1. What is the oxidation state (number) for C in CH₃OH?
   a) +2  b) -2  c) +4  d) -4  e) 0

2. Given the following reaction mechanism,
   \[ \text{O}_2 \rightleftharpoons \text{O} + \text{O}_2 \] (fast equilibrium)
   \[ \text{O} + \text{O}_3 \rightarrow 2 \text{O}_2 \] (slow)

   Derive the rate law for this mechanism to determine the order of reaction with respect to \( \text{O}_2 \).
   \[ \text{rate} = \frac{[\text{O}][\text{O}_3]}{[\text{O}_2]} \]
   \[ K_1 = \frac{[\text{O}][\text{O}_3]}{[\text{O}_2]} \]
   \[ \text{rate} = k_2 K_1 \frac{[\text{O}_3]^2}{[\text{O}_2]} \]
   a) -1  b) -2  c) 1  d) 2  e) 0

3. Which of the following sets of quantum numbers would NOT be possible for an electron in an atom?
   \( n \) \( l \) \( m \) \( s \)
   a) 1 0 0 1/2
   b) 3 2 -1 -1/2
   c) 3 3 1 1/2

4. Which of the following has the smallest atomic radius?
   a) Al  b) S  c) Be  d) O  e) Li

5. What is the electron configuration for O⁺?
   a) 1s²2s²2p⁴  b) 1s²2s²2p³  c) 1s²2s²2p⁵  d) 1s²2s²2p⁶  e) None of these

6. What is the orbital designation for electrons with \( n = 2 \) and \( l = 1 \)?
   a) 1s  b) 2p  c) 2s  d) 3p  e) 2d

7. The ground electron configuration for the phosphorous atom is [Ne] 3s²3p³. How many unpaired electrons are there?
   a) 1  b) 2  c) 3  d) 4  e) 0

8. Which of the following has the highest first ionization energy?
   a) Na  b) Cl  c) Al  d) Mg

9. \( \text{He}^+ \) has one electron. If the electron is removed from ground state \( \text{He}^+ \), what electronic transition occurs?
   a) \( n = 1 \) to \( n = 2 \)  b) \( n = 2 \) to \( n = \infty \)  c) \( n = 0 \) to \( n = 1 \)  d) \( n = 1 \) to \( n = \infty \)  e) \( n = 2 \) to \( n = 1 \)

10. If a beam of yellow light (\( \lambda = 580 \text{ nm} \)) can eject electrons from a metal surface, will blue light (\( \lambda = 450 \text{ nm} \)) be able to eject electrons from this metal surface?
    a) yes  b) no  c) Can not be determined from information given.

**FORMULAS:** \[ |\Delta E| = E_{\text{photon}} \]

\[ E = h \nu \]

\[ E = hc/\lambda \]