an object and it moves a distance. Work done is the energy transferred (be it heat, gravitational potential, elastic potential, heat or kinetic) to that object. Use the equations: Work done (J) = Force (N) x Distance (m) W= Fd			
	Know that kinetic energy is due to the movement of a mass. **(HT only) Use the equation:** **kinetic energy = ½ x mass (kg) x velocity² (m^2/s^2)** **K.E. = ½ m v^2**			
	Know that gravitational potential energy (P.E.) increases with the height of an object above the ground and the increase in the weight of the object (mg). **(HT only) Use the equation:** **Change in potential energy (J) = mass (kg) x gravitational field strength (N/kg) x change in height (m)** **P.E. = mgh** Know that when lifting an object work is done against gravity by the lifting force and it is transferred to potential energy. Know that when an object falls work is done by gravity and is all transferred to kinetic energy assuming no energy is lost as heat due to friction and air resistance.			
	Know that when a spring is stretched by a force the extension of the spring is measured from stretched length minus original length. Use the equation for Hooke's Law: Force applied to spring (N) = spring constant (N/cm) x extension (cm) F = kx			
	(HT only) Calculate the work done in stretching a spring by finding the area under the force-extension (F-x) graph which is the same as using the equations:			

	Work done (J) = ½ x stretching force (N) x extension (m) = ½Fx			
	Know and understand how energy efficiency of vehicles can be improved (e.g. by reducing aerodynamic losses/air resistance and rolling resistance, idling losses and inertial losses)			
	Know the principles of forces and motion to an analysis of safety features of cars e.g. air bags and crumple zones			
	Specified Practical Work: Investigation of the force-extension graph for a spring			
Topic 2.5 Stars and Planets	Know the main features of our solar system: their order, size, orbits and composition to include the Sun, terrestrial planets and gaseous giant planets, dwarf planets, comets, moons and asteroids			
	Know the features of the observable universe planets, planetary systems, stars and galaxies. Know that a galaxy is a collection of billions of stars and all the galaxies we can see is the observable universe.			
	Know that an astronomical units (AU) is the distance between the Sun and the Earth and is equal to approximately 150 million kilometres. Know that and light years (l-y) is a measure of distance and is equal to how far light travels in 1 year and is equal to approximately 9.5 million million km or 63 241 AU.			
	Know the main observable stages in the life cycle of stars of different masses, using the terms: protostar, main sequence star, red giant, supergiant, white dwarf, supernova, neutron star and black hole			
	Understand the fact that the stability of stars depends upon a balance between gravitational force and a combination of gas and radiation pressure. Know that stars generate their energy by the fusion of increasingly heavier elements.			
	Know that material returns, including heavy elements, into space during the final stages in the life cycle of giant stars. This occurs during a supernova.			
	Describe the origin of the solar system from the collapse of a cloud of gas and dust, including elements ejected in supernovae.			
	(HT only) Know that the Hertzsprung-Russell (H-R) diagram shows the temperature of a star on the x-axis from hot blue stars on the left and cooler red stars on the right and luminosity or brightness on the y-axis with the brightest stars at the top and the dimmest at the bottom. **Know where to locate white dwarf, red giants, supergiant and main sequence stars on the diagram.**			
Topic 2.7 Types of radiation	Know that the nucleon number (A) is the number of protons <u>and</u> neutrons in the nucleus and is at the top left of element symbol and that proton number (Z) is shown bottom left.eg $^{A}_{Z}X$ Therefore the isotope of oxygen shown here $^{18}_{8}O$ has 8 protons and (18-8) 10 neutrons in its nucleus. Know that a proton has a charge of +1 and a neutron 0 charge.			
	Know that an isotope has the same number of protons but a different number of neutrons in its nucleus. E.g. $^{12}_{6}C$ and $^{14}_{6}C$ are both isotopes of carbon.			
	Know that radioactive emissions arise from unstable atomic nuclei because of an imbalance between the numbers of protons and neutrons			
	Know the fact that waste materials from nuclear power stations and nuclear medicine are radioactive and some of them will remain radioactive for thousands of years			
	Know that ionising background radiation is always present as a result of radon gas in the atmosphere, rocks, cosmic rays and to a lesser extent food, the nuclear industry and other manmade sources such as X-rays and respond to information about received dose from			

	different sources (including medical X-rays) and discuss the reasons for the variation in radon levels.			
	Know that alpha radiation is the least penetrating being stopping by skin or paper and beta is more penetrating as it is only stopped by metal a few mm thick or up to a metre of air whereas gamma radiation is the most penetrating power and is only reduced greatly by thick lead. Know that alpha sources are the most harmful inside the body and the least harmful outside the body compared to beta and gamma sources. Know that gamma radiation is the most harmful outside the body and the least harmful inside the body compared to alpha and beta sources. Know the reasons for the long-term storage and containment of nuclear waste			
	Understand the need to deduct the background reading in order to determine the activity of a radioactive sources. The source must be removed to measure the background count.			
	Know that radioactive decay is a random process and therefore multiple readings over a period of time and a mean are needed in order to find a valid reading of the activity of a radioactive source.			
	Understand how to balance nuclear equations for radioactive decay and **producing them. (HT)** **Know that the number of nucleons before and after nuclear decay are always the same along with the amount of charge.**			
	Know the symbols for a beta particle are $_{-1}^{0}e$ or $_{-1}^{0}\beta$			
	Know the symbols for an alpha particle are $_{2}^{4}He$ or $_{2}^{4}\alpha$			
Topic 2.8 Half-life	Understand that radioactive decay can be modelled using a large number of coins or dice. Each die represents an unstable atom if a particular number is rolled – which is a random event – then this means that that "nucleus-die" has decayed into a more stable nuclei and can be removed along with all the others have decayed. The remaining dice represent the undecayed nuclei. The probability of decay can be compared to the probability of throwing a particular number on a dice.			
	 Know how to plot a decay curve like the one on the left and determine the half-life of a radioactive isotope from the curve. Know that the half-life of a radioactive isotope is the <u>time</u> it takes for the activity OR the number of unstable nuclei of the isotope to <u>decrease by half</u>.			
	Use the half -life of carbon-14 or decay curve to date organic material.			
	Understand how beta emitters can be used to measure the thickness of sheets of metal or card using a feedback mechanism.			
	Understand the use of gamma emitters as tracers with a relatively short half-life to diagnose medical problems such as kidney function.			
	Understand the use of alpha emitters with a short half-life as a localised treatment of a cancerous tumour.			
	Understand the use of external gamma emitters to treat and kill cancerous tumours.			

Topics only covered by separate Physics

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Topic 2.4 Further motion concepts	Use the equation: momentum (kg m/s) = mass (kg) x velocity (m/s) p = mv			
	Use the equation as another way of expressing Newton's 2nd Law: Force = Change in momentum/Time			
	Know the law of conservation of momentum which states that the total momentum of a system of particles before a collision or **explosion** is the same as the total momentum after the collision of particles provided there are no external forces. Use the relationship: $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$			
	HT only: Using K.E. = ½ m v^2 to determine if there is a change in kinetic energy before and after a collision. Loss in kinetic energy suggests heat is generated in the collision.			
	Understand that the law of conservation of momentum is a consequence of Newton's 3rd Law as the change in momentum of body A in collision with body B is the equal and opposite to the change in momentum of body B as the forces are equal and opposite as a result of 3rd law.			
	Use the equations of motion: $v = u + at$ $x = ½(u+v)t$ **$x = ut + ½at^2$** **$v^2 = u^2 + 2ax$** Where x = displacement u = initial velocity v = final velocity a = acceleration t = time			
	Know that a moment is a turning force. Calculate a moment from the equation: moment (Nm) = force (N) x distance normal to the direction of the force (m) M = Fd			
	Use the principle of moments to calculate the unknown force or distance: Sum of the clockwise moments = Sum of the anticlockwise moment			
	Specified Practical Work: Investigation of the Principle of Moment			
Topic 2.6 The Universe	Know and understand how atomic absorption spectra can be used to identify gases from a given absorption spectrum and additional data and explain how scientists in the nineteenth century were able to reveal the chemical composition of stars			
	Know and understand how the "cosmological red shift", revealed initially by Sir Edwin Hubble's measurements on the spectra of distant galaxies, revealed that the wavelengths of the absorption lines are increased and that this effect increases with distance.			
	Understand cosmological red shift in terms of the expansion of the Universe since the radiation was emitted.			
	Know and understand that cosmological red shift is evidence for the Big Bang model of the origin of the Universe.			
	Know that Cosmic Microwave Background Radiation is NOW microwave radiation (NOT IONISING) that started as high energy gamma rays when the universe formed at a single point, which is the hot Big Bang model of the origin of the Universe, and have stretched to longer wavelength microwaves as a result of the Universe expanding since the universe formed an estimated 13 800 million years ago.			

Topic 2.9 Nuclear Decay and Nuclear Energy	Know that the absorption of slow neutrons can induce fission (the splitting of the nucleus) in certain nuclei, referred to as fissile nuclei, such as uranium-235 and that the emission of neutrons from such fission reactions can lead to a sustainable chain reaction.			
	Know that the moderator is used to slow neutrons so that they are more likely to cause. Know that control rods are used to absorb neutrons that are produced from fission so that only one neutron goes onto cause another fission reaction.			
	Know that when high energy collisions occur between light nuclei, especially the isotopes of hydrogen-2 ($^{2}_{1}H$ deuterium) and hydrogen-3 ($^{3}_{1}H$ tritium) can result in fusion which releases energy. Know that very high temperatures are required for this to happen so that the hydrogen nuclei have sufficient kinetic energy to overcome the electrostatic repulsion.			
	Know the symbol for a neutron is $^{1}_{0}n$			
	Understand how to balance nuclear equations for fission and fusion as well as **producing them. (HT)** Know that the number of nucleons before and after nuclear reaction are always the same along with the amount of charge.			
	Understand the problems of containment in fission and fusion reactors including neutron and gamma shielding and pressure containment in fission reactors and maintaining a high temperature in fusion reactors.			