1 Time delay in photoelectric effect

$P = I\pi r^2$
a) $t = E/P = \frac{E}{I\pi r^2}$
b) $t = \frac{2E}{3I\pi\lambda^2}$ c) $P = IA$, $t = (hc/\lambda)/P = \frac{hc}{\lambda IA}$

2 Photons interacting with electrons

a)$hc/\lambda - 1.6eV = hc/\lambda_{max}$
b)compton scattering

3 Momentum shift and spatial wavefunction

$\bar{\phi}(k) = \phi(k - k_0)$
$\bar{\psi}(x) = \frac{1}{\sqrt{2\pi}} \int \phi(k - k_0) e^{ikx} dk$
$= \frac{1}{\sqrt{2\pi}} \int \phi(k') e^{i(k'+k_0)x} dk'$
$= e^{ik_0 x} \psi(x)$

4 Double-slit interference of electrons

5 Hydrogen atom ground state as structure of minimum energy allowed by Heisenberg uncertainty

a) $p^2/2m_e - k_e q^2/r$
b)

$$k_e q^2/r^2 = p^2/m_e r$$
$$k_e q^2/r = p^2/m_e$$
$$E = -\frac{k_e q^2}{2m_e r}$$

c) $\lambda = 2\pi r, p = hc/\lambda = hc/2\pi r, p^2$ d)

6 Rutherford scattering