Suggested guidelines for reading the PIC manual

PIC manual is a big document. It is best to read it with a goal in mind, so as to make it easier to differentiate important items from unimportant ones. Let's say you need to use PIC18F4520 to create neuronal spikes by
1) detecting whether the membrane voltage is above threshold,
2) putting out a spike pulse, and
3) providing a discharge signal to the neuron.

First read the pin diagram and locate: analog and digital pin banks, power, ground, clock, master reset pins.

Now, here is a list of questions that need answering for our little problem:

1) Find how many analog and digital channels the PIC has (page 5 and 11)? How many neurons can be controlled with one PIC?

2) To detect whether a membrane voltage is above threshold, we need first to convert the signal on the corresponding analog input channel into digital representation within the PIC. What happens during Analog to Digital conversion (page 225)? How come some pins of the port A are multifunctional? How does one assign function to such pins (page 107, 108)?

3) What is the range and max for the clock frequency (page 11)? What sampling resolution in time does it give us? Will this resolution allow us to implement fast spiking vertebrate-like neurons? How to set up the clock (page 25)?

4) How does a PIC know how much time has elapsed between events in its program, such as between beginning of the spike pulse and end of the spike pulse, 2 msec later (page 125)?

5) You have 2 digital pins, B1 and B2. B1 is responsible for putting out the spike pulse, and pin B2 is responsible for neuronal discharge signal. Both signals are modeled by square pulses. What will be the polarity of those square pulses on B1 and B2. How long will be the discharge pulse and how long will be the neuronal spike pulse? How many timers will you need to run both these processes at once?

6) When we want to execute an instruction (put out a spike pulse on a digital channel) upon detection of a certain event (voltage on an analog channel above threshold), *interrupts* are used to stop the flow of main program and fork into the desired instruction set. Section 9 on page 93 describes what happens within the PIC during that process. Please read and get the general idea.

6) What happens during reset (page 43)?