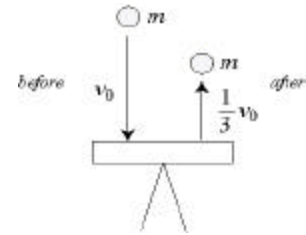


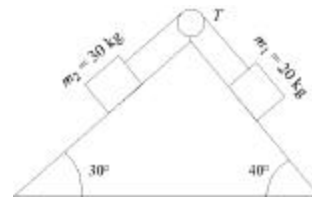


4. A ball of mass  $m$  strikes a scale with a speed  $v_0$ . It rebounds at the speed of  $\frac{1}{3}v_0$ . What is the impact force on the ball? Assume the contact time is  $t$ .



- (1)  $\frac{4}{3} \frac{mv_0}{t}$                       (2)  $\frac{mv_0}{t}$                       (3)  $\frac{2}{3} \frac{mv_0}{t}$                       (4)  $v_0 t$                       (5) 0
5. How many grams of hot steam at  $130^\circ\text{C}$  are needed to heat 1000 g of water at  $50^\circ\text{C}$  to  $90^\circ\text{C}$ ? ( $C_{\text{water}} = 1 \text{ cal/g/}^\circ\text{C}$ ,  $C_{\text{steam}} = 0.46 \text{ cal/g/}^\circ\text{C}$ )
- (1) 71.1                      (2) 36.2                      (3) 326.3                      (4) 0.5                      (5) 13.8
6. The temperature of the sun's surface is 5500 K. How much heat does it radiate in a day assuming the sun is a blackbody (in J)? ( $R_{\text{sun}} = 7 \times 10^8 \text{ m}$ )
- (1)  $2.8 \times 10^{31} \text{ J}$                       (2)  $3.6 \times 10^{20}$                       (3) 560.2                      (4)  $4.3 \times 10^{50}$                       (5)  $3.9 \times 10^6$
7. A 0.5 kg mass vibrates with amplitude 5 cm at the end of a spring whose spring constant is 25 N/m. Find the speed of the mass when its displacement is 4 cm (in m/s).
- (1) 0.21                      (2) 1.4                      (3) 366                      (4) 2.1                      (5) 3.6
8. A 50 cm length of straight pipe is attached to a car's muffler. This tail pipe acts as a tube open on one end but closed on the other. Assume the speed of sound is 360 m/s in the pipe. Find the frequency of its first overtone (Hz) (hint: the second lowest frequency).
- (1) 540                      (2) 300                      (3) 4060                      (4) 15                      (5) 70
9. Which of the following statements is incorrect?
- (1) The fundamental frequency of a string or pipe depends on external force.
  - (2) Waves can pass through each other when they meet.
  - (3) The higher the frequency, the shorter the period.
  - (4) The speed of a wave is given by a product of the frequency and wavelength.
  - (5) A pipe with one end open has a lower fundamental frequency than a closed pipe of the same length.

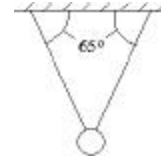
10. Assume zero friction. What is the acceleration of the system? ( $\text{m/s}^2$ )



- (1) 0.42 to the left                      (2) 0.33 to the right                      (3) 0 static                      (4) 3.2 to the left                      (5) 1.6 to the right



18. Find the tension in each cord shown if the object weighs 50 N.



- (1) 27.6 N                      (2) 55.1 N                      (3) 13.7 N                      (4) 22.5 N                      (5) 45.4 N

19. A certain mass undergoes simple harmonic motion at the end of a spring. The period of the motion is 2.10 s. The mass oscillates back and forth through a total distance of 20 cm. Find the maximum speed of the mass.

- (1) 0.3 m/s                      (2) 20 m/s                      (3) 2.1 m/s                      (4) 0.03 m/s                      (5) 70 m/s

20. A heavy weight hangs at the end of a 140-m cable. A worker at the top of the cable notices that when he strikes the top of the cable sideways, the pulse hits the weight after a time of 4.0 s. With about what frequency must he vibrate the top end if the rope is to resonate in its fundamental?

- (1) 0.125 Hz                      (2) 17.5 Hz                      (3) 4.4 Hz                      (4) 557 Hz                      (5) 2.0 Hz