Announcements

① Homework

* Chapter 7 ⇒ due Sunday, Oct. 10
* Chapter 8 ⇒ due Wednesday, Oct. 13
* Chapter 9 ⇒ due Sunday, Oct. 17

② Exam II Tuesday, Oct. 19, 8:20-10:20pm

* Chapters 5-9
* Get Help <u>NOW</u> if you need it!

③ Review Session

* Monday, Oct. 18 (NOT next Monday)
* NPB 1001 (here)

General Circular Motion

① $\vec{x}(t) = R\left[\cos(\theta(t))\hat{\imath} + \sin(\theta(t))\hat{\jmath}\right]$

* $\|\vec{x}(t)\| = R \iff$ a circle
* $\theta(t)$ arbitrary

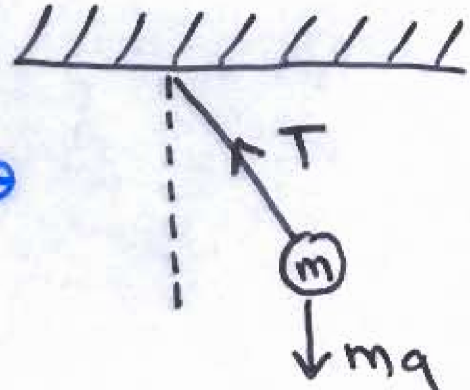
② $\vec{v}(t) = \dot{\theta} R\left[-\sin(\theta)\hat{\imath} + \cos(\theta)\hat{\jmath}\right]$

* $\|\vec{v}(t)\| = R\,|\dot{\theta}(t)|$
* $\vec{x}(t)\cdot\vec{v}(t) = 0$

③ $\vec{a}(t) = \underbrace{-\dot{\theta}^2 R\left[\cos(\theta)\hat{\imath} + \sin(\theta)\hat{\jmath}\right]}_{\vec{a}_c(t)} + \underbrace{\ddot{\theta} R\left[-\sin(\theta)\hat{\imath} + \cos(\theta)\hat{\jmath}\right]}_{\vec{a}_t(t)}$

* NB $\|\vec{a}_c\| = R\dot{\theta}^2 = v^2/R$

$$\boxed{\vec{F} = m\vec{a} \text{ for Pendula}}$$



* centripetal: $m\dfrac{v^2}{R} = T - mg\cos\theta$
* transverse: $mR\ddot{\theta} = mg\sin\theta$

$\therefore\ \ddot{\theta} = \dfrac{g}{R}\sin(\theta)$ <u>HARD</u>

$\frac{1}{2}mv^2 + P(x) = E_0$

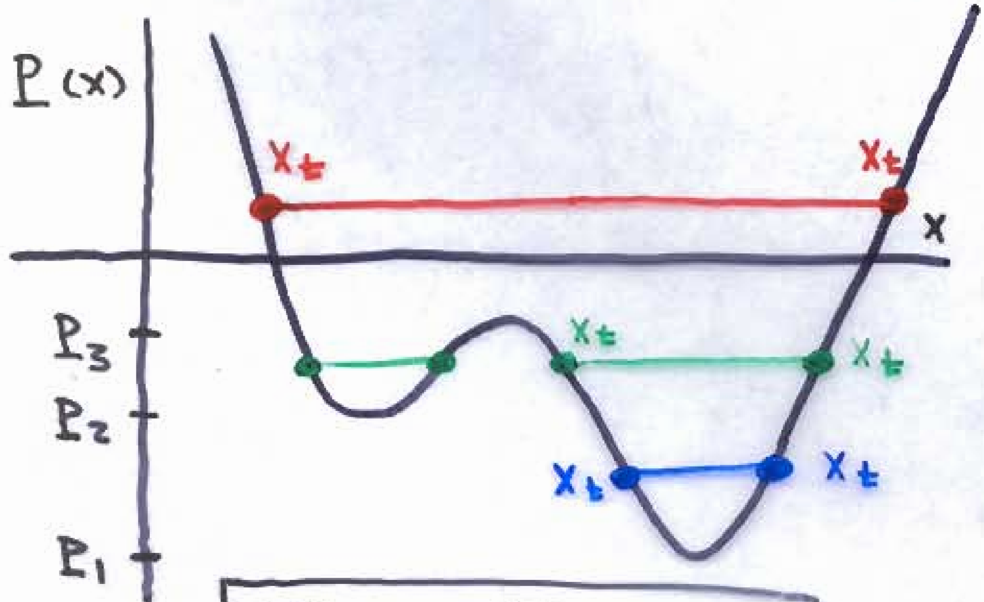
① v_0 & $x_0 \Rightarrow E_0 = \frac{1}{2}mv_0^2 + P(x_0)$

② $K \equiv \frac{1}{2}mv^2$ maximized where $P(x)$ minimized

* $P'(x) = -F(x) \Rightarrow K_{max}$ where $F = 0$

③ $K \geq 0 \Rightarrow P(x) = E_0 - \frac{1}{2}mv^2 \leq E_0$

* $P(x_t) = E_0 \Rightarrow$ "turning point"



$\boxed{\text{Three Motions}}$ NB $E_0 \geq P_1$

① $P_1 \leq E_0 \leq P_2$

② $P_2 < E_0 \leq P_3$

*NB could be in either well

③ $P_3 < E_0$

10/8/04

PHY 2048

$$\underline{P(x) = ax^4 - bx^2 \text{ for } a, b > 0}$$

① What is the force $F(x)$?

(A) $-4ax^3 + 2bx$

(B) $+4ax^3 - 2bx$

(C) $+\frac{1}{5}ax^5 - \frac{1}{3}bx^3$

(D) $-\frac{1}{5}ax^5 + \frac{1}{3}bx^3$

(E) $-kx$

② Where is K maximized?

(A) $x = 0$

(B) $x = F/k$

(C) $x = \pm a/b$

(D) $x = \pm\sqrt{\frac{b}{2a}}$

(E) $x = \pm\sqrt{\frac{b}{4a}}$

③ Suppose $E_0 > 0$. What is the left turning point?

(A) $\sqrt{\frac{b}{a}}$

(B) $-\sqrt{\frac{b + \sqrt{b^2 + 4aE_0}}{2a}}$

(C) $-\sqrt{\frac{b - \sqrt{b^2 + 4aE_0}}{2a}}$

(D) $+\sqrt{\frac{b - \sqrt{b^2 + 4aE_0}}{2a}}$

(E) $(E_0/a)^{1/4}$

Final Facts about Energy

① Friction generates heat

* $\Delta E_{thermal} = \int \|d\vec{x}\| \, \|\vec{F}_f\| \xrightarrow{const.} \|\Delta\vec{x}\| \, \|\vec{F}_f\|$

② Springs

* $P_S = 0$ if no contact
* unattached masses can bounce off!
  - cf. Ch. 8, #28

③ Combine Kinematics with ΔE techniques

* cf Ch. 8, #34