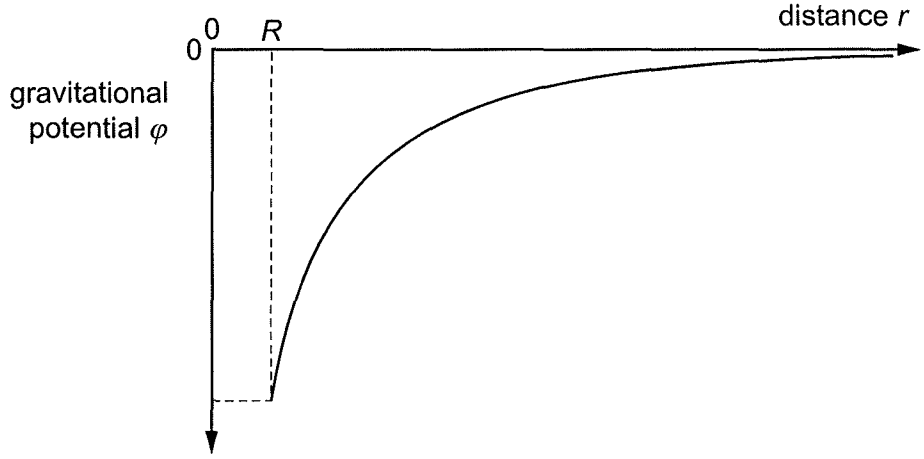
**12** A meteorite of mass $m$ initially has zero velocity relative to a planet. The meteorite falls from a large distance to the planet of mass $M$ and radius $R$. The planet has no atmosphere.

The graph shows the potential $\varphi$ of the meteorite in the gravitational field at a distance $r$ from the centre of the planet.




Which expression is equal to the maximum kinetic energy of the meteorite as it hits the surface?

**A** $m$ multiplied by (magnitude of $\varphi$ at $R$)

**B** $m$ multiplied by (gradient of curve at $R$)

**C** $m$ multiplied by (area between curve and $r$-axis from $R$ to infinity)

**D** $mM$ multiplied by (magnitude of $\varphi$ at $R$)