The most complete AP Physics 1 Equation Sheet for 2025 exam

Stop the last-minute panic

Master the exam with concise explanations

for each formula

BY

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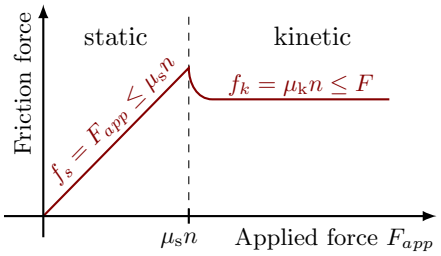
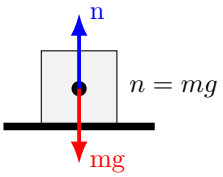
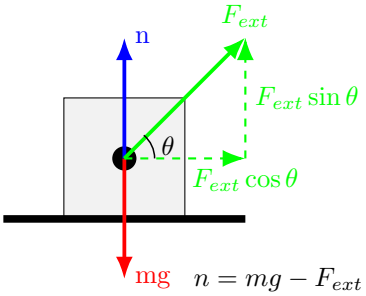
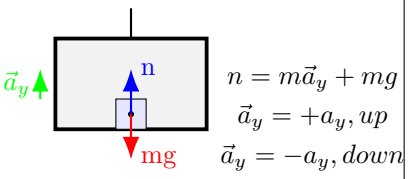
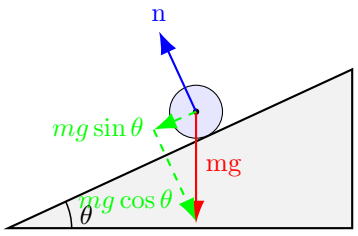
$0 \leq f_s \leq f_{s,max} = \mu_s n$ Direction as necessary to prevent motion.	• If a force $\vec{F}$ is applied to an object on a surface, and the object remains stationary, the force of friction acting on the object is called ***static frictional force***, f_s. • If the component of $\vec{F}$ parallel to the surface exceeds the maximum static frictional force, $f_{s,max}$, the object is on the verge of sliding. • When the object begins to slide on the surface, the frictional force abruptly *decreases* to the kinetic frictional force, f_k. • The coefficient of static friction is typically greater than the coefficient of kinetic friction. In general: $\mu_s > \mu_k$	
Normal Force n	When an object *comes into contact* with a surface, the normal force is the reaction of the surface. • The normal force acts *perpendicular to the surface.* • Only *gravitational* and *electrical forces* can act on an object *without contact.* There are four typical physical scenarios, each with its own normal force denoted as n. 1. The object is at rest on a horizontal surface: $\boldsymbol{n = mg}$ 2. An exerted external force at an angle: $\boldsymbol{n = mg - F_{ext} \sin\theta}$ 3. Inside an accelerated elevator: $\boldsymbol{n = m\vec{a}_y + mg}$ where $\boldsymbol{\vec{a}_y}$ is the elevator's acceleration. 4. On an inclined surface: $\boldsymbol{n = mg\cos\theta}$	    $n = mg\cos\theta$

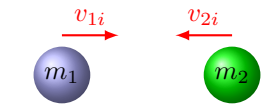
Collisions

AP Notes:

- ✓ **Momentum conservation** is the first principle to apply in the AP collision problems.
- ✓ **Kinetic energy conservation** is only relevant for elastic collisions and when more information is needed
- ✓ Avoid using kinetic energy before momentum in collision problems.
- ✓ In the AP Physics 1 exam, you might have to write down a system of equations without actually solving them. This shows that you understand physics concepts without having to do a lot of math.

Is defined when two or more objects come together.

- Total momentum is conserved (constant) in ***collisions*** of ***all*** *kinds as long as* any external force is zero.
- In ***inelastic collision*** of two objects, the momentum is conserved (it *is* a constant), but the kinetic energy is not (it is not a constant).
- In ***inelastic collision***, the two colliding objects *stick together* (typically, not necessarily) and moves with a common final velocity.
- In ***elastic collision***, both the momentum and kinetic energy of the system are conserved.
- When two objects bounce off each other, the collision might be elastic, or might not be.



Before Collision

Elastic Collision

$p_i = p_f$

$K_i = K_f$

After Collision

Unit 5: Torque and Rotational Motion (10-15%) AP Exam Weighting

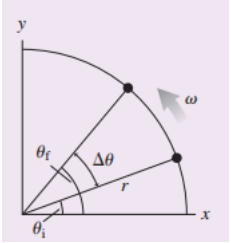
Angular displacement, $\Delta\theta$

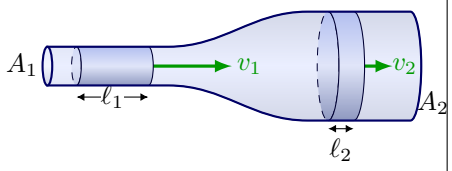
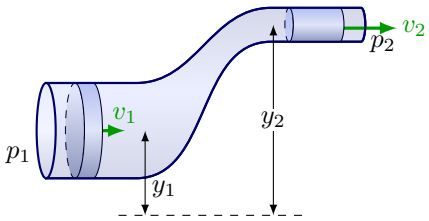
$$1\,\text{rad} = \frac{360^\circ}{2\pi}$$

$$= 57.3^\circ$$

Angular displacement is the angle through which an object has rotated.

- It is measured in radians rather degrees.
- There are 2π radians in one complete rotation (or circle).
- Notice that in the topic of rotational motion, the direction of vector quantities is usually shown with positive and negative signs.



Equation of continuity $A_1 v_1 = A_2 v_2$	• The **conservation of mass** states that the amount of fluid entering a system must be equal to the amount of fluid leaving the system. • The **volume flow rate** states that the volume of fluid passing through a section of a pipe (of varying diameter) per second must be the same at any points along the pipe. • The product Av is called the volume rate of flow. $$\frac{V}{t} = Av$$ • The continuity equation tells us that for an incompressible fluid the product of the velocity of flow and the cross-sectional area of the pipe is constant. $$Av = \text{constant} \Rightarrow A_1 v_1 = A_2 v_2$$	
Bernoulli's Equation	Bernoulli's equation relates the pressure p, flow speed v, and elevation y for any two points along a tube of flow denoted by subscripts 1 and 2. $$p_1 + \rho g y_1 + \frac{1}{2}\rho v_1^2 = p_2 + \rho g y_2 + \frac{1}{2}\rho v_2^2$$ This equation is a direct consequence of applying the law of energy conservation. • Bernoulli's equation states that where the velocity of the fluid is high, the pressure is low, and where the velocity is low, the pressure is high.	
Torricelli's Theorem $v = \sqrt{2gh}$	**Torricelli's theorem** states that the speed of a fluid running out of an opening under the influence of gravity is equal to the speed that an object would attain if it fell freely from the surface of the fluid to the opening. • h is the height difference between the fluid surface and the opening. • Torricelli's Law tells you how fast that water will be flowing based on how far below the water surface the hole is. • The fluid is assumed to be incompressible (density is constant) and non-viscous (no internal friction). • The opening is assumed to be small compared to the cross-sectional area of the container.