

Solutions

Each answer shows the steps, then the **result**.

2.1

- work done by a constant torque:

$$W = \tau\theta = (6 \text{ N m})(4 \text{ rad})$$

- $W = \mathbf{24 \text{ J}}$

2.2

- rotational power:

$$P = \tau\omega = (8 \text{ N m})(5 \text{ rad s}^{-1})$$

- $P = \mathbf{40 \text{ W}}$

2.3

- The change in its rotational kinetic energy

2.4

- Radians

3.1 B

- $W = \tau\theta$

3.2 B

- $P = \tau\omega$ mirrors $P = Fv$

3.3

(a)

- work done by a constant torque:

$$W = \tau\theta = (10 \text{ N m})(3 \text{ rad})$$

- $W = \mathbf{30 \text{ J}}$

(b)

- average power is work per unit time:

$$P = \frac{W}{t} = \frac{30 \text{ J}}{2 \text{ s}}$$

- $P = \mathbf{15 \text{ W}}$

3.4

(a)

- by the work-energy theorem, $\Delta K_{\text{rot}} = W_{\text{net}} = \mathbf{50 \text{ J}}$

(b)

- from rest, all 50 J becomes rotational KE, $\frac{1}{2}I\omega^2 = 50 \text{ J}$:

$$\omega = \sqrt{\frac{2K}{I}} = \sqrt{\frac{2(50 \text{ J})}{4 \text{ kg m}^2}}$$

- $\omega = \mathbf{5 \text{ rad s}^{-1}}$