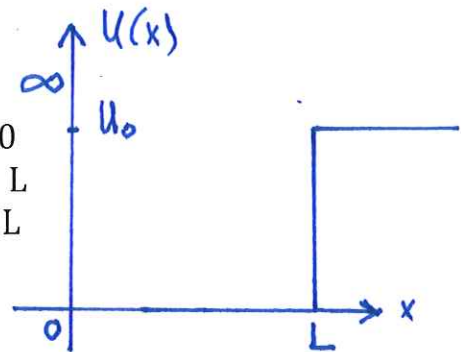


Draw the following table on the top of your answer sheet:

1a	1b	1c	1d	1e	2	Total
15	15	15	5	10	40	100

1. Solve the Schroedinger equation for a particle with mass  $m$  moving with energy  $E$  in a potential

$$U(x) = \begin{cases} \infty, & x < 0 \\ 0, & 0 < x < L \\ U_0, & x > L \end{cases}$$



where  $U_0 > 0$  and  $E > 0$  and  $E < U_0$ .

- Write down the wavefunction in the three regions. (15%)
- Apply the continuity conditions. (15%)
- Find the equation that determines the energy. (15%)
- Obtain an approximate answer for the ground state energy of an electron in such a potential by the iteration method for the case:  
 $U_0 = 200 \text{ eV}$  and  $L = 0.4 \text{ nm}$ . (5%)
- Compare your answer with the ground state energy of an electron in an infinite square well with the same  $L$ . (10%)

2. Show that

$$\psi(x) = A x \exp[-b x^2]$$

is a solution of the Schroedinger equation for a particle moving in the Harmonic Oscillator potential  $V(x) = \frac{1}{2} m \omega^2 x^2$ .

What is the corresponding energy? What is  $b$ ?

(40%)