a. Assuming a oscillator frequency of 12 MHz, configure Timer 2 and the PWM module to produce a square wave with frequency of 3 KHz (just give prescale, PR2 values – I do not want C-code). Choose the prescaler such that the PR2 value is greater than 10.

b.  Timer2 PWM period = (PR2+1) * (4/FOSC) * PRE  (POST is NOT used for PWM period)
     (1/3 KHz) = (PR2+1) * (4/12 MHz) * PRE
     PR2 = [(12 MHz/4) / (3 KHz * PRE)] – 1 = (1000/PRE) - 1
     For PRE = 1, PR2 = 999 (> 255, too large)
     For PRE = 4, PR2 = 249, will work
     For PRE = 16, PR2 = 61.5, so either 61 or 62 will work.

c. Assuming TIMER2 is configured for PWM mode, with a value of 0xC8 for the PR2 value. What value for the upper 8 bits would need to be written to the duty cycle register (CCPR1L) to give a duty cycle of 20%?

   For 20% duty cycle, CCPR1 = 0.2 * 0xC8 = 0.2 * 200 ~ 40

d. Assume Timer2 is configured to produce an interrupt period of X for postscale = 4, prescale =4, and PR2 = 0xC0. If PR2 is changed to 0x20, postscale changed to 15, and prescale changed to 1, how does the new interrupt period Y relate to the old interrupt period of X?

   Old ((PR2+1) * PRE * POST) / New ((PR2+1) * PRE * POST) / = ???
   ((0xC0+1) * 4 * 4)/((0x20+1) * 1 * 15) = (193 * 16)/(33 * 15) = 6.2. The old interrupt period is 6.2x longer than the new interrupt period, or the new interrupt period is 16% of the old interrupt period.

e. Write C code that configures timer1 for a prescale of 8, internal clock, 16-bit read/write mode, turns it on, enables its interrupts, and enables capture mode for every falling edge.

   // initialize timer 1
   // prescale by 8
   T1CKPS1 = 1; T1CKPS0 = 1;
   T1OSCN = 0;   // disable the oscillator
   TMR1CS = 0;  //use internal clock
   T1SYNC = 0;  // sync extern clock
   RD16 = 1;       // 16 bit r/w to timer1
   TMR1ON = 1;
   CCP1CON = 0x04; // every falling edge
   CCP1IF = 0; CCP1IE = 1; IPEN =0, PEIE = 1; GIE = 1; // enable interrupts

f. What is the longest possible period of the Timer1 interrupt using an FOSC = 10 MHz? Give the answer in milliseconds.

   Timer1 Clock period is 1/(10/4 MHz) = 4.0e-7 seconds = .4 μs.
   Using largest prescale of 8, rollover is 0.4 μs * 8 * 2^16 = 209,715.2 μs ~ 210 ms