Conduction case essay sample

1. The rear window of an automobile is defogged by attaching a thin heating element to its inner surface. By electrically heating the element, a uniform heat flux may be established at the inner surface. For 4 mm thick window glass, determine the electrical power required per unit window area to maintain an inner surface temperature of 150C when the interior air temperature and convection coefficient are Ti = 25 0C and hi = 10 W/m2. K, while the exterior (ambient) air temperature is (– 10 0C and h0 = 65 W/m2. K) 2. The walls of a refrigerator are typically constructed by sandwiching a layer of insulation between sheet metal panels. Consider a wall made from fiberglass insulation of thermal conductivity ki = 0. 046 W/m. K and thickness Li = 50 mm and the steel panels, each of thermal conductivity kp= 60 W/m. K and thickness Lp = 3 mm. If the wall separates refrigerated air at the Ti = 40C from ambient air at T0 = 250 C, what is the gain per unit surface area?

Coefficients associated with natural convection at the inner and outer surfaces may be approximated as hi = h0 = 5 W/m2. K. 3. A spherical shell with inner radius r1 and the outer radius r2 has surface temperatures T1 and T2 respectively where T1 > T2. Sketch the temperature distribution on T- r coordinates assuming steady state, one dimensional conduction with constant properties. Briefly justify the shape of your curve. 4. A glass window of width W = 1 m and height H = 2 m is 5 mm thick and has a thermal conductivity of kg= 1. 4 W/m. K. If the inner and the outer surface temperatures of the glass are 150 C and – 200 C respectively, on a cold winter day, what is the rate of heat loss through windows, it is customary to use a double pane construction in which adjoining panes are separated by an

air space. If the spacing is 10 mm and the glass surface in contact with the air have temperatures of 100 C and – 150 C , what is the rate of heat loss from a 1mX 2m window ? The thermal conductivity of air is ka = 0. 024 W/m. K 5. What is the thickness required of a masonry wall having thermal conductivity 0. 75 W/m. K if the heat rate is to be 80 % of the heat rate through a composite structural wall having a thermal conductivity of 0. 25 W/m. K and a thickness of 100 mm? Both walls are subjected to the same surface temperature difference.