AQA A Level Physics –Nuclear Physics Remote Learning Pack
Autumn Term 1a (Week 1-7)

- FLIPPED AROUND PHYSICS https://www.flippedaroundphysics.com/a-level.html includes video tutorials, Core tasks with questions and answers and Exam questions in each episode.
- SENECA Nuclear Physics – covers this topic
- OVERVIEW Videos – https://www.youtube.com/watch?v=ovRsLFGng6A&list=PLGvD8d3gDHUUzllhbZQjHiawf9rIdmAqD (series of 9 short clips) https://www.youtube.com/watch?v=lUhJL7o6_cA
- Snap Revise https://www.youtube.com/watch?v=5SWY2VN8X04
- Cyber Physics https://www.cyberphysics.co.uk/indexDTV.html
- BACKGROUND INFORMATION/ EXTENDED LEARNING https://www.youtube.com/watch?v=-FWxd78sOZ8&t=730s
- Mr Hull Physics (short summary videos from one of my ex-students!) https://www.youtube.com/channel/UCncvHXCeToNcTU6nlw3vNQQ
- **CGP Physics text books – background reading and exam style question**

	In school Lesson Title	Spec Link	Specification detail	Key definitions (to learn)	Resources
	Rutherford Scattering	3.8.1.1.	• Qualitative study of Rutherford scattering. • Appreciation of how knowledge and understanding of the structure of the nucleus has changed over time.	Work function Stopping potential Threshold frequency	• https://www.youtube.com/watch?v=wzALbzTdnc8&t=87s • https://www.youtube.com/watch?v=XBqHkraf8iE • https://www.flippedaroundphysics.com/81-rutherford-scattering.html
	Nuclear Radius	3.8.1.5.	• Estimate of radius from closest approach of alpha particles and determination of radius from electron diffraction. • Knowledge of typical values for nuclear radius. • Coulomb equation for the closest approach estimate. • Dependence of radius on nucleon number: $R = R_o A^{\frac{1}{3}}$ derived from experimental data. • Interpretation of equation as evidence for constant density of nuclear material. • Calculation of nuclear density. • graph of intensity against angle for electron diffraction by a nucleus.	Closest approach Coulomb equation Density Nucleon number	• https://www.youtube.com/watch?v=cp1UAfYSemg • https://www.flippedaroundphysics.com/85-nuclear-radius.html
	Using Radiation safely	3.8.1.2.	• Applications eg to safe handling of radioactive sources.		• https://www.flippedaroundphysics.com/82-alpha-beta-and-gamma-radiation.html
	Alpha Beta Gamma radiation				

	Inverse Square Law for Gamma Radiation		• Their properties and experimental identification using simple absorption experiments; applications eg to relative hazards of exposure to humans. • Applications also include thickness measurements of aluminium foil paper and steel. • Inverse-square law for γ radiation: • Experimental verification of inverse-square law. • Applications eg to safe handling of radioactive sources. • Background radiation; examples of its origins and experimental elimination from calculations. • Appreciation of balance between risk and benefits in the uses of radiation in medicine. • Required practical 12: Investigation of the inverse-square law for gamma radiation.	Exposure Contamination Irradiation Inverse square Law Back ground radiation	
	Nuclear Instability	3.8.1.4.	• Graph of N against Z for stable nuclei. Possible decay modes of unstable nuclei including α, β+ , β− and electron capture. • Changes in N and Z caused by radioactive decay and representation in simple decay equations.	Decay modes Stability NZ plot	• https://www.flippedaroundphysics.com/84-nuclear-instability.html •
	Half Life Nuclear Decay		• Random nature of radioactive decay; constant decay probability of a given nucleus; • Δ N /Δ t = − λN • $N = N_o e^{-\lambda t}$ • Use of activity, A = - λN • Modelling with constant decay probability. • Questions may be set which require students to use $A = A_o e^{-\lambda t}$ • Questions may also involve use of molar mass or the Avogadro constant. • Half-life equation: T ½ = ln2/λ • Determination of half-life from graphical decay data including decay curves and log graphs. • Applications eg relevance to storage of radioactive waste, radioactive dating etc.	Decay constant Activity Probability Random Half life Radioactive dating	• https://www.flippedaroundphysics.com/83-radioactive-decay.html
	Balancing the risk	3.8.1.3	• Applications also include thickness measurements of aluminium foil paper and steel. • Applications eg to safe handling of radioactive sources. • Background radiation; examples of its origins and experimental elimination from calculations. • Appreciation of balance between risk and benefits in the uses of radiation in medicine.		• Research using text books

			• Applications eg relevance to storage of radioactive waste, radioactive dating etc.		
	Nuclear Energy Levels		• Questions may use nuclear energy level diagrams. • Existence of nuclear excited states; γ ray emission; application eg use of technetium-99m as a γ source in medical diagnosis.		• https://www.flippedaroundphysics.com/84-nuclear-instability.html
	Mass and Energy	3.8.1.6	• Appreciation that E = mc 2 applies to all energy changes, • Simple calculations involving mass difference and binding energy. • Atomic mass unit, u. • Conversion of units; 1 u = 931.5 MeV.		• https://www.flippedaroundphysics.com/86-mass-and-energy.html
	Fission and Fusion	3.8.1.6.	• Fission and fusion processes. • Simple calculations from nuclear masses of energy released in fission and fusion reactions.		• https://www.flippedaroundphysics.com/87-induced-fission.html
	Binding energy	3.8.1.6	• Graph of average binding energy per nucleon against nucleon number. • Students may be expected to identify, on the plot, the regions where nuclei will release energy when undergoing fission/fusion. • Appreciation that knowledge of the physics of nuclear energy allows society to use science to inform decision making.		• https://www.youtube.com/watch?v=iL02oXZss2Q • https://www.youtube.com/watch?v=KgcqjlLr97E
	Induced Fission	3.8.1.7	• Fission induced by thermal neutrons; possibility of a chain reaction; critical mass. • The functions of the moderator, control rods, and coolant in a thermal nuclear reactor. • Details of particular reactors are not required. • Students should have studied a simple mechanical model of moderation by elastic collisions. • Factors affecting the choice of materials for the moderator, control rods and coolant. • Examples of materials used for these functions.		• https://www.flippedaroundphysics.com/87-induced-fission.html • https://www.youtube.com/watch?v=1U6Nzcv9Vws
	Nuclear Power and Safety	3.8.1.8	• Fuel used, remote handling of fuel, shielding, emergency shut-down. • Production, remote handling, and storage of radioactive waste materials. • Appreciation of balance between risk and benefits in the development of nuclear power.		• https://www.flippedaroundphysics.com/88-safety-aspects.html