

6.2 Torque and Work

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS rotational kinetic energy 转动动能 • rotational power 转动功率

Objective

Build the skills to answer exam questions on **torque and work**.

You must be able to:

- calculate the **work done by a torque** 力矩做功, $W = \tau \Delta\theta$
- relate the work done by a net torque to the change in **rotational kinetic energy** 转动动能
- define **rotational power** 转动功率 as $P = \tau\omega$
- find the work from the **area** under a torque-versus-angle graph

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Work by a torque

 $W = \tau \Delta\theta$, with $\Delta\theta$ in radians. This is the rotational partner of $W = Fd$.

■ The rotational work-energy theorem

$$W_{\text{net}} = \Delta K_{\text{rot}} = \frac{1}{2}I\omega_f^2 - \frac{1}{2}I\omega_i^2.$$

■ Rotational power

 $P = \tau\omega$. A torque of 8.0 N m through $\Delta\theta = 2.0$ rad does $W = 16$ J.

2 Practice

2.1 A torque of 5.0 N m turns a wheel through 4.0 rad. Find the work done. [1]

2.2 A motor applies 20 N m at $\omega = 15 \text{ rad s}^{-1}$. Find its power output. [2]

2.3 A net work of 30 J is done on a flywheel starting from rest. State its final rotational kinetic energy. [1]

3 Exam-style questions

3.1 The work done by a torque is [1]

A	B
C	D

A $\tau\omega$

B $\tau \Delta\theta$

C $I\alpha$

D $\frac{1}{2}I\omega^2$

3.2 Rotational power is equal to [1]

A	B
C	D

A τ/ω

B $\tau\omega$

C $\tau + \omega$

D $I\alpha$

3.3 A wheel of $I = 0.40 \text{ kg m}^2$, initially at rest, has a 2.0 N m torque applied through 10 rad.

(a) Find the work done. [2]

(b) Find the final angular velocity. [2]