Physics 112 Forces in 1D

F_g $F_{net} = 0\ N$ F_a

1. A 25 kg crate is pulled at a constant velocity with an applied force of 125 N.
   a. Calculate the force of friction. (-125 N)
   b. Calculate the normal force on the crate. (245 N)
   c. Calculate the coefficient of kinetic friction. (0.51).

a) $F_{net} = \sum Forces$

$F_{net} = F_f + F_a$

$0 = F_f + 125$

$\boxed{F_f = -125\ N}$

b) $F_N = F_g$ ← mg

$F_N = mg$

$F_N = (25)(9.81)$

$\boxed{F_N = 245\ N}$

c) $|F_f| = \mu |F_N|$

$\mu = \frac{F_f}{F_N} = \frac{125}{245} = \boxed{0.51}$

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2. A sled has a weight of 75 N and is being pulled with a net force of 15 N. The coefficient of kinetic friction is 0.19.

$F_g = F_N$ F_{net} μ

   a. What is the mass of the sled? (7.6 kg)
   b. What is the force of friction? (14.25 N)
   c. What is the applied force? (29.25 N)

a) $F_g = mg$, $g = 9.81\ m/s^2$

$75 = m(9.81)$

$\frac{75}{9.81} = m$, $m = 7.6\ kg$

b) $F_f = ?$

$F_f = \mu F_N$

$F_f = (0.19)(75\ N)$

$F_f = 14.25\ N$

c) $F_a = ?$

$F_{net} = \sum Forces$

$F_{net} = F_a + F_f$

$15 = F_a + (-14.25)$

$29.25\ N = F_a$

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3. A 55 kg box is moved with a net force of 28 N. The applied force necessary is 185 N.
   a. What is the force of friction? (-157 N)
   b. What is the normal force? (540 N)
   c. What is the coefficient of kinetic friction? (0.29)

a) $F_{net} = \sum Forces$

$F_{net} = F_a + F_f$

$28 = 185 + F_f$

$\boxed{-157\ N = F_f}$

b) $F_N = F_g$

$F_N = mg$

$F_N = (55\ kg)(9.8\ m/s^2)$

$\boxed{F_N = 540\ N}$

c) $F_f = \mu F_N$

$\mu = \frac{F_f}{F_N}$

$\mu = \frac{157}{540} = \boxed{0.29}$

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4. A box is being pulled across the floor at a constant velocity with an applied force of 184 N. The coefficient of kinetic friction is 0.26. μ $F_{net} = 0\ N$ F_a
   a. What is the force of friction? (-184 N)
   b. What is the force of gravity on the box? (708 N)
   c. What is the mass of the box? (72.2 kg)

a) $F_{net} = \sum Forces$

$F_{net} = F_a + F_f$

$0 = 184 + F_f$

$-184\ N = F_f$

b) $F_g = mg$

$F_g = F_N$

$F_f = \mu F_N$

$\Rightarrow F_f = \mu F_g$

$184 = (0.26) F_g$

$-708\ N = F_g$

c) $m = ?$

$F_g = mg$

$-708\ N = m(-9.81\ m/s^2)$

$72.2\ kg = m$

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m, F_g

5. A 46 kg object is being pulled with an applied force of 200 N. The coefficient of kinetic friction is 0.18. → F_a μ
   a. What is the force of gravity on the object? (451 N)
   b. What is the force of friction acting on the object? (81 N)
   c. What is the net force acting on the object? (119 N)

a) $F_g = mg$

$= (46)(-9.81)$

$F_g = -451\ N$ (downward)

$|F_g| = +451\ N$

b) $F_f = ?$

$F_g = F_N \rightarrow 451$

$F_f = \mu F_N$

$F_f = (0.18)(451)$

$F_f = 81N$

c) $F_{net} = \sum Forces$

$F_{net} = F_a + F_f$

$= 200\ N + (-81N)$

$F_{net} = 119\ N$