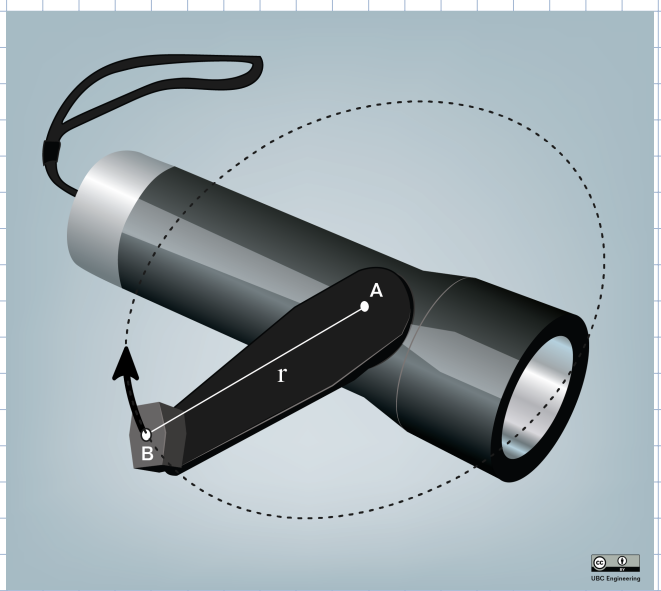
Lucy is playing with a rechargeable flashlight. Spinning the handle generates electrical energy which can be stored to power the 3 W bulb. Lucy rotates the handle with a constant moment of 2 N · m and an average angular velocity of 3 rad/s for 30 s. When she stops turning and switches the flashlight on the bulb stays on for 1 s. Given this information, how efficient is the flashlight in converting mechanical energy to useable electrical energy?




$$\eta = \frac{E_{out}}{E_{in}} = \frac{P_{out}\, t_{out}}{P_{in}\, t_{in}}$$

$$E = Pt$$

$P_{out} = 3W \qquad t_{out} = 1sec$

$P_{in} = M \cdot w = 2N\cdot m \cdot 3 rad/s$

$t_{in} = 30 sec$

$$\eta = \frac{(3W)(1sec)}{(2N\cdot m)(3 rad/s)(30 sec)} = \boxed{0.017 = 1.7\% = \eta}$$