

22-R-WE-TW-28



Lucy is playing with a rechargeable flashlight. It works in that spinning the handle will generate electrical energy which can be stored to power the 3 W flashlight bulb. Lucy rotates the handle with a constant moment of $2 \text{ N} \cdot \text{m}$ 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 electrical energy?

Solution:

$$P_{bulb} = \frac{E_{out}}{t_{bulb}}$$

$$E_{out} = P_{bulb} t_{bulb} = (3)(1) = 3 \text{ [J]}$$

$$P_{charge} = \frac{E_{in}}{t_{charge}} = M\bar{\omega}$$

$$E_{in} = M\bar{\omega} t_{charge} = (2)(3)(30) = 180 \text{ [J]}$$

$$e = \frac{E_{out}}{E_{in}} = \frac{3}{180} = 0.0167$$