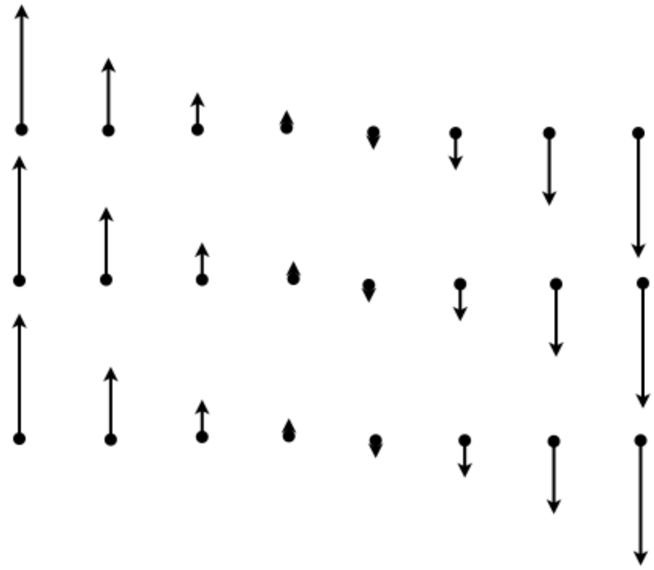
What is the curl (∇x**F**) of this vector field, **F**?

A) = 0 everywhere
B) ≠ 0 everywhere
C) =0 in some places
D) Not enough info to decide



2- 1

What is the curl (∇x**F**) of this vector field, **F**?

A) = 0 everywhere
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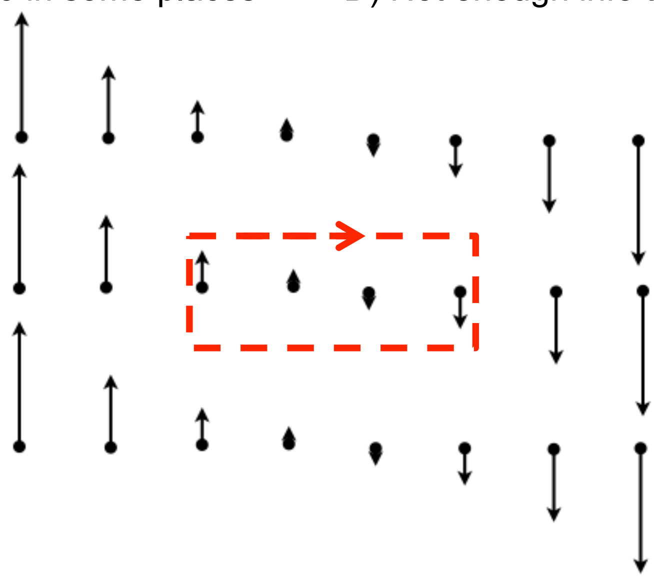


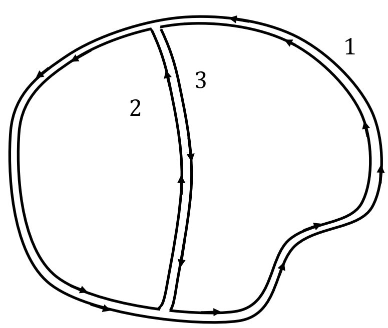
2- 2

Last class: the following are basically all equivalent!

- F(r) is a conservative force
- $\int_{r_o}^{r_1} \vec{F}(r') \cdot d\vec{r}'$ is path independent
- PE is well defined $U(r) = -\int_{r_o}^{r} \vec{F}(r') \cdot d\vec{r}'$
- $\vec{F}(r) = -\vec{\nabla} U(r)$
- $\vec{\nabla} \times \vec{F}(r) = \mathbf{0}$
- $\oint \vec{F}(r') \cdot d\vec{r}' = \mathbf{0}$

2-

Consider the three closed paths 1, 2, and 3 in some vector field **F**, where paths 2 and 3 cover the larger path 1 as shown. What can you say about the 3 path integrals?



A) $\oint_1 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} > \oint_2 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} + \oint_3 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}}$

B) $\oint_1 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} < \oint_2 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} + \oint_3 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}}$

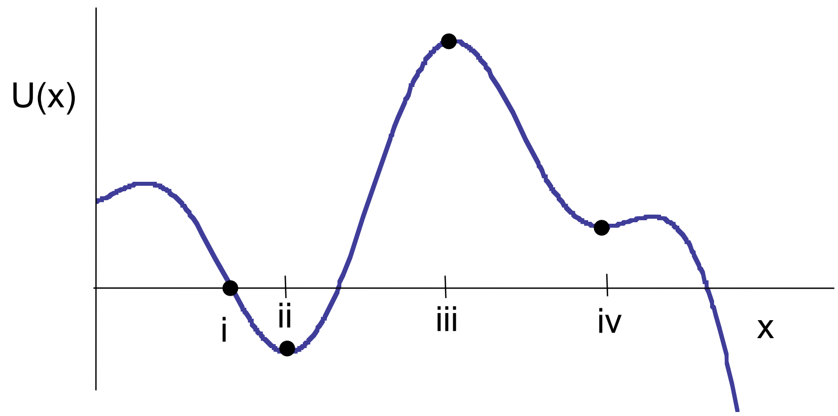
C) $\oint_1 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} = \oint_2 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}} + \oint_3 \vec{\mathbf{F}} \cdot d\vec{\mathbf{s}}$

D) There is no way to decide without knowing $\vec{\mathbf{F}}$

2- 5

Of the four labeled points, at which is the force = 0 ?

A) i only B) ii only
C) ii & iv only D) ii, iii and iv only
E) Some other combination!

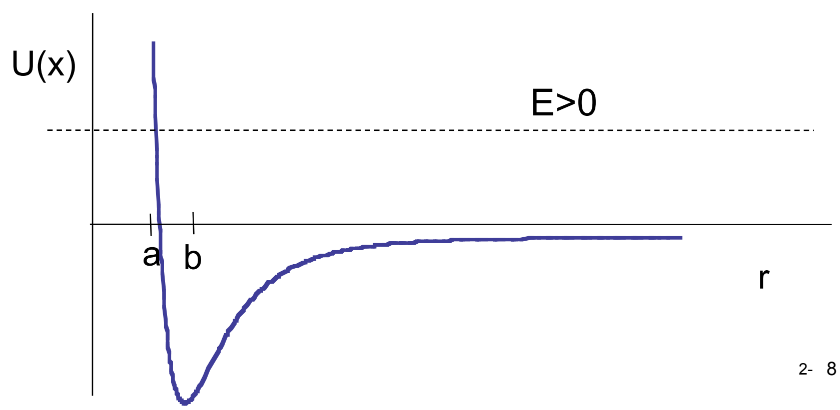


2- 7

Fig 4.12 of Taylor shows PE of H in an HCl molecule.

If the energy, E, is shown (dashed), what's the best description of the motion of the H atom?

A) Trapped, at r=a B) Oscillates around r=b
C) Unbound, the H "escapes" D) Other/????



2- 8

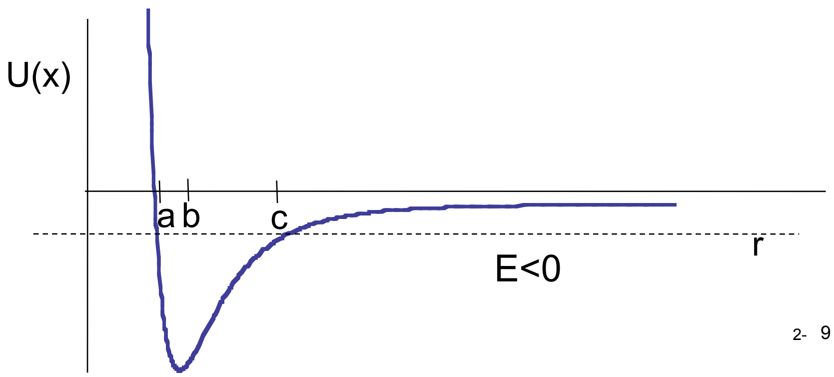
Fig 4.12 of Taylor shows PE of H in an HCl molecule.

If the energy, E, is shown (dashed), what's the best description of the motion of the H?

A) Trapped, at r=a B) Trapped, at a OR c

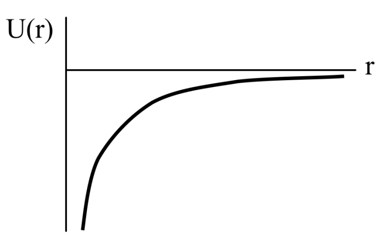
C) Unbound, H "escapes" D) Oscillates around r=b

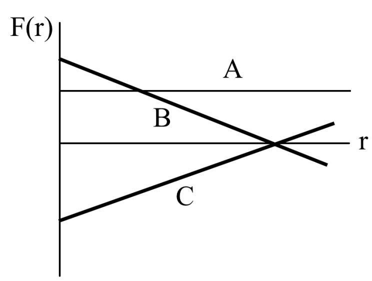
E) Other/???



2- 9

The potential energy of a test mass is shown as a function of distance from the origin U(r) ~ - 1 / r. Which graph shows the corresponding force as a function of distance?





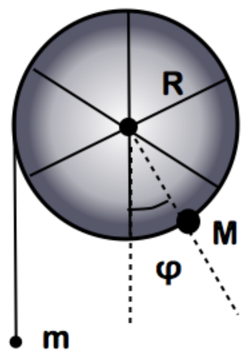
D) None of these!

2- 11

Consider this massless frictionless wheel.
M is attached to the side, while m hangs from a string wrapped around the wheel.

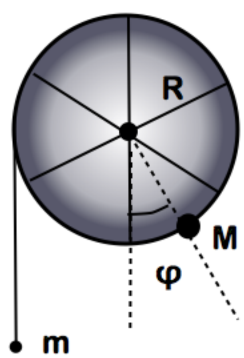
What is the potential energy of m in terms of φ?

A) +mgφ
B) -mgφ
C) +mgRφ
D) -mgRφ
E) Something else, there's got to be some trig!



What is the potential energy of M in terms of φ?

A) MgRcos(φ)
B) MgRsin(φ)
C) MgR(cos(φ)-1)
D) MgR(1-cos(φ))
E) Something else!



Summary:

- 1-D systems, $U(x)$ yields $F(x)=-dU/dx$

- Equilibrium when $U'(x)=0$
- Stable Equilibrium if $U''(x)>0$

-Plots of $U(x)$ vs x give us immediate information (about binding, motion, $v(x)$, $v(t)$, equilibrium, ...)

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2- 18