a. There is a 0.010 m think layer of ice on a circular lake of radius 500 m. Find the mass of the ice.

$m = \rho V = 917(10^{-2})\pi(500)^2$

$= \boxed{7.2\times10^6\ \text{Kg}}$

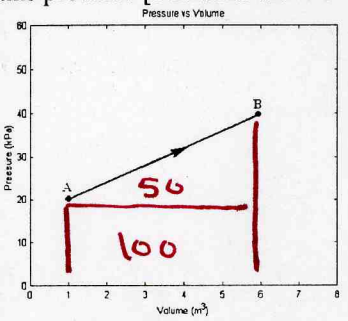
b. A skier coasts down a 100 m high hill starting at 10 m/s. Neglecting the friction between the skies and the snow, determine how fast the skier should be moving at the bottom of the hill.

$\frac{1}{2}mv_0^2 + mgh = \frac{1}{2}mv^2$

$v^2 = v_0^2 + 2gh$

$= 100 + 2(9.8)100 \Rightarrow v = \boxed{45 \text{m/s}}$

c. The internal energy of a gas at the two points is $U_A = 360$ kJ and $U_B = 560$ kJ. What is the heat transferred to the gas during this process? [The units are in kPa and m^3.]



$\Delta U = Q - W$

$Q = \Delta U + W$

$= 200 + 150$

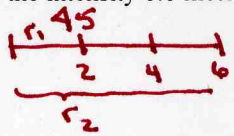
$= \boxed{350\ \text{KJ}}$

d. A ball begins to roll up an inclined plane without slipping at a translational speed of 5.0 m/s. How high does the ball get before turning around? Assume there is no energy loss?

$mgh = \frac{7}{10}mv^2$

$h = \frac{7v^2}{10g} = \boxed{1.8\text{m}}$

e. The intensity of sound is 45 ~~W~~ W/m^2 two meters from a source. What is the intensity 6.0 meters from the source?

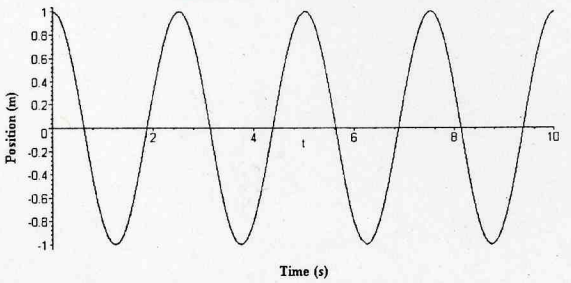


$\frac{I_2}{I_1} = \left(\frac{r_1}{r_2}\right)^2 = \frac{1}{9}$

$\Rightarrow I_2 = \frac{45}{9} = \boxed{5 W/m^2}$

f. For the graph below, give the

i. Amplitude 1.0m ii. Period 2.5s



g. What is the mass of a CO_2 molecule? [C – 12, O – 16]

$m = \frac{44}{6.02\times10^{23}}\ g \times \frac{1\ kg}{1000\ g} = \boxed{7.3\times10^{-26}\ kg}$

h. The moon moves in an approximately circular orbit above the Earth at a distance of 3.85×10^5 km. How fast should the moon be moving to maintain this orbit?

$v = \sqrt{\frac{GM}{r}} = \sqrt{\frac{(6.67\times10^{-11})(5.98\times10^{24})}{(3.85+.06)10^8}}$

$= \sqrt{10.20\times10^6} = \boxed{10^3 \text{m/s}}$

i. An inventor claims to have developed a heat engine that, on each cycle, takes in 120 kcal of heat from a high-temperature reservoir at 400°C and exhausts 48 kcal to the surroundings at 125°C. Would you invest your money in the production of this engine? Explain.

$e = \frac{72}{120} = 0.6 = \boxed{60\%}$

$e_{max} = 1 - \frac{T_C}{T_H} = 1 - \frac{398}{673} = \boxed{41\%}$

No!

j. At a circus a 90 kg man is shot with a speed of 10 m/s from a cannon. Assuming he is accelerated to this speed in half a second, what average force was used to accelerate the man?

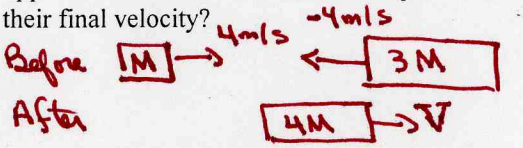
$\bar{F} = \frac{\Delta p}{\Delta t} = \frac{90(10)}{1/2} = \boxed{1800\text{N}}$

k. An 85.0 kg person stands on a scale in an elevator. What is the apparent weight when the elevator is accelerating upward at 2.00 m/s^2?

$W_{app} = mg + ma$

$= \boxed{1003\text{N}}$

l. An object of mass M is moving along the x-axis with velocity 4.0 m/s when it collides with an object of mass 3M traveling in the opposite direction at -4.0 m/s. The objects stick together. What is their final velocity?



$4M + (3M)(-4) = 4MV$

$-8M = 4MV \Rightarrow V = \boxed{-2\text{m/s}}$