

Student ID: _____ Name: _____

**IMPORTANT INFORMATION that you may need:
Final Exam Sp 2016**

Speed of light in empty space (c)	3.0×10^8 m/s
Planck's constant (h)	6.63×10^{-34} J sec = 4.14×10^{-15} eV sec
(\hbar)	1.05×10^{-34} J sec = 6.58×10^{-16} eV sec
Coulomb's constant (k)	8.99×10^9 N m ² /C ²
Charge of an electron (e)	-1.6×10^{-19} C
Mass of an electron (m_e)	9.11×10^{-31} kg
Mass of a proton (m_p)	1.67×10^{-27} kg
Bohr radius (a_B)	5.29×10^{-11} m
Bohr magneton (μ_B)	9.27×10^{-24} J/T

$$hc = 1240 \text{ eV}\cdot\text{nm} \quad ke^2 = 1.440 \text{ eV}\cdot\text{nm}$$

$$1 \text{ electron Volt (eV)} = 1.602 \times 10^{-19} \text{ J} \quad 1 \text{ MeV} = 1 \times 10^6 \text{ eV}$$

$$1 \text{ pm} = 1 \times 10^{-12} \quad 1 \text{ nm} = 1 \times 10^{-9} \text{ m} \quad 1 \text{ }\mu\text{m} = 1 \times 10^{-6} \text{ m} \quad 1 \text{ mm} = 1 \times 10^{-3} \text{ m}$$

Double Slit Interference pattern:

Maxima: $d \sin\theta = m \lambda$ Minima: $d \sin\theta = (m+1/2) \lambda$ with $m = 0, \pm 1, \pm 2, \pm 3, \dots$
where d is the spacing between the slits; λ is the wavelength of the light or the de Broglie wavelength.

Representative wavelength ranges:

Infrared (750 nm – 1000 nm) Red (620 - 750 nm) Orange (590 - 620 nm)

Yellow (570 - 590 nm) Green (495 - 570 nm) Blue (450 – 495 nm)

Violet (380 - 450 nm) Ultraviolet (380 nm – 10 nm)

Schrödinger equation:

$$\text{Time-dependent: } -\frac{\hbar^2}{2m} \frac{\partial^2 \Psi(x,t)}{\partial x^2} + V(x)\Psi(x,t) = i\hbar \frac{\partial \Psi(x,t)}{\partial t}$$

$$\text{Time-independent: } -\frac{\hbar^2}{2m} \frac{d^2 \psi(x)}{dx^2} + V(x)\psi(x) = E\psi(x)$$