Key

Problems

1. A 400-kg bear grasping a vertical tree slides down at constant velocity. What is the friction force that acts on the bear?
2. If a mass of 1 kg is accelerated 1 m/s² by a force of 1 N, what would be the acceleration of 2 kg acted on by a force of 2 N?
3. How much acceleration does a 747 jumbo jet of mass 30,000 kg experience in takeoff when the thrust for each of four engines is 30,000 N?
4. If you stand next to a wall on a frictionless skateboard and push the wall with a force of 30 N, how hard does the wall push on you? If your mass is 60 kg, what's your acceleration?
5. A firefighter of mass 80 kg slides down a vertical pole with an acceleration of 4 m/s². What is the friction force that acts on the firefighter?

(1) $F = ma$

At constant velocity, $a = 0\ m/sec^2$

Friction force = weight = mg =

$(400\ kg)(9.8\ m/sec^2) = 3920\ N$

(2) $F = ma$

$a = \frac{f}{m}$

$a = \frac{2\ kg\cdot m/sec^2}{2\ kg} = 1\ m/sec^2$

(3) $F = ma$

$a = f/m$

Total Thrust $= (4)(30{,}000\ N) =$

$120{,}000\ kg\cdot m/sec^2$

$a = \frac{120{,}000\ kg\cdot m/sec^2}{30{,}000\ kg} = 4\ m/sec^2$

(4) (a) 30 N

(b) $a = \frac{f}{m} = \frac{30\ kg\cdot m/sec^2}{60\ kg} =$

$0.5\ m/sec^2$

Questions

1. How much work is done on a 75-N bowling ball when you carry it horizontally across a 10-m-wide room? $W = Fd = 75\ N \cdot 10\ m = 750\ J$
2. How much work is done on it when you lift it 1 m? What power is expended if you lift it this distance in 1 s? $W = Fd = 75\ N \cdot 1\ m = 75\ J$
3. What is its gravitational potential energy in the lifted position?

$Wt = (mass)g =$ ~~88~~

$Power = \frac{W}{t} = \frac{75\ J}{1\ sec} = 75\ W$

$E_p = mgh = (wt)h = 75\ N \cdot 1\ m = 75\ J$

(5) $Wt = mg =$ ~~88~~ $80\ kg(9.8\ m/sec^2) =$

$784\ N$

Total $F = ma = (80\ kg)(4\ m/sec^2) =$

$320\ N$

Friction force = Wt − Total force =

$784\ N - 320\ N = 464\ N$