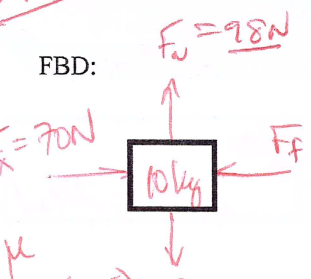
Review Test 5 Forces, Friction, and Angles Period ____ Name Key

1. What is the acceleration of a 10.0-kg turkey if 70.0 N of force are applied to it horizontally? The turkey rests on a table where the coefficient of kinetic friction is 0.3 and the coefficient of static friction is 0.5.

$F_f = (98N)(0.3) = 29.4N$

FBD:



$F_f = F_N \mu$
$= (98N)(0.5)$
$F_{fs} = 49N$

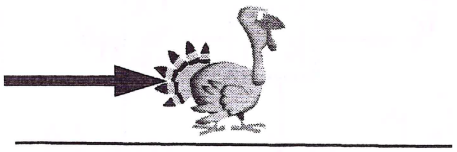
$F_g = m \cdot g$
$= (10kg)(9.8 m/s^2)$
$= 98N$

ΣF_x: $F_x - F_f = ma_x$

ΣF_y: $F_N - F_g = ma^0$

$F_N = F_g = 98N$

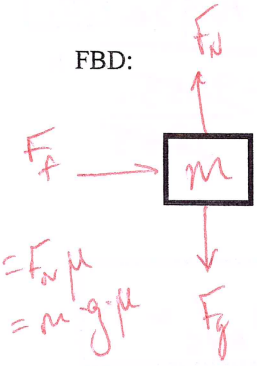
$\frac{70 - 29.4}{10} = \frac{10a}{10}$



$4.06 m/s^2$

2. The rabbit of death hits a patch of ice while chasing a victim. In coming to a stop his acceleration was 2.94 m/s^2. What was the coefficient of kinetic friction?

FBD:



$F_f = F_N \mu$
$= m \cdot g \cdot \mu$

ΣF_x: $F_f = ma$

ΣF_y: $F_N - F_g = 0$

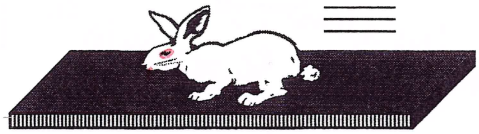
$F_N = F_g = m \cdot g$

$m \cdot g \cdot \mu = m \cdot a$

$a = g \cdot \mu$

$\mu = \frac{a}{g}$

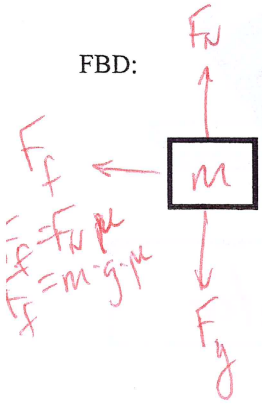
$= \frac{2.94 m/s^2}{9.8 m/s^2}$



0.3
(no unit!)

3. A flat bed truck with a crate of vampire gazelles on it is speeding carelessly along the highway at 50 m/s! The coefficient of static friction between the crate and truck bed is 0.1. What is the maximum acceleration of the truck in order to keep the crate from sliding and setting the bloodthirsty gazelles loose on an innocent public?

FBD:



$F_f = F_N \mu$
$F_f = m \cdot g \cdot \mu$

ΣF_x: $-F_f = ma_x$

ΣF_y: $F_N - F_g = ma^0$

$F_N = F_g = m \cdot g$

$m \cdot g \cdot \mu = ma_x$

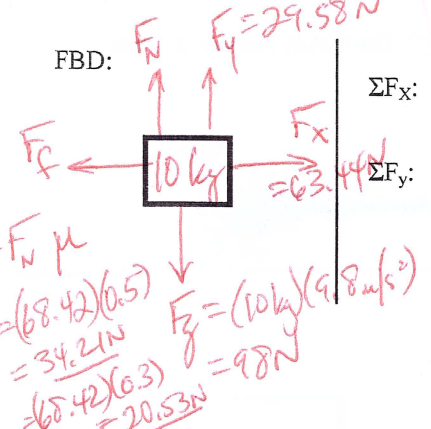
$g \cdot \mu = a_x$

$a_x = (9.8 m/s^2)(0.1)$

$0.98 m/s^2$

4. A force of 70.0 N is applied up at a 25 degree angle made with respect to the horizontal onto a 10.0-kg turkey. The turkey rests on a table where the μ_k is 0.3 and the μ_s is 0.5. What is the acceleration of the turkey?

FBD:



ΣF_x: $F_x - F_f = ma_x$

ΣF_y: $F_N + F_y - F_g = ma^0$

$F_f = F_N \mu$

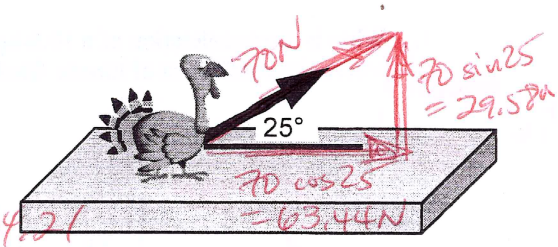
$F_{fs} = (68.42)(0.5) = 34.21N$

$F_{fk} = (68.42)(0.3) = 20.53N$

$F_N = F_g - F_y$

$F_N = 98 - 29.58$

$F_N = 68.42N$



$63.44 > 34.21$

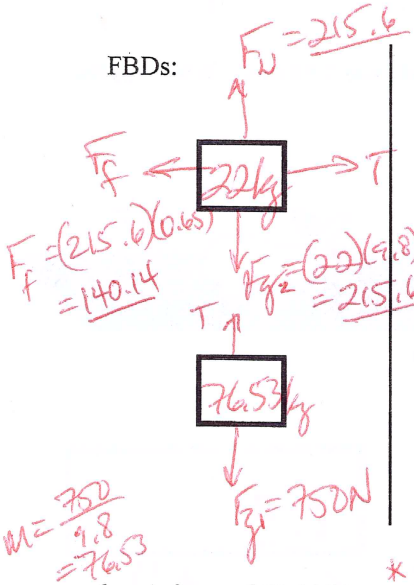
$63.44 - 20.53 = 10a$

10 10

$a = 4.29 m/s^2$

4. What is the acceleration of the 22 kg gazelle (Assume it will move.) Coefficient of kinetic friction is 0.65.

FBDs:



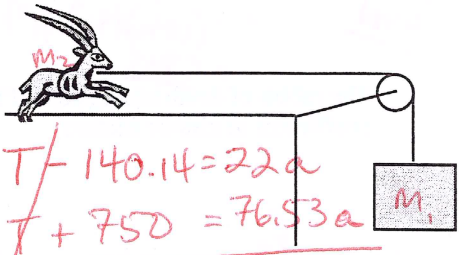
(A) ΣF_x: $T - F_f = ma_x$

ΣF_y: $F_N - F_g = ma^0$

$F_N = F_g$

(B)* ΣF_y: $F_g - T = ma$

$-T + F_{g1} = ma$



$T - 140.14 = 22a$

$-T + 750 = 76.53a$

$609.86 = 98.53a$

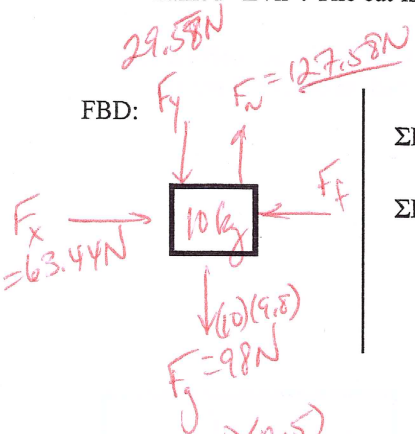
98.53 98.53

$a = 6.19 m/s^2$

*- change from "$T - F_g = ma$" - ask!

6. A force of 70.0 N is applied downward at a 25 degree angle made with respect to the horizontal onto a 10.0-kg black cat named "Evil". The cat is on the floor where the μ_k is 0.3 and the μ_s is 0.5. How far will he slide after one minute?

FBD:



ΣF_x: $F_x - F_s = ma$

ΣF_y: $F_N - F_y - F_g = ma^0$

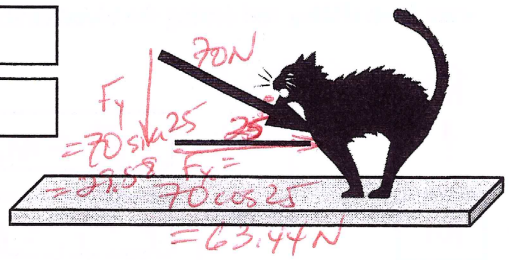
$F_N = F_y + F_g$

$F_N = 29.58 + 98$

$= 127.58N$

$F_{fs} = (127.58N)(0.5) = 63.8N$

$F_{fk} = (127.58)(0.3) = 38.27N$



F_x F_{fs}

$63.44 < 63.8$ → means cat doesn't move!

0 meters