2012 F=ma Exam: Problem 10

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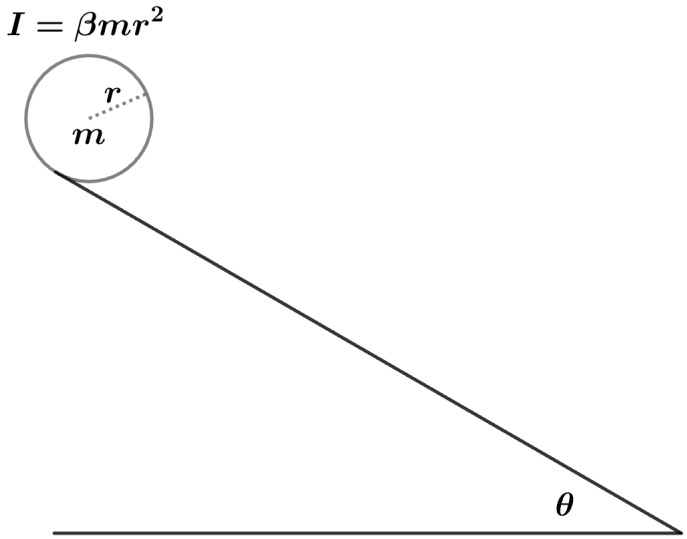

Recall the acceleration of an object rolling without slipping down an inclined plane is given by

$$a = \frac{g \sin \theta}{1 + \beta}$$

where the object has moment of inertia

$$I = \beta m r^2$$

Objects A, B, and D are all solid balls with $\beta = 2/5$ so they reach the bottom at the same time. Object C is a hollow sphere with $\beta = 2/3$ so it has a smaller angular acceleration than a solid sphere. Hence, it takes longer to reach the bottom. Thus,

$$T_C > T_A = T_B = T_D$$

so the answer is $\boxed{\text{D}}$.