Year 12 Physics ATAR

Course and Assessment Outlines

# Term One

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| Week | Syllabus Content | Assessment |
| 1 A | *Term commences on Wednesday.*   * the movement of free-falling bodies in Earth’s gravitational field is predictable * all objects with mass attract one another with a gravitational force; the magnitude of this force can be calculated using Newton’s Law of Universal Gravitation   This includes applying the relationship: |  |
| 2 B | * objects with mass produce a gravitational field in the space that surrounds them; field theory attributes the gravitational force on an object to the presence of a gravitational field   This includes applying the relationship:     * when a mass moves or is moved from one point to another in a gravitational field and its potential energy changes, work is done on the mass by the field   This includes applying the relationships: |  |
| 3 A | * gravitational field strength is defined as the net force per unit mass at a particular point in the field   This includes applying the relationships:     * the vector nature of the gravitational force can be used to analyse motion on inclined planes by considering the components of the gravitational force (that is, weight) parallel and perpendicular to the plane   ***Wednesday: Interhouse Swimming Carnival*** |  |
| 4 B | * projectile motion can be analysed quantitatively by treating the horizontal and vertical components of the motion independently   This includes applying the relationships: |  |
| 5 A | * when an object experiences a net force of constant magnitude perpendicular to its velocity, it will undergo uniform circular motion, including circular motion on a horizontal plane and around a banked track, and vertical circular motion   This includes applying the relationships:  ***Tuesday (3.30- 7pm) Three way conferences 11 and 12***  ***Friday – Pupil Free Day 3- way conferences*** |  |
| 6 B | ***Monday – Labor Day***   * Newton’s Law of Universal Gravitation is used to explain Kepler’s laws of planetary motion and to describe the motion of planets and other satellites, modelled as uniform circular motion   This includes deriving and applying the relationship:     * (SHE)Artificial satellites are used for communication, navigation, remote-sensing and research. Their orbits and uses are classified by altitude (low, medium or high Earth orbits) and by inclination (equatorial, polar and sun-synchronous orbits). Communication via satellite is now used for global positioning systems (GPS), satellite phones and television. Navigation services support management and monitoring of traffic and aircraft movement. Geographic information science uses data from satellites to monitor population movement, biodiversity and ocean currents. | **Task 1, investigation** Circular motion |
| 7 A | * when an object experiences a net force at a distance from a pivot and at an angle to the lever arm, it will experience a torque or moment about that point   This includes applying the relationship:  *τ = rF* sin*θ* where *θ* = angle between the force *F* and the lever arm   * for a rigid body to be in equilibrium, the sum of the forces and the sum of the moments must be zero   This includes applying the relationships: |  |
| 8 B | * electrostatically charged objects exert a force upon one another; the magnitude of this force can be calculated using Coulomb’s Law   This includes applying the relationship:     * point charges and charged objects produce an electric field in the space that surrounds them; field theory attributes the electrostatic force on a point charge or charged body to the presence of an electric field |  |
| 9 A | * a positively charged body placed in an electric field will experience a force in the direction of the field; the strength of the electric field is defined as the force per unit charge   This includes applying the relationship:   * when a charged body moves or is moved from one point to another in an electric field and its potential energy changes, work is done on the charge by the field   This includes applying the relationship: | **Task 2, topic test**:  **Motion and Gravity** |

# Term Two

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| Week | Syllabus Content | Assessment |
| 1A | ***Students commence on Tuesday***.   * the direction of conventional current is that in which the flow of positive charges takes place, while the electron flow is in the opposite direction * current-carrying wires are surrounded by magnetic fields; these fields are utilised in solenoids and electromagnets * the strength of the magnetic field produced by a current is a measure of the magnetic flux density   This includes applying the relationship: |  |
| 2 B | * magnets, magnetic materials, moving charges and current-carrying wires experience a force in a magnetic field when they cut flux lines; this force is utilised in DC electric motors and particle accelerators   This includes applying the relationships:  *F = qvB* sin*θ* where *θ* = angle between the field *B* and the velocity *v*  *F = IℓB* sin*θ* where *θ* = angle between the field *B* and the conductor length *ℓ*   * the force due to a current in a magnetic field in a DC electric motor produces a torque on the coil in the motor.   This includes applying the relationship:  *τ = rF* sin*θ* where *θ* = angle between the force *F* and the lever arm.  ***Thursday: Anzac Day*** |  |
| 3 A | ***Senior School Production***   * an induced emf is produced by the relative motion of a straight conductor in a magnetic field when the conductor cuts flux lines   This includes applying the relationship:  induced emf:  magnetic flux is defined in terms of magnetic flux density and area  This includes applying the relationship:  *Φ = BA*⊥ where *A* = area perpendicular to the field *B* | **Task 4, Inquiry**: Evaluation Unit 3 |
| 4 B | * a changing magnetic flux induces a potential difference; this process of electromagnetic induction is used in step-up and step-down transformers, DC and AC generators   This includes applying the relationships:  where *A* = area perpendicular to the field *B*  AC generator emfmax:       * conservation of energy, expressed as Lenz’s Law of electromagnetic induction, is used to determine the direction of induced current   (SHE) Electromagnetism is utilised in a range of technological applications, including:   * DC electric motor with commutator, and back emf * AC and DC generators * transformers * regenerative braking * induction hotplates * large scale AC power distribution systems. |  |
| 5 A | REVISION SEMESTER 1 EXAMS | **TASK 3: Topic test:** Electromagnetism |
| 6 B | **SEMESTER 1 EXAMS** | **Task 4: exam:**  Semester 1 exams- Unit 3 content |
| 7 B | **SEMESTER 1 EXAMS**  ***Friday – Student Free Day*** |
| 8 A | ***Monday – WA Day***   * light exhibits many wave properties; however, it cannot only be modelled as a mechanical wave because it can travel through a vacuum. * a wave model explains a wide range of light-related phenomena, including reflection, refraction, dispersion, diffraction and interference, such as in Young’s double-slit experiment. A transverse wave model is required to explain polarisation. |  |
| 9 B | * electromagnetic waves are transverse waves made up of mutually perpendicular, oscillating electric and magnetic fields * oscillating charges produce electromagnetic waves of the same frequency as the oscillation; electromagnetic waves cause charges to oscillate at the frequency of the wave * atomic phenomena and the interaction of light with matter indicate that states of matter and energy are quantised into discrete values   ***Thursday and Friday – Year 12 Retreat*** |  |
| 10 A | * on the atomic level, electromagnetic radiation is emitted or absorbed in discrete packets called photons. The energy of a photon is proportional to its frequency. The constant of proportionality, Planck’s constant, can be determined experimentally using the photoelectric effect and the threshold voltage of coloured LEDs   This includes applying the relationships:     * black body radiation and the photoelectric effect are explained using the concept of light quanta   ***Student Free Day***  ***Friday – 3-Way Conferences*** |  |

Term Three

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| Week | Syllabus Content | Assessment |
| 1 A | * atoms of an element emit and absorb specific wavelengths of light that are unique to that element; this is the basis of spectral analysis   This includes applying the relationships:     * the Bohr model of the hydrogen atom integrates light quanta and atomic energy states to explain the specific wavelengths in the hydrogen spectrum and in the spectra of other simple atoms; this model enables line spectra to be correlated with atomic energy-level diagrams and explains the phenomenon of fluorescence and phosphorescence. * on the atomic level, energy and matter exhibit the characteristics of both waves and particles. Young’s double-slit experiment is explained with a wave model but produces the same interference and diffraction patterns when one photon at a time or one electron at a time is passed through the slits (SHE)   This includes applying the relationship: |  |
| 2 B | * The use of devices developed from the application of quantum physics, including the laser and photovoltaic cells, have significantly changed many aspects of society.(SHE) * observations of objects travelling at very high speeds cannot be explained by Newtonian physics. These include the dilated half-life of high-speed muons created in the upper atmosphere, and the momentum of high-speed particles in particle accelerators. * Research studies of cosmic rays show that interactions between cosmic rays and the upper atmosphere produce muons. These particles have a lifetime of about two microseconds and should have ceased to exist before reaching the surface of the Earth. However, because they are travelling near the speed of light, the time dilation effect allows them to complete their journey. Continuing research in the field of high-energy physics is important for improving our understanding of our world and its origins. (SHE) * Einstein’s special theory of relativity predicts significantly different results to those of Newtonian physics for velocities approaching the speed of light | **Task 5, investigation:** Planck’s constant |
| 3 A | * the special theory of relativity is based on two postulates: that the speed of light in a vacuum is an absolute constant, and that all inertial reference frames are equivalent. * motion can only be measured relative to an observer; length and time are relative quantities that depend on the observer’s frame of reference.   This includes applying the relationships: |  |
| 4 B | * relativistic momentum increases at high relative speed and prevents an object from reaching the speed of light   This includes applying the relationship: | **TASK 6: Evaluation and Analysis,** Wave-Particle Duality |
| 5 A | * the concept of mass-energy equivalence emerged from the special theory of relativity and explains the source of the energy produced in nuclear reactions. The mass of an object is constant and independent of its motion   This includes applying the relationship:  ***Friday – Student Free Day*** |  |
| 6 B | ***Monday – Mid Term Break***   * the total energy of a moving object is the sum of the energy due to its mass at rest and kinetic energy   This includes applying the relationships: |  |
| 7 A | * the Big Bang theory explains the expansion of space, which is measured by red shift and is supported by Hubble’s law   This includes applying the relationship:   * the Standard Model is used to describe the evolution of forces and the creation of matter in the Big Bang theory * (SHE)The Big Bang theory describes the early development of the universe, including the formation of subatomic particles from energy and the subsequent formation of atomic nuclei. There is a variety of evidence that supports the Big Bang theory, including Cosmic Background Radiation, the abundance of light elements and the red shift of light from galaxies that obey Hubble’s Law. Alternative theories exist, including the Steady State theory, but the Big Bang theory is the most widely accepted theory today. |  |
| 8 B | * high-energy particle accelerators use electric and magnetic fields to accelerate particles   This includes deriving, understanding, and applying the relationship:     * mass-energy equivalence and the motion of high energy particles in accelerators can be used to test theories of particle physics, including the Standard Model * baryons and mesons are hadrons, which are composite particles made up of quarks |  |
| 9 A | * the Standard Model is based on the premise that all matter in the universe is made up from elementary matter particles called quarks and leptons and their corresponding antiparticles. Fundamental particles interact via the four fundamental forces * the Standard Model explains three of the four fundamental forces (strong, weak and electromagnetic forces) in terms of an exchange of force-carrying particles called gauge bosons; each force is mediated by a different type of gauge boson * lepton number, baryon number and electric charge are quantities that are conserved in all interactions between particles; these conservation laws can be used to support or invalidate proposed reactions |  |
| 10 B | REVISION FOR MOCK EXAMS | **TASK 7: Topic Test:** Relativity, Standard Model and Big Bang |

Term Four

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| Week | Syllabus Content | Assessment |
| 1 B | ***Week 2 of the Holiday and Week 1 Term 4***  Exams; Mock exams Units 3 and 4 | **Task 8:** Semester 2 exams Unit 3 & 4 content |
| 2 A | Exam’s review and revision  Year 12 Valedictory |  |
| 3 B | Final examination break |  |
| 4 A | ATAR Exams (commences on 28 October) |  |
| 5 B | ATAR Exams |  |
| 6 A | ATAR Exams (ends on 15 November) |  |
| 7 B |  |  |
| 8 A |  |  |
| 9 B |  |  |

# Assessment Outline

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| Assessment Component | Assessment Type | Assessment Type Weighting | Assessment Task Weighting | Week Due | Assessment Task |
| Tests | Topic Test | 30 % | 10 % | Term 1, Week 9 | **Task 2:** Gravitational motion, inclined planes, projectile motion and circular motion |
| Topic Test | 30 % | 10 % | Term 2, Week 5 | **Task 3:** Electromagnetism |
| Topic Test | 30 % | 10 % | Term 3, Week 10 | **Task 7:** Special Relativity, Standard Model, and Big Bang |
| Science Inquiry | Investigation | 20 % | 8 % | Term 1, Week 6 | **Task 1:** Circular motion |
| Experiment | 20 % | 6 % | Term 3, Week 2 | **Task 5:** Planck’s constant |
| Evaluation and Analysis | 20 % | 6 % | Term 3, Week 4 | **Task 6: E**valuation and Analysis Wave Particle Duality |
| Examinations | Semester 1 exams | 50 % | 20 % | Term 2, Week 6 & 7 | **Task 4:** Semester 1 exams- Unit 3 content |
| Semester 2 exams | 50 % | 30 % | Week 2 T3 break & Term 4, Week 1 | **Task 8:** Semester 2 exams Unit 3 & 4 content |