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UNIVERSITY OF WINDSOR

Faculty of Engineering

Heat Transfer – MECH 3228

Heat Transfer COMSOL Assignment 1

Due date: June 18th, 2021

Q 1. Consider 1.2 m high and 2 m wide double pane window consisting of two 3 mm thick layers of glass separated by a 12 mm wide stagnant air space. Determine the steady rate of heat transfer through this double pane window and the temperature of its inner surface for a day during which the room is maintained at 24°C while the temperature of the outdoors is -5°C. Take the convection heat transfer coefficients on the inner and outer surfaces of the window to be $h_1 = 10 W/m^2.C$ and $h_2 = 25 W/m^2 \bullet {}^oC$ and disregard any heat transfer by radiation.

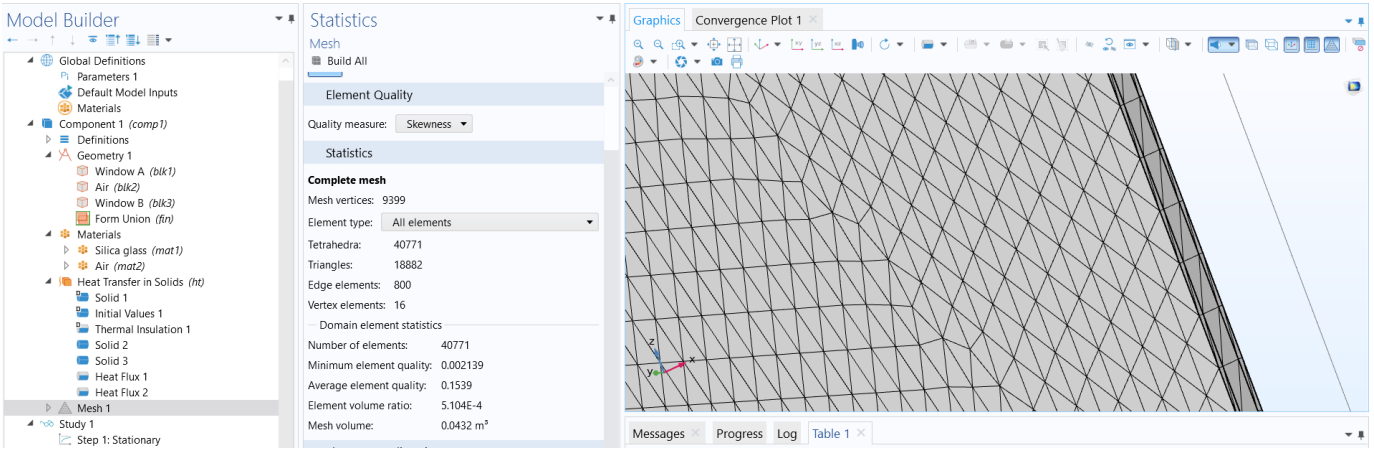
Tasks and deliverables:

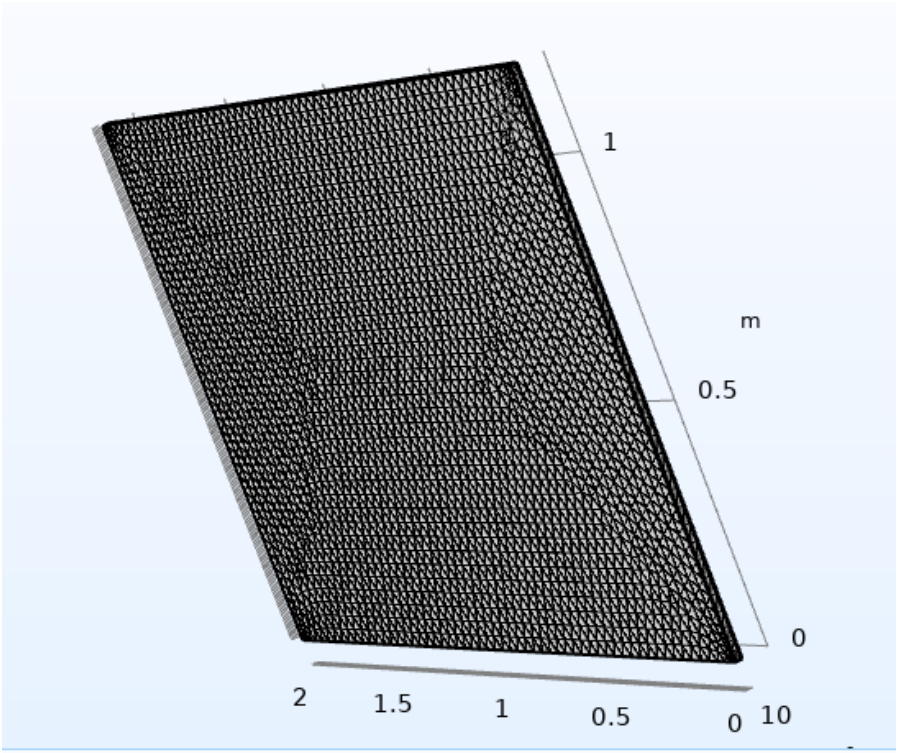
1. Compare your answer with the answer we obtained when we solved the question in class. Are the results different? If yes, discuss what could be the reason. Hint: check the thermal conductivity provided by COMSOL.
2. Provide a screenshot of your mesh and mesh information (i.e. Quads; Edge elements; Vertex elements; and Domain element statistics)
3. Provide a screenshot of your results in COMSOL
    a. Temperature distribution within the window
    b. Results: Normal conductive heat flux; Heat Transfer rate; Inner surface temperature
4. Provide a screenshot of your entire COMSOL window containing your results with the Study being visible

Question 1:

The heat transfer I received when computing through COMSOL is 113.43W while the one demonstrated in class was 114W which is vaguely close. There could be a lot of factors which caused the values to be different with the more important one being significant digits especially when a computer could get the most accurate amount. The inner surface temperature value from COMSOL is 19.38degC and the value calculated in class was 19.2degC which is very similar also leading to the assumption made above about carry decimals which the computer does best. However, the main reason is that the thermal conductivity given by COMSOL for Silica glass is 1.38W/mdegC while we used 0.78W/mdegC which is very different.

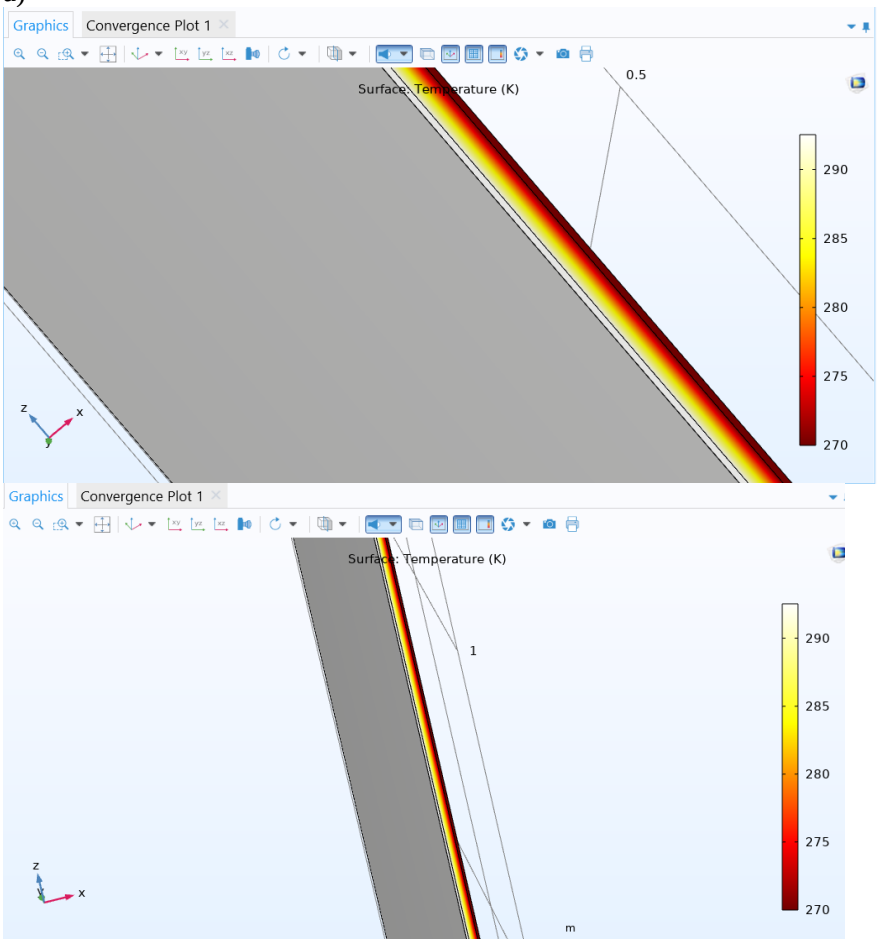
Question 2:



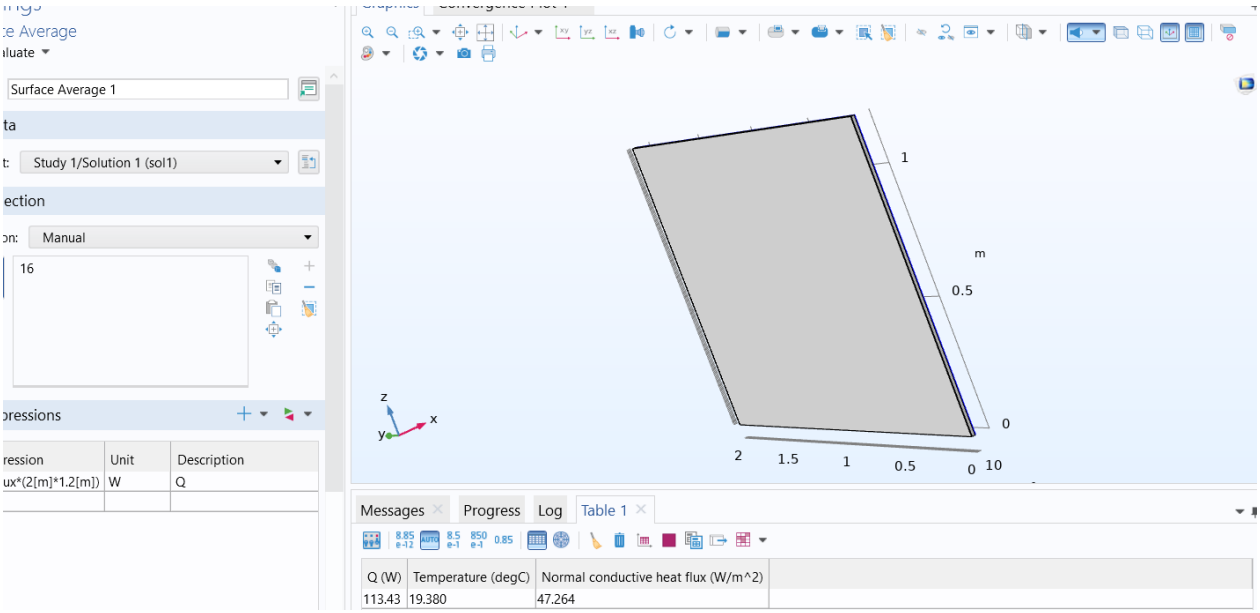


Question 3:

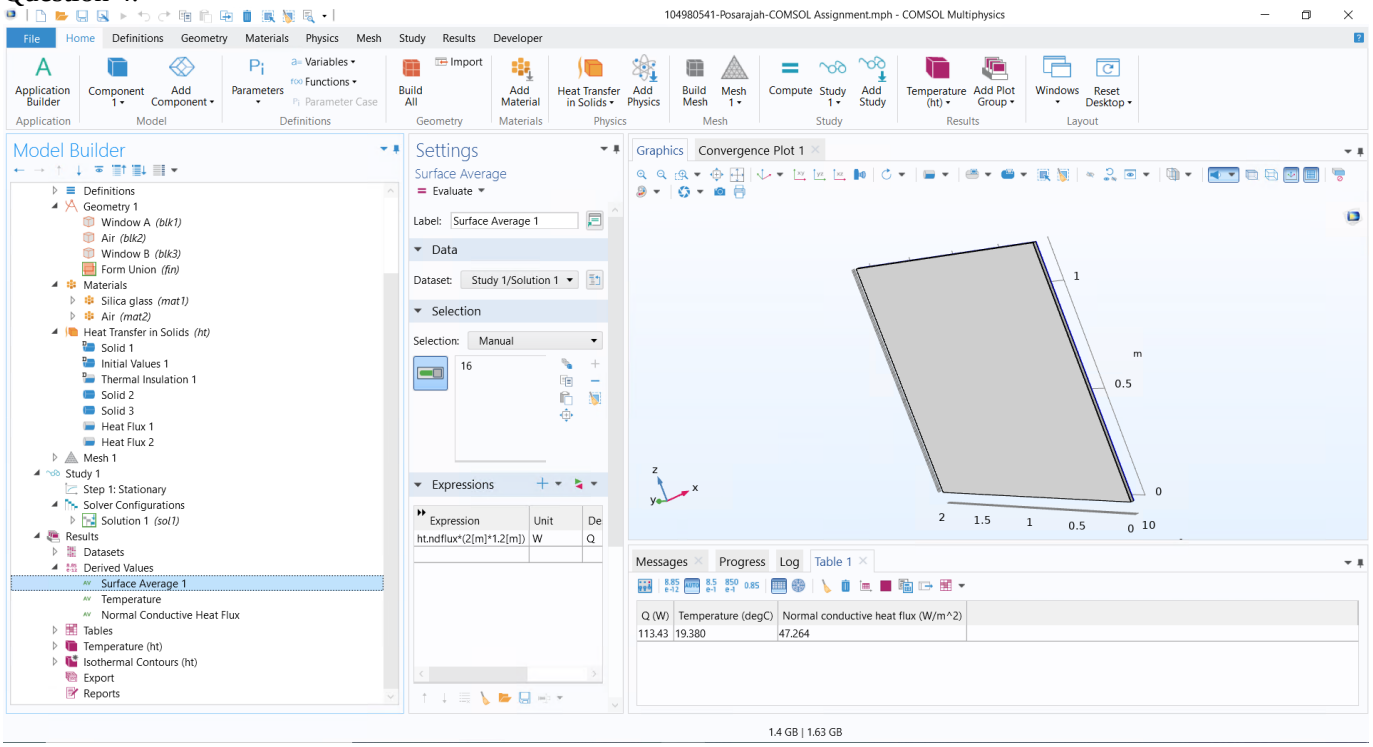
a)



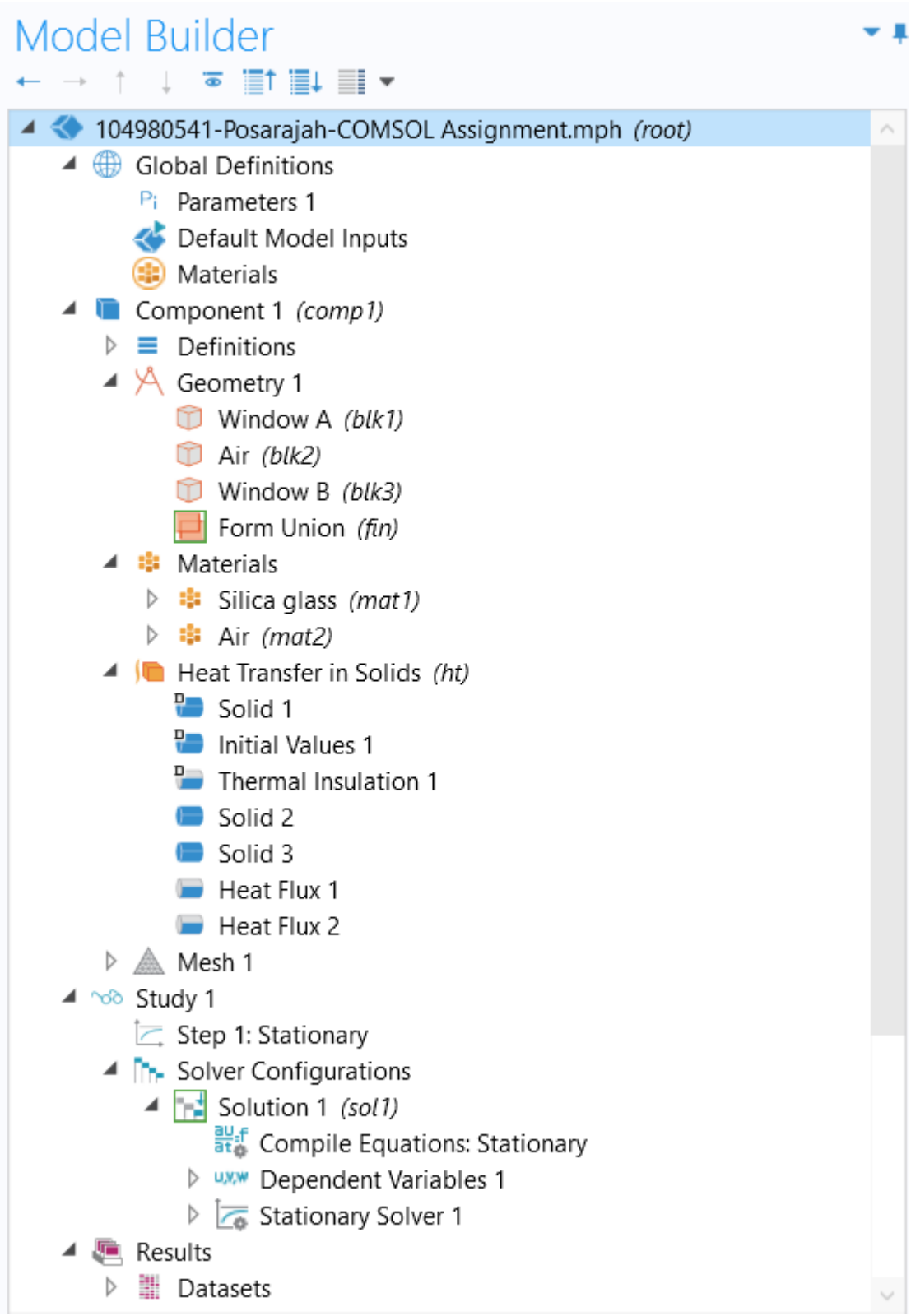
b)

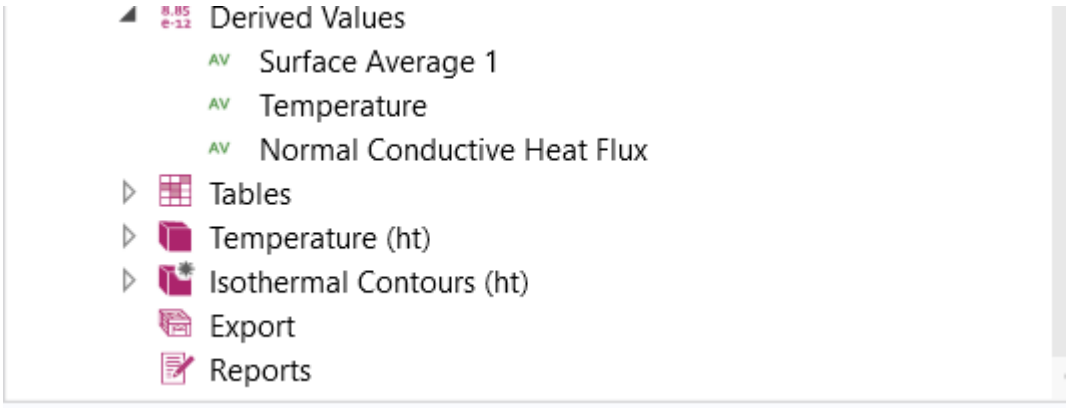


Question 4:



Model Builder Window on next page


Model Builder
104980541-Posarajah-COMSOL Assignment.mph (root)
Global Definitions
Parameters 1
Default Model Inputs
Materials
Component 1 (comp1)
Definitions
Geometry 1
Window A (blk1)
Air (blk2)
Window B (blk3)
Form Union (fin)
Materials
Silica glass (mat1)
Air (mat2)
Heat Transfer in Solids (ht)
Solid 1
Initial Values 1
Thermal Insulation 1
Solid 2
Solid 3
Heat Flux 1
Heat Flux 2
Mesh 1
Study 1
Step 1: Stationary
Solver Configurations
Solution 1 (sol1)
Compile Equations: Stationary
Dependent Variables 1
Stationary Solver 1
Results
Datasets


Derived Values
Surface Average 1
Temperature
Normal Conductive Heat Flux
Tables
Temperature (ht)
Isothermal Contours (ht)
Export
Reports