Hw
1-8-21

① A 5kg body collides with a 20 kg body and exerts 20N on it. So, force exerted by 20kg body on 5 kg body is

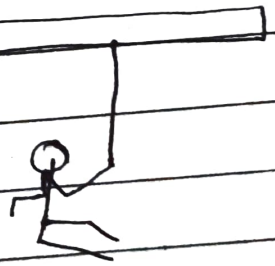
(c) 20N

② A man of mass 50kg is pulling (being suspended from it) a light rope suspended from a roof by what force the rope is pulling the roof?

Ans: Weight = $mg = 50 \times 9.8\,N = 490N$

③ A man of mass 50 kg is pulling (being suspended from it) a rope of mass 5kg suspended from a roof. By what force the rope is pulling the roof?

Ans: Weight = $mg = (50+5) \times 9.8 = 55 \times 9.8\,N = .539N$



④ A pendulum bob of mass 50g is suspended from the ceiling of an elevator. Find the tension in the string if the elevator.

Ans: Given that,

Mass $m = 50\,kg$

Acceleration $a = 1.2\ m/s^2$

Now, we have

$T - mg = ma$

$T = m(g + a)$

a) goes up with acceleration $1.2\ ms^{-2}$

The acceleration is upward

$T = m(g+a)$

$T = \frac{50}{100}(9.8 + 1.2)$

$T = 0.55N$

b) goes up with deceleration $1.2\ ms^{-2}$

$T = m(g-a)$

$T = \frac{50}{1000}(9.8 - 1.2)$

$T = 0.43N$

c) goes up with uniform velocity.

$T = \frac{50}{1000} \times 9.8$

$T = 0.49\ N$

d) goes down with acceleration $1.2\ ms^{-2}$

$T = \frac{50}{1000}(9.8 - 1.2)$

$T = 0.43N$

e) goes down with deceleration $1.2\ ms^{-2}$

$$T = \frac{50}{1000}(9.8 + 1.2)$$

$$T = 0.55N$$

f) goes down with uniform velocity.

$$T = \frac{50}{1000} \times 9.8$$

$$T = 0.49N$$

⑤ A monkey of mass 40 kg climbs on a rope (as shown in figure) which can stand a maximum tension of 600N. In which of the following cases will the rope break: the monkey

a) climbs up with an acceleration of $6\ ms^{-2}$

Mass of the monkey, $m = 40kg$

Acceleration due to gravity, $g = 10\ m/s$

Maximum tension that the rope can bear, $T_{max} = 600N$

Acceleration of monkey, $a = 6m/s^2$ upward

Using Newton's second law of motion, we can write the equation of motion as:

$$T - mg = ma$$

$$T = m(g + a)$$

$$= 40(10 + 6) = 640N$$

Since $T > T_{max}$, the rope will break.

b) climbs down with an acceleration of $4\ ms^{-2}$

Acceleration of monkey, $a = 4\ m/s^2$ down

Using Newton second law of motion, we get equation of motion:

$$mg - T = ma$$

$$T = m(g - a)$$

$$= 40(10 - 4)$$

$$= 240\ N$$

Since $T < T_{max}$, the rope will not break.

c) climbs up with an uniform speed of $5\ ms^{-1}$

The monkey is climbing with uniform speed of 5 m/s. Therefore acceleration is zero, i.e, $a = 0$

Using Newton's second law of motion

$$T - mg = ma$$

$$T - mg = 0$$

$$T = mg$$

$$= 40 \times 10$$

$$= 400N$$

Hence, $T < T_{max}$, the rope will not break.

d) falls down the rope nearly freely under gravity (Ignore the mass of rope)

When the monkey falls freely under gravity, it will acceleration become equal to the acceleration due to gravity i.e., $a = g$

Using Newton's second law of motion, we can write the equation of motion as:

$mg + T = mg$

$T = m(g - g) = 0$

Hence $T < T_{max}$, the rope will not break.