

<b>Chapter 3: Dynamics</b>	
	<ul style="list-style-type: none"> <li>- Newton's laws of motion</li> <li>- Linear momentum and its conservation</li> </ul>
<b>a.</b>	<p><b>State each of Newton's laws of motion.</b></p> <p><b>Newton's First Law</b> Every body continues in a state of rest or uniform motion in a straight line unless a net (external) force acts on it.</p> <p><b>Newton's Second Law</b> The rate of change of momentum of a body is directly proportional to the net force acting on the body, and the <u>momentum change takes place in the direction of the net force.</u></p> <p><b>Newton's Third Law</b> When object X exerts a force on object Y, object Y exerts a force <i>of the same type</i> that is equal in magnitude and opposite in direction on object X.</p> <p>The two forces ALWAYS act on <u>different</u> objects and they form an <b>action-reaction pair</b>.</p>
<b>b.</b>	<p><b>Show an understanding that mass is the property of a body which resists change in motion.</b></p> <p><b>Mass:</b> is a measure of the amount of matter in a body, &amp; is the <u>property of a body which resists change in motion.</u></p>
<b>c.</b>	<p><b>Describe and use the concept of weight as the effect of a gravitational field on a mass.</b></p> <p><b>Weight:</b> is the force of gravitational attraction (exerted by the Earth) on a body.</p>
<b>d.</b>	<p><b>Define linear momentum and impulse.</b></p> <p><b>Linear momentum</b> of a body is defined as the product of its mass and velocity ie <math>p = m v</math></p> <p><b>Impulse of a force</b> / is defined as the product of the force and the time <math>\Delta t</math> during which it acts</p> <p style="text-align: center;">ie <math>I = F \times \Delta t</math> {for force which is <u>const</u> over the duration <math>\Delta t</math>}</p> <p>For a <u>variable</u> force, the impulse = Area under the F-t graph { <math>\int F dt</math>; may need to "count squares" }</p> <p>Impulse is <u>equal in magnitude</u> to the change in momentum of the body acted on by the force. Hence the change in momentum of the body is equal in mag to the area under a (net) force-time graph. {<b>Incorrect</b> to <u>define</u> impulse as <i>change in momentum</i>}</p>
<b>e.</b>	<p><b>Define force as rate of change of momentum.</b></p> <p><b>Force</b> is defined as the rate of change of momentum, ie <math>F = \frac{m(v - u)}{t} = ma</math> or <math>F = v \frac{dm}{dt}</math></p> <p><b>The {one} Newton</b> is defined as the force needed to accelerate a mass of 1 kg by 1 m s<sup>-2</sup>.</p>
<b>f.</b>	<p><b>Recall and solve problems using the relationship <math>F = ma</math> appreciating that force and acceleration are always in the same direction.</b></p> <p>Self-explanatory</p>
<b>g.</b>	<p><b>State the principle of conservation of momentum.</b></p> <p><b>Principle of Conservation of Linear Momentum:</b> When objects of a system interact, their total momentum before and after interaction are equal <u>if no net (external) force acts on the system.</u></p> <p>or, The total momentum of an <b>isolated</b> system is constant ie <math>m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2</math> if net <math>F = 0</math> {for <b>all</b> collisions }</p> <p>NB: Total momentum <b>DURING</b> the interaction/collision is also conserved.</p>
<b>h.</b>	<p><b>Apply the principle of conservation of momentum to solve problems including elastic and inelastic</b></p>

	<b>interactions between two bodies in one dimension. (Knowledge of coefficient of restitution is not required.)</b>
	<p><b>(Perfectly) elastic collision:</b> Both momentum &amp; kinetic energy of the system are conserved.</p> <p><b>Inelastic collision:</b> Only momentum is conserved, total kinetic energy is not conserved.</p> <p><b>Perfectly inelastic collision:</b> Only momentum is conserved, and the particles stick together after collision. (i.e. move with the same velocity.)</p>
<b>i.</b>	<b>Recognise that, for a perfectly elastic collision between two bodies, the relative speed of approach is equal to the relative speed of separation.</b>
	<p>For all <i>elastic</i> collisions, <math>u_1 - u_2 = v_2 - v_1</math></p> <p>ie. <b>relative speed of approach = relative speed of separation</b></p> <p>or, <math>\frac{1}{2} m_1 u_1^2 + \frac{1}{2} m_2 u_2^2 = \frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2</math></p>
<b>j.</b>	<b>Show an understanding that, whilst the momentum of a system is always conserved in interactions between bodies, some change in kinetic energy usually takes place.</b>
	In inelastic collisions, total energy is conserved but Kinetic Energy may be converted into other forms of energy such as sound and heat energy.