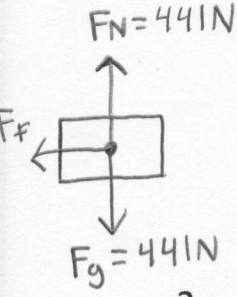
Mr. Walker Lesson 12 Nov. 8, 2011

Homework

1.

A 45 kg toboggan and rider decelerate on level snow at 0.53 m/s². What is the coefficient of friction between the toboggan and the snow?



A. 0.012
(B.) 0.054
C. 0.22
D. 0.53

$F = ma$

$F_g = mg$

$F_g = (45kg)(9.8m/s^2)$

$F_g = 441N$ [down]

so $F_N = 441N$ [up]

$F = ma$

$F_f = (45kg)(0.53m/s^2)$

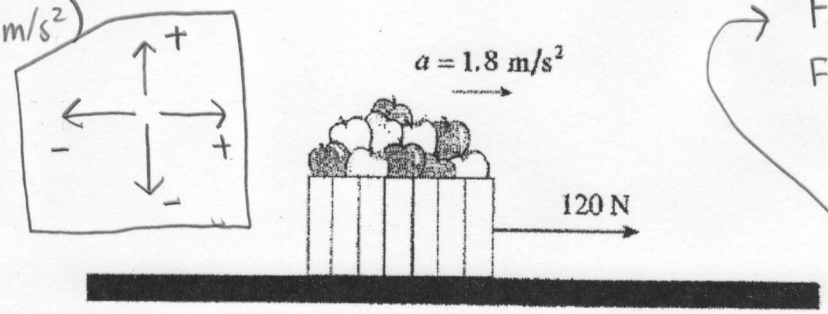
$F_f = 23.85N$ [left]

$F_f = \mu F_N \rightarrow \mu = \frac{F_f}{F_N} = \frac{23.85N}{441N}$

$\mu = 0.054$

2.

A student exerts a 120 N horizontal force on a 25 kg carton of apples, causing it to accelerate over level ground at 1.8 m/s².



$F_{NET} = (25kg)(1.8m/s^2)$

$F_{NET} = 45N$

$F_{NET} = F_a + F_f$

$F_f = F_{NET} - F_a$

$F_f = 45N - 120N$

$F_f = -75N \rightarrow F_f = 75N$ [left]

$F_g = mg$

$F_g = (25kg)(9.8m/s^2)$

$F_g = 245N$ [down]

$\therefore F_N = 245N$ [up]

$F_f = \mu F_N$

$\mu = \frac{F_f}{F_N} = \frac{75N}{245N}$

$\mu = 0.31$

Find the coefficient of friction between the carton and the ground.

(A.) 0.31
B. 0.38
C. 0.49
D. 0.67

note that you cannot have a negative μ, so always use positive values for F_f and F_N when calculating μ.

3.

A net force F acts on an object of mass m, causing it to accelerate at 4.0 m/s². If the same net force F acts on an object of mass $2m$, its acceleration will be

A. 1.0 m/s²
(B.) 2.0 m/s²
C. 4.0 m/s²
D. 8.0 m/s²

Newton's second law

$a \propto F$

$a \propto \frac{1}{m}$

If we apply the same force to an object with double the mass it will accelerate half as much.

$\therefore a = 2.0m/s^2$

4. A 72 kg skydiver (jumps) from a helicopter and is accelerating downwards at 8.6 m/s^2. Find the friction force acting on him.

A. 86 N
B. 620 N
C. 710 N
D. 1 300 N

$F_{NET} = ma$

$F_{NET} = (72kg)(8.6m/s^2)$

$F_{NET} = 619.2N$

$F_g = mg$

$F_g = (72kg)(9.8m/s^2)$

$F_g = 705.6N$ [down]

$F_{NET} = F_g + F_f$

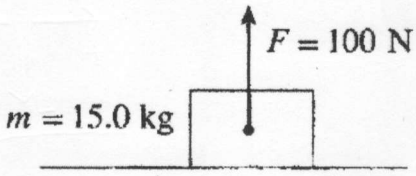
$F_{NET} - F_g = F_f$

$F_f = 619.2N - 705.6N$

$F_f = -86.4N$

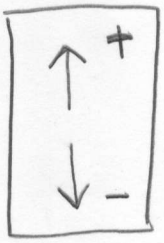
$F_f = 86N$ [up]

5. A 15 kg block on a horizontal surface has a 100 N force acting on it as shown.



What is the normal force?

A. 47 N
B. 100 N
C. 147 N
D. 247 N



$F_g = mg$

$F_g = (15kg)(9.8m/s^2) = 147N$ [down]

$F_{NET} = F_N + F_a + F_g = 0N$

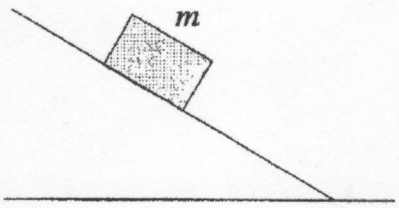
$-F_g = F_N + F_a$

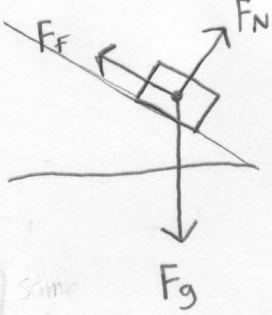
$-F_g - F_a = F_N$

$-(-147N) - 100N = F_N = 47N$ [up]

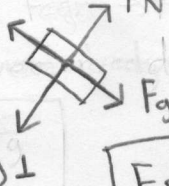
6. A block of mass m remains at rest on an incline as shown in the diagram.

Grade 12 Level Question





In physics 12 you'll learn to decompose F_g into components. When you do this you get the following picture



$F_f < F_g$

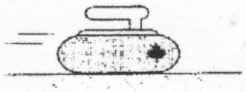
The force acting up the ramp on this block is

A. 0.
B. mg.
C. less than mg.
D. more than mg.

$F_f = F_{g\parallel}$ since there is still $F_{g\perp}$ left over, $F_f < F_g$

7.

A curling rock is travelling to the right across the ice as shown in the diagram.



Which of the following best represents the forces acting on the curling rock?

A. 

B. 

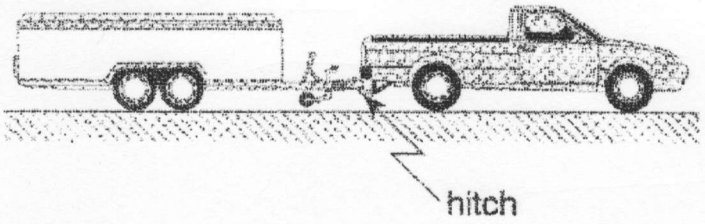
C. 

(D.) 

There is no applied force, the rock is simply gliding!

8.

A 1200 kg trailer is accelerated from rest to 15 m/s in 5.0 s. The average force of friction acting on the trailer is 800 N.



What is the pulling force applied to the trailer through the hitch?

A. 800 N
B. 2800 N
C. 3600 N
(D.) 4400 N

$a = \frac{15 m/s}{5.0 s} = 3 m/s^2$

$F_{NET} = ma = (1200kg)(3 m/s^2) = 3600N$ [right]

$F_f = 800N$ [left]

$F_{NET} = F_a + F_f$

$F_{NET} - F_f = F_a$

$F_a = 3600N - (-800N) = 4400N$ [right]