

## 1 | **Silicon**

### 1.1 | **refirenry**

#### 1.1.1 | **from sand**

#### 1.1.2 | **melted**

#### 1.1.3 | **small molten crystal "seed" lower into a vat**

#### 1.1.4 | **crystal forms**

#### 1.1.5 | **pull cylander from molten reigon**

#### 1.1.6 | **ground to form ingots**

#### 1.1.7 | **sawed with diamond blade to form wafers**

#### 1.1.8 | **wafer scrubbed**

#### 1.1.9 | **edges rounded and surfaces ground smooth and to create uniform thickness**

#### 1.1.10 | **rinsed and etched in "chemicals" to remove impurities**

#### 1.1.11 | **final polish on one side of the wafer**

#### 1.1.12 | **all so that there are no scratches or contamination**

#### 1.1.13 | **then, measured for resistivity**

1. function of dopant concentratian

### 1.2 | **design**

#### 1.2.1 | **circuit design**

#### 1.2.2 | **organization of design team**

1. based on organization of the chip
2. establish microarchitecture that regulates sequences and timings
3. design divided into areas
  - (a) each unit given to logic designer
  - (b) each functional block given to circuit designer who works at transistor level
4. mask designer draws out blueprints on paper

#### 1.2.3 | **transistors**

1. represents digital zero or one

## 2. C-MOS transistors

- (a) complementary metal oxidized transistor
- (b) n type transistor
  - i. surrounded by n-type
  - ii. sandwiching a p-type layer
  - iii. gate electrode is near but not connect to the p type reigon
  - iv. a positive charge in gate attracts electrons and allows electrons to pass
- (c) both types can be made on the same chip using "complementary manufacturing?"
- (d) signals propogate through complex maze of switches

### 1.3 | **structure**

#### 1.3.1 | **cubic atomic structure**

#### 1.3.2 | **4 electrons valence shell**

#### 1.3.3 | **perfect crystal will have no holes**

#### 1.3.4 | **but at room temperature, free electrons can conduct**

### 1.4 | **impurities called dopants**

#### 1.4.1 | **negative**

- 1. arsenic or phosphorus
- 2. one more valence
- 3. n type crystal because negative free carriers

#### 1.4.2 | **positive**

- 1. boron
- 2. missing electron acts like positive carrier, "hole"

#### 1.4.3 | **silicon can be either good or poor conductor (semiconductor)**

- 1. controlled by concentration of dopant