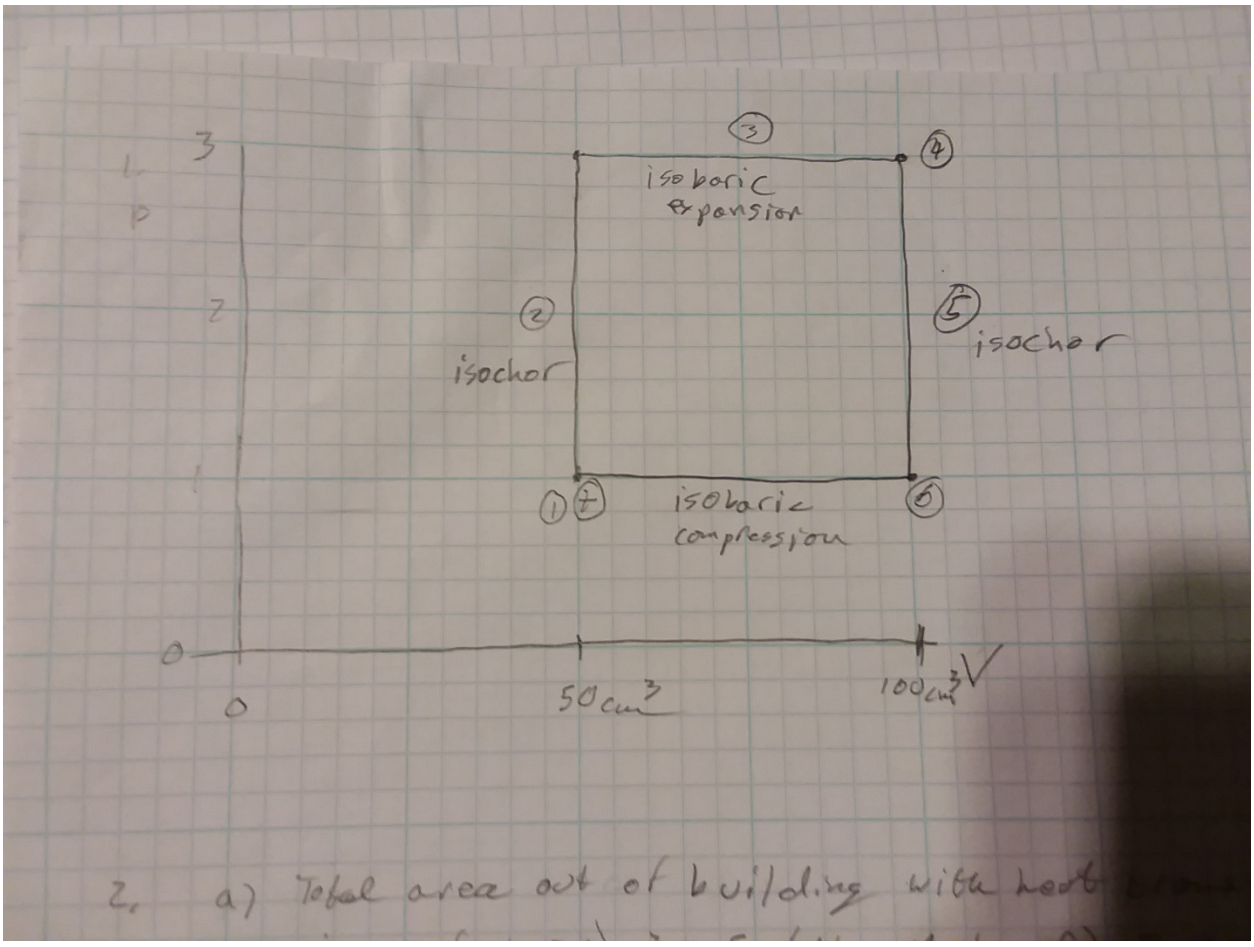

2. a) Total area out of building with heat

3. a) $T_H = 700°C = 973K$
$T_C = 3K$

$\eta_{carnot} = 1 - \frac{3K}{973K} = 0.9969$

b) $\eta = \frac{W_{out}}{Q_H} \rightarrow W_{out} = \eta Q_H$
$= (0.9969 \times 500W)$
$= 428 W$

c) Typical power supplies for Tower computers (newegg.com) are 400W - 1000W so space probe doesn't have much to work with.

2. a) Total area of building with heat transfer is $(20\times20\text{m})\times5 = 2000\ m^2$
Each m^2 passes 50 W so total rate of energy transfer is $(2000\ m^2)\times 50\ W/m^2$
$= 100{,}000\ W$.
Over an 8 hour day total energy

$$Q_c = (100{,}000\ W)\times(8\ hr)\times\frac{3600\ sec}{1\ hr} = 2.88\times10^9\ J$$

If $K = 4 = \frac{Q_c}{W_{in}} \Rightarrow W_{in} = \frac{Q_c}{4} = 7.2\times10^8\ J$

b) If ice stays at 0°C, all we do with energy changes is freeze/melt ice.
So how much ice will 2.88×10^9 J melt?

$$Q = ML \Rightarrow M = \frac{Q}{L} = \frac{2.88\times10^9\ J}{3.33\times10^5\ J/kg} = 8.65\times10^3\ kg$$

c) Same amount of energy (Q_c) and same K (=4) so same electric energy (W_{in})

d) If power company bills $\frac{1}{5}$ as much at night, this is a big win in operational cost (5x less $).