EX1-Study Sheet

Monday, October 26, 2015 07:45

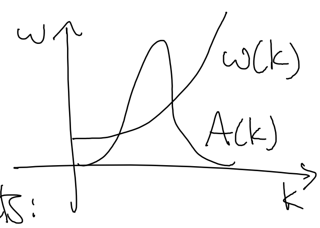
List of Concepts Covered.

* Historical Underpinnings:
  - Planck's law, Bohr model, deBroglie wavelength
    $E = \hbar\omega$, $L = \hbar n$, $p = \hbar k$
  - what basic principle did each contribute to Q.M.?
  - calculations of each effect

* probability distribution $P(x)$ & amplitudes $\psi(x)$
  - calculate $\langle f(x) \rangle$, $\sigma_x^2 = \langle x^2 \rangle - \langle x \rangle^2$
  - Born interpretation of wave function
    how is it similar to / different than classical $P(x)$?

* dispersion relation and wave packets
  - understand relations between E, p, ω, k
    quantization & dispersion
  - be able to calculate v_g, v_ϕ
    from a dispersion curve.
  - construct wave packets as superposition
    of plane waves with amplitude $A(k)$
    (Fourier transforms)
  - describe major features & effects on packets:
    fundamental frequency, carrier frequency, bandwidth.
  - explain wave-particle duality (complementarity)
    and Heisenberg Uncertainty Principle in terms of packets.
  - compare/contrast classical waves/particles w/ quantum.

E	ω
p	k



* Wave equation
  - derive for a string, show that $f(x \pm vt)$ are solutions
  - obtain the velocity and impedance, calculate power transferred.
  - switch back and forth between the dispersion relation and wave eq.

* Schrodinger equation
  - explain how TDSE evolves the state in time

and how the TISE is used to solve the TDSE.
- show how TDSE is a generalization of old quantum theory.
  Planck's law, deBroglie wavelength, dispersion relation.

- solve the TISE for: free particle, infinite square well, SHO.
  calculate amplitudes of initial wavefunction & time dependence
- matrix elements for the SHO.
- what is the role of boundary conditions?

$\hbar^2$