

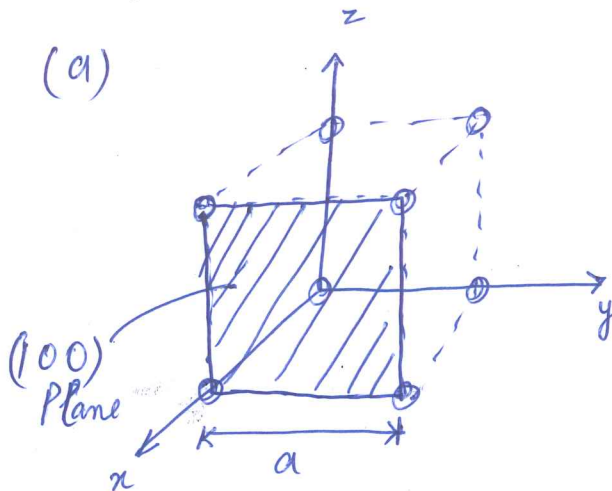


**Habib University**  
**Electrical Engineering Department**  
**Dhanani School of Science & Engineering**

Course	EE 211 – Basic Electronics
Semester	Fall 2022
Section	Section 1
Exam	Quiz – 1a
Instructor	Dr. Ahmad Usman
Total Marks	10

1. Consider a simple cubic structure with a lattice constant of  $a = 4.65 \text{ \AA}$ . Determine the surface density of atoms (atoms/cm<sup>2</sup>) in the
- (100) plane
  - (110) plane

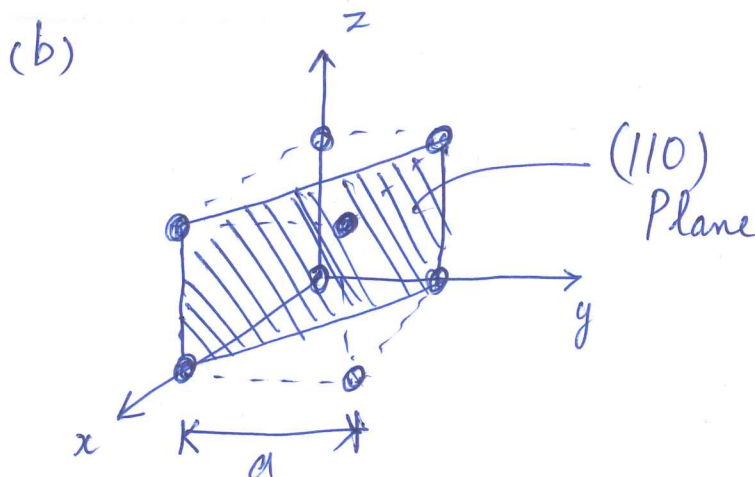
**Note:** Clearly draw the cubic structure and the corresponding planes. Give your answers up to four decimal places.



$$\begin{aligned} \text{No. of atoms on (100) plane} &= \frac{1}{4} \times 4 \\ &= 1 \end{aligned}$$

$$\text{Area of plane (cm}^2\text{)} = 2.16225 \times 10^{-15} \text{ cm}^2$$

$$\begin{aligned} \text{No. of atoms/cm}^2 &= \frac{1}{2.16225 \times 10^{-15}} \\ &= \underline{4.6248 \times 10^{14} \text{ atoms/cm}^2} \end{aligned}$$



$$\begin{aligned} \text{No. of atoms on (110) plane} &= \frac{1}{4} \times 4 = 1 \end{aligned}$$

$$\begin{aligned} \text{Area of plane} &= a \times \sqrt{2}a \\ &= \sqrt{2}a^2 \end{aligned}$$

$$\text{No. of atoms/cm}^2 = \underline{3.2702 \times 10^{14} \text{ atoms/cm}^2}$$

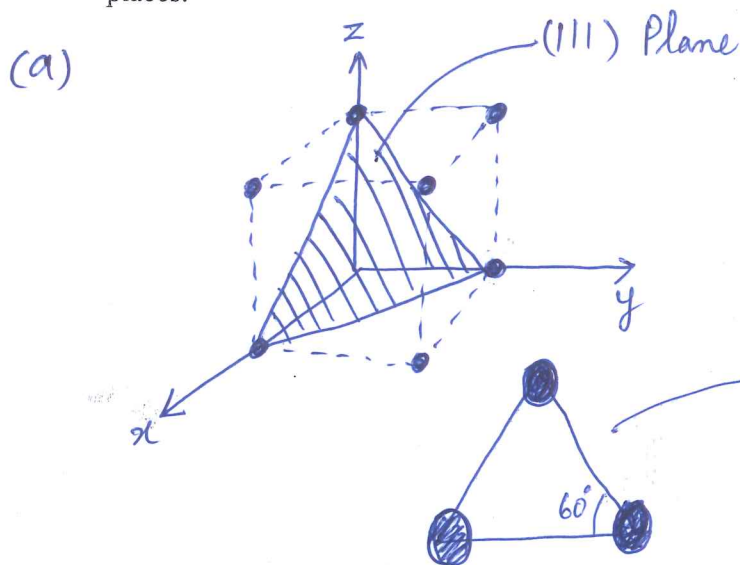


**Habib University**  
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**Dhanani School of Science & Engineering**

Course	EE 211 – Basic Electronics
Semester	Fall 2022
Section	Section 1
Exam	Quiz – 1b
Instructor	Dr. Ahmad Usman
Total Marks	10

1. Consider a simple cubic structure with a lattice constant of  $a = 5.46 \text{ \AA}$ . Determine the surface density of atoms (atoms/cm<sup>2</sup>) in the
- (111) plane
  - (100) plane

**Note:** Clearly draw the cubic structure and the corresponding planes. Give your answers up to four decimal places.



Area of (111) plane

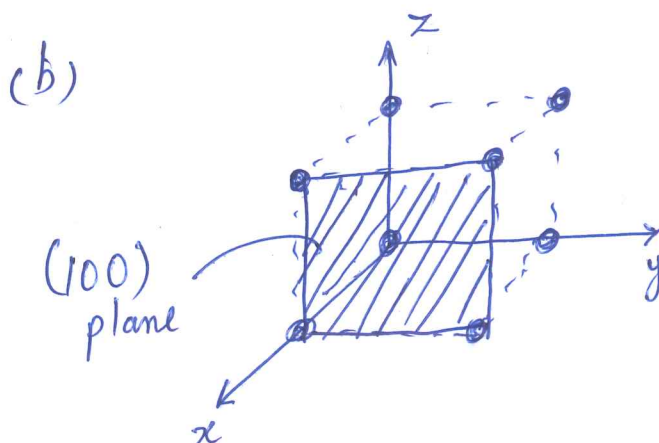
$$= \frac{1}{2} (\sqrt{2}a) (\sqrt{3/2}a) = \frac{\sqrt{3}}{2} a^2$$

No. of atoms on the plane

$$= \frac{60^\circ}{360^\circ} \times 3 = 0.5 \text{ atoms}$$

$$\text{No. of atoms/cm}^2 = \frac{0.5}{\sqrt{3/2} a^2}$$

$$= 1.9366 \times 10^{14} \text{ atoms/cm}^2$$



Area of the (100) plane

$$= a \times a = a^2$$

No. of atoms on the plane

$$= \frac{1}{4} \times 4 = 1$$

$$\text{No. of atoms/cm}^2 = \frac{1}{a^2}$$

$$= 3.3544 \times 10^{14} \text{ atoms/cm}^2$$