# Unit 5 - Week 3

**Course outline**

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## Assignment 3

**The due date for submitting this assignment has passed.**
**As per our records you have not submitted this assignment.**

**Due on 2020-02-19, 23:59 IST.**

1) Choose the incorrect statement regarding silicon crystal structure from below: ***2 points***

- Silicon has Zinc blend structure
- In 100 family of planes two dangling bonds and two bonds connected to bulk are present per atom
- In 110 family of planes two covalent bonds are formed with atoms on the plane and one bond is made with atoms below the plane
- The 111 plane intersects x-axis at x=a, y-axis at y=a and the plane is parallel to z-axis
- The order of binding strength of different planes of silicon is 111>110>100

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*The 111 plane intersects x-axis at x=a, y-axis at y=a and the plane is parallel to z-axis*
*The order of binding strength of different planes of silicon is 111>110>100*

2) What will be the angle (in degrees) between 121 and 110 plane? ***2 points***

- 54.7
- 75
- 30
- 45

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*30*

3) A plane make intercepts 5, 4 and 6 at x-, y- and z- axes respectively. Which of the following will be the equation of the mentioned plane? ***1 point***

- 12x+15y+10z = 60
- 12x+15y+10z = 1
- x/5+y/4+z/6 = 0
- 5x+4y+6z=1
- 5/x + 4/y + 6/z =1

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*12x+15y+10z = 60*

4) Which of the following is isotropic etchant? ***1 point***

- 30% KOH solution
- HNA etchant
- EDP at $115^0$ C
- TMAH at $70^0$ C to $90^0$ C

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*HNA etchant*

5) Which of the following methods cannot control the etching rate of silicon substrate? ***1 point***

- Concentration of KOH solution
- Temperature at which etching takes place
- Thickness of the masking layer
- Boron doping concentration of Si substrate

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*Thickness of the masking layer*

6) Choose the correct statement : ***1 point***
i.Boron doping concentration at certain regions can be increased so that, those regions will act as mask and will not be etched away and structures like diaphragm and cantilevers could be obtained
ii. There is no etching along <111> direction of a single crystal Si wafer using KOH solution

- Only i is correct
- Only ii is correct
- Both i and ii are correct
- Both i and ii are wrong

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*Only i is correct*

7) A <100> silicon wafer is 500 µm thick. A mask consists of rectangular window of unknown size. The sides of the window are parallel to <110>. After wafer etching a hole size of 50 µm × 80 µm is formed on the other side of the wafer (50 µm along X axis, and 80 µm along Y axis). What will be the size of the mask window, along X axis? The undercut rate is negligible. (inward slope = $54.74^0$)
_______ µm

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*(Type: Range) 740,770*

***2 points***

8) With the data given in question number 7, determine the size of the mask window, along Y axis. _______ µm

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*(Type: Range) 777,800*

***1 point***

9) Thickness of a <100> silicon wafer is 410 µm. A square window of 1000 µm size is opened in the oxide on the front surface of the wafer with the mask edge aligned parallel to the <110> direction. The oxide on the back of the wafer is completely etched. This wafer is subjected to anisotropic etchant whose etch rate along the <100> direction is 50 µm/hour. Due to this etching process for duration 4 hours, a square diaphragm of thickness t µm and side x µm has been created. Determine the diaphragm thickness t in µm
_________ µm

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*(Type: Numeric) 10*

***2 points***

10) With the data given in question number 9, determine diaphragm side x in µm

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*(Type: Range) 700,730*

***2 points***

11) I need to deposit a thin copper layer on my silicon sample. Which of the following method(s) could be used for this? ***2 points***

- Thermal evaporation
- Dip coating
- Sputtering
- Spin coating
- Spray painting

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*Thermal evaporation*
*Sputtering*

12) What resolution (in pm) could be achieved, theoretically, by e-beam lithography while applying a 20 KV input?
___________ pm

No, the answer is incorrect.
Score: 0
**Accepted Answers:**
*(Type: Range) 28,34*

***3 points***