

HOMEWORK 4 (due Thurs. Mar.16)

Read:

Goldstein's Notes on Probability (Course Documents)

Hoffmann, Chapters 2-8, 11, 13, 14 to p.186. This is to be read over the next two weeks.

It covers the historical development of quantum physics.

You may choose to read all the chapters - they're interesting.

Feynman, Chapter 6 - read for next assignment.

Problems: (1 and 2 use some basic concepts in probability. There will be a handout.)

1. Assume you have a single normal six-sided die (one of a pair of dice).
 - (a) What is the probability of getting one 5 in one toss of the die?
 - (b) What is the probability of getting **only** one 5 in two tosses of the die?
 - (c) What is the probability of getting **at least** one 5 in two tosses of the die?
 - (d) What is the probability of getting 0 or 1 or 2 or 3 fives in three tosses of the die?
 - (e) What is the probability of getting **only** one 5 in eight tosses of the die?
 - (f) What is the probability of getting **only** two fives in eight tosses of the die?
2. It is observed that for 1000 radioactive Iodine(131) atoms an average of 455 undergo decay in 1 week.
 - (a) What is the rate of decay per week?
 - (b) Suppose you have a sample of 35,000 I(131) atoms. What is the average number that will decay in one week?
 - (c) What is the average number that will be left after 3 weeks?
3. WGBH broadcasts at a frequency of 89.7 MHz (1 MHz= 10^6 /sec).
 - (a) What is the wavelength of its EM waves?
 - (b) If you receive 1/1000 Watts of power, how many photons does your radio receive in 1 sec?
4. Blackbody radiation from the sun's surface (T=5700 K) is peaked at 5.1×10^{-7} m or 510 nm.
 - (a) Is that in the visible region?
 - (b) The cosmic background radiation peaks at wavelength 1.06 mm. What temperature does that correspond to?
5. In Bohr's model of the Hydrogen atom a photon is emitted when the electron drops from one orbit to a lower one.

What are the energy, frequency and wavelength for a transition from $n=3$ to $n=2$ or $n=1$?

