

3.2 Equilibrium of a rigid body

Name: _____ Class: _____ Date: _____ **Total: 15 marks**

KEY WORDS centre of mass 质心 • equilibrium 平衡 • toppling 翻倒 • sliding 滑动
• moment 力矩

Objective

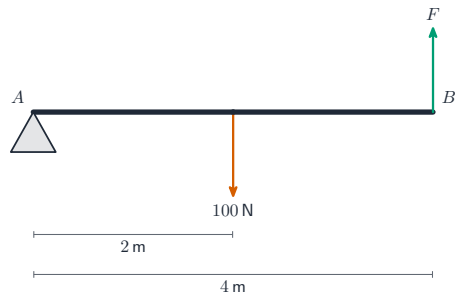
Build the skills to answer exam questions on the **equilibrium of a rigid body** 刚体平衡 — **moments** 力矩, the **centre of mass** 质心, and conditions for **toppling** 翻倒 or **sliding** 滑动. Take $g = 10 \text{ m s}^{-2}$.

You must be able to:

- take moments about a point (force $\times$ perpendicular distance)
- apply the two equilibrium conditions (forces and moments both balance)
- decide whether a body topples or slides first

1 Worked examples

■ Taking moments



Taking moments about the pivot A balances the turning effects

Uniform beam AB, length 4 m, weight 100 N, pivot at A, force F at B:
moments about A $\rightarrow F \times 4 = 100 \times 2 \Rightarrow F = 50 \text{ N}$.

2 Practice

2.1 A force of 20 N acts 3 m from a pivot, at right angles. Find its moment. [2]

2.2 State the two conditions for a rigid body to be in equilibrium. [2]

3 Exam-style questions

3.1 The moment of a force about a point is force multiplied by: [1]

- | | |
|---|---|
| A | B |
| C | D |
- A time
B the perpendicular distance
C mass
D velocity

3.2 A uniform ladder AB of weight 200 N and length 6 m rests with A on rough ground and B against a smooth vertical wall, at 60° to the horizontal.

(a) By taking moments about A, find the reaction at the wall. [4]

(b) Hence find the friction force at the ground. [2]

3.3 A uniform rod AB of length 2 m and weight 40 N rests horizontally on supports at A and at C , where C is 1.5 m from A . Find the reaction at each support. [4]
