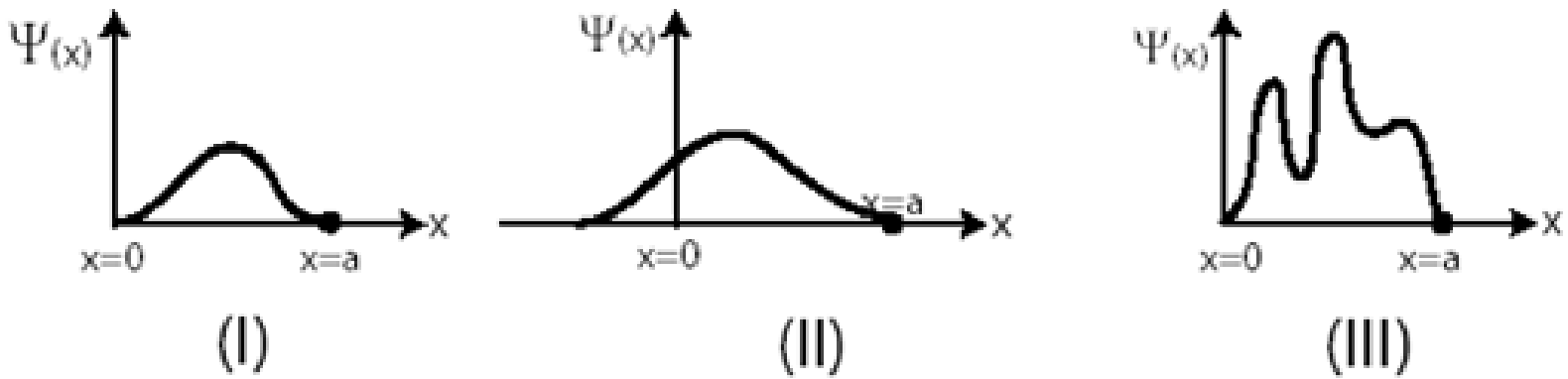
Choose all of the following wavefunctions that are valid wavefunctions for a 1D particle-in-a-box of width a (boundaries between $x = 0$ and $x = a$) at time $t = 0$:



CHM 305 The Quantum World

Lecture 6: The Postulates of Quantum Mechanics (pt. 1)

Reading: McQuarrie Ch. 4

Last lecture we discussed…

Quantum operators:

- are linear

$$\hat{A}\sum_{i=1}^{\infty} c_i\psi_i = \sum_{i=1}^{\infty} c_i a_i \psi_i$$

- may or may not commute

$$\hat{A}\hat{B}\psi(x) \neq \hat{B}\hat{A}\psi(x)$$

Eigenfunctions of an operator:

- are normalized

$$\int_{-\infty}^{\infty} |\psi_n(x)|^2 dx = 1$$

- are mutually orthogonal

$$\int_{-\infty}^{\infty} \psi_n^*(x)\psi_m(x)dx = 0$$

- form a complete set

$$\Phi(x) = \sum_{n=1}^{\infty} b_n \psi_n(x)$$

Road map for today's lecture

Discuss the five *Postulates of Quantum Mechanics*

1. Wave functions represent probability distributions
2. Operators represent physical quantities, or observables
3. Measurements with operators read out eigenvalues
4. How to calculate expectation values of measurements
5. The time-dependent Schrödinger equation

Practice problem #1

Consider the superposition state

$$\rho(x) = \frac{\sqrt{3}}{2}\psi_1(x) + \frac{i}{2}\psi_2(x)$$

where $\psi_n(x)$ is the eigenfunction of the $\hat{A}$ operator with eigenvalue a_n.

- What are the possible values we would measure when applying $\hat{A}$ to $\rho(x)$?
- What are the probabilities of making each of those measurements?

Practice problem #2

For the same superposition state from Problem 1, given by

$$\rho(x) = \frac{\sqrt{3}}{2}\psi_1(x) + \frac{i}{2}\psi_2(x)$$

What is the expected value of the A observable you would get from averaging together many repeated measurements with the $\hat{A}$ operator?

Wrapping up

- **Next time:** the Postulates pt. 2 – time dependence of probability distributions and expectation values
- **Today's reading:** McQuarrie Ch. 4
- **In the last minute or two**: Your muddiest point from today's lecture?