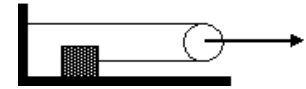


4. A block is positioned on an inclined surface with a coefficient of static friction of 0.75. At what angle of inclination with respect to the horizontal, will the block start sliding down?



- (1) 37° (2) 49° (3) 41° (4) 53° (5) 75°

5. One end of a string is attached to a wall and the other end to a block of mass $m = 2$ kg as shown in figure. A force $F = 40$ N is applied to the massless pulley, also shown in figure. If the coefficient of kinetic friction between the block and the floor surface is 0.6, what is the acceleration in m/s^2 of the block?



- (1) 4 (2) 6 (3) 8 (4) 10 (5) 12

6. A ski lift raises 100 passengers averaging 660 N in weight per person to a height of 150 m in 60 seconds, at a constant speed. What average power is required of the force making the lift?

- (1) 165 kW (2) 66 kW (3) 150 kW (4) 300 kW (5) 100 kW

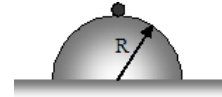
7. A brick of mass $m = 4$ kg is attached to a spring hanging from the ceiling. The spring constant k is 100 N/m. The brick is then slowly lowered by hand, thus stretching the spring until it reaches equilibrium. How much work did the spring do while the brick was lowered?

- (1) -8 J (2) -16 J (3) 0 J (4) 8 J (5) 16 J

8. A force F acts on a particle of mass 2 kg causing it to move in one dimension according to the equation $x(t) = 5 + 4t - 2t^2$ (t is in seconds and x is in meters). Find the work done by the force F from $t = 0$ sec to $t = 3$ sec.

(1) 48 J (2) 24 J (3) -12 J (4) -24 J (5) 0 J

9. A boy is initially seated on top of a hemispherical ice mound of radius R . He begins to slide down the ice, with a negligible initial speed. If the ice is virtually frictionless, at what height above the ground does he lose contact with the ice mound?

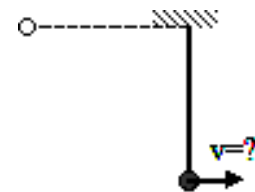


(1) $(2/3)R$ (2) $(1/3)R$ (3) $(1/4)R$ (4) $(2/5)R$ (5) $(3/4)R$

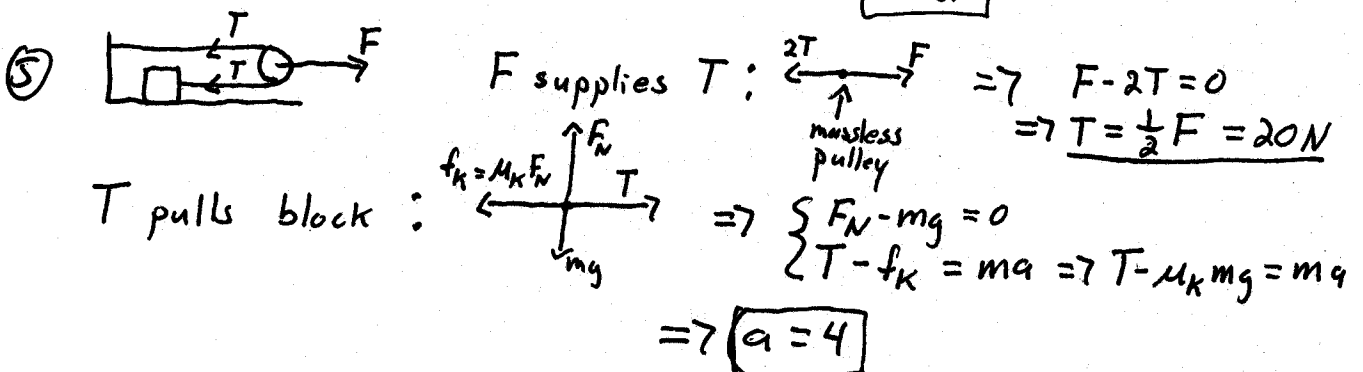
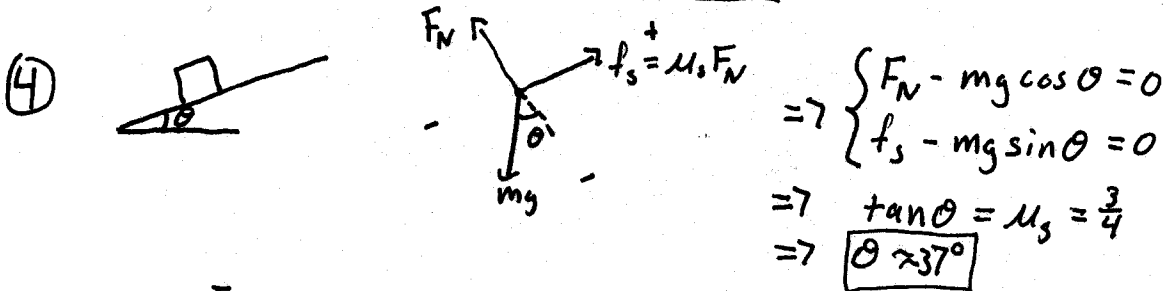
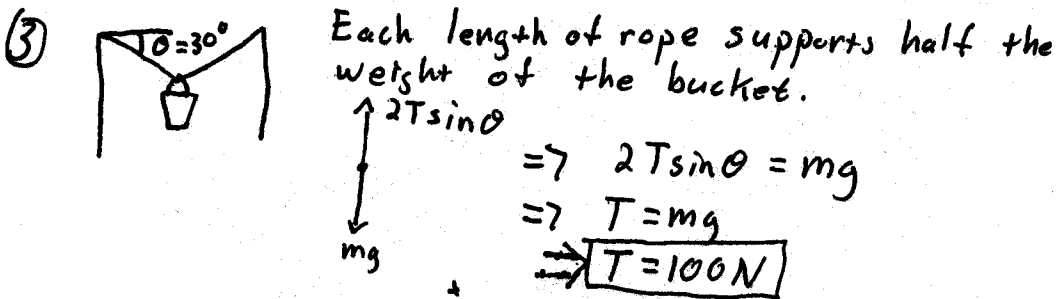
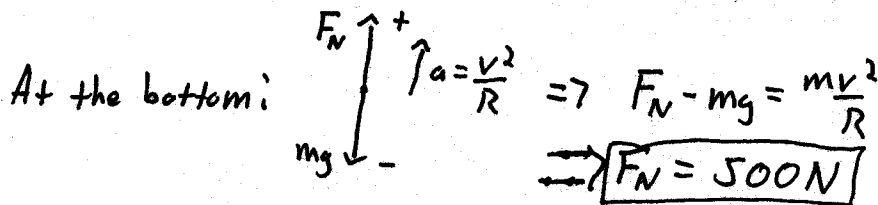
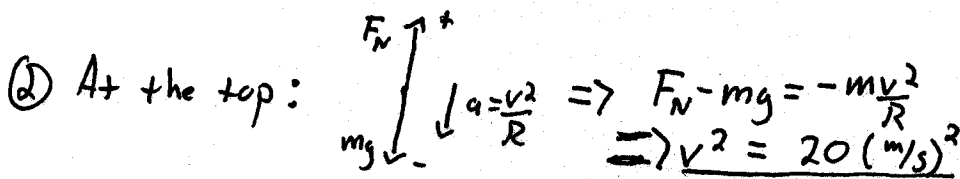
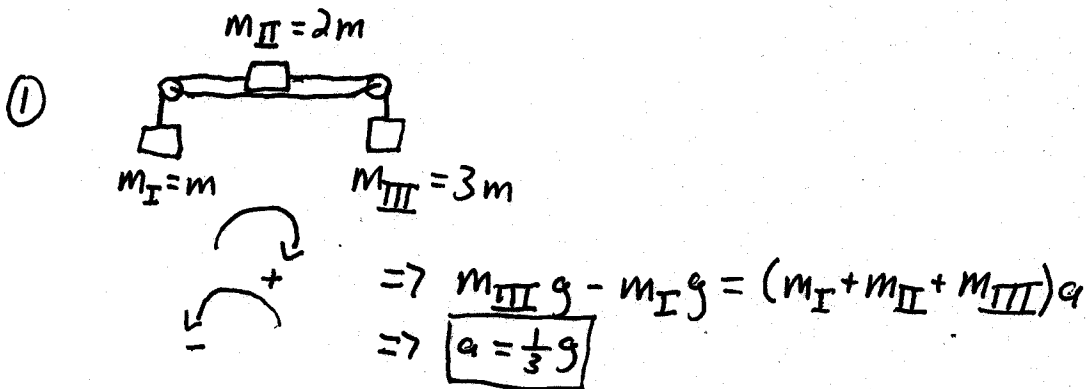
10. A golf ball is struck by a golf club and falls on a green eight feet above the tee. The potential energy of the Earth-ball system is greatest:

(1) when the ball reaches the highest point in its flight
 (2) just after the ball lands on the green
 (3) just after the ball is struck
 (4) just before the ball is struck
 (5) when the ball comes to rest on the green

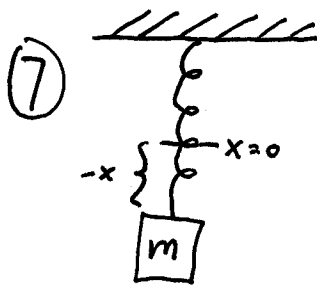
11. A pendulum consists of a massless string of length R with a mass m attached to the end. The pendulum is held horizontally and allowed to swing downwards. How fast is it going at the bottom of the swing?



(1) $\sqrt{2gR}$ (2) \sqrt{gR} (3) $\sqrt{2gR}/m$ (4) $m\sqrt{gR}$ (5) mgR



⑥ $P = Fv = [(100)(660)] \left[\frac{150}{60} \right] = \boxed{165 \text{ kW}}$



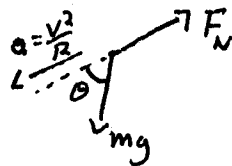
In equilibrium: $Kx - mg = 0$

$$\Rightarrow x = \frac{mg}{K} = \frac{2}{5} m$$

$W = -\frac{1}{2} Kx^2 = \boxed{-8 \text{ J}}$ - because block ends up farther away from $x=0$

⑧ $v(t) = \frac{dx(t)}{dt} = (4 - 4t) \text{ m/s}$

$W = \Delta K = \frac{1}{2} m ([v(3)]^2 - [v(0)]^2) = \boxed{48 \text{ J}}$



$$F_N - mg \cos \theta = -m \frac{v^2}{R}$$

loses contact when $F_N = 0$

$$\Rightarrow v^2 = gR \cos \theta \quad \text{①}$$

If $U = mgR$ at the top then $U = mgR \cos \theta$ when contact is lost.

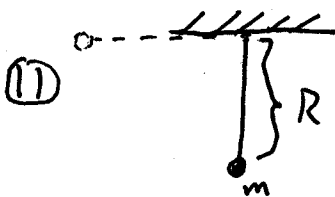
Cons of E $\Rightarrow mgR = \frac{1}{2} mv^2 + mgR \cos \theta$

$$\Rightarrow v^2 = 2gR(1 - \cos \theta) \quad \text{②}$$

① = ② $\Rightarrow \cos \theta = \frac{2}{3} \quad \therefore h = R \cos \theta = \boxed{\frac{2}{3} R}$


⑩ $E = U + K$ conserved

at highest pt. $K = 0 \Rightarrow U = E$ (max)




Cons of E $\Rightarrow \frac{1}{2} mv^2 = mgR$

$$\Rightarrow \boxed{v = \sqrt{2gR}}$$

⑫  Cons of E $\Rightarrow \frac{1}{2}mv^2 = mgL\sin\theta + \Delta E_{th}$
 $\Rightarrow \Delta E_{th} = \boxed{2J}$

⑬ $F(x) = -\frac{d}{dx}U(x) = (4-x)e^{-x/4}$
 $F(0) = \boxed{4N}$

⑭ Cons of E $\Rightarrow \frac{1}{2}mv^2 = f_k d$
 $= \mu_k mgd$
 $\Rightarrow d = \boxed{100m}$ (after converting $\frac{m_i}{h} \rightarrow \frac{m}{s}$)

⑮  $F = \mu_s F_N = \mu_s (m+M)g$
 $= \boxed{30N}$