

T-L 5-16



a) what are allowed energies of ptcl mass  $m$  confined to 1-D box?

$$E_n = \frac{p_n^2}{2m} = \frac{h^2}{2m\lambda_n^2}$$

but  $\lambda_n = \frac{2L}{n}$

so  $E_n = \frac{h^2 n^2}{8mL^2}$

$$E_n = n^2 E_1 \quad \checkmark$$

b) For an electron in box w/  $L = 0.1 \text{ nm}$ ,

$$E_1 = 37.6 \text{ eV}$$

$$E_2 = 2^2 \cdot E_1$$

etc

5 ————— 940 eV

4 ————— 602 eV

3 ————— 338 eV

2 ————— 150 eV

1 ————— 37.6 eV

} spacing not to scale

c) for  $n=2 \rightarrow 1$  transition,  $f_{21} = \frac{4E_{21}}{h} = 2.72 \text{ e}16 \text{ Hz}$

$n=3 \rightarrow 2$   $f_{32} = 4.5 \text{ e}16 \text{ Hz}$

$n=5 \rightarrow 1$   $f_{51} = 2.2 \text{ e}17 \text{ Hz}$