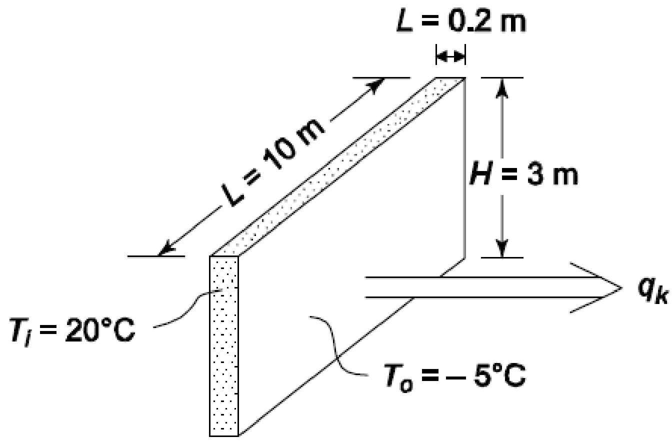
1. State the differences between the various heat transfer modes
2. What is the driving force for heat transfer?
3. Which one of the following is not a material constant:
    - Thermal conductivity
    - Convective heat transfer coefficient
    - Electron free path
4. Under what circumstances can one expect radiation heat transfer to be significant?
5. Evaluate the claim which indicates that heat cannot be transferred in a vacuum.
6. By equations, show what is meant by the term "one-dimensional and steady state" in the context of conduction heat transfer?
7. How ***one-dimensional conditions*** can be achieved for the "one-dimensional and steady state" heat transfer.
8. State the way by which heat can transfer in solids.
9. Show how the conductivity of liquid can be enhanced.
10. Why quartz show high thermal conductivity although it is an electrical insulator.
11. Derive the equations that represent the thermally conductivity through the thickness direction of bilayer walls.
12. Compare the conductivity in the following pairs:
    - Water and Water-Al_2O_3 suspension.
    - Pure copper and copper alloys
    - Fine grained pure copper and coarse grained pure copper
    - 1000 nm pure copper film and 100 nm pure copper film
    - Pure copper at room temperature and elevated temperatures.

- He and Ne.

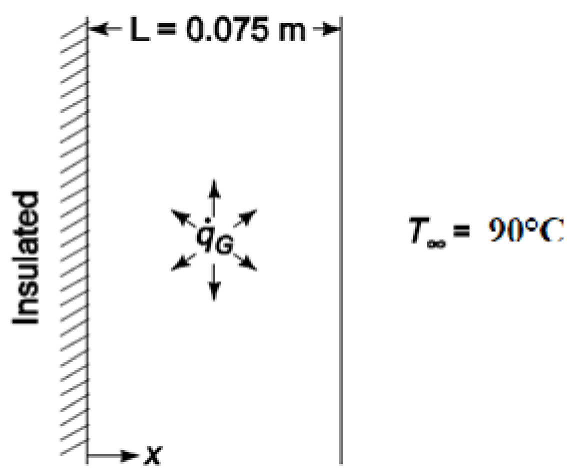
13. What is the contact resistance?

14. What is the electron free path?

Problem 1
If inner and outer faces of a concrete wall with thickness of 20 cm is kept at a temperature 20 °C and -5 C, respectively, and the thermal conductivity of the concrete is 1.2 W/(m.K). Determine the heat loss through a wall 10 m long and 3 m high.



Problem 2
A wall with 7.5 cm thickness (shown below) generates heat at the rate of 105 W/m^3. One side of the wall is insulated, and the other side is exposed to an environment at 90°C. The convective heat transfer coefficient between the wall and the environment is 500 W/(m^2.K). Under one-dimensional-steady state conditions, and if the thermal conductivity of the wall is 12 W/m.K, calculate the maximum temperature in the wall.



Problem 3

A composite wall (shown below) has uniform temperatures. If the thermal conductivities of the wall materials are: k_A = 70 W/m.K, k_B = 60 W/m.K, k_C = 40 W/m. K, and k_D = 20 W/m.K, and contact resistance at each interface R_i = 0.1 K/W, determine the rate of heat transfer through this section of the wall and the temperatures at the interfaces. (Surfaces normal to heat transfer direction are isothermal).