HSC Physics

Exam Planner

Your guide for exam goal-setting, preparation and success.

CONNECT EDUCATION
An Elevate Education Brand

Subject: Physics

EXAM DATE ....

GOAL ....

Topic: Advanced Mechanics	Do I have it in my notes?	Note-making deadline	Memorising deadline
Analyse the motion of projectiles by resolving the motion into horizontal and vertical components, making the following assumptions:			
– A constant vertical acceleration due to gravity			
– Zero air resistance			
Apply the modelling of projectile motion to quantitatively derive the relationships between the following variables:			
– Initial velocity			
– Launch angle			
– Maximum height			
– Time of flight			
– Final velocity			
– Launch height			
– Horizontal range of the projectile (ACSPH099)			
Conduct a practical investigation to collect primary data in order to validate the relationships derived above.			
Solve problems, create models and make quantitative predictions by applying the equations of motion relationships for uniformly accelerated and constant rectilinear motion			

Conduct investigations to explain and evaluate, for objects executing uniform circular motion, the relationships that exist between:			
– Centripetal force			
– Mass			
– Speed			
– Radius			
Analyse the forces acting on an object executing uniform circular motion in a variety of situations, for example:			
– Cars moving around horizontal circular bends			
– A mass on a string			
– Objects on banked tracks (ACSPH100)			
Solve problems, model and make quantitative predictions about objects executing uniform circular motion in a variety of situations, using the following relationships:			
– $a_c = \frac{v^2}{r}$			
– $v = \frac{2\pi r}{T}$			
– $F_c = \frac{mv^2}{r}$			
– $\omega = \frac{\Delta\theta}{t}$			
Investigate the relationship between the total energy and work done on an object executing uniform circular motion			
Investigate the relationship between the rotation of mechanical systems and the applied torque			
– $\tau = r_{\perp}F = rF\sin\theta$			

Apply qualitatively and quantitatively Newton's Law of Universal Gravitation to:			
– Determine the force of gravity between two objects $F = \frac{GMm}{r^2}$			
– Investigate the factors that affect the gravitational field strength $g = \frac{GM}{r^2}$			
– Predict the gravitational field strength at any point in a gravitational field, including at the surface of a planet (ACSPH094, ACSPH095, ACSPH097)			
Investigate the orbital motion of planets and artificial satellites when applying the relationships between the following quantities:			
– Gravitational force			
– Centripetal force			
– Centripetal acceleration			
– Mass			
– Orbital radius			
– Orbital velocity			
– Orbital period			
Predict quantitatively the orbital properties of planets and satellites in a variety of situations, including near the Earth and geostationary orbits, and relate these to their uses (ACSPH101)			
Investigate the relationship of Kepler's Laws of Planetary Motion to the forces acting on, and the total energy of, planets in circular and non-circular orbits using: (ACSPH101)			
– $V = \frac{2\pi r}{T}$			
– $\frac{r^3}{T^2} = \frac{GM}{4\pi^2}$			

Derive quantitatively and apply the concepts of gravitational force and gravitational potential energy in radial gravitational fields to a variety of situations, including but not limited to:			
– The concept of escape velocity $v_{esc} = \sqrt{\frac{2GM}{r}}$			
– Total potential energy of a planet or satellite in its orbit $U = -\frac{GMm}{2r}$			
– Total energy of a planet or satellite in its orbit $U + K = -\frac{GMm}{r^2}$			
– Energy changes that occur when satellites move between orbits (ACSPH096)			
– Kepler's Laws of Planetary Motion (ACSPH101)			

Topic: Electromagnetism	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Investigate and quantitatively derive and analyse the interaction between charged particles and uniform electric fields, including: (ACSPH083)			
– Electric field between parallel charged plates $E = \frac{V}{d}$			
– Acceleration of charged particles by the electric field $\overrightarrow{F_{net}} = m\vec{a}, \vec{F} = q\vec{E}$			
– Work done on the charge $W = qV, W = qEd,$			
Model qualitatively and quantitatively the trajectories of charged particles in electric fields and compare them with the trajectories of projectiles in a gravitational field			
Analyse the interaction between charged particles and uniform magnetic fields, including: (ACSPH083)			
– Acceleration, perpendicular to the field, of charged particles			
– The force on the charge $F = qv \perp B = qvBsin\theta$			
Compare the interaction of charged particles moving in magnetic fields to:			

Describe the limitation of the wave model of light in explaining experimental results related to the photoelectric effect.			
Interpret electron diffraction patterns as evidence for the wave-like nature of matter			
Distinguish between the diffraction patterns produced by photons and electrons			
Calculate the de Broglie wavelength of matter: $\lambda = \frac{h}{p}$.			
Compare the momentum of photons and of matter of the same wavelength including calculations using: $p = \frac{h}{\lambda}$			
Explain the production of atomic absorption and emission line spectra, including those from metal vapour lamps			
Interpret spectra and calculate the energy of absorbed or emitted photons: $\Delta E = hf$			
Analyse the absorption of photons by atoms, with reference to:			
– The change in energy levels of the atom due to electrons changing state			
– The frequency and wavelength of emitted photons: $E = hf = \frac{hc}{\lambda}$			
Describe the quantised states of the atom with reference to electrons forming standing waves, and explain this as evidence for the dual nature of matter			
Interpret the single photon/electron double slit experiment as evidence for the dual nature of light/matter			
Explain how diffraction from a single slit experiment can be used to illustrate Heisenberg's uncertainty principle			
Explain why classical laws of Physics are not appropriate to model motion at very small scales.			
Compare the production of light in lasers, synchrotrons, LEDs and incandescent lights.			

– The interaction of charged particles with electric fields			
– Other examples of uniform circular motion (ACSPH108)			
Investigate qualitatively and quantitatively the interaction between a current-carrying conductor and a uniform magnetic field $F = lI \perp B = lIBsin\theta$ to establish: (ACSPH080, ACSPH081)			
– Conditions under which the maximum force is produced			
– The relationship between the directions of the force, magnetic field strength and current			
– Conditions under which no force is produced on the conductor			
Conduct a quantitative investigation to demonstrate the interaction between two parallel current-carrying wires			
Analyse the interaction between two parallel current-carrying wires $\frac{F}{l} = \frac{\mu_0}{2\pi}\frac{I_1 I_2}{r}$and determine the relationship between the International System of Units (SI) definition of an ampere and Newton's Third Law of Motion (ACSPH081, ACSPH106)			
Describe how magnetic flux can change, with reference to the relationship $\Phi = B_{\|\|}A = BAcos\theta$ (ACSPH083, ACSPH107, ACSPH109)			
Analyse qualitatively and quantitatively, with reference to energy transfers and transformations, examples of Faraday's Law and Lenz's Law $\varepsilon = -N\frac{\Delta\phi}{\Delta t}$, including but not limited to: (ACSPH081, ACSPH110)			
– The generation of an electromotive force (emf) and evidence for Lenz's Law produced by the relative movement between a magnet, straight conductors, metal plates and solenoids			
– The generation of an emf produced by the relative movement or changes in current in one solenoid in the vicinity of another solenoid			
Analyse quantitatively the operation of ideal transformers through the application of: (ACSPH110)			
– $\frac{V_p}{V_s} = \frac{N_p}{N_s}$			

– $V_p I_p = V_s I_s$			
Evaluate qualitatively the limitations of the ideal transformer model and the strategies used to improve transformer efficiency, including but not limited to:			
– Incomplete flux linkage			
– Resistive heat production and eddy currents			
Analyse applications of step-up and step-down transformers, including but not limited to:			
– The distribution of energy using high-voltage transmission lines			
Investigate the operation of a simple DC motor to analyse:			
– The functions of its components			
– Production of a torque $\tau = nIA \perp B = nIABsin\theta$			
– Effects of back emf (ACSPH108)			
Analyse the operation of simple DC and AC generators and AC induction motors (ACSPH110)			
Relate Lenz's Law to the law of conservation of energy and apply the law of conservation of energy to:			
– DC motors and			
– Magnetic braking			

Topic: The Nature of light	**Do I have it in my notes?**	**Note-making deadline**	**Memorising deadline**
Investigate Maxwell's contribution to the classical theory of electromagnetism, including:			
– Unification of electricity and magnetism			

– Prediction of electromagnetic waves			
– Prediction of velocity (ACSPH113)			
Describe the production and propagation of electromagnetic waves and relate these processes qualitatively to the predictions made by Maxwell's electromagnetic theory (ACSPH112, ACSPH113)			
Conduct investigations of historical and contemporary methods used to determine the speed of light and its current relationship to the measurement of time and distance (ACSPH082)			
Conduct an investigation to examine a variety of spectra produced by discharge tubes, reflected sunlight or incandescent filaments			
Investigate how spectroscopy can be used to provide information about:			
– The identification of elements			
Investigate how the spectra of stars can provide information on:			
– Surface temperature			
– Rotational and translational velocity			
– Density			
– Chemical composition			
Conduct investigations to analyse qualitatively the diffraction of light (ACSPH048, ACSPH076)			
Conduct investigations to analyse quantitatively the interference of light using double slit apparatus and diffraction gratings $d sin\theta = m\lambda$ (ACSPH116, ACSPH117, ACSPH140)			
Analyse the experimental evidence that supported the models of light that were proposed by Newton and Huygens (ACSPH050, ACSPH118, ACSPH123)			

Conduct investigations quantitatively using the relationship of Malus' Law $I = I_{max} \cos^2 \theta$ for plane polarisation of light, to evaluate the significance of polarisation in developing a model for light (ACSPH050, ACSPH076, ACSPH120)			
Analyse the experimental evidence gathered about black body radiation, including Wien's Law related to Planck's contribution to a changed model of light (ACSPH137)			
– $\lambda_{max} = \frac{b}{T}$			
Investigate the evidence from photoelectric effect investigations that demonstrated inconsistency with the wave model for light (ACSPH087, ACSPH123, ACSPH137)			
Analyse the photoelectric effect $K_{max} = hf - \phi$ as it occurs in metallic elements by applying the law of conservation of energy and the photon model of light, (ACSPH119)			
Analyse and evaluate the evidence confirming or denying Einstein's two postulates:			
– The speed of light in a vacuum is an absolute constant			
– All inertial frames of reference are equivalent (ACSPH131)			
Investigate the evidence, from Einstein's thought experiments and subsequent experimental validation, for time dilation $t = \frac{t_0}{\sqrt{\left(1-\frac{v^2}{c^2}\right)}}$ and length contraction $l = l_0\sqrt{\left(1 - {v^2}/{c^2}\right)}$, and analyse quantitatively situations in which these are observed, for example:			
– Observations of cosmic-origin muons at the Earth's surface			
– Atomic clocks (Hafele–Keating experiment)			
– Evidence from particle accelerators			
– Evidence from cosmological studies			
Describe the consequences and applications of relativistic momentum with reference to:			
– $p_v = \frac{m_0 v}{\sqrt{\left(\frac{v^2}{1-c^2}\right)}}$			

– The limitation on the maximum velocity of a particle imposed by special relativity (ACSPH133)			
Use Einstein's mass–energy equivalence relationship $E = mc^2$ to calculate the energy released by processes in which mass is converted to energy, for example: (ACSPH134)			
– Production of energy by the sun			
– Particle–antiparticle interactions, eg positron–electron annihilation			
– Combustion of conventional fuel			

Topic: From the Universe to the Atom	Do I have it in my notes?	Note-making deadline	Memorising deadline
Investigate the processes that led to the transformation of radiation into matter that followed the 'Big Bang'			
Investigate the evidence that led to the discovery of the expansion of the Universe by Hubble (ACSPH138)			
Analyse and apply Einstein's description of the equivalence of energy and mass and relate this to the nuclear reactions that occur in stars (ACSPH031)			
Account for the production of emission and absorption spectra and compare these with a continuous black body spectrum (ACSPH137)			
Investigate the key features of stellar spectra and describe how these are used to classify stars			
Investigate the Hertzsprung-Russell diagram and how it can be used to determine the following about a star:			
– Characteristics and evolutionary stage			
– Surface temperature			
– Colour			
– Luminosity			

Investigate the types of nucleosynthesis reactions involved in Main Sequence and Post-Main Sequence stars, including but not limited to:			
– Proton–proton chain			
– CNO (carbon-nitrogen-oxygen) cycle			
Investigate, assess and model the experimental evidence supporting the existence and properties of the electron, including:			
– Early experiments examining the nature of cathode rays			
– Thomson's charge-to-mass experiment			
– Millikan's oil drop experiment (ACSPH026)			
Investigate, assess and model the experimental evidence supporting the nuclear model of the atom, including:			
– The Geiger-Marsden experiment			
– Rutherford's atomic model			
– Chadwick's discovery of the neutron (ACSPH026)			
Assess the limitations of the Rutherford and Bohr atomic models			
Investigate the line emission spectra to examine the Balmer series in hydrogen (ACSPH138)			
Relate qualitatively and quantitatively the quantised energy levels of the hydrogen atom and the law of conservation of energy to the line emission spectrum of hydrogen using:			
– $E = hf$			
– $E = \frac{hc}{\lambda}$			
– $\frac{1}{\lambda} = R\left[\frac{1}{n_f^2} - \frac{1}{n_i^2}\right]$(ACSPH136)			

Investigate de Broglie's matter waves, and the experimental evidence that developed the following formula:			
– $\lambda = \frac{h}{mv}$ (ACSPH140)			
Analyse the contribution of Schrödinger to the current model of the atom			
Analyse the spontaneous decay of unstable nuclei, and the properties of the alpha, beta and gamma radiation emitted (ACSPH028, ACSPH030)			
Examine the model of half-life in radioactive decay and make quantitative predictions about the activity or amount of a radioactive sample using the following relationships:			
– $N_t = N_0 e^{-\lambda t}$			
– $\lambda = \frac{ln\ 2}{t^1/_2}$			
Where Nt= number of particles at time t, N0= number of particles present at t=0, λ= decay constant, $t_{1/2}$ = time for half the radioactive amount to decay (ACSPH029)			
Model and explain the process of nuclear fission, including the concepts of controlled and uncontrolled chain reactions, and account for the release of energy in the process (ACSPH033, ACSPH034)			
Analyse relationships that represent conservation of mass-energy in spontaneous and artificial nuclear transmutations, including alpha decay, beta decay, nuclear fission and nuclear fusion (ACSPH032)			
Account for the release of energy in the process of nuclear fusion (ACSPH035, ACSPH036)			
Predict quantitatively the energy released in nuclear decays or transmutations, including nuclear fission and nuclear fusion, by applying: (ACSPH031, ACSPH035, ACSPH036)			
– The law of conservation of energy			
– Mass defect			
– Binding energy			

Topic: Practical investigation	Do I have it in my notes?	Note-making deadline	Memorising deadline
Independent, dependent and controlled variables			
The Physics concepts specific to the investigation and their significance, including definitions of key terms, and Physics representations			
The characteristics of scientific research methodologies and techniques of primary qualitative and quantitative data collection relevant to the selected investigation, including experiments (gravity, magnetism, electricity, Newton's laws of motion, waves) and/or the construction and evaluation of a device; precision, accuracy, reliability and validity of data; and the identification of, and distinction between, uncertainty and error			
Identification and application of relevant health and safety guidelines			
Methods of organising, analysing and evaluating primary data to identify patterns and relationships including sources of uncertainty and error, and limitations of data and methodologies			
Models and theories, and their use in organising and understanding observed phenomena and Physics concepts including their limitations			
The nature of evidence that supports or refutes a hypothesis, model or theory			
The key findings of the selected investigation and their relationship to concepts associated with waves, fields and/or motion			
The conventions of scientific report writing and scientific poster presentation, including Physics terminology and representations, symbols, equations and formulas, units of measurement, significant figures, standard abbreviations and acknowledgment of references.			

– Einstein's mass–energy equivalence relationship $E=mc^2$			
Analyse the evidence that suggests:			
– That protons and neutrons are not fundamental particles			
– The existence of subatomic particles other than protons, neutrons and electrons			
Investigate the Standard Model of matter, including:			
– Quarks, and the quark composition hadrons			
– Leptons			
– Fundamental forces (ACSPH141, ACSPH142)			
Investigate the operation and role of particle accelerators in obtaining evidence that tests and/or validates aspects of theories, including the Standard Model of matter (ACSPH120, ACSPH121, ACSPH122, ACSPH146)			

Practice Schedule

PRACTICE EXAM	DEADLINE
Practice Exam 1	
Practice Exam 2	
Practice Exam 3	
Practice Exam 4	
Practice Exam 5	
EXAM DATE:	

Congratulations!

You're ready! Now relax and think about how good it will feel leaving the exam room knowing the hard work has paid off. Congratulations and good luck (not that you need it)!

CONNECT
EDUCATION
An Elevate Education Brand

www.connecteducation.education

hello@connecteducation.com.au

1300 667 945