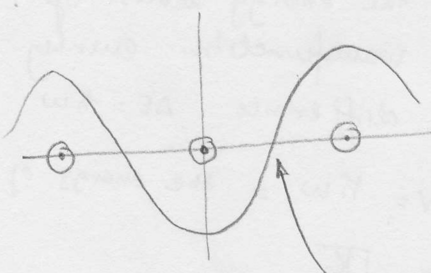
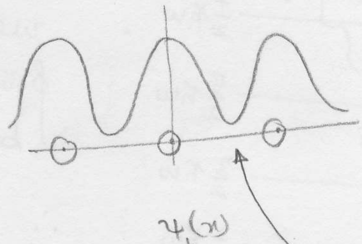
Conceptual Questions

41.6.

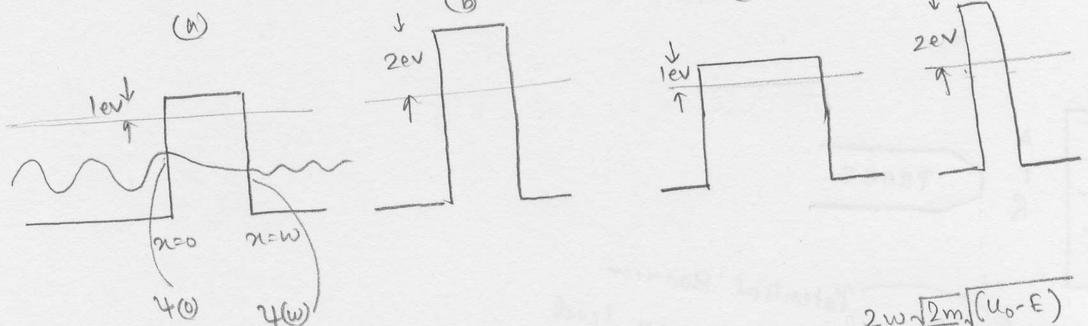


⇒ Probability of finding electron goes to zero at this point



In the region between the atoms there is always a non-zero probability of the existance of electron. This implies electron sharing and hence $\psi_b(x)$ is the bonding orbital.

41.7



we have $P_{tunnel} = \left|\frac{\psi(w)}{\psi(0)}\right|^2 = e^{-\frac{2w}{\eta}} = e^{-\frac{2w\sqrt{2m}\sqrt{(U_0-E)}}{\hbar}}$

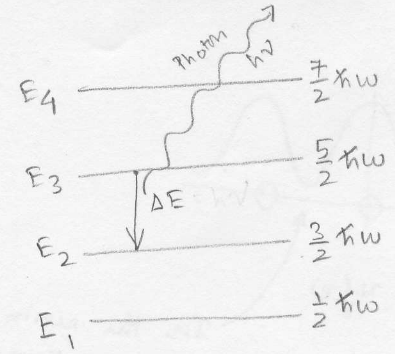
from the expression we find that doubling w will decrease the P_{tunnel} more than doubling (U_0-E) since the square root increases slowly than the value (U_0-E) hence $e^{-\sqrt{(U_0-E)}}$ decreases slower than $e^{-(U_0-E)}$

Hence,

$$(P_{tunnel})_d > (P_{tunnel})_b > (P_{tunnel})_a > (P_{tunnel})_c$$

E&P

41.17.



ENERGY LEVELS FOR HARMONIC POTENTIAL WELL SOLUTIONS.

we have the energy levels of harmonic potential well wavefunctions evenly separated by energy difference $\Delta E = \hbar\omega$

$\therefore \quad \Delta E = h\nu = \hbar\omega$ = the energy of the emitted photon.

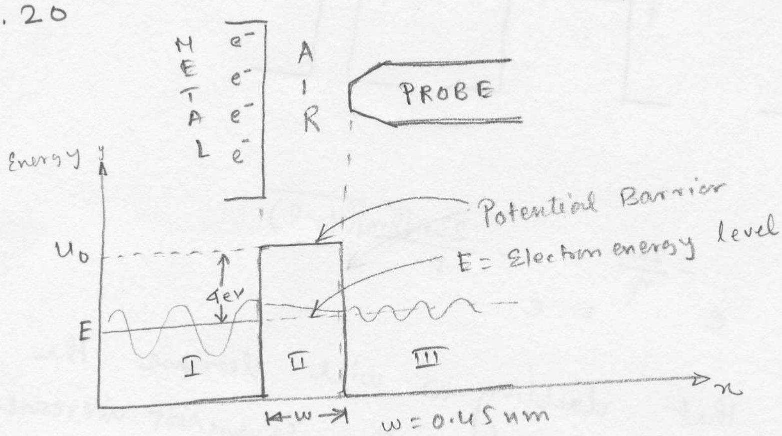
and $\omega = \sqrt{\frac{K}{m}}$

then $h\frac{c}{\lambda} = \frac{h}{2\pi}\sqrt{\frac{k}{m_e}}$

$\therefore \quad k = \left(\frac{2\pi c}{\lambda}\right)^2 m_e = \left(\frac{2\pi \times 3\times10^{8}}{1200\times10^{-9}}\right)^2 \times 9.1\times10^{-31}$

$= 2.25\ \text{N/m}$

41.20



E = Energy of electron in metal

To be in Region (II) {air} the electron has to leave the metal body and hence it must be supplied by the excess energy $(U_0 - E) = 4\text{eV}$ and this according to definition is precisely the work function of the metal.

$\therefore \quad \eta = \frac{\hbar}{[2m(U_0-E)]^{1/2}} = 9.72\times10^{-11}\ \text{m}$

$\therefore \quad P_{tunnel} = e^{-2w/\eta} = e^{-2(0.45\times10^{-9})/(9.72\times10^{-11})}$

$= 9.5\times10^{-5}$

$= 0.0095\ \%$

Conceptual Question

42.9 Inside a discharge tube atoms are excited due to collisions hence the 3s and 3p orbitals are not completely filled by many excited Neon atoms. There fore these might be transitions from $3p \rightarrow 3s$ giving red-orange emitted photons.

Inside an ordinary glass tube (absence of discharge) most Neon atoms are in ground states (unexcited) Hence most of them have completely filled 3s, 3p orbitals. Hence no transition might take place between these two by absorption. The only transition possible is from the ground state to some excited state (for eg $3p \rightarrow 4s$, etc) and the photon that can be absorbed is in the UV region and not visible region since the transition energy is relatively higher.