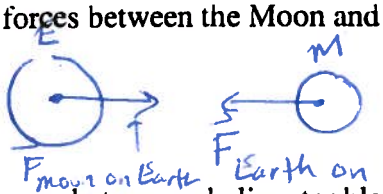
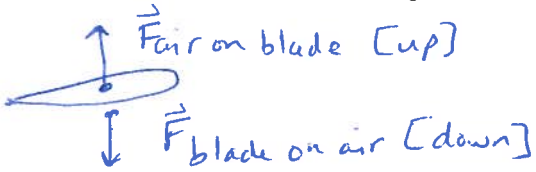
SPH4U0

Newton's Laws: Review

1) Draw the action-reaction forces between the Moon and the Earth.



2) Draw the action-reaction forces between a helicopter blade and the air.



3. Coyote and Roadrunner are involved in a tug of war. Coyote wins, pulling Roadrunner into a mud puddle. Why did Coyote win?

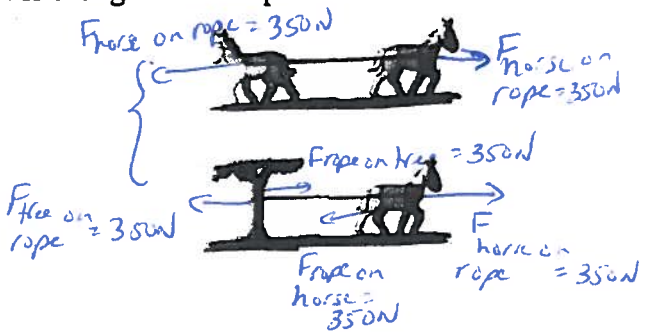
a) Coyote exerted a greater force on the rope than Roadrunner.
b) The rope exerted a greater force on Roadrunner than Coyote.
c) Coyote exerted a greater force on the ground than Roadrunner.
d) All of the above.

They must exert equal force on the rope due to Newton's 3rd Law

The external force of the ground on their feet is greater in the direction that Roadrunner moves.

4. A rope has a breaking strength of 400 N. A horse which can pull with a maximum force of 350 N attempts to break a rope which is attached to a tree. The rope does not break.

A second horse which can also pull with a maximum force of 350 N is brought in to help the first horse as shown below. Will the rope break? Explain.



No - The situations are identical. In both cases, by Newton's 3rd Law the pairs of action-reaction forces at either end are magnitude of 350N. The tension is thus 350N.

Second Law: F= ma

5. A 2.0 kg curling stone travelling at 5.0 m/s [East] strikes a second stone which is at rest. The collision lasts for 10.0 ms and the first stone's velocity becomes 2.0 m/s [West]. Determine the net force on the first stone during the collision.

Let E = +

$m = 2.0$ kg
$\vec{v}_1 = 5.0$ m/s [E]
$\vec{v}_2 = 2.0$ m/s [W]
$\Delta t = 10.0$ ms $= 0.010$ s
$\vec{a} = ?$
$\vec{F}_{net} = ?$

$\Delta\vec{v} = \vec{v}_2 - \vec{v}_1 = 5.0\text{ m/s} - (-2.0\text{ m/s}) = 700.\text{ m/s}^2$ [W]
$\Delta t \qquad 0.010\text{ s}$

$\vec{F} = m\vec{a} = (2.0\text{ kg})(700.\text{ m/s}^2\text{ [W]}) = 1.40 \times 10^3\text{ N [W]}$

Gravity due to the Earth

$F_g = mg \quad g = 9.80\text{ m/s}^2$

6. An 50.0 kg student rides up the LASS elevator with a recycling bin. If the elevator is moving at a constant velocity of 4.0 m/s [up], what is the normal force of the elevator floor on the student?

$\vec{v} \uparrow 4.0\text{ m/s [up]}$
$m = 50.0$ kg
$\vec{F}_g = ?$
$\vec{F}_N = ?$

$F_g = mg = (50.0\text{ kg})(9.80\text{ m/s}^2)$ [D]
$= 490\text{ N [D]}$

Since $\vec{a} = 0$, $\vec{F}_{net} = 0$ and $|\vec{F}_N| = |\vec{F}_g|$
$F_N = 490$ N