Chapter D - Problems

Blinn College - Physics 2425 - Terry Honan

Problem D.1

The same force acts at different times on two masses. m_1 is given an acceleration of $4\,\mathrm{m/s^2}$ and m_2 is given an acceleration of $1\,\mathrm{m/s^2}$.

(a) What is the ratio of the masses, m_2/m_1?

(b) Suppose the two masses are combined and the same force is acted on the combination. What is its acceleration?

Problem D.2

A 2 ton truck provides an acceleration of $3\,\mathrm{ft/s^2}$ to a 4 ton trailer. If the truck exerts the same force on the road while pulling a 16 ton trailer, what acceleration results? Assume there are no resistive forces.

Problem D.3

A 5 g bullet is accelerated to $300\,m/s$ down a 72 cm gun barrel. Assuming a uniform acceleration, what is the net force on the bullet in the gun barrel?

Problem D.4

The displacement of 20 kg mass as a function of time in SI units is given by:

$$\vec{r}(t) = \left\langle 2t^3 - 9t - 15,\, -6t^2 + 5t + 18 \right\rangle.$$

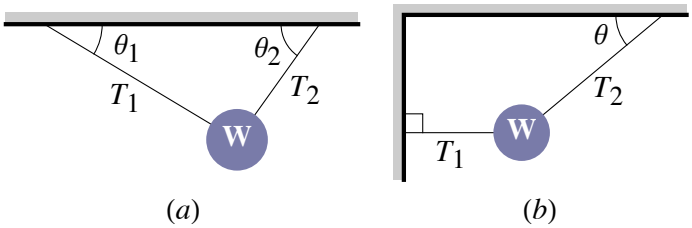
What is the net force acting on the mass as a function of time? What is the net force at $t = 2$ s?

Problem D.5

Two forces $\vec{F}_1$ and $\vec{F}_2$ act on a 12 kg mass to produce an acceleration of magnitude $3\,\mathrm{m/s^2}$ in the negative y-direction. If the first force is given by $\vec{F}_1 = \langle -30, 20 \rangle$ N then what is the value of the second force $\vec{F}_2$?

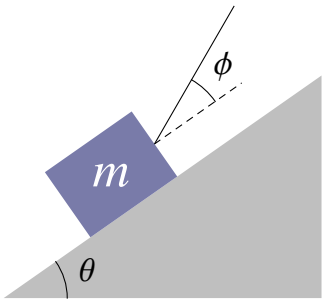
Problem D.6

A weight W hangs from two strings as shown. What are both tensions T_1 and T_2? Leave your answers as multiples of W.
(a) $\theta_1 = 35\,°$ and $\theta_2 = 65\,°$
(b) Solve using θ as arbitrary.



(a) (b)

Problem D.7

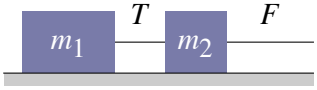


(a) A block of mass m is lowered down an incline at a constant speed v by a rope as shown above. What is the tension in the rope T?

(b) A block of mass m is lowered down an incline at a constant acceleration a (down the incline) by a rope as shown above. What is the tension in the rope T?

(c) A block of mass m is pulled up an incline at a constant acceleration a (up the incline) by a rope as shown above. What is the tension in the rope T?

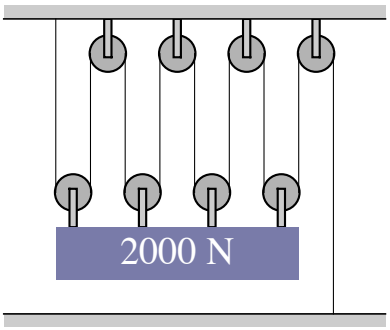
Problem D.8



Two blocks with masses m_1 and m_2 are dragged along a frictionless surface as shown. They are pulled by a force F and are connected by a string. What is the tension T between the blocks?

Problem D.9

Assume all pulleys are ideal. This means they are frictionless and massless.



(a) With what tension does the floor pull downward on the rope on the right?

(b) If the rope on the right is disconnected from the floor then what tension is needed to lift the weight at a constant speed of $3\ \frac{\text{m}}{\text{s}}$?

(c) What tension is needed to lift the weight at a constant upward acceleration of $2\ \frac{\text{m}}{s^2}$?

(d) What tension is needed to lower the weight at a constant downward acceleration of $2\ \frac{\text{m}}{s^2}$?

Problem D.10

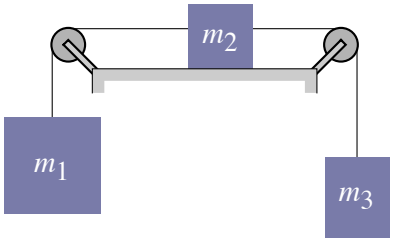
What is the minimum stopping distance for a car with an initial speed of 30 mi/hr given a coefficient of static friction of 0.55? How would this change on an icy day with a coefficient of 0.15?

Problem D.11

Three masses are connected as shown m_1 is the largest and m_2 slides with a coefficient of friction μ_k.

(a)What is the acceleration of the system?

(b) If $m_1 = 10\,\text{kg}$, $m_2 = 4\,\text{kg}$, $m_3 = 6\,\text{kg}$ and $\mu_k = 0,35$ then find the value of a. What are the two tensions, between m_1 and m_2 and between m_2 and m_3?



Problem D.12

A mass m on a steep incline of angle θ with a coefficient of static friction μ_s is held by a rope that is parallel to the incline and pulling up the incline. Without the rope the mass will slide down the incline. For what range of tensions will the mass not slide. Note that if the tension is sufficiently large the mass will slide up the incline.