

S.B.B Chill Cooler (HW 2.2)

1. We would be able to use Comsol to help us develop the thermal circuit profile (schematic) for heat extraction analysis.

2. Bill of Materials

- Cooler - \$48.99

https://www.amazon.com/Coleman-Insulated-Portable-Leak-Proof-Capacity/dp/B0BLXL7QFM/ref=sr_1_2_mod_primary_new?crid=1GKXE4YDK6PYN&keywords=coleman%2Bcooler%2B52%2Bquart&qid=1696897756&sbo=RZvfv%2F%2FHxDF%2BO5021pAnSA%3D%3D&sprefix=coleman%2Bcooler%2B52%2Caps%2C93&sr=8-2&th=1

- R134 refrigerant compressor - \$473

https://www.amazon.com/dp/B082TXZ7R6?ref=cm_sw_r_apin_dp_C15CCF88BZFTWBKXR7WQ

- Fan option 1 - \$17

https://www.amazon.com/120mm-Waterproof-Ventilation-Cooling-3500RPM/dp/B08KY3PFYV/ref=asc_df_B08KY3PFYV/?tag=hyprod-20&linkCode=df0&hvadid=647234334956&hvpos=&hvnetw=g&hvrnd=6818783264549998129&hvpone=&hvptwo=&hvgmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-1950519777588&psc=1&gclid=CjwKCAjwyY6pBhA9EiwAMzmfwYU7UMVoRWJzQPDLy0HkGrP7yzl3CMd9R33liYIM9A4dWtVnuar67hoCjl8QAvD_BwE

- Second Fan option - \$38.00

https://www.amazon.com/TITAN-Waterproof-Dustproof-Cooling-120mm/dp/B07MSGZJ46/ref=asc_df_B07MSGZJ46/?tag=&linkCode=df0&hvadid=366315306136&hvpos=&hvnetw=g&hvrnd=6818783264549998129&hvpone=&hvptwo=&hvgmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-811921614371&ref=&adgrpid=75347436639&th=1

- (TEC) Second cooling option - \$41.00

https://www.amazon.com/dp/B07HCBMJM4/ref=sspa_dk_detail_1?psc=1&pd_rd_i=B07HCBMJM4&pd_rd_w=jjAOn&content-id=amzn1.sym.386c274b-4bfe-4421-9052-a1a56db557ab&pf_rd_p=386c274b-4bfe-4421-9052-a1a56db557ab&pf_rd_r=2091MY8PFER7SG0C580F&pd_rd_wg=Bgllc&pd_rd_r=1ccfaa7b-6de3-4160-b33e-2a9100bbb06e&s=industrial&sp_csd=d2lkZ2V0TmFtZT1zcF9kZXRhWxZGhlfWF0aWM

- Soft copper tubing (25ft) - \$24.00

<https://www.homedepot.com/p/Everbilt-1-4-in-x-20-ft-Soft-Copper-Refrigeration-Coil-Tubing-D-04020PS/100343040>

- Refrigerant - \$12.00

https://www.autozone.com/a-c-charging-and-refrigerant/r134a-refrigerant/p/shoppro-r134a-refrigerant-12oz/3275_0_0?spps.s=1755&cmpid=LIA:US:EN:AD:NL:1000000:ACC:19323145846&&CATARGETID=120054150001286292&CADevice=c&gclid=CjwKCAjwyY6pBhA9EiwAMzmfwa0a372

[vAya0mz1mqHBGKYdxueFZz5VMKz9WvDVb5dANtTpE0E4PPBoCLdMQAvD_BwE&gclid=aw.ds](https://www.amazon.com/Milwaukee-48-11-2460-REDLITHIUM-Extended-Lithium-Ion/dp/B07FB8N31X/ref=asc_df_B07FB8N31X/?tag=hyprod-20&linkCode=df0&hvadid=309813767497&hvpos=&hvnetw=g&hvrnd=1671583942409991274&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-638042324111&psc=1)

- Battery - \$89.00

https://www.amazon.com/Milwaukee-48-11-2460-REDLITHIUM-Extended-Lithium-Ion/dp/B07FB8N31X/ref=asc_df_B07FB8N31X/?tag=hyprod-20&linkCode=df0&hvadid=309813767497&hvpos=&hvnetw=g&hvrnd=1671583942409991274&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-638042324111&psc=1

- Battery adapter - \$13.00

https://www.amazon.com/Milwaukee-Converter-Terminals-Connector-Robotics/dp/B0BK88BXZ5/ref=asc_df_B0BK88BXZ5/?tag=hyprod-20&linkCode=df0&hvadid=652500096716&hvpos=&hvnetw=g&hvrnd=6066249072580741862&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-2008855658155&psc=1&gclid=CjwKCAjwyY6pBhA9EiwAMzmfwTYOMAKbznBQjIJRoaoWVEeUtfIVX6GoqTid3MFDDaWfbYcCD0QPIBoC4CIQAvD_BwE

- Thermostat on/off switch - \$14.00

https://www.amazon.com/FainWan-Temperature-Controller-Thermostat-One-Channel/dp/B09PN5F3S5/ref=sr_1_1_sspa?keywords=12+volt+temperature+switch&qid=1696899765&sr=8-1-spons&sp_csd=d2lkZ2V0TmFtZT1zcF9hdGY&psc=1

- Fasteners - \$7.00

<https://www.homedepot.com/p/8-32-x-3-4-in-Phillips-Hex-Zinc-Plated-Machine-Screw-50-Pack-806402/204283034>

- Threaded inserts for mounting - \$8.00

https://www.amazon.com/LOKMAN-Pieces-8-32UNC-Threaded-Knurled/dp/B07BFV8GHT/ref=asc_df_B07BFV8GHT/?tag=hyprod-20&linkCode=df0&hvadid=241964173834&hvpos=&hvnetw=g&hvrnd=472820212109377842&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-448964137119&th=1

- Mounting plate - (\$54 total) \$13.50 for each plate

https://www.amazon.com/UHMW-Polyethylene-Plastic-Sheet-Natural/dp/B07VZ7CQSB/ref=asc_df_B07VZ7CQSB/?tag=hyprod-20&linkCode=df0&hvadid=674004419480&hvpos=&hvnetw=g&hvrnd=7894311333460200818&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9015378&hvtargid=pla-2204839130600&psc=1&gclid=CjwKCAjwyY6pBhA9EiwAMzmfwQ7XQ2TKGXCYkCZy9wwiYg0Q1Jr31ifs6yVw2QgaHV6rs7MZY8ughoCU7oQAvD_BwE

Total cost for option 1 = \$719.49

Total cost for option 2 = \$272.49

For option 1 a good selling price to the public is \$899.36 (25% markup)

For option 2 a good selling price to the public is \$342.36 (25% markup)

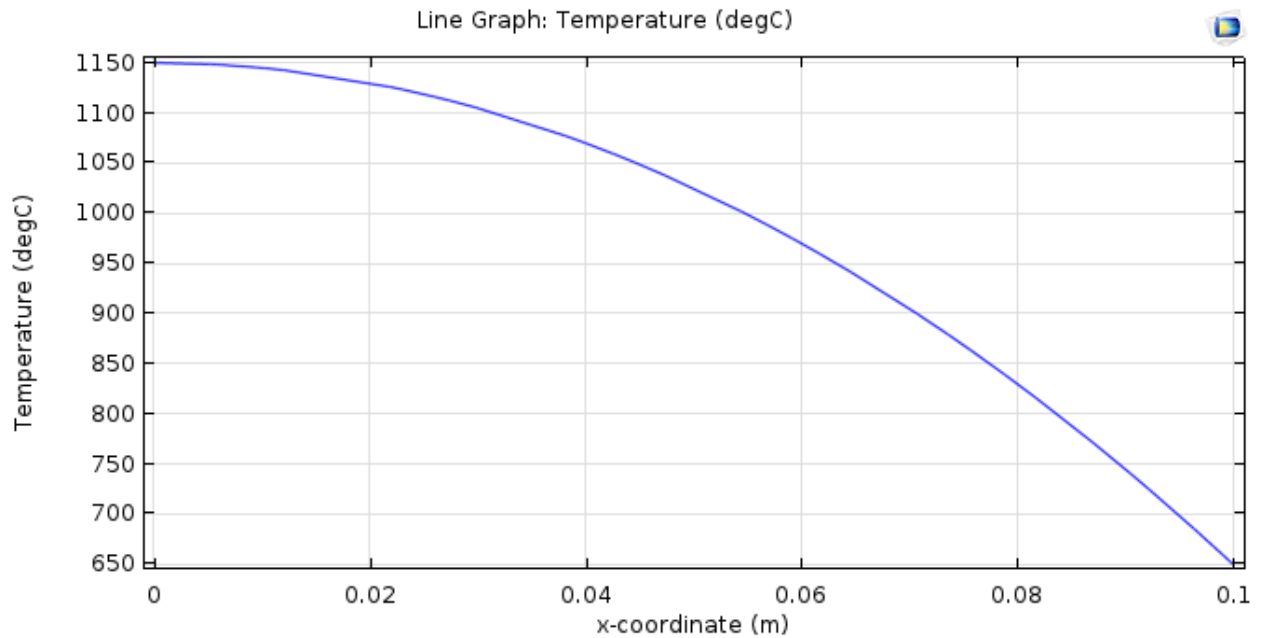
MET 440 HW 2.2 Group 5

Problem 5-3

Plain slab $L=0.1\text{m}$

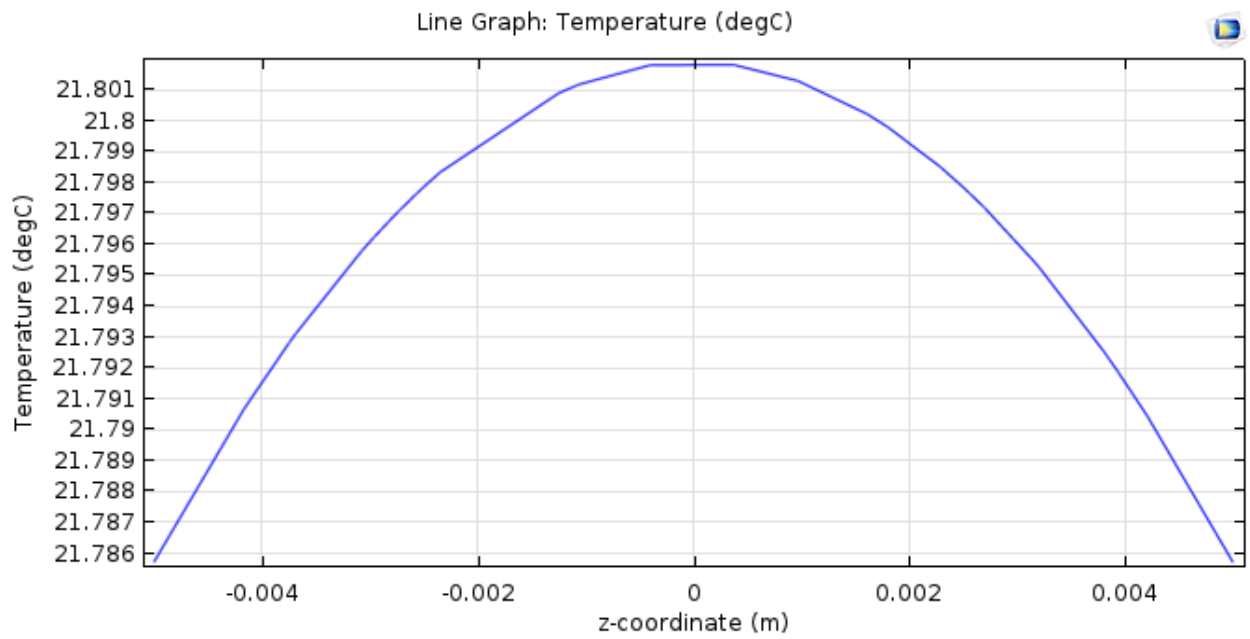
$X=0$, insulated, $X=L$, dissipated convection w/ $h=200\text{ W/m}^2\text{C}$, $t_{\text{inf}}=150\text{ degC}$, $k_{\text{wall}}=10\text{ W/m C}$,
 $g=10\text{ W/M}^3$

Temperatures at the surface are $X=0$ is 1150degC & $X=L$ is 650degC .



Problem 5-14

Copper rod, $r=0.05\text{m}$ $k=386\text{W/m}\cdot\text{C}$, $g=10^6\text{ W/m}^3$, $t_{\text{inf}}=20\text{degC}$, $h=1400\text{W/m}^2$



Problem 3

$L=0.1$, $k=20\text{W/m C}$, $h = 400\text{W/m}^2\text{C}$, $t = 150\text{ degC}$, $g=2*10^6\text{W/m}^3$.

