3 letters of rec

GPA

Grad Applications

GRE
→ General
→ Subject

Statement of Purpose
→ Research

I'll email Mr/Ms ETS

Now & Summer

* Think about 3 LoR writers
→ @ least one research

Fall Senior year

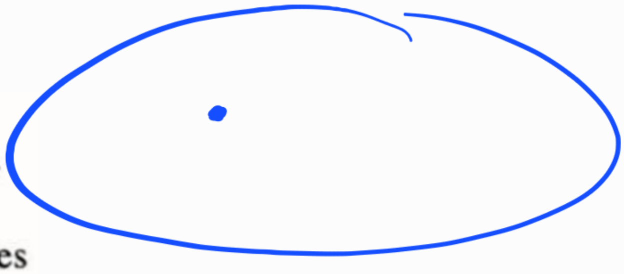
→ List grad schools & ask about letters

→ Apps due Dec 1 – Dec. 31

Questions about pre-diagnostic

3. When it is about the same distance from the Sun as is Jupiter, a spacecraft on a mission to the outer planets has a speed that is 1.5 times the speed of Jupiter in its orbit. Which of the following describes the orbit of the spacecraft about the Sun?

(A) Spiral
(B) Circle
(C) Ellipse
(D) Parabola
(E) Hyperbola



$K + U = E_{tot}$

"Bound" $E_{tot} < 0$

In a $\frac{1}{r}$ Potential

* $E_{tot} > 0$: Hyperbola
* $E_{tot} < 0$: Ellipse
* $E_{tot} = 0$: Parabola

Virial Thm.

$\langle K \rangle = -\frac{1}{2}\langle U \rangle$

13. A particle of mass m is acted on by a harmonic force with potential energy function $V(x) = m\omega^2 x^2/2$ (a one-dimensional simple harmonic oscillator). If there is a wall at $x = 0$ so that $V = \infty$ for $x < 0$, then the energy levels are equal to

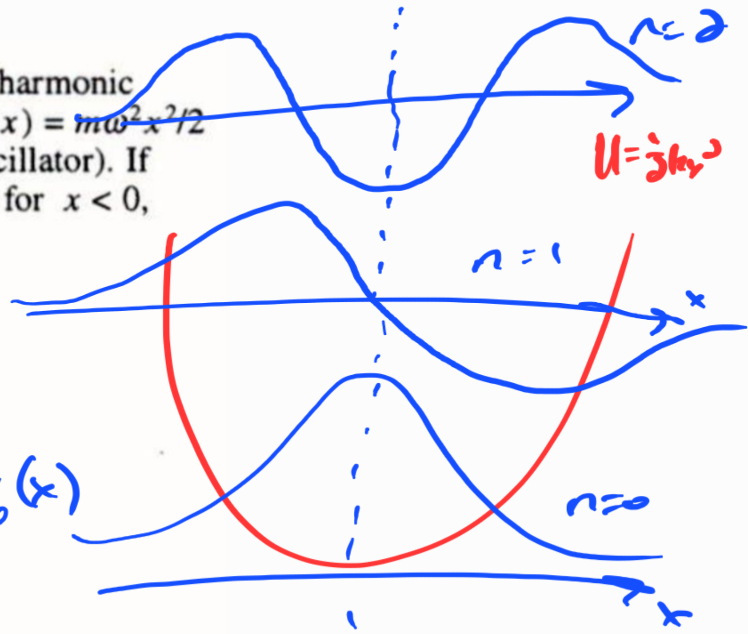
(A) $0,\ \hbar\omega,\ 2\hbar\omega,\ \ldots$

(B) $0,\ \frac{\hbar\omega}{2},\ \hbar\omega,\ \ldots$

(C) $\frac{\hbar\omega}{2},\ \frac{3\hbar\omega}{2},\ \frac{5\hbar\omega}{2},\ \ldots$

(D) $\frac{3\hbar\omega}{2},\ \frac{7\hbar\omega}{2},\ \frac{11\hbar\omega}{2},\ \ldots$

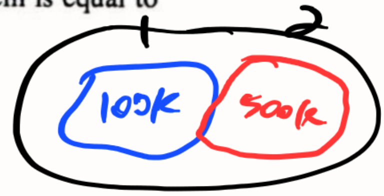
(E) $0,\ \frac{3\hbar\omega}{2},\ \frac{5\hbar\omega}{2},\ \ldots$



$E_n = \hbar\omega[n + \frac{1}{2}]$

20. A body of mass m with specific heat C at temperature 500 K is brought into contact with an identical body at temperature 100 K, and the two are isolated from their surroundings. The change in $\boxed{\text{entropy}}$ of the system is equal to

(A) $(4/3)mC$
(B) $mC\ln(9/5)$
(C) $mC\ln(3)$
(D) $-mC\ln(5/3)$
(E) 0



$dQ = mC\,dT$

$T_f = 300K$

$$\int dS = \int \frac{dQ}{T} = \Delta S$$

$$\Delta S = \int_{T_i}^{T_f} mc\,\frac{dT}{T} = mc\ln\frac{T_f}{T_i}$$

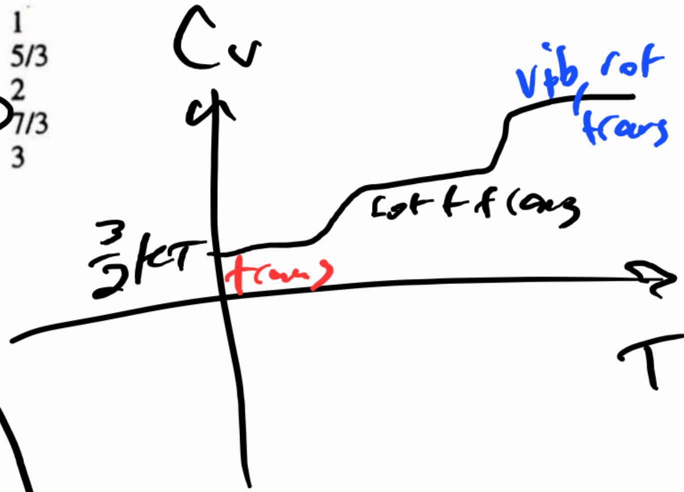
$$\Delta S = \Delta S_1$$

$$mc\ln\frac{300K}{100K} + mc\ln\left(\frac{300K}{500K}\right)$$

$$= mc\ln\left(\frac{300\cdot 300}{100\cdot 500}\right) = mc\ln\left(\frac{9}{5}\right)$$

21. For an ideal diatomic gas in thermal equilibrium, the ratio of the molar heat capacity at constant volume at very high temperatures to that at very low temperatures is equal to

(A) 1
(B) 5/3
(C) 2
(D) 7/3
(E) 3

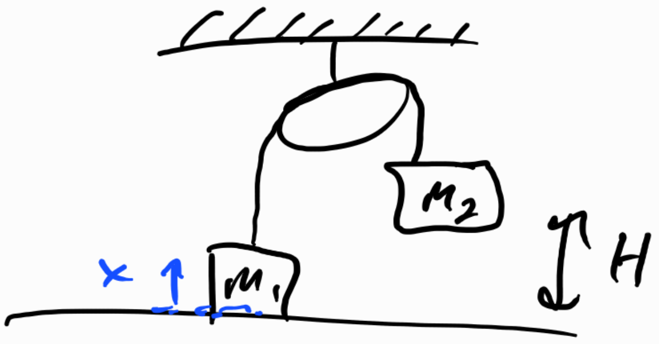


$\frac{1}{2}kT$ $\forall$ d.o.f.

$$C_v = \frac{f}{2}R$$

Lagrangians & Hamiltonians

$M_2 > M_1$



$* \quad L(q,\dot{q}) = K - U$

$* \quad \frac{\partial L}{\partial q} = \frac{d}{dt}\frac{\partial L}{\partial \dot{q}}$

for our ex., x and $\dot{x}$

$$L = \frac{1}{2}(M_1 + M_2)\dot{x}^2 - M_2 g(H - x) - M_1 g x$$

$$\frac{\partial L}{\partial x} = g[M_2 - M_1]$$

$$\frac{d}{dt}\left[\frac{\partial L}{\partial \dot{x}}\right] = \frac{d}{dt}\left[(M_1 + M_2)\dot{x}\right] = (M_1 + M_2)\ddot{x}$$

E-L eq. $\Rightarrow \quad \frac{d}{dt}\left[\frac{\partial L}{\partial \dot{x}}\right] = \frac{\partial L}{\partial x}$

$$\boxed{\ddot{x} = \left(\frac{M_2 - M_1}{M_2 + M_1}\right)g}$$

$H = \frac{p^2}{2m}$

$\frac{\partial H}{\partial p} = \frac{2p}{2m} = v$

$H = K + U$ Hamiltonian (Total Energy if L doesn't depend on t.)

$$\boxed{p \equiv \frac{\partial L}{\partial \dot{q}}}$$

$H = H(p, q)$

$$\dot{q} = \boxed{+}\frac{\partial H}{\partial p}$$

$$\dot{p} = \boxed{-}\frac{\partial H}{\partial q}$$