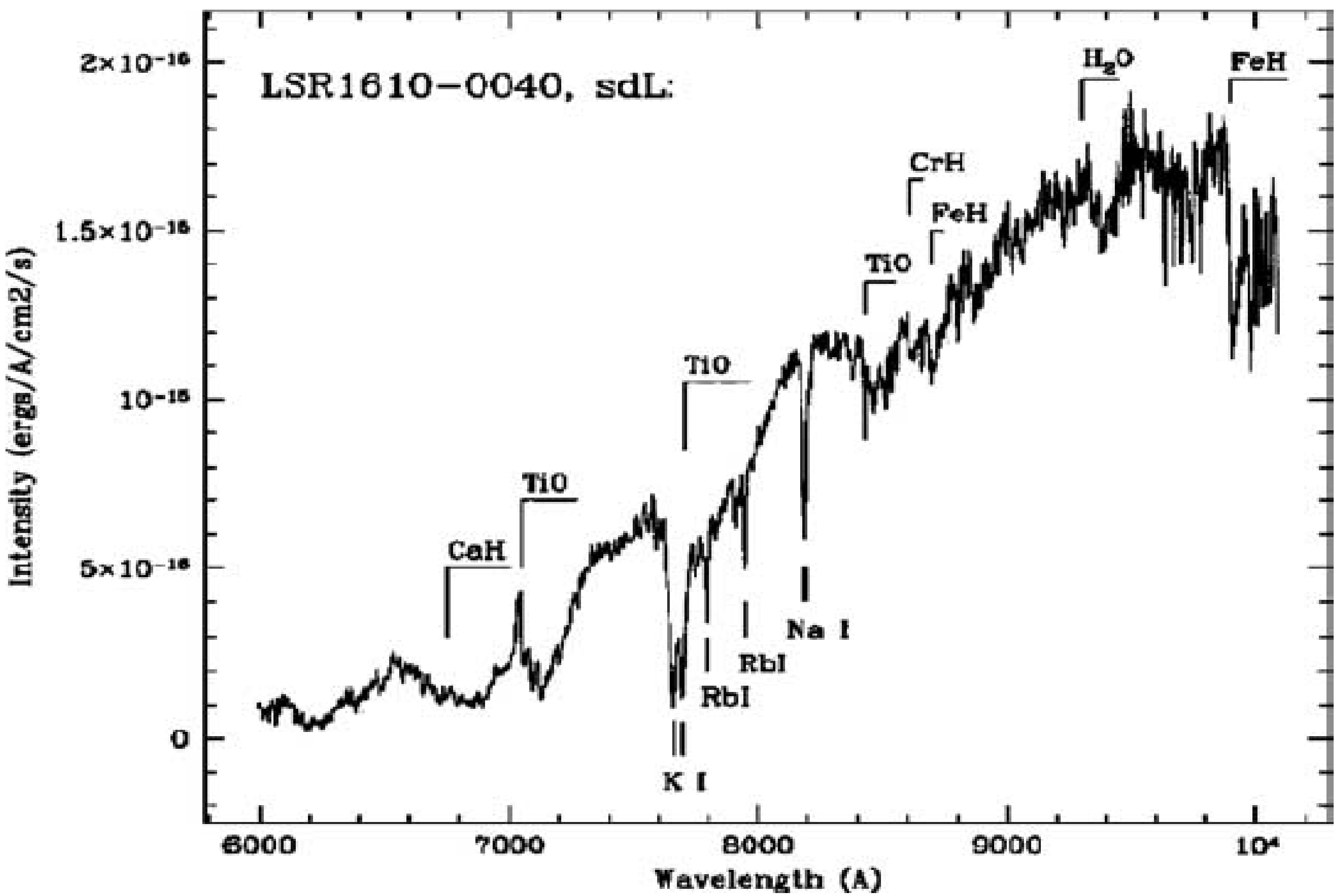
Administrative business

Syllabus for Minor 1 - up to harmonic oscillator

Note Title

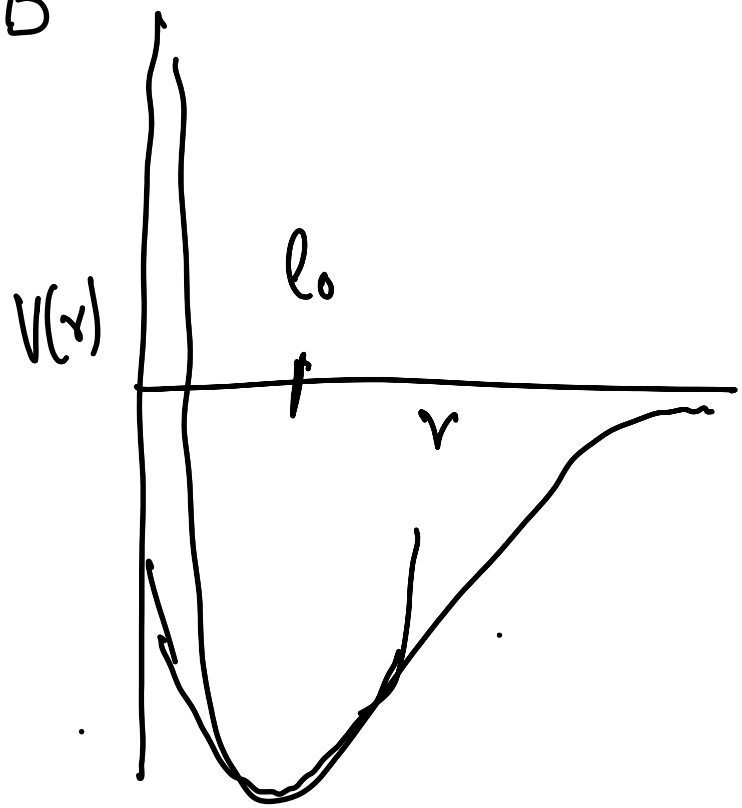
01-02-2011



Ti O $\quad A \underset{r}{-} B$

Morse potential

$$V(r) = D\left(1 - e^{-\beta(r-l_0)}\right)^2$$

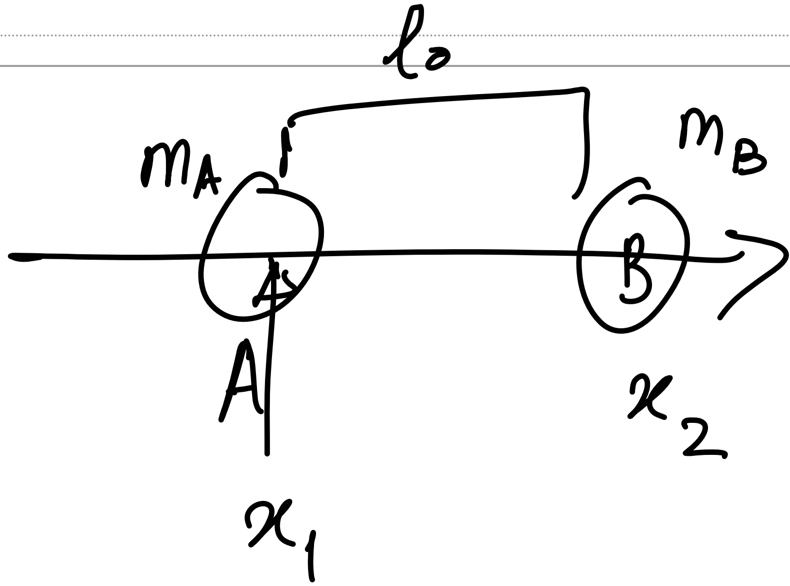


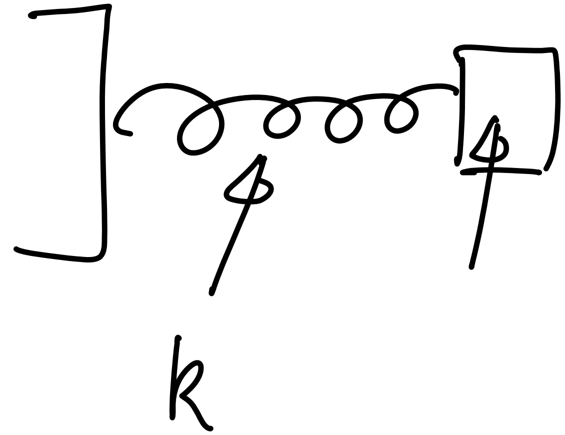
$$\beta(r-l_0)^2$$

$$x = r - l_0$$

$$V(x) = \frac{1}{2}kx^2$$

$$F(x) = -kx$$





$$m_A \frac{d^2 x_1}{dt^2} = -k\,(x_2 - x_1 - l_0)$$

$$m_B \frac{d^2 x_2}{dt^2} = k\,(x_2 - x_1 - l_0)$$

$$\boxed{M \frac{d^2 X}{dt^2} = 0}$$

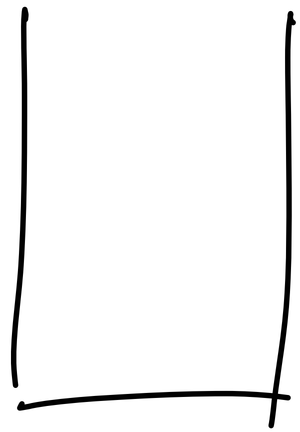
$$M = m_A + m_B$$

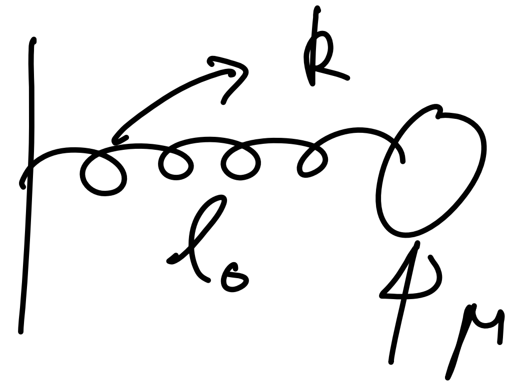
$$X = \frac{m_A x_1 + m_B x_2}{M}$$

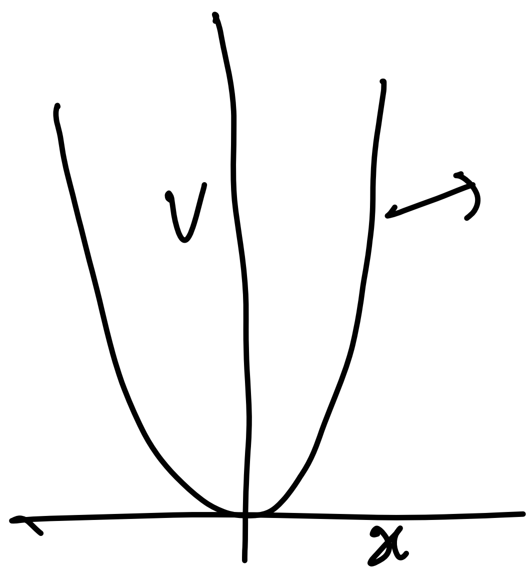
Free particle

$$\mu \frac{d^2}{dt^2}(x_2 - x_1) = -k(x_2 - x_1)$$

$$\frac{1}{\mu} = \frac{1}{m_1} + \frac{1}{m_2}$$

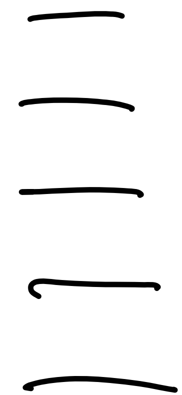






$\frac{1}{2} k x^2$

$$\hat{H} = -\frac{\hbar^2}{2\mu}\frac{d^2}{dx^2} + \frac{1}{2}kx^2$$



Schrödinger equation

$$\hat{H}\psi = E\psi$$

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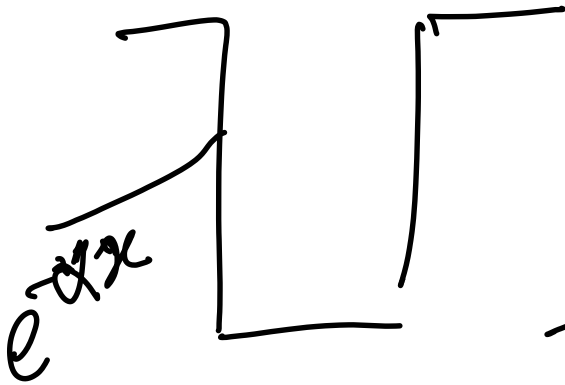
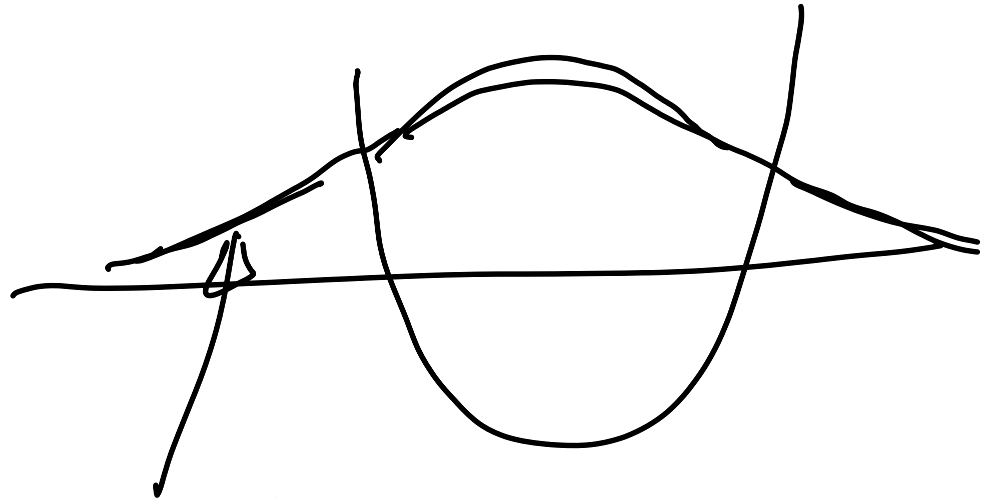
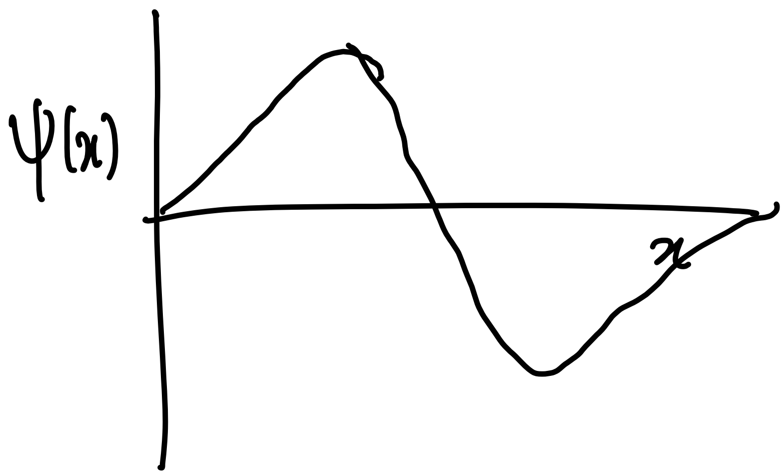


$$\frac{1}{2} k x^2$$





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$$-\frac{\hbar^2}{2\mu}\frac{d^2\psi}{dx^2} + \frac{1}{2}kx^2\psi = E\cancel{\psi}$$

$$\psi = e^{-\alpha x^2}$$

$x \to \infty$

$$\psi \sim e^{-\frac{\alpha}{2}x^2}$$

$$\psi(x) = e^{-\frac{\alpha x^2}{2}} \times g(x)$$

polynomial in x

$$e^{\alpha x^2} \Leftarrow g(x) = a_0 + a_1 x + a_2 x^2 + \cdots$$