Units 3 and 4 Course Planning Day: Starting Points for developing an Assessment Task

Assessment Task A: application of physics concepts to explain a model, theory, device, design or innovation

Unit 3, Outcome 1

Contexts	Assessment Criteria		Task components
	High Level of achievement	**Minimum level of achievement**	
Toys that use motion concepts. Circ: flutterbye fairy, fidget spinners, bey blades Projectiles (nerf gun) Hot Wheels tracks: collisions, GPE to KE, circ motion Springs: wind-up toys	• Sample calculations • Clearly link theory to device and use scientific language • Apply similar principles to similar toys or describe improvements to toy • Compare to other toys	• State observation of use of toy • State theory / energies used but not linked well to device usage	• Identify types of energy used / converted • Describing components of design of device • Documented in a log book

Unit: **3, Outcome: 2.**

Contexts	Assessment Criteria	Task components
Maglev train, Voltmeter, Ammeter, Motors (Series, Shunt and Compound), Loudspeaker, Mass spectrometer, Velocity selector, Dielectric elastomer (Electrical energy to mechanical work), Electric field sensor, Magnetometer, Pulsed electric field (food preservation)	i) What does it do? (Physics terms and their Accurate use) ii) How does it work? (Explanation, Coherence and Completeness) <u>High level of achievement</u> i) sound knowledge and precise description ii) shows deep understanding, successfully collates and analyses relevant information, constructs a logical, thorough of a device. <u>Minimum level of achievement</u> i) little knowledge and limited relevance ii) shows poor understanding, some sense of structure, but incomplete coverage of information and concepts.	Students select or are allocated a device. They use a log-book in class to research it, which can be retained in class. Then with their log-books under SAC conditions: • Describe the purpose of your chosen device, • Explain its operation using relevant physics concepts, units and typical values for quantities, • Hand-draw a labelled diagram to support the explanation, • Acknowledge references.

Unit 3 Outcome 3

Contexts	Assessment Criteria		Task components
	High Level of achievement	**Min level of achievement**	
Transmission of electricity	• Apply Lenz's law to explain why induced current will travel in a particular direction • Explain using Faraday's Law the impact changing each variable has • Identify and explain the positioning and function of step up and step down transformers	• Apply Lenz's law to predict direction of a current • Apply Faraday's law to calculate unknown quantities • Complete calculations regarding transformer output and input	• Explaining the effect of changing number of coils, magnetic field strength • Explain how a transformer works • Looking at the use of transformers in a power distribution grid • Calculations involving coils, voltage and current • Calculations involving power input and output using different transformers • Compare AC and DC transmission and different voltages and currents • Explain the need for the use of inverters

Unit 4, Outcome 1

Contexts	Assessment Criteria		Task components
	High Level of achievement	**Minimum level of achievement**	
Application of relativity to GPS satellites	• Describe what physics aspects in calculating in time and position • Time dilation, laws of motion, Transforms, Twin paradox, Non-accelerating inertial references frames, • How signal is produced, How it is received, How it is calculated • Appropriate use of physics terms • Calculate orbital characteristics	• Some attempt to explain relativity • Changes measurements of time and space • Attempts to use relativity terms	• Heavens above website Heavens-Above • Research relevant data source

Assessment Task B: analysis and evaluation of primary and/or secondary data, including data plotting, identified assumptions or data limitations, and conclusions.

Unit 3 Outcome 1

Contexts	Assessment Criteria		Task components
Evaluation of projectile motion • Launch a projectile consistently • Measure distance, time and ??? height	**High Level of achievement** • Understanding measurement uncertainty • Calculate uncertainty. • Apply accurately Newton's laws • ??? a qualitative calculation of air resistance • Graphically represent Dist vs time with uncertainty bars	**Min level of achievement** • Attempt to do the high level • Results contain inaccuracies	• Experiment with balls and projectiles • Measure variety of balls mass/size • 2 same mass, diff size • 2 same size diff mass • 3 balls in each

Unit 3 Outcome 2

Contexts	Assessment Criteria		Task components
Analysing $F_g = GMm/r^2$ (secondary data) Plotting F_g vs $1/r^2$ and finding G, using gradient and comparing to G	**High Level of achievement** • Able to interpret the data provided • Organised data in useful including tables / graphs • Identifies data limitations • Compare values to theoretical data	**Min level of achievement** • Manipulate data • Complete a table in some meaningful way • Some use of significant figures	• Give them data (mass values and r values) • Use data to answer questions

Unit: **3, Outcome: 3.**

<table>
<tr><th rowspan="2">Contexts</th><th colspan="2">Assessment Criteria</th><th rowspan="2">Task components</th></tr>
<tr><th>High Level of achievement</th><th>Minimum level of achievement</th></tr>
<tr><td>Induced emf in a coil.
(Using secondary data)</td><td>Able to explain the purpose of the investigation.
Able to interpret the data provided.
Able to do appropriate calculations.
systematically collated data, appropriate to the investigation.
organised and presented data in useful and meaningful ways, including tables and graphs.
Able to analyse the information from the graph.
Able to evaluate the data and draw relevant inferences.
Identifies data limitations.
used appropriate numbers of significant figures throughout.</td><td>Can identify the purpose of the investigation.
Can identify the data that is relevant.
Able to do some of the calculation and manipulation of the data.
Limited attempt to collate data
Attempts to construct a graphical representation of the data.
Limited attempt to analyse the data.
Attempted to present data in a meaningful way.
Occasionally used appropriate numbers of significant figures</td><td>Investigate the magnitude of the emf produced in a solenoid when dropping a permanent magnet through it. Vary the initial height or strength of the falling magnet.
Identify the purpose of the task.
Explain the theory underpinning the investigation.
Select appropriate data and organise it in a meaningful way.
Interpret the data and relate this to the purpose of the task.
Comment on any limitations of the data.</td></tr>
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Unit 4 Outcome 1

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<tr><th>High Level of achievement</th><th>Min level of achievement</th></tr>
<tr><td>PE Effect investigation at Synchrotron</td><td>Proper calculation of Planck's Constant, threshold frequency and work function including uncertainties from measured data
comparison of two models for light and
limitations of wave model</td><td>Do all calculations but not evaluating uncertainties and not explaining limitation of light model</td><td>Excursion to Synchrotron
Analysing data</td></tr>
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Assessment Task C: problem-solving, applying physics concepts and skills to real-world contexts

Unit: 3, Outcome: 1

Contexts	Assessment Criteria		Task components
	High level of achievement	**Minimum level of achievement**	
Luna Park rides	• Able to explain the sources of the forces on the passenger, their effect and why any may vary. • Able to draw a force diagram. • Able to calculate the value of the forces, given speed and radius. • Able to convert energy changes between GPE and KE at different parts of the rides. • Can identify the driving mechanism in a ride. • Successfully collates and analyses relevant information, concepts and data to analyse and evaluate this context.	• Can describe the experience using physics terms. • Can identify the forces involved acting on the passenger. • Can describe the energy changes.	• Draw a properly labelled force diagram for the Twin Dragon, Enterprise and Scenic Railway. • Calculate the value of relevant quantities, making reasonable estimates of the values of various parameters and dimensions. • Explain the changes in GPE and KE of and the forces on a passenger during each ride. • Identify potential risks and suggest safety protocols.

Unit: 3, Outcome: 2

Contexts	Assessment Criteria		Task components
How do we decide the content of a mixture of ionised gas?	**High level of achievement**	**Minimum level of achievement**	Mass spectroscopy
	• Able to demonstrate a knowledge of how the device works, • Abel to integrate ideas of E, B and grav fields	• Able to do simple calculations.	• Explanation of what a mass spectrometer is • Accelerate due to E field • Curve due to B field • Give unknown gases and predict their mass from given information

Unit 3, Outcome 3

<table>
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<tr><th>High Level of achievement</th><th>Min level of achievement</th></tr>
<tr>
<td>Energy / power transmission over large distances
Problem:
• How can transformers be used to reduce power loss in long-distance energy transmission?
• What would happen if you changed the conditions? Give examples, e.g. higher voltage</td>
<td>• Correctly calculate power loss with / without transformers using transformer equations
• Correct explanation of purpose of transformers (ratio of turns) and their operations
• Drawing waveforms
• Understanding of voltage loss, power loss</td>
<td>• Identify the appropriate technique for transmission
• Identify how transformers reduce power loss in transmission lines
• Recognise that transformers can step or step down</td>
<td>• Potentially could do experimentally – try different configurations
• Calculating power losses in DC transmission vs AC transmission with transformers
• Operation of transformers
• Explain how to reduce a power loss
• Use of photovoltaic cells – limitation of positioning and DC
• Analyse real world example, e.g. look at household power supply</td>
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Unit: **4**, **Outcome: 1**

Contexts	Assessment Criteria		Task components
	High Level of achievement	**Minimum level of achievement**	
Cosmic ray showers	• Able to explain the limitation of classical physics in explaining this phenomenon. • Able to explain that time dilation (or length contraction) occurs for the particles. • Able to correctly apply mathematical models for time dilation (or length contraction) to the particles. • Can justify why more particles are detected than predicted by classical physics. • Consistently used appropriate physics terminology, representations, and conventions • used clear, coherent and concise expression to communicate.	• Can identify the limitation of classical physics in explaining this phenomenon. • Can identify that time dilation (or length contraction) occurs. • Attempts to apply mathematical models for time dilation (or length contraction), but with limited success. • Attempts to compare classical prediction with experiment results. • Attempted to use appropriate physics terminology. • Occasionally used clear expression to communicate.	Investigate the observational evidence for the special theory of relativity. • Describe both the 'classical and relativistic' physics interpretations of this phenomena. • Identify key differences between the two. • Model the distance travelled by the particles in both a 'classical and relativistic' scenarios. • Explain the real world findings.

Assessment Task D: comparison and evaluation of two solutions to a problem, two explanations of a physics phenomenon or concept, or two methods and/or findings from practical activities.

Unit: **3**, **Outcome: 1**

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<tr><th>High Level of achievement</th><th>Minimum level of achievement</th></tr>
<tr><td>Travelling by vehicle around a corner – banked versus non-banked solutions</td><td>• Correctly apply physics of circular motion to differentiate between the two cases
• Able to quantitatively compare the two cases
• Able to justify the use of banking and any relevant constraints
• Consistently use appropriate terminology and effective representations of physical concepts.
• Select key data and information to compare the two solutions.
• Successfully apply evidence based argument to analyse and evaluate the two solutions.</td><td>• Identify appropriate formulae for modelling the two situations
• Indicate the direction of overall force on a cornering vehicle
• Identify that friction between the tyres and the road enables the car to turn
• Identify that a banked road enables a car to turn with less reliance on friction than a non-banked road, for the same cornering speed.
• Label basic elements of diagrams representing the two solutions
• Identify relevant information needed to compare the two solutions.
• Attempt to use the information to compare the two solutions</td><td>• Describe each method of cornering, including using labelled diagrams identifying forces involved and direction of motion
• Compare relative sizes of relevant forces
• Model effect of speed on the requirements of road surface and wheels
• Evaluate benefits of each method
• Comment on limitations of each solution
• Identify key design parameters in the solution to this problem</td></tr>
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Unit 3 Outcome 2

Contexts	Assessment Criteria		Task components
	High Level of achievement	**Min level of achievement**	
Motors Compare the design of two simple DC motors (e.g. Beakman motor)	• Expand to multiple coils • Describe and explain the components of a DC motor • Analyse uncertainties and error • Systematic comparison • Quantitative comparison of motor speed / strength / power • Demonstration of useful application of motors • Linking physics concepts e.g. polarity and direction of movement • Uses correct terminology consistently	• Identify components of a motor • Draw diagram of fields and forces acting on a motor • Able to explain basic design (label and identify input / output) • Draw field lines • Describe forces	• Investigate the effect of number of loops (or 2 sets of loops) • Collect data / findings • Analyse data • Compare and evaluate designs / impact of number of loops (high / low) • Students construct DC motor in groups – present it to others (Not assessed) • Task written (Q'ns) • Provide photos of two different motors and ask high and low level questions

Unit: 3, Outcome: 3

Contexts	Assessment Criteria		Task Components
	High Level of achievement	**Minimum level of achievement**	
Some appliances require DC power: compare production of DC using a generator versus PV cells	• Correctly apply physics of induction to quantitatively model the power produced by a DC generator • Able to quantitatively compare the DC generator with a PV array • Able to quantitatively and qualitatively justify use of a particular solution for a given scenario • Consistently use appropriate terminology and effective representations of physical concepts. • Select key data and information to compare the two solutions. • Successfully apply evidence based argument to analyse and evaluate the two solutions.	• Can relate power output to product of voltage and current output • Can describe how a generator produces a potential difference • Can relate the strength of the potential difference to properties of the generator such as rotational speed and magnetic field strength. • Label basic elements of a diagram representing the two solutions • Identify relevant information needed to compare the two solutions. • Attempt to use the information to compare the two solutions	• Describe the features of DC power produced by PV cells – current and voltage • Describe the features of DC power produced by DC generator – current and voltage • Compare form and relative sizes of typical currents and voltages • Investigate examples of application of each solution • Justify use of particular type of DC power supply for a given scenario eg measurement of the magnetic field around a current carrying wire

Unit 4 Outcome 1

Contexts	Assessment Criteria		Task components
	High Level of achievement	**Min level of achievement**	
The nature of light - wave-particle duality	• Explain three aspects of an experiment that supports light as a wave. • Explain three aspects of an experiment that supports light as a particle. • Complete calculations to give quantified comparisons between light as waves and matter.	• Explain one aspect of an experiment that supports light as a wave. • Explain one aspect of an experiment that supports light as a particle.	• Describe the features of the photoelectric effect. • Explain and analyse the results of Young's double slit experiment. • Calculate respective wavelengths. • Diffraction - single slit. Piece of hair and a laser. Also Toothbrush. • Populate energy of light from emission spectra.
Comparing the properties of light and matter	• Provide evidence of how both light and matter exhibit wave like behaviour and apply this understanding to compare and contrast two sets of data. • Interpret problems to complete multi step calculations.	• Provide evidence of how both light and matter exhibit wave like behaviour. • Complete simple calculations when formulas are provided	• Compare and analyse diffraction images for photons and electrons. • Explain and analyse standing waves. • Calculate wavelengths and momentum.