

NAME:

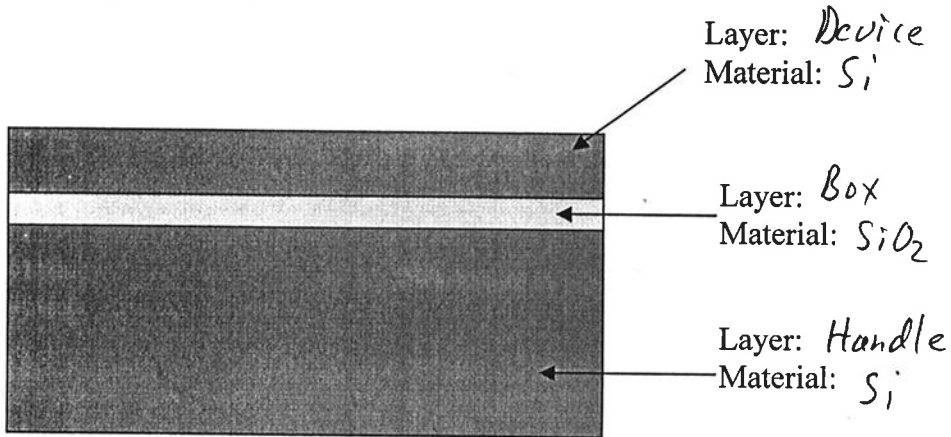
Exam #1

ELEC 5820/6820

Wed 2/24/10

## Problems:

- 1) A cross-sectional drawing of an SOI wafer is presented below. (a) Label the layers and the materials (10 points):



- (b) What does "SOI" stand for (5 points)?

Silicon - On - Insulator

- 2) Which one of the following is not a wet etchant (5 points):

EDP,

CMP,

TMAH,

KOH

- 3) A surface that water wets is said to be (5 points):

Hydrophobic,

Hydrophilic,

Hygroscopic,

Hydrogenated

- 4) A technique using heat and high voltage to bond Si to borosilicate glass (5 points):

Fusion Bonding,

Adhesive Bonding,

Anodic Bonding,

Eutectic Bonding

Match the question with an answer by writing the letter of the answer in the blank next to the question. No answer is used more than once. (20 points)

Questions

- 1) This machine is used in photolithography: M
- 2) Equal in all directions: J
- 3) Reactive ion etching of a Si wafer is an example of: K
- 4) A raised area of Si created by etching down the Si around it: E
- 5) A very dangerous liquid used to etch SiO<sub>2</sub>: H
- 6) An unwanted pyramidal defect sometimes on (100) planes during wet etching: O
- 7) A plot of breakdown voltage vs. pressure-distance for a gas: C
- 8) A machine that can remove used photoresist from a Si wafer: B
- 9) A sequential alternating process of etching and passivation: I
- 10) This grows on Si exposed to the atmosphere: A

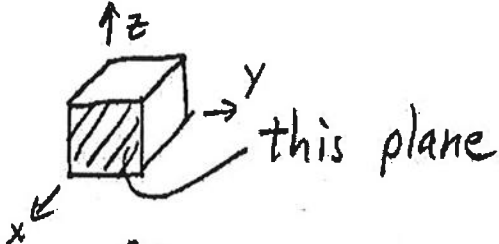
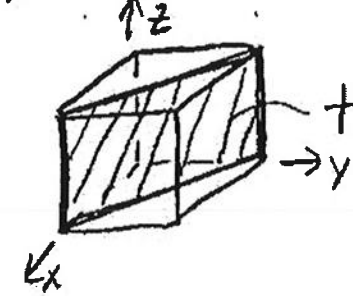
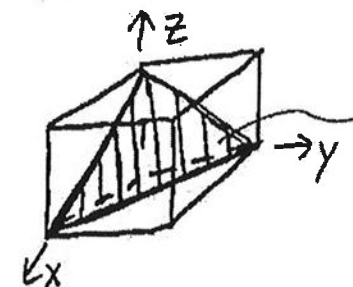
**Answers to choose from**

- |                             |                             |
|-----------------------------|-----------------------------|
| <del>A)</del> Native oxide  | <del>J)</del> Bosch Process |
| <del>B)</del> Asher         | <del>J)</del> Isotropic     |
| <del>C)</del> Paschen curve | <del>K)</del> Dry etching   |
| D) Aspect ratio             | L) XeF <sub>2</sub>         |
| <del>E)</del> Mesa          | <del>M)</del> Mask aligner  |
| F) Phosphosilicate glass    | N) Anisotropic              |
| G) Parylene                 | <del>O)</del> Hillock       |
| <del>H)</del> HF            | P) Wet Etching              |

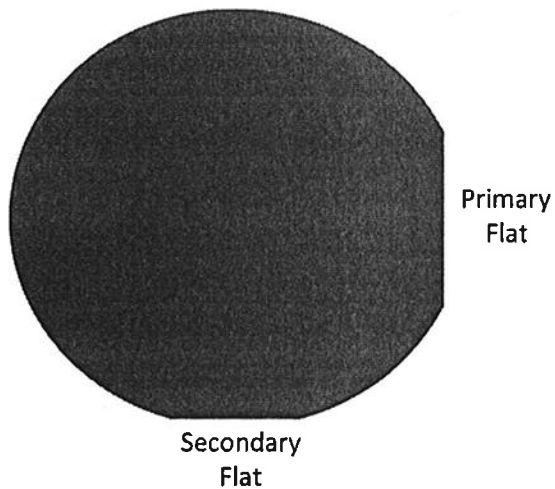
5) Define a "plasma" (5 points):

A quasi-neutral gas of charged and neutral particles characterized by a collective behavior

6) For each of the 3 drawings below, give the name of the identified plane, the Miller index for that plane and the Miller representation for the vector normal to that plane (15 points):

- a.  Front Face Plane,  $(100)$ ,  $\langle 100 \rangle$
- b.  this plane Diagonal Face Plane,  $(110)$ ,  $\langle 110 \rangle$
- c.  this plane  
Incline Face Plane,  $(111)$ ,  $\langle 111 \rangle$

7) Identify the type of Si wafer (doping and Miller Index) depicted below (5 points):



P-Type (100)

8) Which machine would you use to deposit a polysilicon thin film (5 points)?

LPCVD,

Evaporator,

DRIE,

Spinner

9) Which machine would you use to deposit a conformal coating of  $\text{SiO}_2$  on a Si wafer that has metal features (5 points)?

LPCVD,

PECVD,

Oxidation Furnace,

Electroplating Bath

10) Name the six energy domains used to describe MEMS devices (10 points):

1. Electrical
2. Mechanical
3. Magnetic
4. Thermal
5. Chemical
6. Radiative

