Eduqas Physics – Component 3

Module C: The physics of sports

This topic studies the use of the centre of gravity in explaining how stability and toppling is achieved in various sporting contexts. The concept of moment of inertia is introduced together with the principle of conservation of angular momentum and their application to different sporting contexts is studied. Projectile motion and the Bernouilli equation and their application to sporting events is also studied.

You should be able to demonstrate and show your understanding of:	**Progress and understanding:**			
	1	**2**	**3**	**4**
How to use the centre of gravity to explain how stability and toppling is achieved in various sporting contexts				
How to use the principle of moments to determine forces within • various muscle systems in the human body, and • other sporting contexts, for example, sailing				
How to use Newton's 2nd law in the form $Ft = mv - mu$ in various sporting contexts				
The coefficient of restitution as Relative speed after collision $e = \frac{Relative\ speed\ after\ collision}{Relative\ speed\ before\ collision}$ and also use it in the form $e = \sqrt{\frac{h}{H}}$ where h is the bounce height and H is the drop height				
What is meant by the moment of inertia of a body				
How to use equations to determine the moment of inertia, I, for example • a solid sphere $I = \frac{2}{5}mr^2$ • a thin spherical shell $I = \frac{2}{3}mr^2$ where *m* is the mass and *r* is the radius				
The idea that angular acceleration, α , is defined as the rate of change of angular velocity, ω, and how to use the equation $\alpha = \frac{\omega_2 - \omega_1}{t}$				
The idea that torque, τ, is given as $\tau = I\alpha$				
Angular momentum, J, is given as $J = I\omega$ where ω is the angular velocity				
The principle of conservation of angular momentum and use it to solve problems in sporting contexts				

You should be able to demonstrate and show your understanding of:	Progress and understanding:			
	1	2	3	4
How to use the equation for the rotational kinetic energy, $rotational\ KE = \frac{1}{2}I\omega^2$				
How to use the principle of conservation of energy including the use of linear and rotational kinetic energy as well as gravitational and elastic potential energy in various sporting contexts				
How to use projectile motion theory in sporting contexts				
How to use Bernoulli's equation $p = p_0 - \frac{1}{2}\rho v^2$ in sporting contexts				
How to determine the magnitude of the drag force using $F_D = \frac{1}{2}\rho v^2 A C_D$ where C_D is the drag coefficient				