Multiple Choice (Worth up to 10 points): Two spheres look identical and have the same mass; however, one is known to be hollow and the other solid. Which method would determine which is which?

1. Roll them down an incline.
2. Drop them from the same height. $U = \sqrt{2gh}$; No Mass.
3. Weigh them on a scale. Same Mass = Same weight
4. None of these

Hollow & Solid are different shapes & thus have different Moment of Inertias (I). As such will Roll at different Rates.
Open Response (Worth up to 25 points): Consider a wheel of radius 1m, mass 10kg, and moment of inertia $I = \frac{1}{2}MR^2$ (it's a solid disk). The wheel rolls without slipping along a straight line when it encounters an uphill slope. The wheel starts with an angular speed of $30\text{rad/s}$ but the rotation slows down as the wheel rolls uphill. Eventually the wheel comes to a stop and rolls back downhill. How far does the wheel roll in the uphill direction, $h$, before it stops? Recall that $v = r\omega$.

\[
Mg h_i + \frac{1}{2} m v_i^2 + \frac{1}{2} I \omega_i^2 = mgh_f + \frac{1}{2} m v_f^2 + \frac{1}{2} I \omega_f^2
\]

\[
\frac{1}{2} m (rw)^2 + \frac{1}{2} \frac{1}{2}MR^2 \cdot \omega^2 = mgh_f
\]

\[
\frac{1}{2} Mr^2 \omega^2 + \frac{1}{4} Mr^2 \omega^2 = mgh_f
\]

\[
\frac{3}{4} r^2 \omega^2 = gh_f
\]

\[
h_f = \frac{\frac{3}{4} r^2 \omega^2}{g}
\]

\[
= \frac{\frac{3}{4} (1m)^2 (30 \text{ rad/s})^2}{9.8 \text{ m/s}^2}
\]

\[
= 68.88 \text{ m}
\]