AAQ Applied Science Unit 3 Physics
Personal Learning Checklist

A: Understanding waves and optical fibres

Objective A1: Working with waves	Confidence (R/A/G) 1	 2	 3
A1.1 Wave types and features			
• Understand the common features of waves • periodic time • wave speed • wavelength • frequency • amplitude • oscillation			
• graphical and diagrammatic representation of wave features.			
A1.2 Transverse and Longitudinal waves • Identify the similarities and differences between transverse and longitudinal waves			
A1.3 Concepts of; displacement, coherence, path difference, phase difference and superposition of waves as applied to diffraction gratings.			
• emission of different light frequencies due to electron energy level changes within the atom.			
• using diffraction gratings to form line emission spectra			
• using the lines of emission spectra to identify elements in gases.			
A1.4 Wave equation • Using the wave equation: $v = f\lambda$			
A1.5 Concepts and applications of stationary waves and resonance in strings and pipes			
• concepts and applications of stationary waves and resonance to musical instruments.			
• using the equation: speed of a transverse wave on a string, v = √(T/μ) where T is the tension in the string and μ is the mass per unit length of the string			

Objective **A2 Principles of optical fibres**	Confidence (R/A/G) 1	 2	 3
A2.1 Concept of refraction and total internal reflection (TIR)			
• use equations for refractive index $n = \frac{c}{v} = \sin i / \sin r$			
• know that total internal reflection only occurs when the angle of incidence in the more optically dense medium is greater than the critical angle			
• calculate the critical angle at a glass–air interface given the refractive index of glass using: $\sin c = l/n$			
• know how cladding of optical fibres effects the critical angle in the fibre			

A2.2 Applications of optical fibres in engineering, communication, and medicine.			
A2.3 Differences between analogue and digital signals			

Objective **A3: Uses of electromagnetic waves in communication**	Confidence (R/A/G)		
	1	2	3
A3.1 All electromagnetic waves travel at the speed of light in a vacuum.			
A3.2 Use the inverse square law in relation to the intensity of a wave: $I = k/r2$			
A3.3 Regions of electromagnetic spectrum overlap and have different frequencies and wavelengths			
• using electromagnetic waves and frequencies in communication applications, to include: • satellite communication and GPS positioning • mobile phones • Bluetooth© • infrared • Wi-Fi			

B: Forces in transportation and Newtons Laws of Motion

Objective **B1 Measurement and representation of motion**	Confidence (R/A/G)		
	1	2	3
B1.1 Standard SI units			
• standard SI units and symbols for initial velocity (u), final velocity (v), distance and displacement (s), time (t), and acceleration (a). • units of speed: kilometres per second (kms-1), kilometres per hour (kmh-1).			
B1.2 Calculating speed and average speed			
• speed = distance ÷ time • average speed = total distance ÷ total time.			
B1.3 Using vector and scalar quantities to describe motion:			
• using velocity as a vector quantity that has magnitude and direction • using distance as a scalar quantity that has magnitude only • using displacement/time graphs to find velocity • using velocity time graphs to describe the motion of an object • using velocity/time graphs to find the distance travelled from the area beneath the graph • using velocity/time graphs to find acceleration as rate of change of velocity from the gradient of the graph, $a = (v-u)/t$ • find the acceleration of a trolley moving down a gradient • use equations for the calculation of motion: $s = (u + v)t/ 2$ $v = u + at$ $s = ut + ½at^2$			

$v^2 = u^2 + 2as$			
B1.4 Understand the applications of accelerometers, to include: 'fitbits', mobile phones and blood pressure monitors			
B2 Laws of motion			
B2.1 Newton's First Law of Motion – the application of a resultant force to make an object move or stop			
B2.2 Definitions of inertia, mass and weight.			
• inertia as a resistance to change in motion			
• gravitational field strength (g) and weight			
• calculations for weight, equation $W = mg$			
B2.3 Calculation of the coefficient of friction (μ) using the equation: **force $F = \mu\mathrm{N}$ where N is the normal reaction force, the weight of object on a horizontal surface.**			
• measuring coefficient of static friction, where F is the force applied just as the object is about to move • measuring coefficient of dynamic (kinetic) friction, where F is the force applied to keep the object moving at a constant velocity.			
B2.4 Calculating the momentum (p) of objects using the equation $p = m\mathrm{v}$			
B2.5 Using Newton's Second Law of Motion, force is proportional to rate of change of momentum, to include: $F = (m\mathrm{v}-m\mathrm{u})/t$ and $F = m\mathrm{a}$ force is proportional to acceleration for a constant mass			

• calculations using Newtons Second Law
• implications for transportation when travelling at high speed with low mass and low speed with high mass
• use of impact force controls:
  • air bags
  • seat belts
  • helmets for motor bike users
  • passenger 'cells'
  • crumple zones.			

B2.6 Newton's third law of motion action and reaction are equal and opposite			
B2.7 Know that if F is the resultant force on an object, the object accelerates, if the forces are balanced F is zero and the object is moving at a constant velocity or stationary effect of air resistance, drag and terminal velocity in different applications, to include: • vehicles on roads • falling parachutes • objects falling in liquids			

C: Electrical circuits and the transfer of energy

Objective **C1 Use of electrical components**	Confidence (R/A/G)		
	1	2	3
C1.1 Identifying circuit symbols			
C1.2 Defining terminology – current, potential difference, energy and power			
identifying the electrical units of measurement: • current in amps (A) • potential difference in volts (V) • power in watts (W) • energy in joules (J) • resistance in ohms (Ω)			
C1.3 Connecting circuits with cells, batteries, power supplies, lamps, resistors, variable resistors, switches, ammeters and voltmeters.			
• using electrical meters in series and parallel to measure current and potential difference			
• using an ohmmeter to measure the resistance of a component			
C1.4 Using electrical components in circuits: • filament lamps • diodes • thermistors • light dependent resistors (LDR) • photodiodes and light emitting diodes (LED)			

Objective **C2 Equations**	Confidence (R/A/G)		
	1	2	3
C2.1 Using equations for electrical calculations:			
• power = potential difference × current (P = IV) • voltage = current × resistance (V = IR) • power = work done/ time (P = E/t) • energy = potential difference × current × time (E = VIt)			

Objective **C3 Electrical energy usage**	Confidence (R/A/G)		
	1	2	3
C3.1 Relating to different domestic appliances to calculate energy usage.			
C3.2 Relating fuse size to current.			
C3.3 Calculating transferred energy using the equation: Energy transferred = power in kilowatts × time in hours (kWh = kW × h)			

Objective **C4 Energy transfer**	Confidence (R/A/G)		
	1	2	3
C4.1 Defining units – joules (J), kilojoules (kJ), mega joules (MJ)			
C4.2 Converting temperatures between Celsius (°C) and Kelvin (K)			
C4.3 The transfer of energy to give a change of temperature and change of state			
C4.4 Temperature change • measuring specific heat capacity of liquids and solids • using equation: Thermal energy = mass × specific heat capacity × temperature change $\Delta Q = m\ c\ \Delta T$ • unit of measurement of specific heat capacity $J\ kg^{-1}K^{-1}$			

Objective **C5 Change of state**	Confidence (R/A/G)		
	1	2	3
C5.1 Measuring specific latent heat fusion and vapourisation for a liquid			
C5.2 Using the equation: **Thermal energy = mass x specific latent heat. $\Delta Q = m\ L$**			