VCE Physics
Some Possible Practical Activities

Unit 1 How can thermal effects be explained? Thermodynamics

	Practical Activity	Description	Type
1	Phenomena	Introductory practical activity on heating and cooling phenomena to stimulate curiosity and generate context questions for later assessment, for example: i) Dab metho on wrist, ii) Wet thermometer in front of fan, iii) See 'vicphysics.org' for more	Introductory
	1st Law	Calorimeter	Experiment
	Heat Capacity	i) Mixing liquids heated to different temperatures, ii) Adding a heated block to water, iii) Determine the heat capacity of thermos, iv) Use a microwave oven to estimate heat capacity	Experiments
	Latent Heats	i) Add ice to hot water, ii) Use a microwave oven to estimate latent heat	Experiments
	Absolute Zero	Absolute Zero from Volume of Gas vs Temp.	Experiment
2	Energy transfer mechanisms	Keeping it Hot – design, build & test a thermos for a plastic cup of hot water from Reverse Art Truck materials.	Investigation
	EM Spectrum	Spectra from an incandescent light globe as the voltage increases	Class exercise
	Thermal radiation	Applets on Wien's law and Stefan-Boltzmann Law	IT
	Energy balance	Simulation of energy flow in the atmosphere	Spreadsheet

Unit 1 What is Matter? Cosmology and Nuclear Physics

	Practical Activity	Description	Type
1	Properties of radiation	Show the range of alpha, beta and gamma radiation	Demonstration
2	Half life	Simulation with dice	Experiment
3	Half life	Measurement of a short lived radioisotope, e.g Protactinium, Caesium 137	Class exercise / experiment
4	Radioactive Decay	Simulation of radioactive decay	Spreadsheet

Unit 1 How do electric circuits work? Electricity

	Practical Activity	Description	Type
1	Potential difference	Measure and graph voltage drops around a simple circuit of a battery and two resistors across connecting wires, resistors and the battery	Experiment
2	Ohm's Law	Measure and graph the voltage across the and current through a resistor	Experiment
3	Resistors in series	Measure and graph the voltages across each of two resistor in series, as well as the voltage across the combination for various current values	Experiment
4	Resistors in parallel	Measure and graph currents through each of two resistor in parallel, as well as the current through the combination for various voltage values	Experiment

5	Non-ohmic resistor	Measure and graph the voltage across and the current through a 12 V light globe as the voltage is increased.	Experiment
6	Diode	Measure and graph the voltage across and the current through a diode as the voltage is increased in both orientations	Experiment
7	LDR, Thermistor	Measure and graph the voltage across and the current through an LDR or a thermistor as the voltage is increased.	Experiment
8	Voltage divider	Measure output voltage as thermistor is heated.	Experiment
9	Household wiring	Investigate a 'Wiring in a House Demonstration Board'	Experiment
10	Internal resistance	Measure and graph the voltage across and the current through an old battery under a variety of resistive loads	Experiment
11	Photovoltaic panel	Measure the voltage output and current from a PV panel under a variety of resistive load and light conditions.	Experiment
12	Dissection of an electrical device	Dissect an electrical appliance such as a heater, dryer, iron, etc Note: the power cord should be c	Exercise

These can be packaged as a booklet of activities that students can work through at their own pace.

Unit 2 How can motion be described and explained? **Motion**

	Practical Activity	Description	Type
1	Accelerated motion	Record position vs time of a glider on an inclined air track and generate displacement and velocity vs time graphs	Experiment
2	Complex motions	Use a motion detector to describe actions such as walking. Use video analysis to investigate movement in athletics.	Class exercise Experiment
3	Motion under gravity	Drop a quadratic string, a string with pendulum bobs at distances so that they hit the ground at equal time intervals. Drop 0.5kg and 5kg masses at same time on to foam. Use ultrasound motion detector to display the motion of a bouncing basketball.	Demonstrations
4	Reaction force	Use bathroom scales to investigate the reaction force when standing, leaning or in a lift.	Class exercise
5	Combining forces	Use a Forces table to show vector addition of forces and also components of forces Use a Newton's cart on front bench to show force components.	Class exercise Demonstration
6	Newton's 2nd law	Record position vs time of a glider on a level air track accelerated by a falling mass. Investigate acceleration for a range of values of falling masses and total mass moved. Use a Newton's cart on front bench to investigate how acceleration depends on mass for a constant force.	Experiment Demonstration

7	Hooke's Law	Measure, graph and analyse the extension of a spring produced by various masses.	Experiment
8	Energy transfer and transformations	Measure drop and rebound height of a rubber ball. (GPE, efficiency, KE) Time 10 lifts of a 2.0 kg mass from shoulder level (GPE, Power) Time the run up a flight of stairs (GPE, Power) Measure time and distance of a loaded trolley rolling down a slope (GPE, KE) Time the drop of balls of different densities from roof height (GPE, KE, air resistance) * These can be done as a round robin of short activities	Experiment
9	Momentum in collisions	Measure speeds of air track gliders before and after impact to investigate conservation of momentum. Newton's Cradle	Class exercise Demonstration

Experimental investigations

The sporting impacts of a ball with a bat
The motion of a bungee jumper
The friction of running shoes
The performance of a parachute
The motion of weightlifting
The energy of magnetic collisions
The bounce of a basketball
The motion and energy transfer of a mechanical wind up toy
The physics of walking
The physics of a sprint start
The bounce in track shoes
Kicking a football
Design of car bumper
Shock absorbers
Energy of a catapult

Unit 2 Option 2.1 : What are stars?
Unit 2 Option 2.2: Is there life beyond the Earth's Solar System?

	Practical Activity	Description	Type
1	Solar observation	Observe changes in the sun, note safety concern.	Class exercise / homework
2	Spectral analysis	Observe spectral lines in chemical samples.	Experiment
3	Doppler shift	Show Doppler shift with sound by analogy.	Demonstration

Experimental Investigations

Sunspot activity
Online telescope observations
Spectral analysis of an incandescent lamp
Search for Pulsars through Parkes
Stellar image analysis programs

Unit 2: Option 2.3 : How do forces act on the human body?

	Practical Activity	Description	Type
1	Centre of Mass	Determine the position of the centre of mass of various objects from hammers to humans by various methods	Experiment
2	Compression, tension and shear	Use a range of everyday objects to demonstrate effects of compression, tension and shear. Investigate how the behaviour of living tissue under load compares with common building materials, including wood and metals	Demonstration Experiment
3	Young's modulus	Stretch copper wire to fracture	Experiment

Experimental Investigations

Bending of a beam
Bending of a cantilever
The creep of rubber
Properties of glued joints
Effect of reinforcing
Strength of human hair
Effect of heat treatment on metals and materials

Unit 2 Option 2.4: How can AC electricity charge a DC device?

	Practical Activity	Description	Type
1	Use of a multimeter	Measure and compare AC and DC voltages of a power pack. Measure resistance of several resistors.	Experiment
2	Use of a CRO	Measure voltages of a battery. Measure AC voltages and compare with those of a multimeter.	Experiment
3	Properties of diodes	Measure the forward and reverse bias with simple circuit to give the voltage current characteristics of a diode.	Experiment
4	Rectifier	Use diodes to construct and use both a half wave and full wave rectifier.	Experiment
5	Capacitor	Investigate the charging and discharging of a capacitor, and its use in smoothing AC.	Experiment
6	Voltage regulators	Construct and use a circuit to demonstrate the characteristics of a voltage regulator.	Experiment
7	AC to DC power supply	Construct an AC to DC power supply, use meters and a CRO to diagnose faults, and once working, evaluate its performance, then investigate the effect on the ripple voltage of changing various parameters of the circuit.	Experiment

Experimental Investigations

Frequency response of an AC to DC power supply

Efficiency of an AC to DC power supply

Unit 2 Option 2.5 : How do heavy things fly?

	Practical Activity	Description	Type
1	Measuring lift and drag	Use top loading balances to measure the lift and drag on an aerofoil.	Investigation
2	Bernoulli effect	Place a table tennis ball in an air stream from an air track hose.	Demonstration
3	Propeller thrust	Use a top loading balance to measure thrust from a propeller attached to a DC motor for different values of supply voltage	Investigation

Experimental Investigations

Aerofoil design

Wind problems around buildings

Drag of objects in water

The drop in pressure with fast flow

The drag on spheres and other shapes

When does water flow become turbulent?

Unit 3 Option 2.8 : How to particle accelerators work?

	Practical Activity	Description	Type
1	Electrons in Electric and Magnetic Fields	Use a magnet to deflect an electron beam in a Maltese Cross tube, a paddle wheel tube, a deflection tube and a CRO.	Demonstration
2	Modelling Synchrotron radiation with a laser	Use a laser beam to produce diffraction patterns with fibres of different sizes, two dimensional meshes and gauzes and between two bolts.	Demonstration or class exercise
5	Two Dimensional Diffraction Effects with Microwave apparatus	Model X-ray diffraction through a crystal with microwave diffraction through an array of thumb tacks	Demonstration
6	Modelling X-ray interference in a crystal with microwaves	Model the interference of X-rays from different crystal layers with microwaves reflected from two rows of coins	Demonstration

Unit 2 Option 2.9: How can human vision be enhanced?

	Practical Activity	Description	Type
1	Introductory activity	A series of short exercises on the properties of light that can be done over about two periods, which can be used to generate a set of questions which the study of light will provide answers. See Vicphysics.org for activities and questions	Observation exercise
2	Reflection of Light in a plane mirror	Use a plane mirror to investigate the behaviour of light.	Experiment
3	Reflection of Light in a concave mirror	Use a concave mirror to investigate the behaviour of light.	Experiment
4	Refraction of Light	Use semicircular plastic dish and glass or perspex rectangular blocks to investigate Snell's law	Experiment
5	Refraction of Light in a convex lens	Use a convex lens to investigate the behaviour of light	Experiment
6	Refraction of light in the eye	Remove the optic nerve from a bull's eye, wrap the eye in clear wrap, then view the world from the back. Remove the lens, place on a glass slide and put over text	Demonstrations
7	Optical devices	Investigate the optical properties microscopes, telescopes and spectacles	Investigation

Experimental Investigations

The sensitivity of the eye	Depth of focus of a microscope	Moire fringes
	Caustic curves	Fresnel lenses

Unit 2 Option 2.10: How do instruments make music?

	Practical Activity	Description	Type
1	Types of waves	Use a slinky to demonstrate transverse and longitudinal waves.	Demonstration
2	Samples of sound waves	Use a signal generator and a loudspeaker to produce a range of frequencies and to illustrate human frequency response.	Demonstration
3	Speed of Sound	Use stop watches to measure speed of sound by echo method.	Class Exercise
4	Intensity & Intensity Level	Use a dB meter to measure a variety of sounds.	Class Exercise
5	Reflection of waves	Use a slinky to show reflection of transverse and longitudinal pulses at fixed and free ends.	Demonstration
6	Superposition of waves	Use a slinky to show the superposition of transverse pulses.	Demonstration
7	Standing waves in air	Observe nodes formed between a speaker and a reflections from a hard barrier. Alternative equipment: Sound machine	Demonstration
8	Standing waves in air	Observe sound in a large diameter long plastic tube over a Meeker burner	Demonstration
9	Standing waves in strings	Attach a weighted string to a ticker timer	Demonstration / experiment
10	Standing waves in springs	Use a slinky to show harmonics in stretched spring	Demonstration
11	Standing waves in blades	Vibrate together 3 hacksaw blades of different lengths	Demonstration
12	Standing waves in rods	Hit rods end on while holding at a node	Demonstration
13	Standing waves in air	Observe resonance with tuning forks above a variable length air column.	Experiment
14	Standing waves in air	Blow into the adjustable wooden organ pipe	Demonstration
15	Harmonics	Conduct a frequency analysis of various instruments	Investigation
16	Beats	Use two frequency sources to produce beats and show on a CRO	Demonstration

Unit 2 Option 2.11: How can performance in ball sports be improved?

	Practical Activity	Description	Type
1	Coefficient of restitution	How does the coefficient of restitution vary with ball type, impact surface and speed of impact?	Investigation
2	Friction	Transition from sliding to rolling	Investigation
3	Double pendulum	Tracker analysis of a gold swing	Investigation
4	Drag	Tracker analysis of a falling object	Investigation
5	Magnus effect	Motion of a Magnus glider	Investigation

Experimental Investigations See under Motion above.

Unit 3: How fast can things go? Motion in one and two dimensions

	Practical Activity	Description	Type
1	Circular motion	Investigate how the centripetal acceleration of a revolving rubber stopper, as measured by the number of washers on the end of the line, is affected by changes in radius and frequency. Investigate how the centripetal acceleration of a passenger in a Luna Park ride is related to the dimensions and speed of the ride.	Experiment Excursion
2	Projectile motion	Use ballistics car to demonstrate components. Investigate range, maximum height and time of flight for a range of angles and initial speed	Demonstration Experiment
3	Changes in Potential energy	Use a dropped mass attached to a spring to investigate the transformation of energy between gravitational potential energy, spring potential energy and kinetic energy. Investigate the energy transformation in a Luna park ride.	Experiment Excursion
4	Momentum and kinetic energy in collisions	Measure speeds of air track gliders before and after impact to investigate conservation of momentum and the elasticity of the collision. Newton's Cradle	Class exercise Demonstration
5	Reaction force	Use bathroom scales to investigate the reaction force when standing, leaning against a wall or in a lift. Investigate how the centripetal acceleration of a passenger in a Luna Park ride and determine the value of the reaction force.	Class exercise Excursion

Unit 3: How do things move without contact? Fields

	Practical Activity	Description	Type
1	Satellite motion	Analysis of the Moons of the Solar System	Spreadsheet
2	Coulomb's Law	Dependence of electric force on charge and separation	Experiment
3	Electric Field	Plotting of electric field of various configurations Electric fields in a wire	Experiment Experiment
4	Properties of magnets	Investigate Force between magnets Investigate magnetic field of bar and horseshoe magnets	Demonstration or Class Exercise
5	Oersted's Experiment	Show magnetic effect of an electric current in magnetic field	Demonstration
6	Left Hand Rule	Show magnetic force on current loop Show movement of Al rod on rails with horseshoe magnet Show slow oscillation of loudspeaker cone	Demonstration Demonstration Demonstration
7	Magnetic field of Solenoid	Use current balance kit to determine magnetic field of a solenoid	Experiment
8	Turning Effect in a meter	Investigate meter mechanism with small compass	Class Exercise
9	Model DC Motor	Show motor principle with models	Demonstration
10	Dissection of DC Meter	Dissect a small DC motor then reassemble	Class Exercise

Unit 3: How are fields used to move electrical energy? Electromagnetism

	Practical Activity	Description	Type
1	Electromagnetic Induction	Show generation of induced EMF by magnet in solenoid	Demonstration
2	Model Generator	Use a model generator to demonstrate production of AC and DC.	Demonstration
3	Electromagnetic Induction	Investigate Lenz' Law	Formal Experiment
4	Electromagnetic Induction	Drop strong magnet through an Al cylinder	Demonstration
5	Transformer	Show effect of Turns ratio on voltage and current	Demonstration
6	Transmission Lines	Show the effect of transformers on Power loss and voltage drop	Demonstration

Explanation of the operation of a device

AC synchronous motor	Three phase motor	Loudspeakers	Linear motor
DC shunt wound motor	Alternator	Microphone	Telephony
Magnetohydrodynamics	DC Generator	Relays	Homopolar motor
Industrial lifting magnets	Transformer	Particle accelerators	Magnetic damping
DC series wound motor	Transmission line	Mass spectrometer	Analog meter
Three phase generator	Maglev trains	MRI	

Unit 4 How can waves explain the behaviour of light? Wave properties of light

	Practical Activity	Description	Type
1	Introductory activity	A series of short exercises on the properties of light which can be used to generate a set of questions. See vicphysics.org for activities and questions.	Observation exercise
2	Types of waves	Use a slinky to demonstrate transverse waves. Use a ripple tank to demonstrate wave properties	Demonstrations
3	Reflection of Light in a plane mirror	Use a plane mirror to investigate the behaviour of light.	Experiment
4	Reflection of Light in a concave mirror	Use a concave mirror to investigate the behaviour of light.	Experiment
5	Refraction of Light	Use semicircular plastic dish and glass or perspex rectangular blocks to investigate Snell's law	Experiment
6	Refraction of Light in a convex lens	Use a convex lens to investigate the behaviour of light	Experiment
7	Refraction of light in the eye	Remove the optic nerve from a bull's eye, wrap the eye in clear wrap, then look through. Remove the lens, place on a glass slide and use	Demonstrations
8	Total Internal Reflection	Show total internal reflection. Show TIR in optical fibres and light pipes.	Demonstrations
9	Dispersion of Light	Show the colour components of white light. Produce a rainbow with a hose and measure each colour's angle to determine its refractive index.	Demonstration Experiment
10	Polarisation	Rotate one polaroid slide on top of another. Place layers of sellotape between the slides to show colour effects. Place a crystal of Iceland Spar on the OHP, then put a polaroid slide over it.	Demonstrations

Unit 4 How are light and matter similar? **Light and matter**

	Practical Activity	Description	Type
1	Interference and Diffraction of light	Investigate diffraction and interference of light through red and blue filters with slides of double and single slits of varying size	Class Exercise or Experiment
2	Photoelectric Effect	Discharge of electroscope with zinc plate on top with UV light	Demonstration
3	Photoelectric Effect	Investigate the effect of intensity and frequency of light incident on a metal surface on the energy of ejected electrons	Class Exercise
4	Hydrogen Spectrum	Investigate the energy levels of Hydrogen	Class Exercise
5	Energy gap in LEDs	Investigate the triggering voltage for LEDs producing light of different wavelengths	Experiment

Unit 4: Practical Investigation: Possible topics

Motion of a parachute
Motion of a balloon
Forces and energies of a bouncing ball
Sweet spot of a tennis racket
Energy transfer in a pole vault
Motion on a trampoline
Physics of a sprint start
Forces and energies in stretched rubber
The bounce time of a ball

Efficiency of a cycle dynamo
Efficiency of a DC motor

Sellotape and polarised light
Patterns in stressed materials
Double refraction of Iceland spar
Brewster's angle
Fresnel lenses
Optical activity of sodium chlorate
Light scattering and polarised light