1. Maxwell-Boltzmann distribution defines
   a. velocity of a gas atom/molecule 
   b. distribution of velocities of atoms/molecules in gas 
   c. temperature of gas 
   d. number of gas atoms/molecules in a given volume 
2. Mean free path ($\lambda_{mf}$) of gas atoms/molecules is related to gas pressure ($P$) as
   a. $\propto \exp (-P)$ 
   b. $\propto P^2$ 
   c. $\propto P^{-1}$ 
   d. $\propto P$ 
3. Which of the following vacuum pump(s) should be used for a deposition chamber where you want to deposit highly pure thin film of semiconducting material?
   a. Rotary pump 
   b. Roots pump 
   c. Diffusion pump backed by rotary pump 
   d. Turbo-molecular pump backed by rotary/roots pump 
4. Which pressure gauge should you choose for measuring pressure in the range of $10^{-7}$ to $10^{-10}$ torrs?
   a. Thermocouple gauge 
   b. Pirani gauge 
   c. Baratron gauge 
   d. Penning gauge 
5. Questions 5 and 6 are based on this: After pumping down (creating vacuum) in a thin film deposition chamber with volume 30 liters to a base pressure of $1x10^{-6}$ torrs, the vacuum pumps are isolated. The pressure inside the chamber rises to $1x10^{-5}$ torrs in 15 minutes. 
   a. What is the leakage rate in vacuum system?
      a. $5.0x10^{-7}$ torr-liters/sec 
      b. $3.0x10^{-7}$ torr-litres/sec 
      c. $1.5x10^{-7}$ torr-litres/sec 
      d. $1.5x10^{-8}$ torr-litres/sec 
6. If a vacuum pump with effective pumping speed of 40 litres/sec is attached to the vacuum chamber, what is the ultimate pressure that can be reached?
   a. $7.5x10^{-9}$ torrs 
   b. $5.0x10^{-9}$ torrs 
   c. $5.0x10^{-8}$ torrs 
   d. $7.5x10^{-10}$ torrs 
7. How long would it take to deposit 200 Å thick gold film over a 5 cm$^2$ area using a 2 cm$^2$ source at 1500 K placed in planetary configuration in a deposition chamber of radius 20 cm? (atomic weight of gold = 197, density = 19.3 gm/cm$^3$ and vapor pressure of gold @ 1500 K = $5.0x10^{-3}$ torr.)
   a. 10 minutes 
   b. 1 hour 
   c. 2.5 hours 
   d. ~ 1 day
8. What is the wavelength range of laser for PLD using non-metallic targets?
   a. Ultraviolet (200 nm – 400 nm)
   b. Visible (400 nm – 700 nm)
   c. Infrared (700 nm – 1 mm)
   d. Microwave (1 mm – 1 meter)

9. For a uniform thin film deposition over large number of substrates you should use
   a. point source
   b. surface source
   c. highly directional source
   d. keep substrates and source in planetary arrangement

10. In electron-beam thin film deposition technique, the electron beam is scanned on the
     surface of material to be evaporated by
     a. moving source crucible with respect to electron-beam
     b. using electric field to deflect electron-beam
     c. using magnetic field to deflect electron-beam
     d. using piezoelectric crystal for small vibrations