Things to know by heart---Review for test 1---*Physics for Today*

	Equation	Metric Units
Displacement - an object's distance and direction from an earlier location. The symbol that we use for displacement is Δ X. If you know an object's starting velocity and acceleration, you can calculate its displacement with the following formula:	$\Delta X = X_2 - X_1$ $\Delta X = \mathrm{V_o t} + \frac{1}{2}\mathrm{a t}^{2}$	meters meters; m
Speed- The rate at which an object changes its position.		meters/sec
Vector- Something that has both magnitude and direction.		
Average Velocity- ($\bar{V}$) An object's average speed and direction.	$\bar{V} = \frac{\Delta \mathrm{X}}{\Delta \mathrm{T}}$	m/s
Instantaneous Velocity- (V) An object's speed and direction at a particular time.	$\mathrm{V} = \mathrm{V_0} + \mathrm{a\,t}$	meters/sec; m/s
Acceleration- ('A')The rate at which an object's velocity changes. You can change an object's velocity by changing its speed or direction.	$A \equiv \frac{\Delta \mathrm{V}}{\Delta \mathrm{T}}$	m /sec^2 ;m/s/s
The **acceleration** of all objects **in freefall** ('**g**'), near the Earth's surface, when we disregard air friction, is always **10 m/s/s** down.		
Inertia- An object's resistance to a change in its velocity. The more inertia an object has, the harder it is to change its speed or direction.		
Mass- (' m') A measure of an object's inertia. If an object has a large mass, it has a lot of inertia.		kilogram; kg
Force-(F) A push or pull.		Newton; $\frac{\mathrm{kg \cdot m}}{\mathrm{sec}^2}$
Force of gravity- The force of attraction that all objects have for each other.	$F = \frac{\gamma m_1 m_2}{d^2}$	Newton
Torque-The turning effect of a force.	$\mathrm{torque} \equiv \mathrm{F} \perp \mathrm{d}$	meter-newtons; foot-pounds
Angular velocity- ('ω')The rate at which an object is spinning.		$\frac{revolutions}{\mathrm{min}ute}$
Moment of inertia- ('I') An object's resistance to a change in its angular velocity.	$I \equiv m d^2$	$\mathrm{kg \cdot m}^2$
Angular momentum- ('L') The product of an object's moment of inertia and its angular velocity. Angular momentum is conserved.	$L \equiv I\omega$	

Newton's Three laws of motion:

1. An object at rest will remain at rest, an object in motion will remain in motion at a constant velocity, unless an unbalanced force is applied to it.
2. The acceleration of an object is directly proportional to the unbalanced force applied to the object and inversely proportional to the object's mass. $$A = \frac{\sum F}{M}$$
3. For every force applied to an object, there is another force that is exactly equal in magnitude but opposite in direction applied to the other object.

Here is an example of one of the more mathematical questions that may be asked on test 1:

A fast moving radio controlled car enters the room and is moving with a velocity of 6 m/sec. After 2 seconds it is moving at 10 meters per second and is 16 meters from the place where it first entered the room. In two more seconds it is moving at 14 m/s.
Determine the following: **a)** its initial velocity **b)** its acceleration **c)** distance traveled after 4 seconds **d**) the object's velocity after 3 seconds.

Part (a) Initial velocity is the velocity of an object at the beginning of the problem. From reading the problem, we determine that the initial velocity of the object is **6 m/sec**.

Part(b) Acceleration is defined as the rate at which an object's velocity changes.

$$A = \frac{\Delta V}{\Delta T} = \frac{10\frac{m}{s} - 6\frac{m}{s}}{2\,\text{sec}} = \frac{4\frac{m}{s}}{2\,\text{sec}} = 2\frac{m}{\text{sec}^2}$$

Part(c) Use the displacement formula to determine how far the object has gone. Note that the initial velocity of the car is 6 m/s and that we determined in part 'b' that the acceleration of the car is 2m/s/s. Also notice that we want the distance traveled in 4 seconds.

$V_o = 6\text{m/s}$ $a = 2\text{m/s}^2$ $t = 4$ seconds

Therefore, since $\Delta X = V_o t + \frac{1}{2} a t^2$

$$\Delta X = 6 \cdot 4 + \frac{1}{2} 2 \cdot 4^2 = 40\ meters$$

Part d: Use the instantaneous velocity rule.

$$V = V_o + at = 6\frac{m}{s} + \left(2\frac{m}{s^2} \bullet 3\,\text{sec}\right) = 6\frac{m}{s} + 6\frac{m}{s} = 12\frac{m}{s}$$

Study hard and good luck on the exam.
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