2023-Ph-H1-Q4

Section: Our Dynamic Universe

Topic: Energy and Power

Summary:

A pendulum bob of mass m is released from rest at height h. We must determine which change doubles the speed v at its lowest point.

Solution:

Using conservation of energy:

$$mgh = \frac{1}{2}mv^2 \quad \Rightarrow \quad v = \sqrt{2gh}\,.$$

To double v, we require:

$$v' = 2v = \sqrt{2gh'} \quad \Rightarrow \quad (2v)^2 = 4(2gh) = 2gh' \quad \Rightarrow \quad h' = 4h.$$

Answer: A. Change the height to 4h.

Guidance for Students:

- Speed at the bottom depends on $\sqrt{h}$; mass cancels out.
- To double speed, height must increase by a factor of 4.

Revision Tips:

- **Energy conversion:** GPE converts to KE at the bottom.
- **Scaling:** If $v \propto \sqrt{h}$, doubling v means quadrupling h.