EE180J. Homework#2, sp 2106.solns.

(1)

Homework #2/ EE180J

1) $P_{OUT} = 10\,KW$

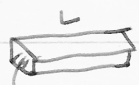
$P_{IN} = (IV)_{IN} = (2A \times 10\,KV) = \cancel{20\,watts}\ 20\,K\,watts$

$\therefore EFF = P_{OUT}/P_{IN} = \frac{10\,KW}{20\,KW} = \boxed{0.5 = EFF} = 50\%$

2) Heat is the total amount of Kinetic Energy due to molecular motion in a system. It depends on the size of the system.

Temperature is a measure of heat, but ~~pres~~ represents the average kinetic energy of motion of atoms/molecules in the system. It does not depend upon size.

3)



$A = 25\,cm^2$, $L = 30\,cm = \Delta l = 0.3\,m$

$\Delta T = 100°C - 20°C = 80°C. = 80°K$ //

Al bar, thermal conductivity $K = 205\ W/m°K$

$\therefore P = KA\frac{\Delta T}{\Delta l} = \frac{205\,W}{m°K} \times 25 \times 10^{-4}\,m^2 \times \frac{80°K}{.3\,m} = \cancel{136.7}\ 136.7\ Watts$

$\boxed{P = 136.7\ watts}$

② cont Hmwk #2/EE80J sp2016

4) 1 hp = 745.7 watts

∴ Honda Civic at 140 hp ⟹ 104.4 kWatts

estimate size of roof ~ 4'x5' = 1.86 m²

∴ power produced by PV panels (20% efficiency) covering roof is:

$$P_{roof} = 0.2 \times P_{solar} \times \underbrace{A_{roof}}_{=1.86\,m^2}$$

you can use several i'mes for solar power (insolation) in Northern Calif.

$$P_{solar}/area \approx 0.25\ kW/m^2$$

∴ at roof, $P_{roof} = 0.25 \frac{kW}{m^2} \times 1.86\,m^2 = .465\ kW$

w/ 20% eff/ $P_{roof}^{ACT} = .465\ kW \times .2 = 93\ watts = P_{roof}^{ACT}$

more than 10^3 smaller than you need

5) # homes = 8×10^4, P_{AVG} = 900 kWh/month per home

$$P_{AVG} = \frac{900\ kWh}{month\left(\frac{30\ days}{month}\right) \times \left(\frac{24\ hr}{day}\right)} = 1.25\ kWatts$$

if array is 20% eff.

then power/home = ~~1.25 kWatts / .2 = 250 watts/home~~

= 1.25 kWatts / 0.2 = 6.25 kWatts of solar needed per home.

∴ $P_{all\ homes} = 8 \times 10^4 \times 6.25\ kW = 50 \times 10^4$ kWatts

∴ $A_{tot} = \frac{5 \times 10^5\ kWatts}{.25\ kW/m^2} = 2 \times 10^6\ km^2 = 2\ km^2$