

National curriculum or specification coverage

AQA Advanced Level Physics – Specification 7408

3.8.1 Radioactivity

- 3.8.1.1 Rutherford scattering
- 3.8.1.2 α , β and γ radiation
- 3.8.1.3 Radioactive decay
- 3.8.1.4 Nuclear instability
- 3.8.1.5 Nuclear radius
- 3.8.1.6 Mass and energy
- 3.8.1.7 Induced fission
- 3.8.1.8 Safety aspects

3.9.1 Telescope

- 3.9.1.1 Astronomical telescope consisting of two converging lenses
- 3.9.1.2 Reflecting telescopes
- 3.9.1.3 Single dish radio telescopes, I-R, U-V and X-ray telescopes
- 3.9.1.4 Advantages of large diameter telescopes

3.9.2 Classification of stars

- 3.9.2.1 Classification by luminosity
- 3.9.2.2 Absolute magnitude, M
- 3.9.2.3 Classification by temperature, black-body radiation
- 3.9.2.4 Principles of the use of stellar spectral classes
- 3.9.2.5 The Hertzsprung-Russell (HR) diagram
- 3.9.2.6 Supernovae, neutron stars and black holes

3.9.3 Cosmology

- 3.9.3.1 Doppler effect
- 3.9.3.2 Hubble's law
- 3.9.3.3 Quasars
- 3.9.3.4 Detection of exoplanets

Year 13 Long Term Scheme of Learning 2026-2027

Subject: A Level Physics (Teacher one)

Date	Exams/ Assessments	Learning Intentions	Core Task / Assessments	
31/08 /26		3.8.1.1 Rutherford scattering - Qualitative study of Rutherford scattering. - Appreciation of how knowledge and understanding of the structure of the nucleus has changed over time.		
07/09 /26				
14/09 /26				
21/09 /26		3.8.1.2 α , β and γ 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 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.		
28/09 /26		Y12 Revisit - Particles and Radiation - Projectile motion & Newtons laws of motion		
05/10 /26				
12/10 /26				
19/10 /26	Y13			
26/10 /26	HALF TERM			
02/11 /26		3.8.1.3 Radioactive decay Random nature of radioactive decay;		
09/11 /26				

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16/11 /26		- constant decay probability of a given nucleus with relevant equations. - Use of activity with relevant equations. - Modelling with constant decay probability. - 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.	
23/11 /26			
30/11 /26		3.8.1.4 Nuclear instability - Graph of $N - Z$ for stable nuclei - Possible decay modes of unstable nuclei and electron capture. - Changes in N and Z caused by radioactive decay and representation in simple decay equations. - Questions using nuclear energy level diagrams. - Existence of nuclear excited states; - Gamma ray emission; application eg use of technetium-99m as a source in medical diagnosis. 3.8.1.5 Nuclear radius - 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 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. 3.8.1.6 Mass and energy - 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; $1 u = 931.5 \text{ MeV}$ - Fission and fusion processes.	

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		- Simple calculations from nuclear masses of energy released in fission and fusion reactions. - Graph of average binding energy per nucleon against nucleon number. - 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.	
07/12/26		Y12 Revisit - Waves - Electricity	
14/12/26			
21/12/26	CHRISTMAS HOLIDAY		
28/12/26			
04/01/27		3.8.1.7 Induced fission - 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. 3.8.1.8 Safety aspects - 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.	
11/01/27			

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18/01/27		3.9.1.1 Astronomical telescope consisting of two converging lenses	
25/01/27		- Ray diagram to show the image formation in normal adjustment. - Angular magnification in normal adjustment. - Focal lengths of the lenses.	
01/02/27		3.9.1.2 Reflecting telescopes - Cassegrain arrangement using a parabolic concave primary mirror and convex secondary mirror. - Ray diagram to show path of rays through the telescope up to the eyepiece. - Relative merits of reflectors and refractors including a qualitative treatment of spherical and chromatic aberration. 3.9.1.3 Single dish radio telescopes, I-R, U-V and X-ray telescopes - Similarities and differences of radio telescopes compared to optical telescopes, including structure, positioning and use, together with comparisons of resolving and collecting powers. 3.9.1.4 Advantages of large diameter telescopes - Minimum angular resolution of telescope. - Rayleigh criterion - Collecting power is proportional to diameter² - rad as the unit of angle. - Comparison of the eye and CCD as detectors in terms of quantum efficiency, resolution, and convenience of use.	
08/02/27	Y13		
15/02/27	HALF TERM		
22/02/27		3.9.2.1 Classification by luminosity	
01/03/27		- Apparent magnitude - The Hipparcos scale. - Dimmest visible stars have a magnitude of 6.	
08/03/27		Relation between brightness and apparent magnitude. Difference of 1 on magnitude scale is equal to an intensity ratio of 2.51.	
15/03/27		Brightness is a subjective scale of measurement.	

22/03
/27

3.9.2.2 Absolute magnitude, M

- Parsec and light year.
- Define absolute magnitude

3.9.2.3 Classification by temperature, black-body radiation

- Stefan's law and Wien's displacement law.
- General shape of black-body curves, use of Wien's displacement law to estimate black-body temperature of sources.
- Assumption that a star is a black body.
- Inverse square law, assumptions in its application.
- Use of Stefan's law to compare the power output, temperature and size of stars

3.9.2.4 Principles of the use of stellar spectral classes

- Description of the main spectral class (OBAFGKM)
- Temperature related to absorption spectra limited to Hydrogen Balmer absorption lines: requirement for atoms in an $n=2$ state

3.9.2.5 The Hertzsprung-Russell (HR) diagram

- General shape: main sequence, dwarfs and giants.
- Axis scales range from -10 to $+15$ (absolute magnitude) and $50\,000\text{ K}$ to $2\,500\text{ K}$ (temperature) or OBAFGKM (spectral class).
- Familiar with the position of the Sun on the HR diagram.
- Stellar evolution: path of a star similar to our Sun on the HR diagram from formation to white dwarf.

3.9.2.6 Supernovae, neutron stars and black holes

- Defining properties: rapid increase in absolute magnitude of supernovae; composition and density of neutron stars; escape velocity $> c$ for black holes.
- Gamma ray bursts due to the collapse of supergiant stars to form neutron stars or black holes.
- Comparison of energy output with total energy output of the Sun.

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- Use of type 1a supernovae as standard candles to determine distances. Controversy concerning accelerating Universe and dark energy.
- Students should be familiar with the light curve of typical type 1a supernovae.
- Supermassive black holes at the centre of galaxies.
- Calculation of the radius of the event horizon for a black hole, Schwarzschild radius

3.9.3.1 Doppler effect

- Use equations applied to optical and radio frequencies.
- Calculations on binary stars viewed in the plane of orbit.
- Galaxies and quasars.

3.9.3.2 Hubble's law

- Red shift
- Simple interpretation as expansion of universe; estimation of age of universe, assuming H is constant
- Qualitative treatment of Big Bang theory including evidence from cosmological microwave background radiation, and relative abundance of hydrogen and helium.

3.9.3.3 Quasars

- Quasars as the most distant measurable objects.
- Discovery of quasars as bright radio sources.
- Quasars show large optical red shifts; estimation involving distance and power output.
- Formation of quasars from active supermassive black holes.

3.9.3.4 Detection of exoplanets

- Difficulties in the direct detection of exoplanets.
- Detection techniques will be limited to variation in Doppler shift (radial velocity method) and the transit method.
- Typical light curve.

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29/03 /27	SPRING BREAK		
05/04 /27			
12/04 /27		Catch up on required practicals if needed. Exam Retrieval, Revision and Practice. - Paper 1 - Paper 2 - Paper 3	
19/04 /27			
26/04 /27			
03/05 /27			
10/05 /27			
17/05 /27			
24/05 /27			
31/05 /27	HALF TERM		
07/06 /27		Exam Season	
14/06 /27			
21/06 /27			
28/06 /27			
05/07 /27			
12/07 /27			