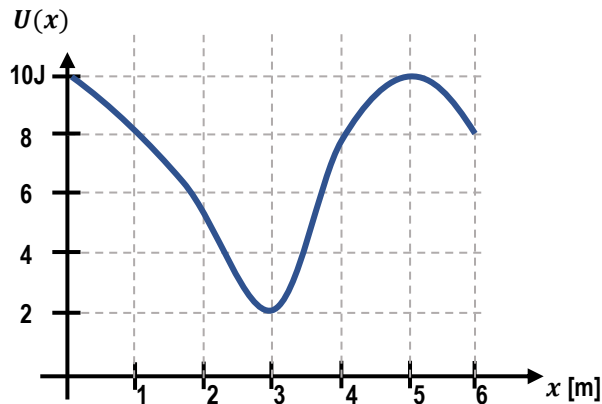


CONCEPT: INTRO TO POTENTIAL ENERGY GRAPHS

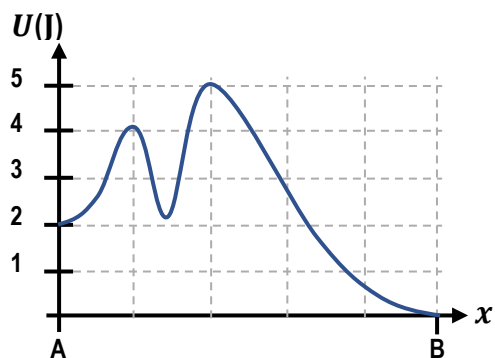
- Potential Energy $U(x)$ graphs plot the **potential energy** of an object in the y-axis vs. _____ in the x-axis.
 - **TOTAL** Mech. Energy **M.E** = _____ at any point and is always conserved ($W_{nc} = 0$).
 - Kinetic Energy is the _____ between **M.E.** and **$U(x)$** .

EXAMPLE: A 0.5 kg marble moves according to the potential energy graph shown. If you release the marble from rest at $x_0 = 1\text{ m}$, **a)** What is the total Mechanical Energy of the marble? **b)** What is the marble's kinetic energy at $x = 3\text{ m}$? **c)** Calculate the speed of the marble at $x = 4\text{ m}$. **d)** Without touching the marble again, can it ever reach $x = 5\text{ m}$?



- If no energy is added, objects remain “stuck” underneath the line for **M.E.**, between two **TURNING POINTS**.

PROBLEM: A particle with a mass of 0.1kg moves according to the Potential Energy graph shown. What minimum speed does the particle need at Point A to reach Point B?

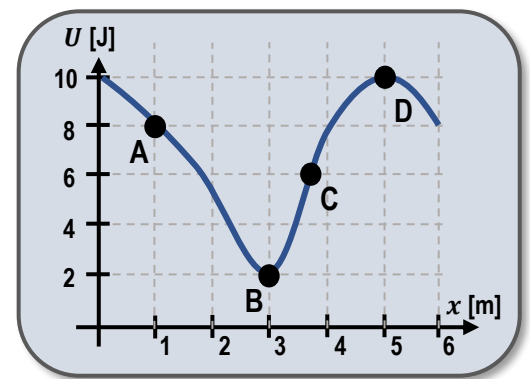


CONCEPT: FORCES AND EQUILIBRIUM POSITIONS IN POTENTIAL ENERGY GRAPHS

- In $U(x)$ graphs, the sign of $F(x)$ at any point is the opposite sign of the _____.
 - When slope of $U(x)$ is DOWN/negative, F is [+ | - | 0]
 - When slope of $U(x)$ is FLAT/horizontal, F is [+ | - | 0] $\rightarrow$ **Equilibrium Points**
 - When slope of $U(x)$ is UP/positive, F is [+ | - | 0]
- There are two TYPES of Equilibrium points:
 - 1) **STABLE** Equil.: $U(x)$ has a local [**MINIMUM** | **MAXIMUM**], curves _____. If “nudged”, objects _____ return.
 - 2) **UNSTABLE** Equil.: $U(x)$ has a local [**MINIMUM** | **MAXIMUM**], curves _____. If “nudged”, objects _____ return.

EXAMPLE: A ball moves according to the potential energy graph shown.

a) Determine if the Force acting on the ball is [+ / - / 0] for Points A–D.



b) Determine the positions of stable equilibrium.

c) Determine the positions of unstable equilibrium.

PROBLEM: A marble moves along the x -axis according to the potential-energy function shown below. **a)** At which of the labeled points is the force on the marble zero? **b)** Which of the labeled x -coordinates is a position of stable equilibrium?

