

## Homework 2: Silicon & Project

### Question 1 (project)

In no more than 500 words and a maximum of 2 figures, describe the Flow cytometer on chip. Please cite any references you used from literature.

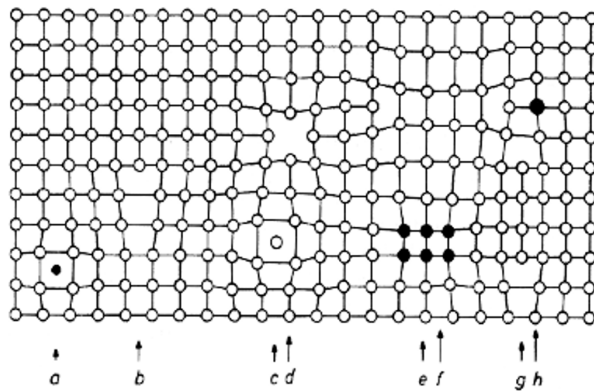
### Question 2 (Silicon Fabrication)

Please mention the sequential process steps of the wafer fabrication.

1)	
2)	
3)	
4)	
5)	
6)	
7)	
8)	
9)	
10)	

### Question 3 (Silicon Defects)

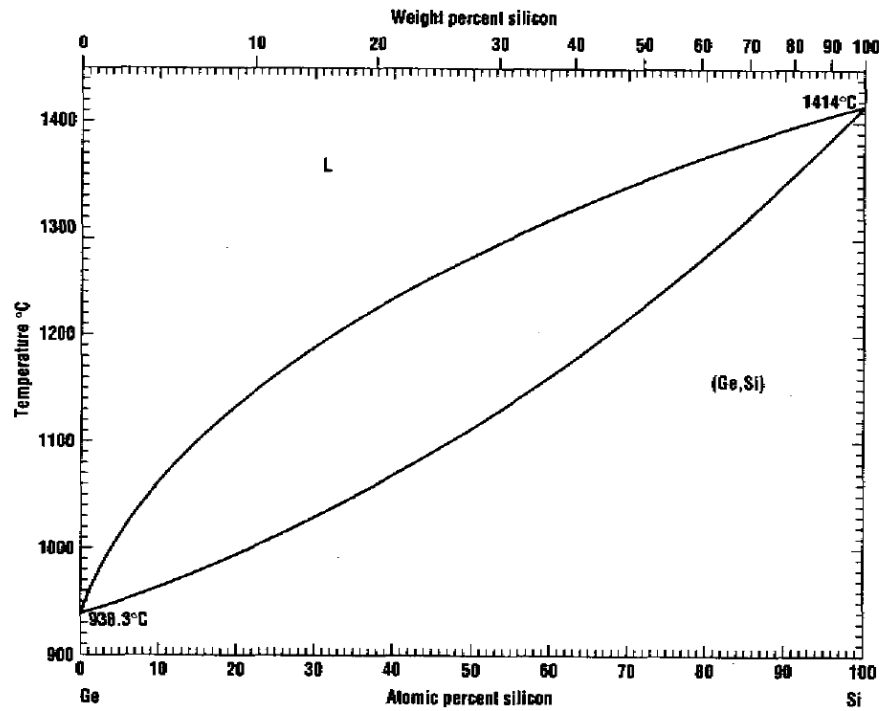
Please mention all the crystal defects (a-h) depicted in the figure below.



a)	
b)	
c)	
d)	
e)	
f)	
g)	
h)	

### Question 4 (substrate materials)

A mixture of 40% of silicon and 60% germanium (**by weight**) is heated to 1150 °C. If the material is in thermal equilibrium, what is the concentration of silicon in the melt? At what temperature will the entire charge melt? The sample temperature is raised to 1400 °C, then slowly cooled back down to 1150 °C. What is the concentration of silicon in the solid phase?



*Phase diagram of Ge-Si*

**Question 5 (substrate materials)**

A silicon wafer 500  $\mu\text{m}$  thick having a diameter of 4 in. contains 5.41 mg of boron uniformly distributed in the substitutional sites. Find (i) the boron concentration in atoms/ $\text{cm}^3$  and (ii) the average distance between the boron atoms.

**Question 6 (process flow)**

Design and briefly describe a process flow (with figures) for fabricating the following dual-channel structure. How many lithography steps and etch steps are used in the fabrication process?

