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Personalised Learning Checklist

Date Reviewed and RAG Rating

AQA A Level Physics (Concept)
P6 :Further mechanics and thermal physics
P6.1: Periodic motion

No Knowledge
Insecure
Secure

Recall that motion in a circular path at constant speed implies there is an acceleration and requires a centripetal force										
Use the equation $\omega = v/r = 2\pi f$ for magnitude of angular speed										
Recall that the radian is a measure of an angle and estimate the acceleration and centripetal force in situations that involve rotation										
Use the equation $a = v^2/r = \omega^2 r$ for centripetal acceleration										
Use the equation $F = mv^2/r = m\omega^2 r$ for centripetal force										
Describe and analyse characteristics of simple harmonic motion (SHM).										
Describe the condition for SHM as: $a \propto -x$										
Define and use the equations $a = -\omega^2 x$ and $x = A \cos \omega t$ and $v = \pm \omega \sqrt{(A^2 - x^2)}$										
Sketch relationships between x, v, a and $-t$ for simple harmonic oscillators.										
Draw graphical representations linking the variations of x, v and a with time										
Explain how the $v - t$ graph is derived from the gradient of the $x - t$ graph and that the $a - t$ graph is derived from the gradient of the $v - t$ graph										
Recall that maximum speed $= \omega A$ and maximum acceleration $= \omega^2 A$										
Use the small-angle approximation in the derivation of the time period for examples of approximate SHM										
Use the equation $T = 2\pi \sqrt{(m/k)}$ for the study of a mass spring system and $T = 2\pi \sqrt{(l/g)}$ for a simple pendulum										
Explain the variation of E_k, E_p, and total energy with both displacement and time										

Describe the effects of damping on oscillations										
Explain how free and forced vibrations can be measured quantitatively										
Explain resonance and describe the effects of damping on the sharpness of resonance										
Describe examples of these effects in mechanical systems and situations involving stationary waves										
Investigate the factors that determine the resonant frequency of a driven system										
P6.2: Thermal physics										
Describe internal energy as the sum of the randomly distributed kinetic energies and potential energies of the particles in a body										
Explain how the internal energy of a system is increased when energy is transferred to it by heating or when work is done on it (and vice versa)										
Complete calculations involving transfer of energy and continuous flow										
Explain that during a change of state the potential energies of the particle ensemble are changing but not the kinetic energies.										
Use the equation $Q = mc\Delta\Theta$ for a change of temperature, where c is specific heat capacity.										
Use the equation $Q = ml$ for a change of state where l is the specific latent heat										
Describe gas laws as experimental relationships between p, V, T and the mass of the gas										
Explain the concept of absolute zero of temperature.										
Use the ideal gas equation: $pV = nRT$ for n moles and $pV = NkT$ for N molecules										
Recall that work done $= p\Delta V$										
Recall and use the following constants: Avogadro constant N_A, molar gas constant R, Boltzmann constant k										
Describe and explain the following: molar mass and molecular mass.										
Investigate Boyle's law (constant temperature) and Charles's law (constant pressure) for a gas										

Explain Brownian motion as evidence for existence of atoms										
Explain the relationships between ***p, V and T*** in terms of a simple molecular model										
Explain that the gas laws are empirical in nature whereas the kinetic theory model arises from theory										
Use and derive the equation $pV = \frac{1}{3}Nm(c_{rms})^2$										
Use a simple algebraic approach for conservation of momentum										
Explain that for an ideal gas internal energy is the kinetic energy of the atoms										
Use the equation ***average molecular kinetic energy*** $= \frac{1}{2}m(c_{rms})^2 = \frac{3}{2}kT = 3RT / 2N_A$										
Explain how knowledge and understanding of the behaviour of a gas has changed over time										

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AQA A Level Physics (Concept) **P7: Fields and their consequences** **P7.1: Fields** No Knowledge Insecure Secure										
Describe the concept of a force field as a region in which a body experiences a non-contact force										
Recognise that a force field can be represented as a vector, the direction of which must be determined by inspection										
Describe how force fields arise from the interaction of mass, of static charge, and between moving charges										
Explain the similarities and differences between gravitational and electrostatic forces										
P7.2: Gravitational fields										
Describe what gravity is										
Use the equation $F = Gm_1 m_2 / r^2$ for magnitude of force between point masses where G is the gravitational constant										
Be able to estimate the gravitational force between a variety of objects										
Be able to represent a gravitational field by gravitational field lines										
Use the equation $g = F/m$ with g as force per unit mass										
Use the equation $g = GM/r^2$ for magnitude of g in a radial field										
Define gravitational potential, including zero value at infinity										
Describe what gravitational potential difference is										
Use the equation: work done in moving mass for m given by $\Delta W = m\Delta V$										
Explain what equipotential surfaces are and explain why no work is done when moving along an equipotential surface										

Use the equation: $V = -GM/r$ for V in a radial field										
Explain the significance of the negative sign										
Draw graphical representations of variations of g and V with r										
Use the equation: $g = -\Delta V/\Delta r$ for V related to g										
Determine ΔV from area under graph of g against r										
Describe orbital period and speed related to radius of circular orbit; ab derive $T^2 \propto r^3$										
Estimate various parameters of planetary orbits, eg kinetic energy of a planet in orbit										
Calculate total energy of an orbiting satellite, escape velocity and describe synchronous orbits										
Describe the use of satellites in low orbits and geostationary orbits, to include plane and radius of geostationary orbit										
Use logarithmic plots to show relationships between T and r for given data										
P3: Electric fields										
Use the equation $F = 1/4\pi\varepsilon_0 \times Q_1 Q_2/r^2$ for the force between two charges in a vacuum										
Describe what the permittivity of free space is, ε_0										
Recall that air can be treated as a vacuum when calculating force between charges										
Recall that for a charged sphere, charge may be considered to be at the centre										
Compare magnitude of gravitational and electrostatic forces between subatomic particles										
Estimate the magnitude of the electrostatic force between various charge configurations										
Be able to represent electric fields by electric field lines and explain electric field strength										
Use the equation: $E = F/Q$, where where E is the force per unit charge										

Use the equation: $E = V/d$, for magnitude of E in a uniform field										
Derive the equation: $Fd = Q\Delta V$ from work done for moving charge between plates										
Describe the trajectory of moving charged particle entering a uniform electric field initially at right angles										
Use the equation $E = 1/4\pi\varepsilon_0 \times Q/r^2$, for magnitude of E in a uniform field										
Investigate the patterns of various field configurations using conducting paper (2D) or electrolytic tank (3D)										
Define absolute electric potential, including zero value at infinity, and of electric potential difference										
Use the equation: $\Delta W = Q\Delta V$ for work done in moving charge Q										
Explain what equipotential surfaces are and explain why no work is done when moving charge along an equipotential surface										
Use the equation: $V = 1/4\pi\varepsilon_0 \times Q/r^2$ for magnitude of V in a radial field										
Draw graphical representations of variations of E and V with r										
Use the equation: $E = \Delta V/\Delta r$ to related V to E										
Determine ΔV from the area under graph of E against r										
P4: Capacitance										
Define capacitance and use the equation: $C = Q/V$										
Describe the dielectric action in a capacitor by $C = A\varepsilon_0\varepsilon_r/d$										
Define relative permittivity and dielectric constant										
Determine the relative permittivity of a dielectric using a parallel-plate capacitor										
Describe the action of a simple polar molecule that rotates in the presence of an electric field										
Investigate the relationship between C and the dimensions of a parallel-plate capacitor										

Interpret the area under a graph of charge against pd $E = \frac{1}{2} QV = \frac{1}{2} CV^2 = \frac{1}{2} Q^2/C$										
Draw graphical representation of charging and discharging of capacitors through resistors										
Draw corresponding graphs for ***Q, V*** and ***I*** against time for charging and discharging										
Interpret gradients and areas under graphs										
Calculate time constants ***RC*** including their determination from graphical data										
Use the equation: $T_{\frac{1}{2}} = 0.69RC$ for time to halve										
Use the equation: $Q = Q_0 e^{-t/RC}$ for quantitative treatment of capacitor discharge										
Use the equation: $Q = Q_0 (1 - e^{-t/RC})$ for quantitative treatment of capacitor charge										
Use the corresponding equations for ***V*** and ***I***										
Investigate the charge and discharge of capacitors										
P5: Magnetic fields										
Describe force on a current-carrying wire in a magnetic field: $F = BIl$ when field is perpendicular to current										
Describe and use Fleming's left hand rule										
Explain magnetic flux density ***B*** and give a definition for the tesla										
Investigate how the force on a wire varies with flux density, current and length of wire using a top pan balance										
Describe force on charged particles moving in a magnetic field, using $F = BQv$ when the field is perpendicular to velocity										
Recall the direction of force on positive and negative charged particles										
Describe the circular path of particles in application in devices such as the cyclotron										
Explain the terms: magnetic flux density $\phi = BA$, and flux linkage $N\phi$, where ***B*** is normal to ***A*** and ***N*** is the number of turns cutting the flux										

Describe flux and flux linkage passing through a rectangular coil rotated in a magnetic field as flux linkage $N\phi = BANcos\theta$										
Investigate, the effect on magnetic flux linkage of varying the angle between a search coil and magnetic field direction										
Describe simple experimental phenomena for electromagnetic induction										
Describe and apply Faraday's and Lenz's laws for electromagnetic induction										
Use the equation: $\varepsilon = N\Delta\phi/\Delta$ for magnitude of induced emf = rate of change of flux linkage										
Describe applications such as a straight conductor moving in a magnetic field										
Use the equation: $\varepsilon = BAN\omega \sin \omega t$ for emf induced in a coil rotating uniformly in a magnetic field										
Recall Sinusoidal voltages and currents, root mean square, peak and peak-to-peak values for sinusoidal waveforms only										
Use the equation: $I_{rms} = I_0/\sqrt{2}\,;\, V_{rms} = V_0/\sqrt{2}$										
Apply the calculation of mains electricity peak and peak-to-peak voltage values										
Use an oscilloscope as a dc and ac voltmeter, to measure time intervals and frequencies, and to display ac waveforms										
Use the following transformer equation: $N_s/N_p = V_s/V_p$										
Use the equation: $I_s V_s / I_p V_p$ to calculate transformer efficiency										
Describe and explain the production of eddy currents and causes of inefficiencies in a transformer										
Describe the transmission of electrical power at high voltage including calculations of power loss in transmission lines										

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AQA A Level Physics (Concept) **P8: Nuclear physics** **P8.1: Radioactivity** No Knowledge / Insecure / Secure	**Date Reviewed and RAG Rating**									
Describe the qualitative study of Rutherford scattering										
Describe how knowledge and understanding of the structure of the nucleus has changed over time										
Describe the properties and experimental identification using simple absorption experiments for α, β and γ radiation										
Describe and explain the hazards of exposure for humans to α, β and γ radiation										
Describe the applications of α, β and γ radiation										
Recall the inverse-square law for γ radiation: $I = k/x^2$ and use experiments for verification of inverse-square law										
Explain how radioactive sources can be handled safely										
Define background radiation giving examples of its origins and experimental elimination from calculations.										
Evaluate the balance between risk and benefits in the uses of radiation in medicine										
Describe the random nature of radioactive decay; constant decay probability of a given nucleus										
Use the equations: $\Delta N/\Delta t = -\lambda N$; $N = N_0 e^{-\lambda t}$ and $A = \lambda N$										
Use modelling to describe constant decay probability										
Investigate the decay equation (including the use of experimental data, dice simulations etc) and a variety of analytical methods										
Use the equation: $A = A_0 e^{-\lambda t}$										
Use the half life equation: $T_{\frac{1}{2}} = \ln 2/\lambda$										

Determine half-life from graphical decay data including decay curves and log graphs										
Describe application for radioactive decay e.g. relevance to storage of radioactive waste, radioactive dating etc										
Draw graphs of N against Z for stable nuclei										
Describe possible decay modes of unstable nuclei including α, β+, β− and electron capture										
Describe changes in N and Z caused by radioactive decay and representation in simple decay equations										
Interpret nuclear energy level diagrams										
Recall the existence of nuclear excited states; γ ray emission; discuss applications e.g. use of technetium-99m as a γ source in medical diagnosis										
Estimate nuclear radius from closest approach of alpha particles and determination of radius from electron diffraction										
Recall of typical values for nuclear radius and use the Coulomb equation for the closest approach estimate										
Describe how the nuclear radius depends on the nucleon number										
Derive $R = R_0 A^{1/3}$ from experimental data and interpret the of equation as evidence for constant density of nuclear material										
Calculate nuclear density and describe the graph of intensity against angle for electron diffraction by a nucleus										
Recall that $E = mc^2$ applies to all energy changes										
Complete simple calculations involving mass difference and binding energy										
Recall and use the Atomic mass unit, u and conversion of units; $1\ u = 931.5\ MeV$										
Describe and explain fission and fusion processes										
Complete simple calculations from nuclear masses of energy released in fission and fusion reactions										
Draw graphs of average binding energy per nucleon against nucleon number										

Identify, on a plot, the regions where nuclei will release energy when undergoing fission/fusion										
Describe how knowledge of the physics of nuclear energy allows society to use science to inform decision making										
Describe fission as induced by thermal neutrons; possibility of a chain reaction due to critical mass										
Explain the functions of the moderator, control rods, and coolant in a thermal nuclear reactor.										
Describe simple a mechanical model of moderation by elastic collisions										
Recall factors affecting the choice of materials for the moderator, control rods and coolant and give examples of materials used										
Describe safety aspects of fuel used, remote handling of fuel, shielding, emergency shut-down										
Describe safety aspects of production, remote handling, and storage of radioactive waste materials.										
Evaluate the of balance between risk and benefits in the development of nuclear power										

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AQA A Level Physics (Concept) **P9: Astrophysics (optional)** **P9.1: Telescopes**	No Knowledge Insecure Secure	**Date Reviewed and RAG Rating**								
Recall that astronomical telescope consisting of two converging lenses										
Draw ray diagrams to show the image formation in normal adjustment										
Describe angular magnification in normal adjustment										
Use the equation: ***M = angle subtended by image at eye/ angle subtended by object at unaided eye***										
Calculate the Focal lengths of the lenses by using the equation: $M = f_o/f_e$										
Describe cassegrain arrangement using a parabolic concave primary mirror and convex secondary mirror for reflecting telescopes										
Draw ray diagram to show path of rays through the reflecting telescope up to the eyepiece										
Discuss the relative merits of reflectors and refractors including a qualitative treatment of spherical and chromatic aberration										
Recall what single dish radio telescopes, I-R, U-V and X-ray telescopes are										
Discuss the similarities and differences of radio telescopes compared to optical telescopes (Inc. structure, positioning and use)										
Compare the resolving and collecting powers of radio telescopes										
Describe the advantages of large diameter telescopes for minimum angular resolution of telescope										
Use the equation: Rayleigh criterion, $\theta \approx \lambda/D$										
Recall that collecting power is proportional to ***diameter*** ^{2}										
Compare the eye and CCD as detectors in terms of quantum efficiency, resolution, and convenience of use										

P9.2: Classification of stars										
Recall how stars are classified by luminosity and that the apparent magnitude, m										
Recall and describe the Hipparcos scale										
Recall that the dimmest visible stars have a magnitude of 6										
Discuss the relationship between brightness and apparent magnitude										
Recall that a difference of 1 on the magnitude scale is equal to an intensity ratio of 2.51										
Recall that brightness is a subjective scale of measurement										
Describe what a Parsec and a lightyear are										
For absolute magnitude define M, in relation to m: $m - M = 5 \log d/10$										
Recall how stars are classified by temperature and black-body radiation										
Apply Stefan's law and Wien's displacement law										
Recall the general shape of black-body curves, and use of Wien's displacement law to estimate black-body temperature of sources										
Use the equation: $\lambda_{max} T = \text{constant} = 2.9 \times 10^{-3}$ m K										
Recall the assumption that a star is a black body										
Use of Stefan's law to compare the power output, temperature and size of stars $P = \sigma A T^4$										
Describe the spectral classes OBAFGKM in terms of colour, temperature and prominent absorption lines										
Describe what the Hertzsprung-Russell (HR) diagram shows										
Describe the general shape: main sequence, dwarfs and giants										
Use axis scales range from –10 to +15 (absolute magnitude) and 50 000 K to 2 500 K (temperature) or OBAFGKM (spectral class)										

Recall the position of the Sun on the HR diagram										
Describe stellar evolution: path of a star similar to our Sun on the HR diagram from formation to white dwarf										
Define properties: rapid increase in absolute magnitude of supernovae; composition and density of neutron stars; escape velocity > c for black holes.										
Recall that gamma ray bursts are due to the collapse of supergiant stars to form neutron stars or black holes										
Compare energy output with total energy output of the Sun										
Describe the use of type 1a supernovae as standard candles to determine distances										
Discuss controversy concerning accelerating Universe and dark energy										
Recall the light curve of typical type 1a supernovae										
Recall that supermassive black holes are at the centre of galaxies										
Calculate the radius of the event horizon for a black hole using Schwarzschild radius (R_s), $R_s \approx 2GM/c^2$										
P9.3: Cosmology										
Describe the Doppler effect										
Apply $\Delta f/f = v/c$ and $z = \Delta\lambda/\lambda = -v/c$ for $v << c$ to optical and radio frequencies.										
Complete calculations on binary stars viewed in the plane of orbit										
Describe what galaxies and quasars are										
Define and use Hubble's law										
Use the following equation: $v = Hd$ for red shift										
Make simple interpretations for expansion of universe; estimation of age of universe, assuming H is constant										
Evaluate qualitative data for Big Bang theory including evidence from cosmological microwave background radiation, and relative abundance of H & He										

Define quasars as the most distant measurable objects										
Describe the discovery of quasars as bright radio sources										
Recall that quasars show large optical red shifts; estimation involving distance and power output										
Describe the formation of quasars from active supermassive black holes										
Discuss the difficulties in the direct detection of exoplanets										
Describe how detection techniques will be limited to variation in Doppler shift (radial velocity method) and the transit method										
Recognise a typical light curve										