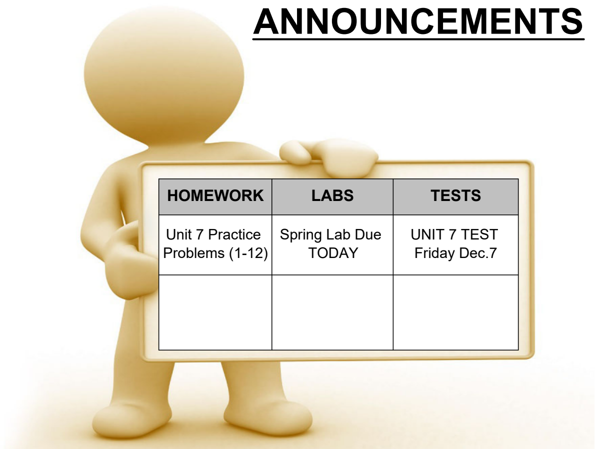
ANNOUNCEMENTS



HOMEWORK	LABS	TESTS
Unit 7 Practice Problems (1-12)	Spring Lab Due TODAY	UNIT 7 TEST Friday Dec.7

7.4 TENSION

LEARNING TARGETS

7.3	I can define, analyze, and solve dynamic problems involving tension forces and connected objects.

REVIEW

Some Types of Forces			
Force	**Symbol**	**Definition**	**Direction**
Friction	F_f	The contact force that acts to oppose sliding motion between surfaces	Parallel to the surface and opposite the direction of sliding
Normal	F_N N	The contact force exerted by a surface on an object	Perpendicular to and away from the surface
Spring	F_{sp} F_s	A restoring force; that is, the push or pull a spring exerts on an object	Opposite the displacement of the object at the end of the spring

REFERENCE PAGE

$f = \mu N$

$$\left|\vec{F}_f\right| \leq \mu \left|\vec{F}_n\right|$$

$$\left|\vec{F}_s\right| = k\left|\vec{x}\right|$$

$F_s = kx$

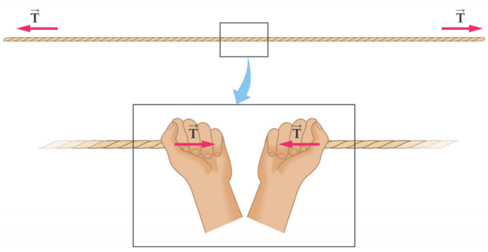
F = force

k = spring constant

μ = coefficient of friction

tension

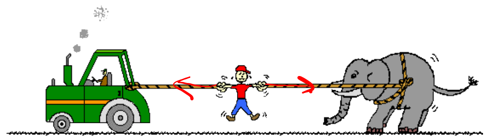
When you pull on a string or rope, it becomes taut. We say that there is tension in the string.



TENSION

F_T

Tension (T) is a pulling force exerted by a string, rope, cable, or similar object on another object.



TENSION

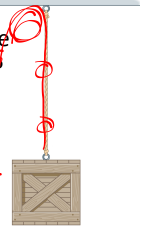
The tension in a real rope will vary along its length, due to the weight of the rope.

We will assume that all ropes, strings, wires, etc. are massless unless otherwise stated.

IDEAL

TENSION

What is the tension in the rope if the box has a mass of 10 kg?



$F_{net} = 0$

$T_{R,B} = F_{g,B}$

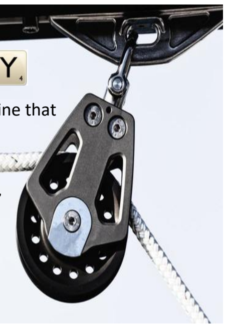
$T_{R,B} = mg$

$T_{R,B} = 98\ N$

PULLEY

A **pulley** is a simple machine that redirects tension forces.

An **ideal pulley** has no mass, and no friction. It simply changes the direction of the tension in a string, without changing its magnitude.



TENSION

A 50.0-kg bucket is being lifted by a rope. The rope will not break if the tension is 525 N or less. The bucket started at rest, and after being lifted 3.0 m, it is moving at 3.0 m/s. If the acceleration is constant, is the rope in danger of breaking?

$F_{net} = T_{R,B} - F_{g,B}$

$ma = T_{R,B} - mg$

$ma + mg = T_{R,B}$

$(50)(1.5) + (50)(9.8) = T_{R,B}$

$565\ N = T_{R,B}$

$y_0 = 0$

$v_0 = 0$

$y_f = 3.0\ m$

$v_f = 3.0\ m/s$

$a = ?$

$v_f^2 = v_0^2 + 2a(y_f - y_0)$

$\frac{v_f^2}{2y_f} = a = 1.5\ m/s^2$

Applications of Tension

PRACTICE

UNIT 7 PROBLEMS

(13-14)

7.4 TENSION FORCES

13. Pulling up on a rope, you lift a 4.25-kg bucket of water from a well with an acceleration of 1.80 m/s². What is the tension in the rope?
14. You are helping to repair a roof by loading equipment into a bucket that workers hoist to the rooftop. If the rope is guaranteed not to break as long as the tension does not exceed 450 N and you fill the bucket until it has a mass of 42 kg, what is the greatest acceleration that the workers can give the bucket as they pull it to the roof?