Chapter 10 - Mechanics

Forces and Motion

Chapter Overview

1. Force Diagrams
2. Forces as Vectors
3. Forces and Acceleration
4. Motion in 2 Dimensions
5. Connected Particles
6. Pulleys

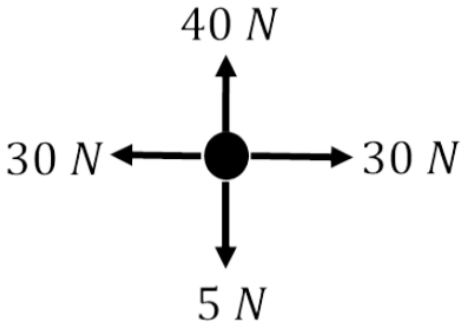
Topics	What students need to learn:		
	Content		Guidance
8 Forces and Newton's laws	8.1	Understand the concept of a force; understand and use Newton's first law.	Normal reaction, tension, thrust or compression, resistance.
	8.2	Understand and use Newton's second law for motion in a straight line (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors).	Problems will involve motion in a straight line with constant acceleration in scalar form, where the forces act either parallel or perpendicular to the motion. Resolving forces is not required. Problems will involve motion in a straight line with constant acceleration in vector form, where the forces are given in $\mathbf{i}-\mathbf{j}$ form or as column vectors.
	8.3	Understand and use weight and motion in a straight line under gravity; gravitational acceleration, g, and its value in S.I. units to varying degrees of accuracy.	The default value of g will be $9.8\,\mathrm{m\,s^{-2}}$ but some questions may specify another value, e.g. $g = 10\,\mathrm{m\,s^{-2}}$ The inverse square law for gravitation is not required and g may be assumed to be constant, but students should be aware that g is not a universal constant but depends on location.
	8.4	Understand and use Newton's third law; equilibrium of forces on a particle and motion in a straight line; application to problems involving smooth pulleys and connected particles.	Equilibrium problems will not require forces to be resolved (restricted to forces in two perpendicular directions or simple cases of forces given as 2-D vectors). For pulley problems, the strings will either be horizontal or vertical. Connected particle problems could include problems with particles in contact, e.g. lift problems.

1. Force Diagrams

Recall Newton's laws of motion:

1. An object will remain at rest or continue to move **in a straight line at a constant speed** unless it is acted upon by a **resultant force**
2. The force needed to accelerate a particle is equal to the product of its mass and the acceleration of the particle: **F = ma**
3. Every action has an equal and opposite reaction

When drawing a force diagram, make sure you include **all** of the forces which might be acting on an object (see Chapter 8). Consider the forces acting on each object, one at a time. You can draw the resultant force and describe the motion of the object.



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