**Quiz on Chapter III: Silicon Dioxide and Silicon Nitride**

**Multiple Choice Questions:**

1. **What is the primary purpose of silicon dioxide (SiO₂) in semiconductor fabrication?**  
   a) Conducting electricity  
   b) Acting as a protective and insulating layer  
   c) Enhancing thermal conductivity  
   d) Increasing mechanical strength
2. **Which oxidation process produces a higher quality oxide with fewer defects?**  
   a) Wet oxidation  
   b) Dry oxidation  
   c) Rapid Thermal Oxidation (RTO)  
   d) Chemical Vapor Deposition (CVD)
3. **In the Deal-Grove model, what governs the parabolic regime of oxide growth?**  
   a) Surface reactions  
   b) Diffusion of oxidants through the oxide  
   c) External pressure  
   d) Crystallographic orientation of silicon
4. **Which chemical is often added during oxidation to reduce mobile ions in silicon dioxide?**  
   a) Silane (SiH₄)  
   b) Ammonia (NH₃)  
   c) Hydrogen chloride (HCl)  
   d) Nitric acid
5. **What is the typical refractive index range of silicon nitride (Si₃N₄) in the visible spectrum?**  
   a) 1.0 to 1.5  
   b) 1.8 to 2.5  
   c) 2.5 to 3.0  
   d) 3.0 to 3.5

**True/False Questions:**

1. Thermal oxidation in tube furnaces can be divided into linear and parabolic regimes.  
   True / False
2. Sputtering is primarily a chemical reaction process that involves the decomposition of precursor gases.  
   True / False
3. Silicon nitride has high thermal conductivity, making it a poor choice for thermal barriers.  
   True / False
4. In wet oxidation, water vapor reacts with silicon to form SiO₂ at a faster rate than dry oxidation.  
   True / False
5. Plasma Enhanced Chemical Vapor Deposition (PECVD) can operate at lower temperatures than traditional CVD methods.  
   True / False

**Short Answer Questions:**

1. Describe the main difference between dry oxidation and wet oxidation in terms of the oxidizing agents and the resulting oxide quality.
2. Explain the significance of the Deal-Grove model in predicting oxide growth on silicon.
3. List two advantages of using silicon nitride (Si₃N₄) as a dielectric layer in integrated circuits.
4. Why are chlorine additives like HCl used during the oxidation process in semiconductor fabrication?
5. Compare the advantages of PECVD and HWCVD in the deposition of silicon nitride.

**Essay Question:**

1. Discuss the importance of silicon dioxide and silicon nitride in modern semiconductor technology. Include their roles in device fabrication, their properties, and the challenges associated with their deposition.