

Assessment

Assessed with a 1 hour, 60 mark written paper where all questions are answered.

Useful Data

Acceleration of free fall, g 9.81 ms^{-2}

Module 1: Motion

You should be able to...	Unaware of this section	I am aware of this, but need to do more work	I understand this area well
1.1.1 Physical quantities and units			
...explain that some physical quantities consist of a numerical magnitude and a unit.			
... use correctly the named units listed in this specification as appropriate.			
... use correctly the following prefixes and their symbols to indicate decimal sub-multiples or multiples of units: pico (p), nano (n), micro (μ), milli (m), centi (c), kilo (k), mega (M), giga (G), tera (T).			
...make suitable estimates of physical quantities included within this specification.			
1.1.2 Scalars and vectors			
...define <i>scalar</i> and <i>vector</i> quantities and give examples.			
...draw and use a vector triangle to determine the resultant of two coplanar vectors such as displacement, velocity and force.			
...calculate the resultant of two perpendicular vectors such as displacement, velocity and force.			
... resolve a vector such as displacement, velocity and force into two perpendicular components.			
1.1.3 Kinematics			
...define <i>displacement</i> , <i>instantaneous speed</i> , <i>average speed</i> , <i>velocity</i> and <i>acceleration</i> .			
...select and use the relationships $\text{average speed} = \frac{\text{distance}}{\text{time}}$ $\text{acceleration} = \frac{\text{change in velocity}}{\text{time}}$ to solve problems.			
...apply graphical methods to represent displacement, speed, velocity and acceleration.			
...determine velocity from the gradient of a displacement against time graph.			
...determine displacement from the area under a velocity against time graph.			

You should be able to...	Unaware of this section	I am aware of this, but need to do more work	I understand this area well
...determine acceleration from the gradient of a velocity against time graph.			
1.1.4 Linear motion			
...derive the equations of motion for constant acceleration in a straight line from a velocity against time graph.			
<p>.. select and use the equations of motion for constant acceleration in a straight line:</p> $v = u + at$ $s = \frac{1}{2} (u + v) t$ $s = ut + \frac{1}{2} at^2$ $v^2 = u^2 + 2as$			
...apply the equations for constant acceleration in a straight line, including the motion of bodies falling in the Earth's uniform gravitational field without air resistance.			
...explain how experiments carried out by Galileo overturned Aristotle's ideas of motion.			
...describe an experiment to determine the acceleration of free fall g using a falling body.			
...apply the equations of constant acceleration to describe and explain the motion of an object due to a uniform velocity in one direction and a constant acceleration in a perpendicular direction.			

Module 2: Forces in action

You should be able to...	Unaware of this section	I am aware of this, but need to do more work	I understand this area well
1.2.1 Force			
...solve problems using the relationship: net force = mass x acceleration ($F = ma$) appreciating that acceleration and the net force are always in the same direction			
...define the <i>newton</i> .			
...apply the equations for constant acceleration and $F = ma$ to analyse the motion of objects.			
...recall that according to the special theory of relativity, $F = ma$ cannot be used for a particle travelling at very high speeds because its mass increases.			
1.2.2 Non-linear motion			
...explain that an object travelling in a fluid experiences a resistive or a frictional force known as drag.			
...state the factors that affect the magnitude of the drag force.			
...determine the acceleration of an object in the presence of drag			
...state that the <i>weight</i> of an object is the gravitational force acting on the object.			
...select and use the relationship: weight = mass x acceleration of free fall ($W = mg$)			
...describe the motion of bodies falling in a uniform gravitational field with drag.			
...use and explain the term <i>terminal velocity</i> .			
1.2.3 Equilibrium			
...draw and use a triangle of forces to represent the equilibrium of three forces acting at a point in an object.			
...state that the <i>centre of gravity</i> of an object is a point where the entire weight of an object appears to act.			
...describe a simple experiment to determine the centre of gravity of an object.			
...explain that a couple is a pair of forces that tends to produce rotation only.			
...define and apply the <i>torque of a couple</i> .			
...define and apply the <i>moment of force</i> .			
...explain that both the net force and net moment on an extended object in equilibrium is zero.			
...apply the principle of moments to solve problems, including the human forearm.			
...select and use the equation for density: $p = m v$			
...select and use the equation for pressure: $P = F / A$ where F is the force normal to the area A			
1.2.4 Car safety			
...define <i>thinking distance</i> , <i>braking distance</i> and <i>stopping distance</i> .			

You should be able to...	Unaware of this section	I am aware of this, but need to do more work	I understand this area well
...analyse and solve problems using the terms thinking distance, braking distance and stopping distance.			
...describe the factors that affect thinking distance and braking distance.			
...describe and explain how air bags, seat belts and crumple zones in cars reduce impact forces in accidents.			
...describe how air bags work, including the triggering mechanism.			
...describe how the trilateration technique is used in GPS (global positioning system) for cars.			

Module 3: Work and Energy

You should be able to...	Unaware of this section	I am aware of this, but need to do more work	I understand this area well
1.3.1 Work and conservation of energy			
... define <i>work done</i> by a force.			
...define the <i>joule</i> .			
...calculate the work done by a force using: $W = Fx$ and $W = Fx \cos \theta$			
...state the principle of <i>conservation of energy</i> .			
...describe examples of energy in different forms, its conversion and conservation, and apply the principle of energy conservation to simple examples.			
...apply the idea that work done is equal to the transfer of energy to solve problems.			
1.3.2 Kinetic and potential energies			
...select and apply the equation for kinetic energy: $E_k = \frac{1}{2} mv^2$			
...apply the definition of work done to derive the equation for the change in gravitational potential energy.			
...select and apply the equation for the change in gravitational potential energy near the Earth's surface: $E_p = mgh$			
...analyse problems where there is an exchange between gravitational potential energy and kinetic energy.			
...apply the principle of conservation of energy to determine the speed of an object falling in the Earth's gravitational field.			
1.3.3 Power			
...define <i>power</i> as the rate of work done.			
...define the <i>watt</i> .			
...calculate power when solving problems.			
...state that the <i>efficiency</i> of a device is always less than 100% because of heat losses.			
...select and apply the relationship for efficiency: $\text{efficiency} = \frac{\text{useful output energy}}{\text{total input energy}} \times 100\%$			
...interpret and construct Sankey diagrams.			
1.3.4 Behaviour of springs and materials			
...describe how deformation is caused by a force in one dimension and can be tensile or compressive.			
...describe the behaviour of springs and wires in terms of force, extension, elastic limit, Hooke's law and the force constant (i.e. force per unit extension or compression).			

You should be able to...	Unaware of this section	I am aware of this, but need to do more work	I understand this area well
...select and apply the equation: $F = kx$ where k is the force constant of the spring or the wire.			
...determine the area under a force against extension (or compression) graph to find the work done by the force.			
...select and use the equations for elastic potential energy $E = \frac{1}{2} Fx \quad \text{and} \quad E = \frac{1}{2} kx^2$			
...define and use the terms <i>stress</i> , <i>strain</i> , <i>Young's modulus</i> and <i>ultimate tensile strength</i> (<i>breaking stress</i>).			
...describe an experiment to determine the Young modulus of a metal in the form of a wire.			
...define the terms <i>elastic deformation</i> and <i>plastic deformation</i> of a material.			
...describe the shapes of the stress against strain graphs for typical ductile, brittle and polymeric materials.			