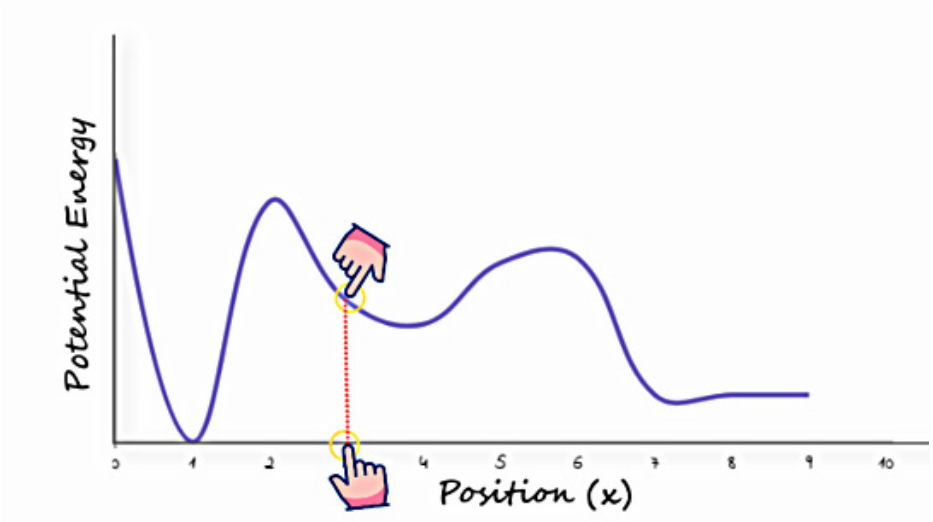
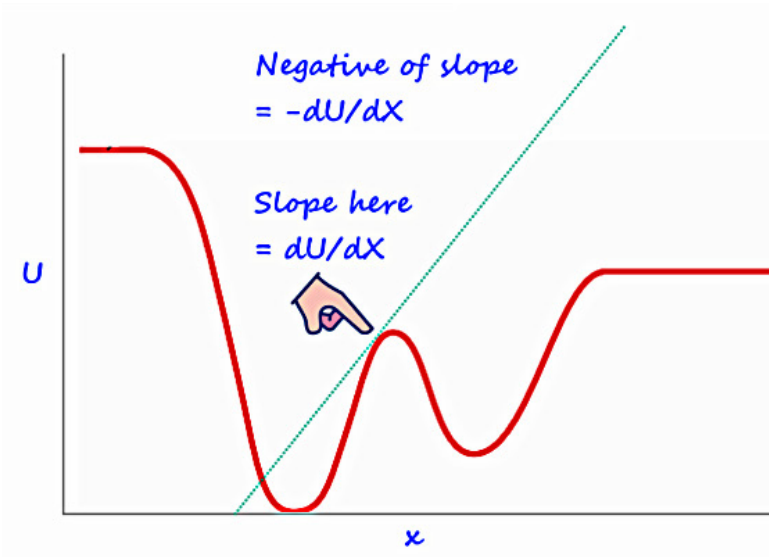
Potential Energy Curves
(& how to read them)



- If an object is subjected to a conservative force, its potential energy changes
- A plot of PE and position of the object is called a PE curve

Slope at a point = Magnitude of Force



$W = F \Delta X$

$\Delta U = -W$

$\Delta U = - F \Delta X$

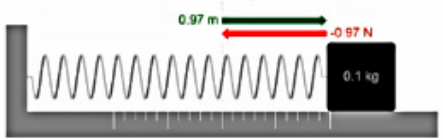
$F = - (\Delta U / \Delta X)$

$F = - dU/dX$

- Often PE is represented by the symbol "U" on a PE Curve
- The negative of slope at any point is equal to the force acting on the object at that point

Examples Using the Formula F = -dy/dx

1



$U = 1/2\,(kx^2)$ (PE of spring)

$dU/dx = kx$

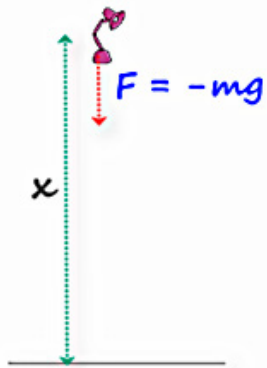
$F = -kx$

2

$U = mgx$

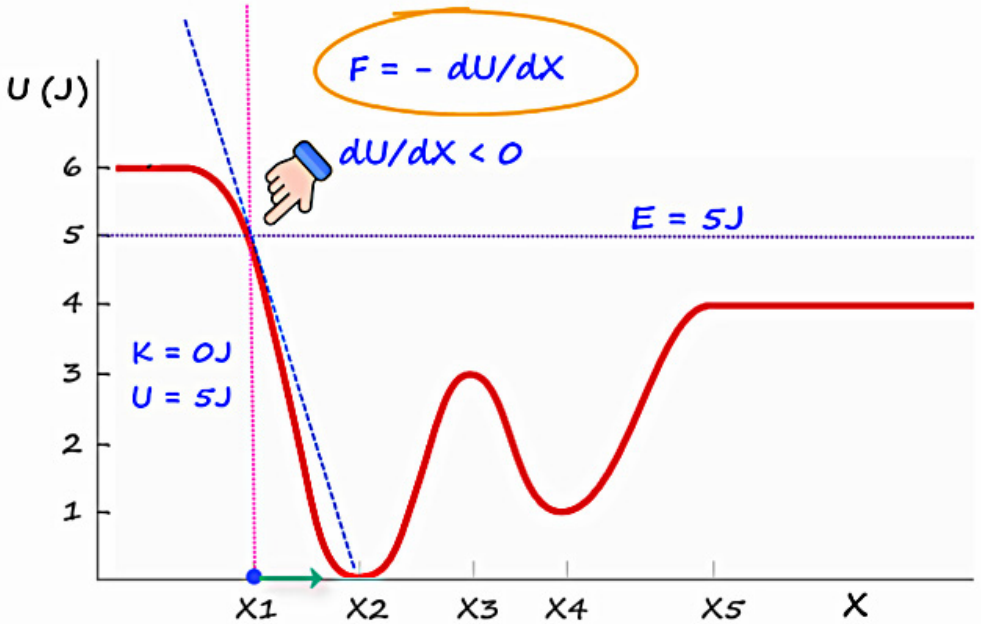
$dU/dx = mg$

$F = -mg$



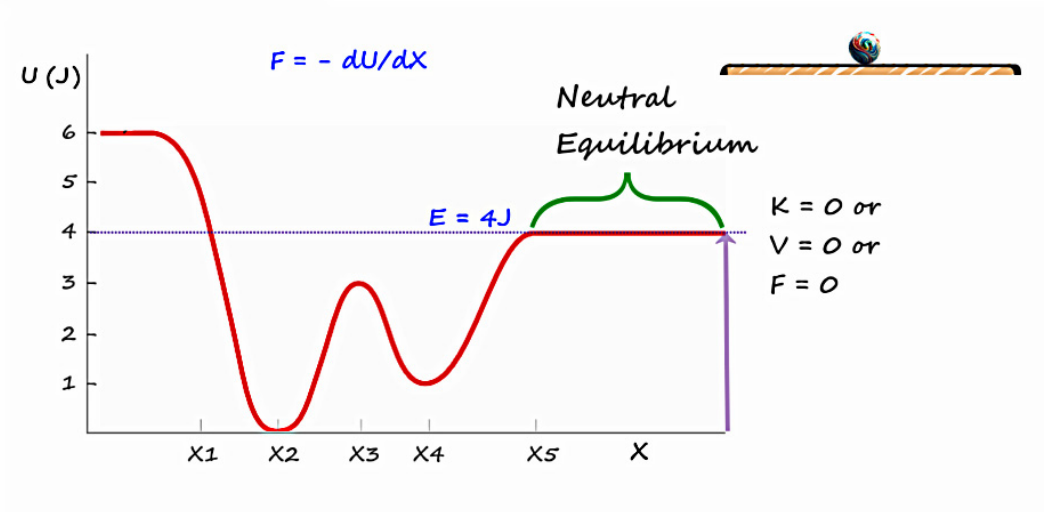
- Find differential of "U" of a spring or that of an object at a height X above the Earth.
- Take minus of the differential, then the results is the force acting on the object at that point

Turning Point on a PE Curve



- If total energy of a particle is E and PE is U, then KE = E-U
- If at any point, (a) KE = 0 (b) U = E & (c) beyond that point KE turns -ve, it is called a TURNING POINT
- At such points the direction of motion of the particle reverses

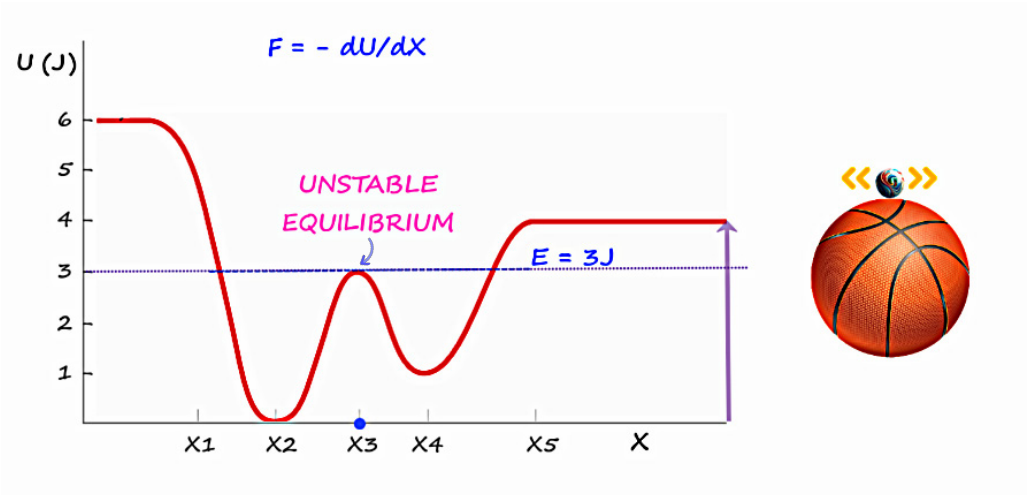
Neutral Equilibrium



- If for any stretch of x values, KE = 0 and therefore U = E, it is called NEUTRAL EQUILIBRIUM
- No force acts on the particle and it is stationary

- A marble placed on a flat table is in neutral equilibrium. You move it to the left or the right, it will continue to rest at its new position.

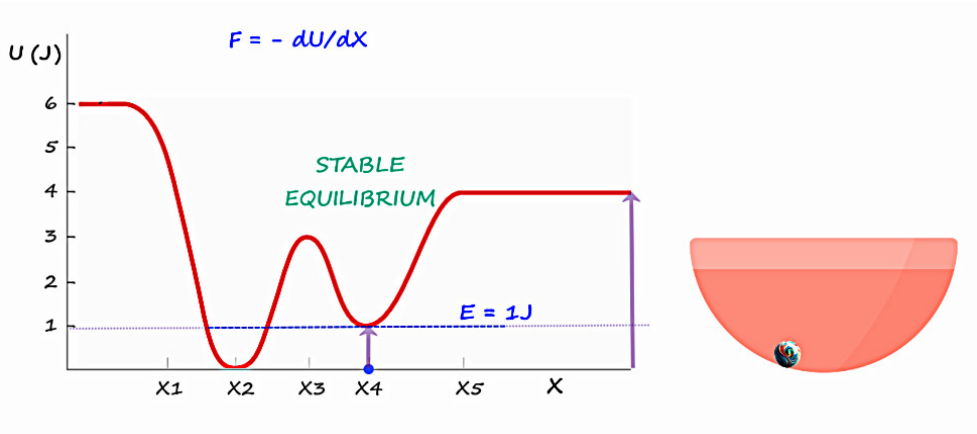
Unstable Equilibrium



- At such points the slope is zero and the particle is stationary
- if it is displaced slightly in either direction, a non-zero force pushes it farther in the same direction

- The particle is then said to be in UN-STABLE EQUILIBRIUM.
  A marble placed on a ball is in unstable equilibrium.

Stable Equilibrium



- At such points the slope is zero and the particle remains stationary
- It has zero KE, or zero velocity and no force acting on it at this point

- If we push the particle left or right, a restoring force will appear that will take it back to X4. The particle is said to be in STABLE EQUILIBRIUM. A marble in a bowl is in stable equilibrium