2007 F=ma Exam: Problem 15

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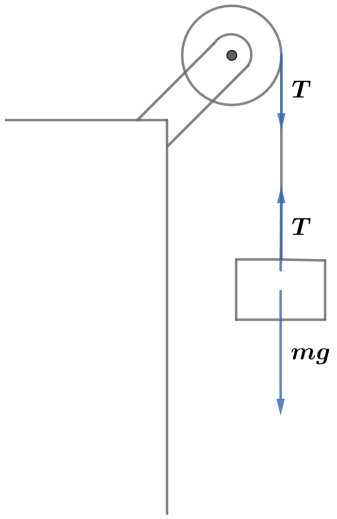

Applying Newton's 2nd law to the mass, we have

$$mg - T = ma$$

Applying Newton's 2nd law to the disk, we have

$$\tau = I\alpha$$
$$TR = \frac{1}{2}MR^2\alpha$$

Since there is no slipping, $a = R\alpha$:

$$T = \frac{1}{2}Ma$$

Adding this equation to the first equation, we obtain

$$mg = \left(m + \frac{M}{2}\right)a$$
$$a = \frac{2mg}{2m + M}$$

The tension is then

$$T = \frac{1}{2}Ma = \frac{Mmg}{2m + M} = \frac{(8\,\text{kg})(6\,\text{kg})(10\,\text{m/s}^2)}{2(6\,\text{kg}) + 8\,\text{kg}} = 24\,\text{N}$$

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