ME 409

LAB 7 : Natural convection in a rectangular cavity
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Mesh : 200 mm×100 mm
Named walls -
   1. **Top wall**
   2. **Bottom Wall**
   3. **Left Wall**
   4. **Right Wall**

Flow Type – Laminar
Number of Steps – 100
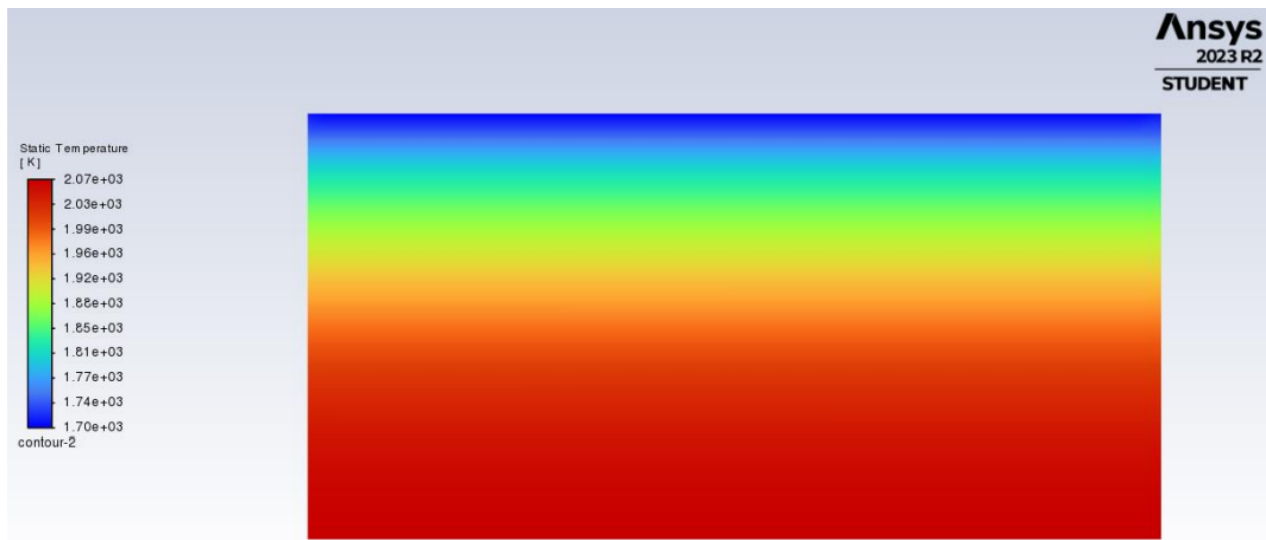**Step Size - 0.5 sec**
steps/iteration-100
Transient Heat Flow
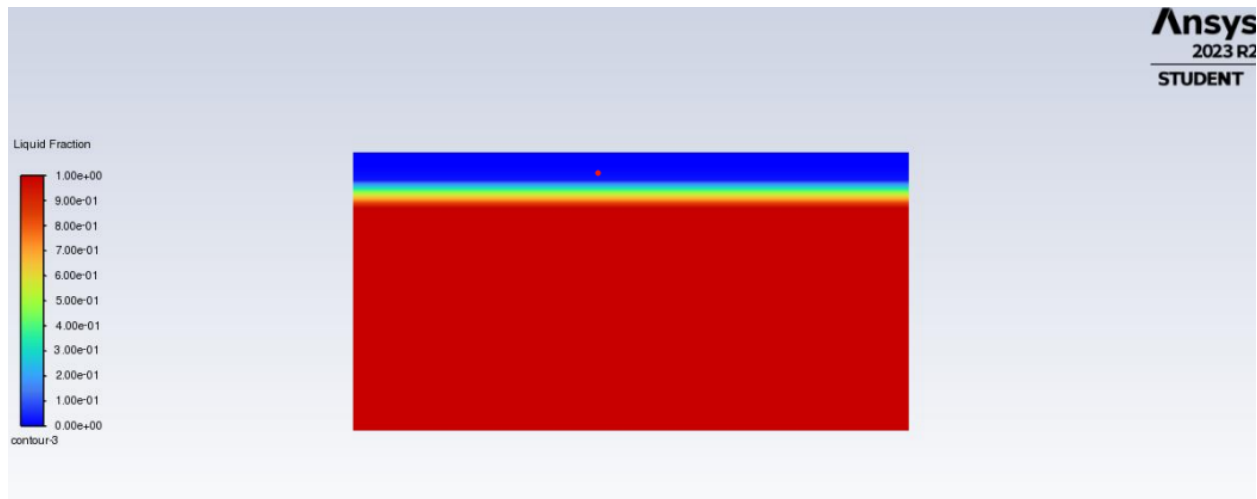
CONTOUR PLOTS FOR DIFFERENT CONDITIONS:

1 Without gravity, i.e. in y direction, acceleration = 0 m/s^2

Solidification: Here the initial temperature is taken as 2100 k and the temperature of the upper wall to be kept as 1700 k, and the side and bottom heat flux is 0.
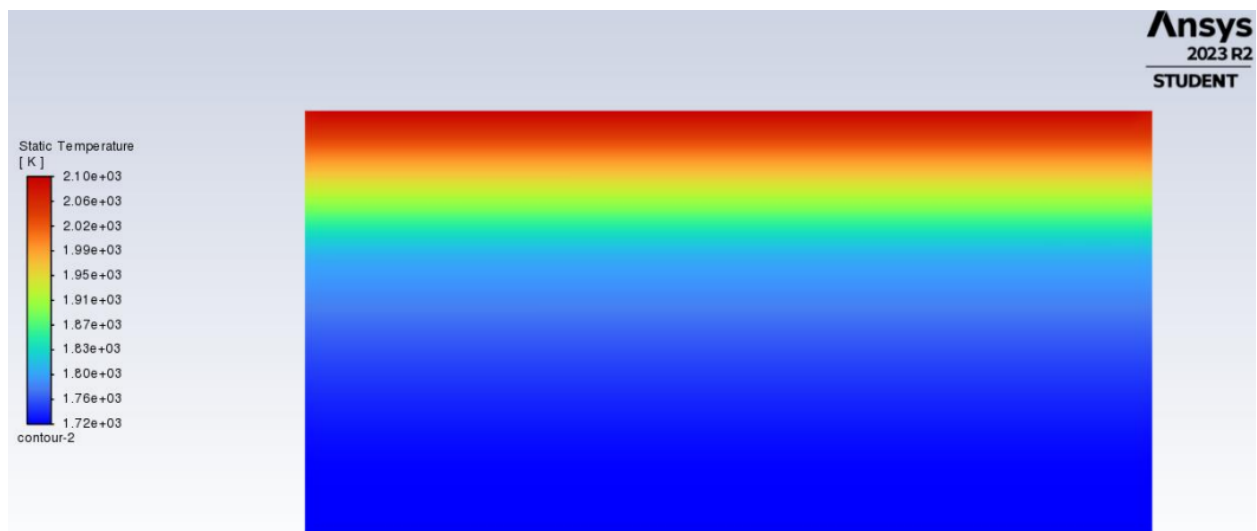**Temperature contour -**
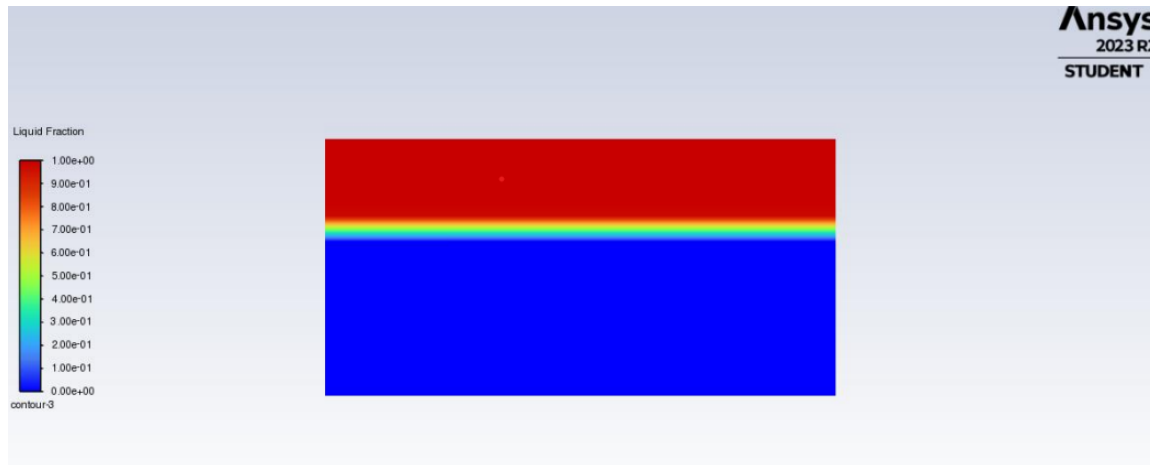
Liquid fraction contour -

Note: Without g, no velocity vector will be produced.

Melting: here the initial temperature is taken as 1700 k and the temperature of the upper wall is kept at 2100 k, thus melting occurs. Also, heat flux from the bottom, right, and left walls is zero.
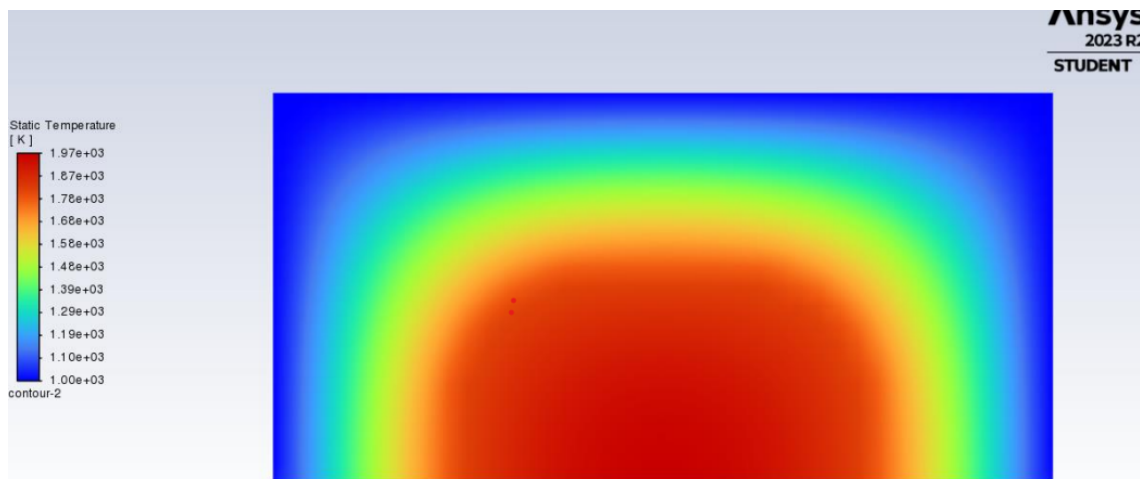
Temperature contour -
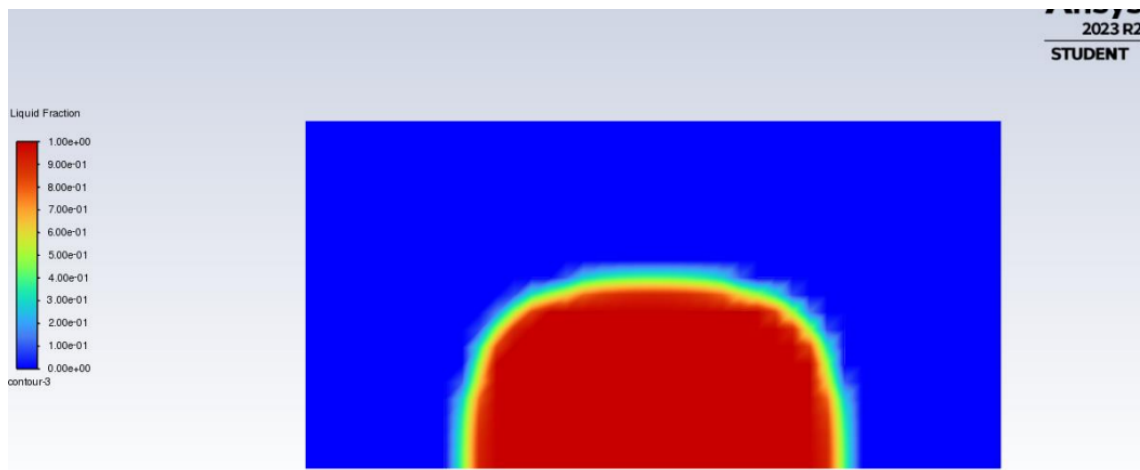

Liquid fraction -

Solidification - Here we are keeping the side and top walls at 1000 k temperature and the initial temperature is 2100 k. The heat flux from the bottom wall is zero.

Temperature contour -
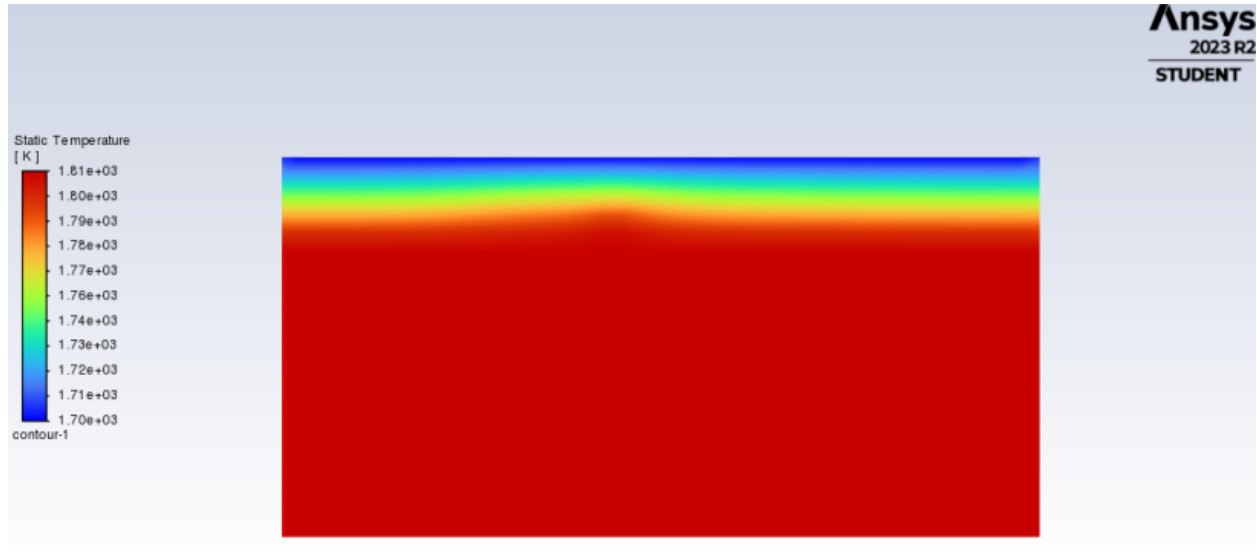

Liquid fraction -

Note: there is no velocity vectors because of symmetrical distribution in absence of gravity.
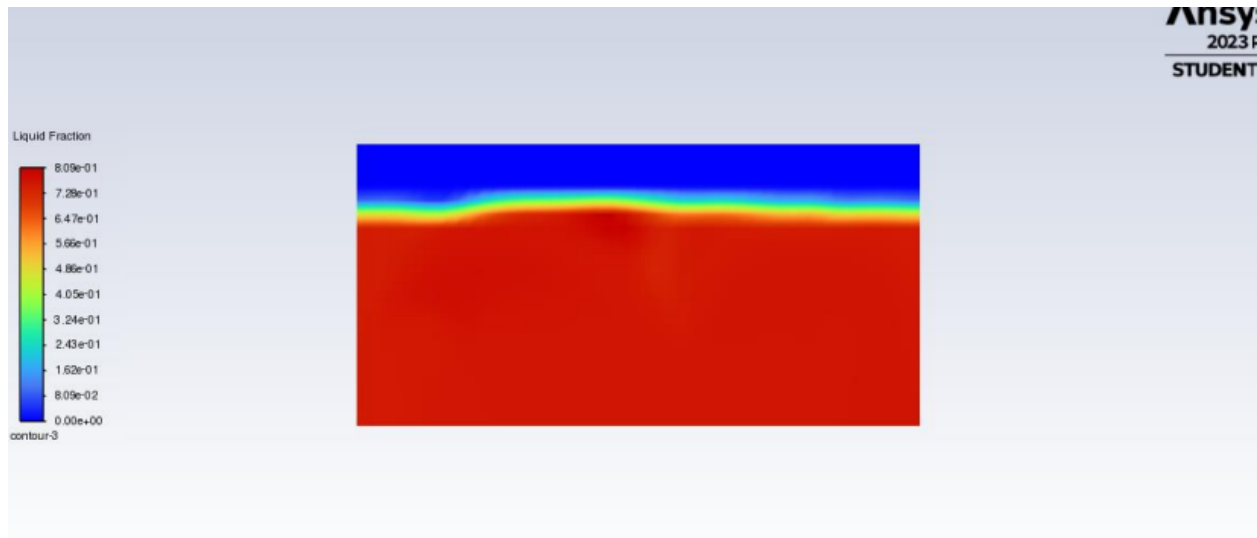
2 With gravity, i.e. in y direction, acceleration = -9.8 m/s^2

Solidification: BCs - Here we are keeping the top wall temperature at 1700 k and the initial temperature at 2100 k. Heat flux at the side and bottom walls is zero.
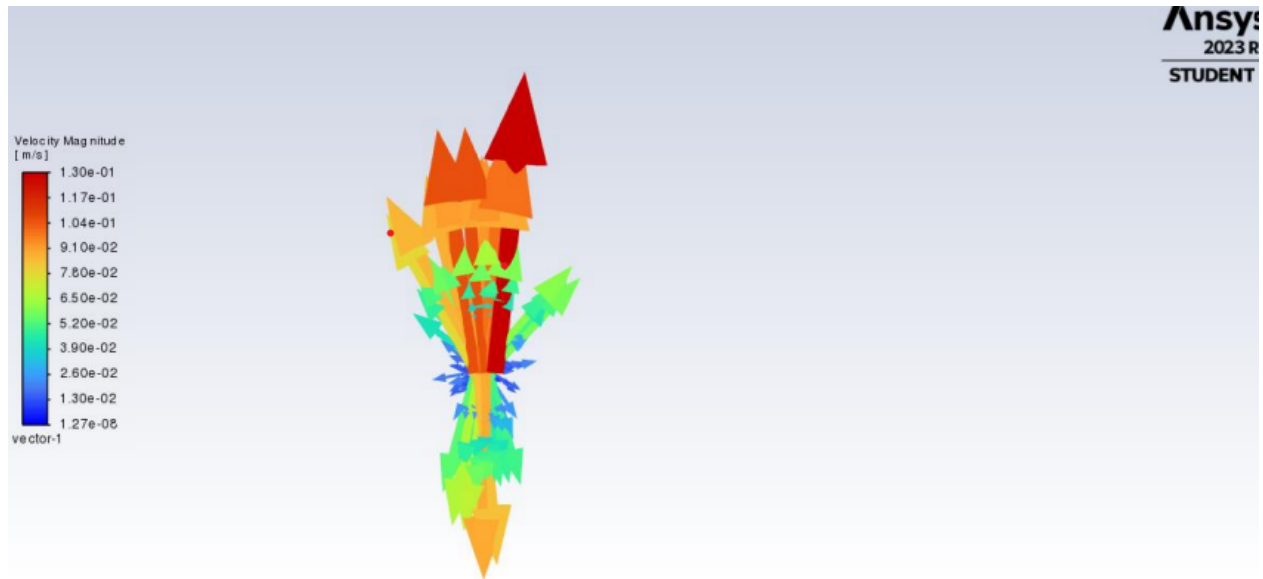
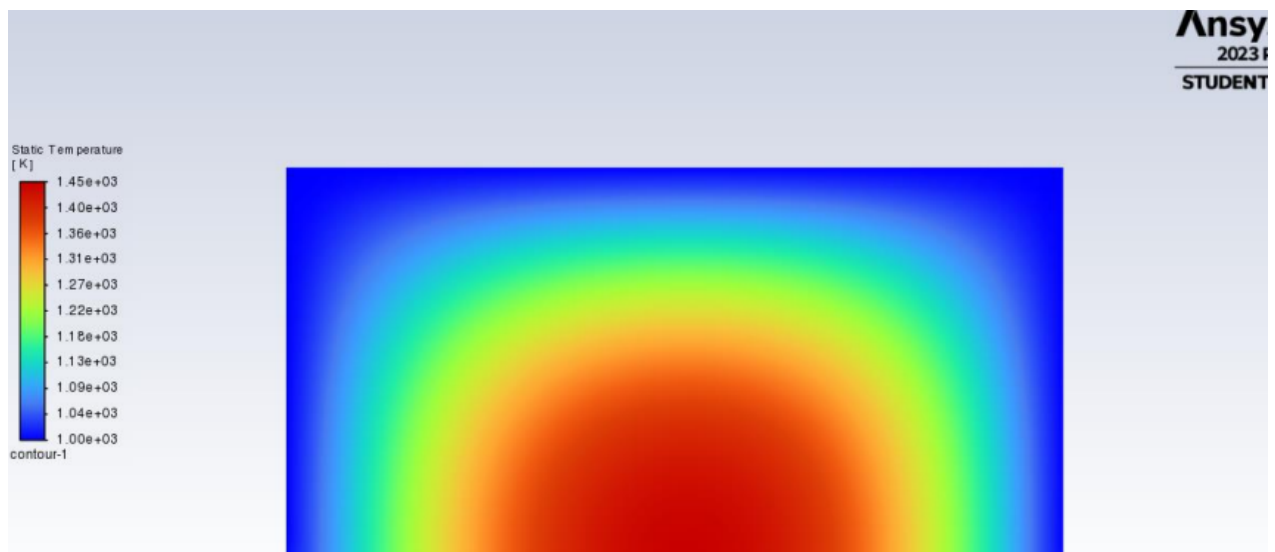**Temperature contour -**

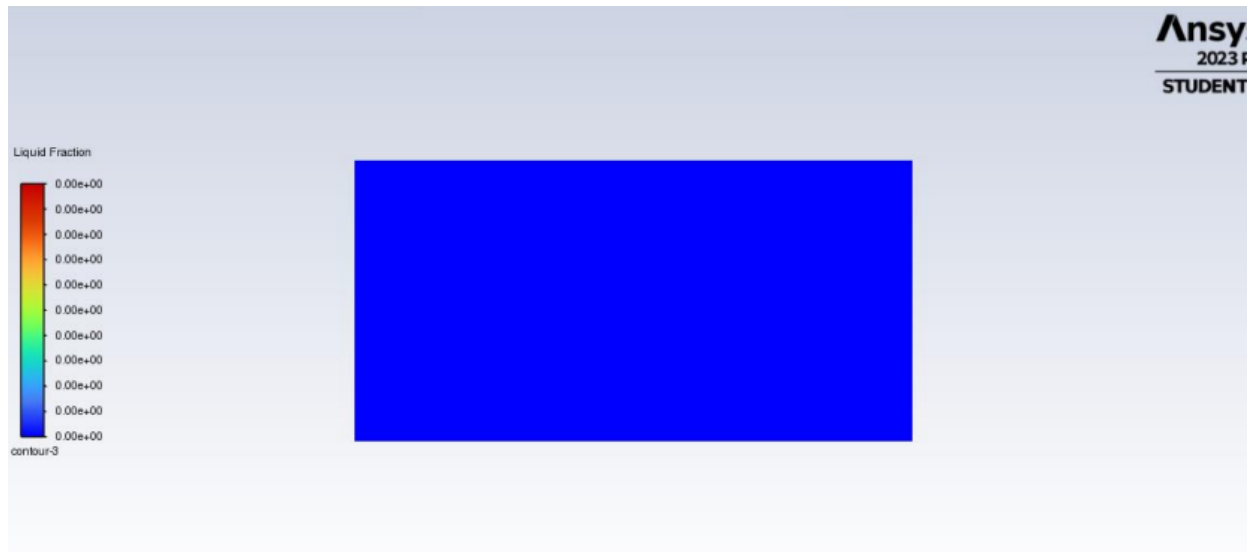**Liquid fraction -**

Velocity Vectors -

Note: presence of gravity produces velocity vectors.

Solidification - Here we are keeping the side and top walls at 1000 k temperature and the initial temperature is 2100 k. The heat flux from the bottom wall is zero.
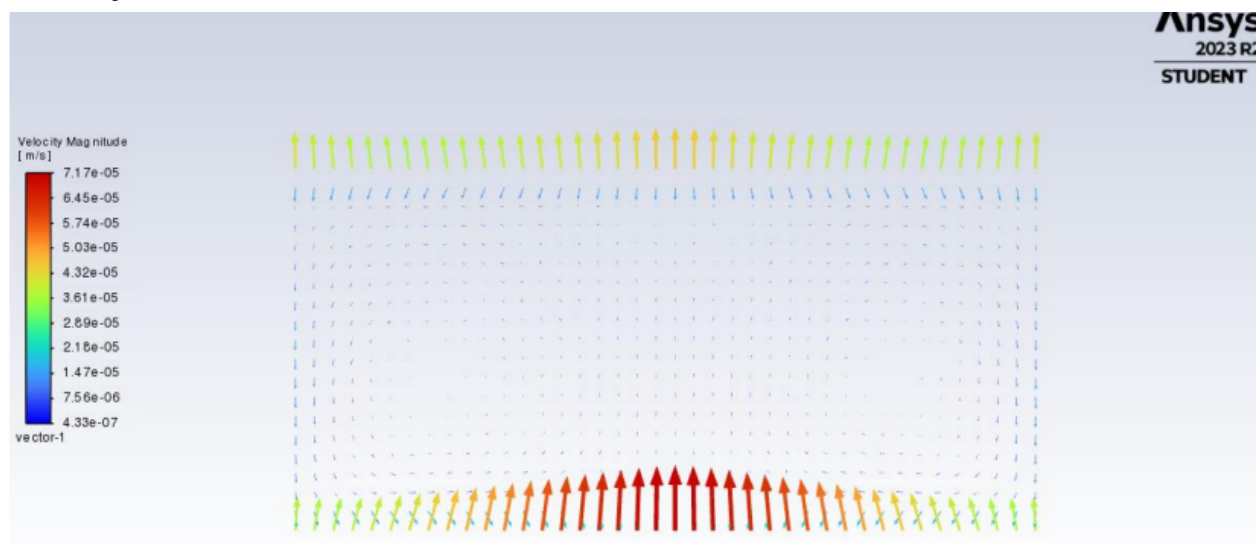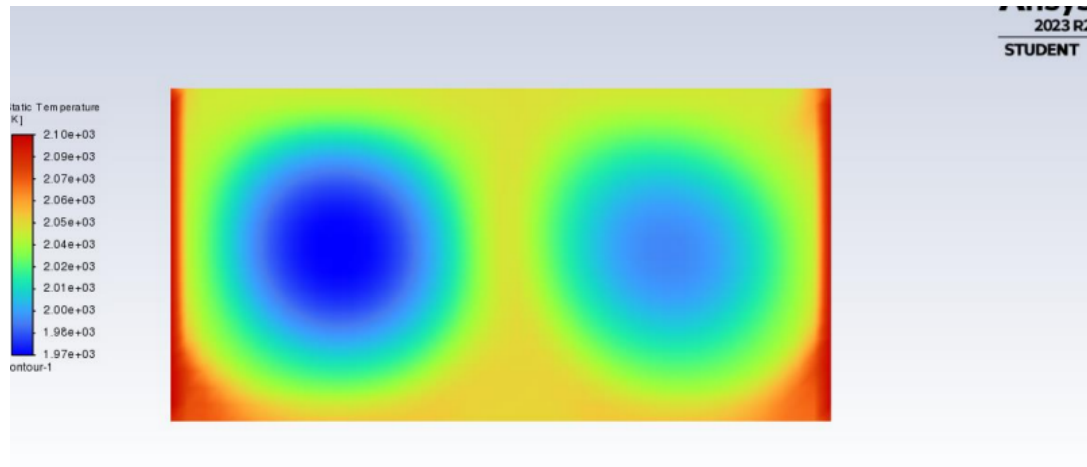
Temperature Contour –

Liquid fraction -

Liquid Fraction

0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00
0.00e+00

contour-3

Velocity Contour -

Velocity Magnitude
[m/s]

7.17e-05
6.45e-05
5.74e-05
5.03e-05
4.32e-05
3.61e-05
2.89e-05
2.18e-05
1.47e-05
7.56e-06
4.33e-07

vector-1

Note: Gravity makes a lot of difference; we can compare it with graphs of the same case without gravity.

Melting- final case, here we are taking the temperature of the side walls to be 2100 K, whereas the initial temperature is kept at 1700 K, and of course the heat flux from the side walls is zero.

Temperature contour -

Liquid Fraction -

Velocity vector