ABRHS PHYSICS NAME: KEY

Force Problems I

1. A car of mass 1000 kg is accelerating with a constant rate of 1.5 m/s^2. What is the net force acting on the car?

$m = 1000$ kg
$a = 1.5$ m/s^2

$\Sigma F = ma$

$\Sigma F = (1000)(1.5)$

$\Sigma F = 1500$ N

2. An airplane is accelerating down the runway. The mass of the airplane is 15,000 kg. If the engines are producing a net force of 45,000 N, what is the acceleration of the airplane?

$m = 15{,}000$ kg
$\Sigma F = 45{,}000$ N

$\Sigma F = ma$

$45{,}000 = (15{,}000)a$

$a = 3$ m/s^2

3. There is a net force of 200 N acting on a girl on a skateboard. If her acceleration is 4 m/s^2, what is her mass?

$\Sigma F = 200$ N
$a = 4$ m/s^2

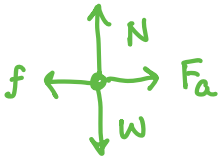
$\Sigma F = ma$

$200 = m(4)$

$m = 50$ kg

4. Tony is pulling Manny, who is sitting in a toy wagon. Tony is pulling with a force of 250 N. Manny and the wagon have a combined mass of 75 kg. If there is also a frictional force of magnitude 100 N acting on Manny and the wagon, what is Manny's acceleration?

$F_a = 250$ N
$f = 100$ N
$m = 75$ kg



$\Sigma F_x = ma$

$F_a - f = ma$

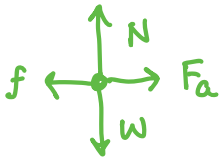
$250 - 100 = (75)a$

$150 = 75a$

$a = 2$ m/s^2

5. Sasha is pushing Kara with a force 350 N. Kara has a mass of 50 kg. If Kara is accelerating with a rate of 2 m/s^2, what is the magnitude of the force of friction acting on Kara?

$F_a = 350$ N
$m = 50$ kg
$a = 2$ m/s^2



$\Sigma F_x = ma$

$F_a - f = ma$

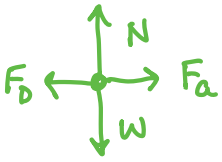
$350 - f = (50)(2)$

$350 - f = 100$

$f = 250$ N

6. A car of mass 1500 kg is accelerating with a rate of 3 m/s^2. If the magnitude of the retarding forces on the car is 6000 N, how much force must the engine be producing?

$F_D = 6000$ N
$m = 1500$ kg
$a = 3$ m/s^2



$\Sigma F_x = ma$

$F_a - F_D = ma$

$F_a - 6000 = (1500)(3)$

$F_a - 6000 = 4500$

$F_a = 10{,}500$ N

ABRHS PHYSICS NAME: _____

Force Problems I

7. You are in your car, mass 1500 kg, traveling down the highway with a speed of 25 m/s. You see traffic ahead and apply the brakes. You slow down to 15 m/s in 4 seconds. What was the net force on the car?

$m = 1500\ kg$
$v_i = 25\ m/s$
$v_f = 15\ m/s$
$t = 4\ s$

$a = \frac{v_f - v_i}{t}$

$a = \frac{15 - 25}{4}$

$a = -2.5\ m/s^2$

$\Sigma F = ma$

$\Sigma F = (1500)(-2.5)$

$\Sigma F = -3750\ N$

8. A happy physics student wants to determine how much force she can produce. Starting from rest, she accelerates and covers 5 meters in only 1.5 seconds. If she has a mass of 55 kg, what was the net force on her?

$v_i = 0\ m/s$
$\Delta x = 5\ m$
$t = 1.5\ s$
$m = 55\ kg$

$\Delta x = \frac{1}{2}at^2 + v_i t$

$5 = \frac{1}{2}a(1.5)^2$

$a = 4.44\ m/s^2$

$\Sigma F = ma$

$\Sigma F = (55)(4.44)$

$\Sigma F = 244\ N$

9. A skateboarder, mass 75 kg, coasts from 15 m/s to 10 m/s over a distance of 25 meters. What was the magnitude of the force of friction acting on the skateboarder?

$m = 75\ kg$
$v_i = 15\ m/s$
$v_f = 10\ m/s$
$\Delta x = 25\ m$

$v_f^2 = v_i^2 + 2a\Delta x$

$(10)^2 = (15)^2 + 2a(25)$

$100 = 225 + 50a$

$-125 = 50a$

$a = -2.5\ m/s^2$

Because coasting there is no "applied" force trying to speed up the skateboarder, so

$\Sigma F = ma$

$\Sigma F = (75)(-2.5)$

$\Sigma F = -188\ N$

Answers

1) 1500 N *2) 3 m/s²* *3) 50 kg*
4) 2 m/s² *5) 250 N* *6) 10,500 N*
7) –3750 N *8) 244 N* *9) 188 N*