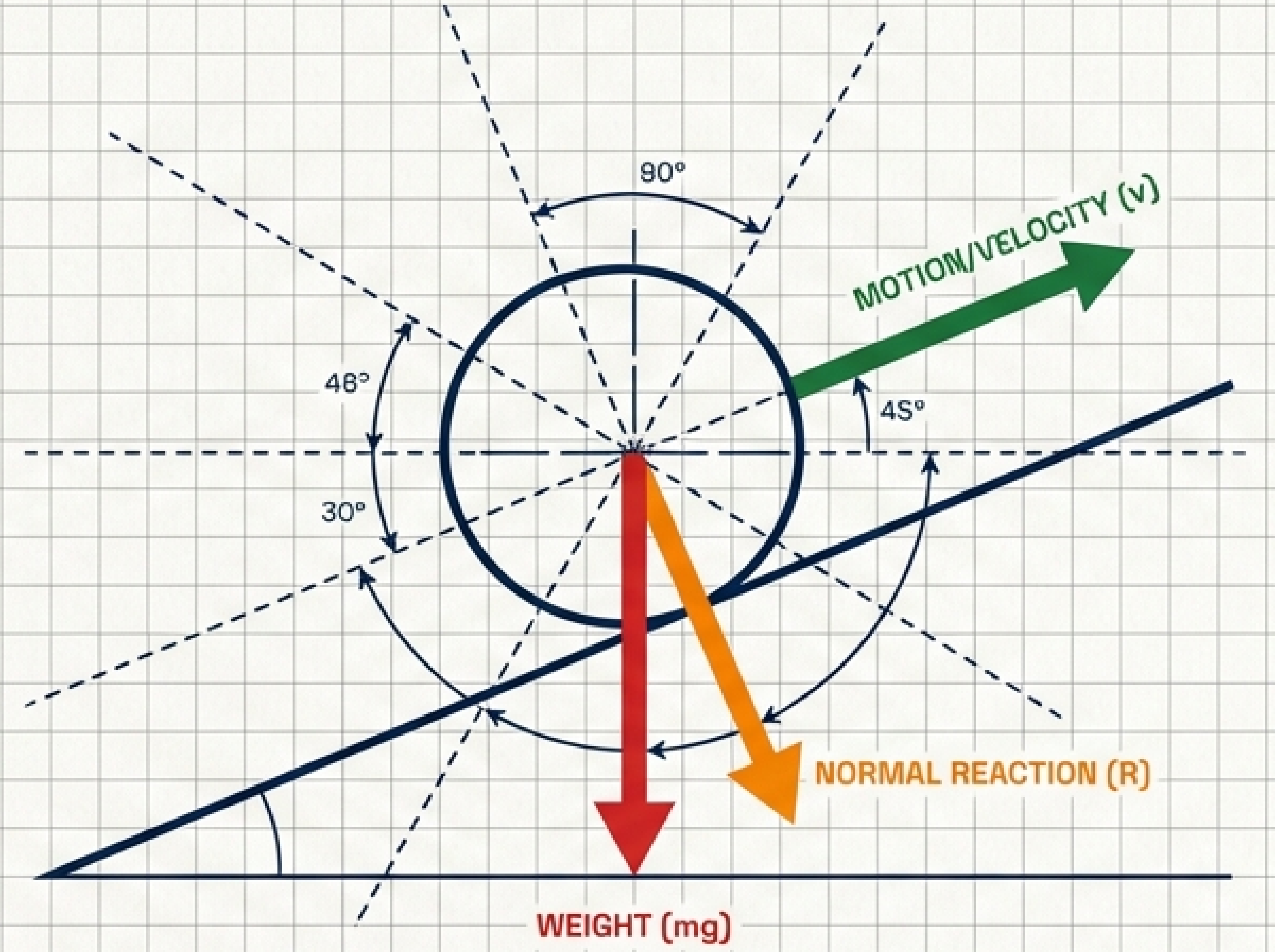


MECHANICS 1: THE TACTICAL EXAM PLAYBOOK

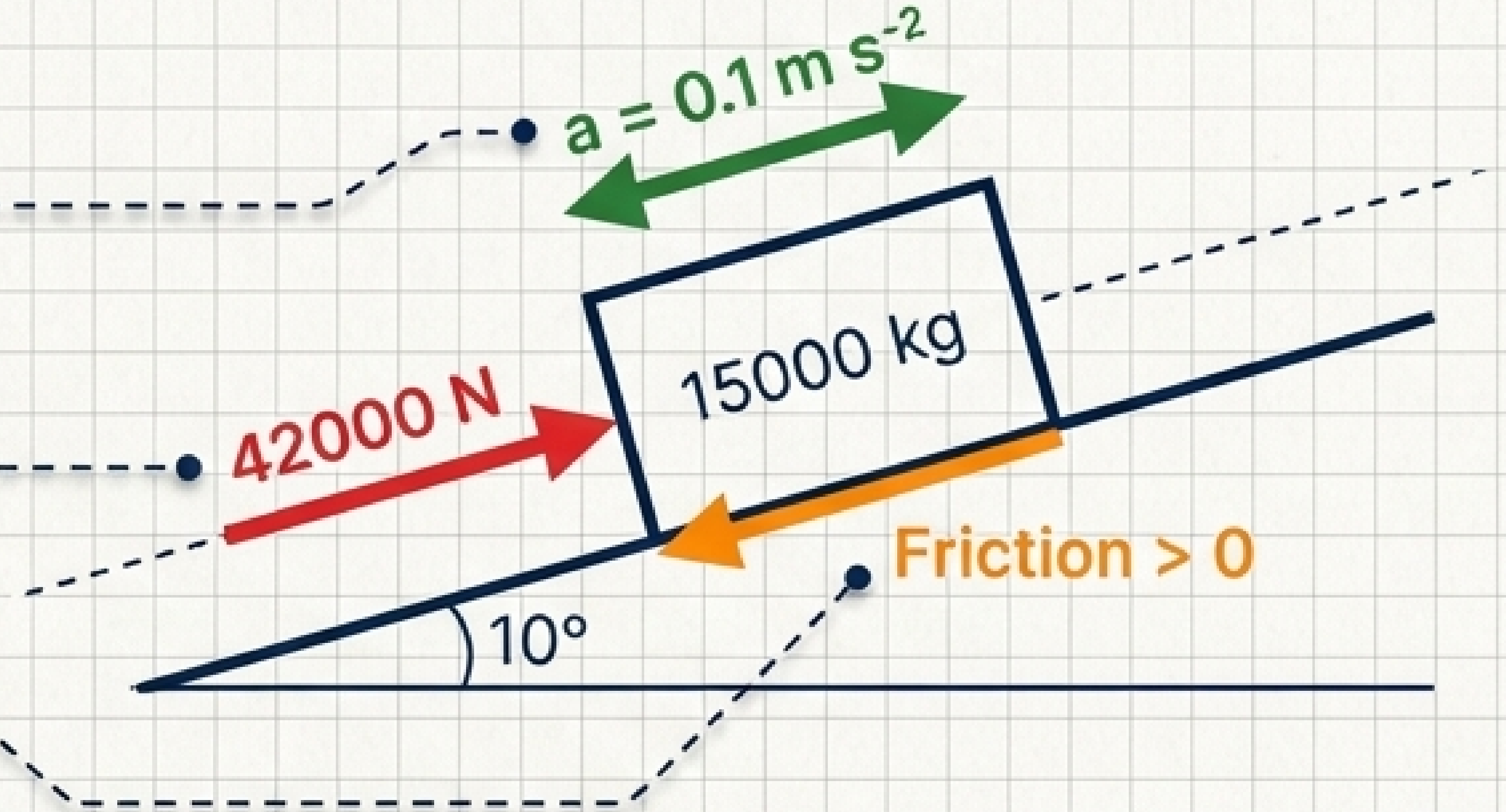
A visual diagnostic guide to translating mixed exam questions into executable physics.

BASED ON EDEXCEL M1 REVIEW EXERCISE 2

THE NOISE

3. A shipping container of mass 15000 kg is being pulled by a winch up a rough slope that is inclined at 10° to the horizontal. The winch line imparts a constant **force** of 42000 N, which acts parallel to and up the slope, causing the shipping container to **accelerate** at a constant rate of 0.1 m s^{-2}.

THE SIGNAL

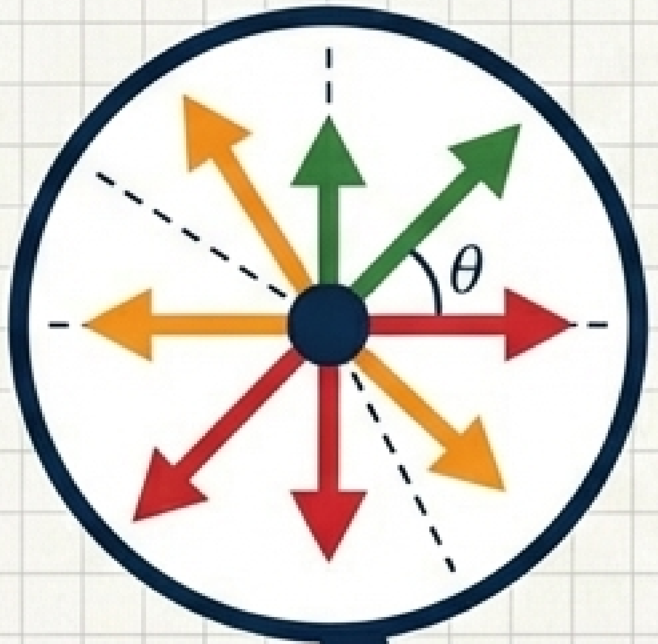


Applied forces	Weights	Micro-typoraphic
42000 N	a = 0.1 m s^{-2}	-

Inter

Exam questions are just physical blueprints disguised as paragraphs. Your first task is to draw the map.

The Universal Mechanics Algorithm

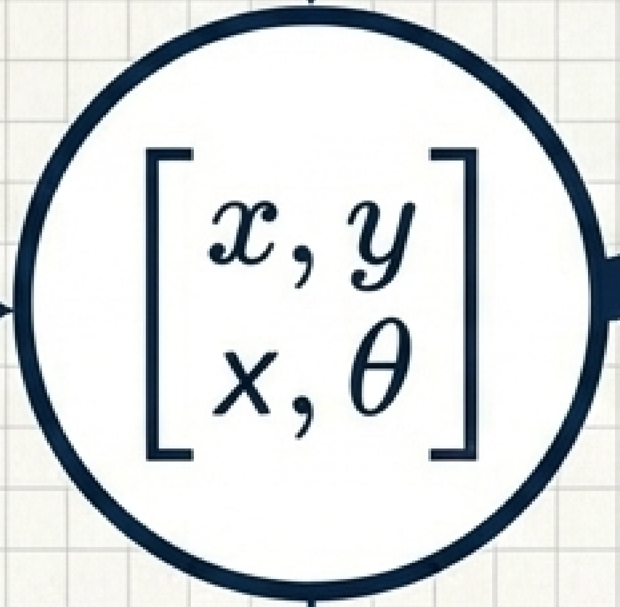


1. Model & Map

Draw the system. Assign vectors for all Forces (Red), Reactions (Orange), and Accelerations (Green).

2. Resolve & Equate

Apply the state of motion to generate equations. Compare parallel vs. perpendicular, before vs. after, or clockwise vs. anticlockwise.

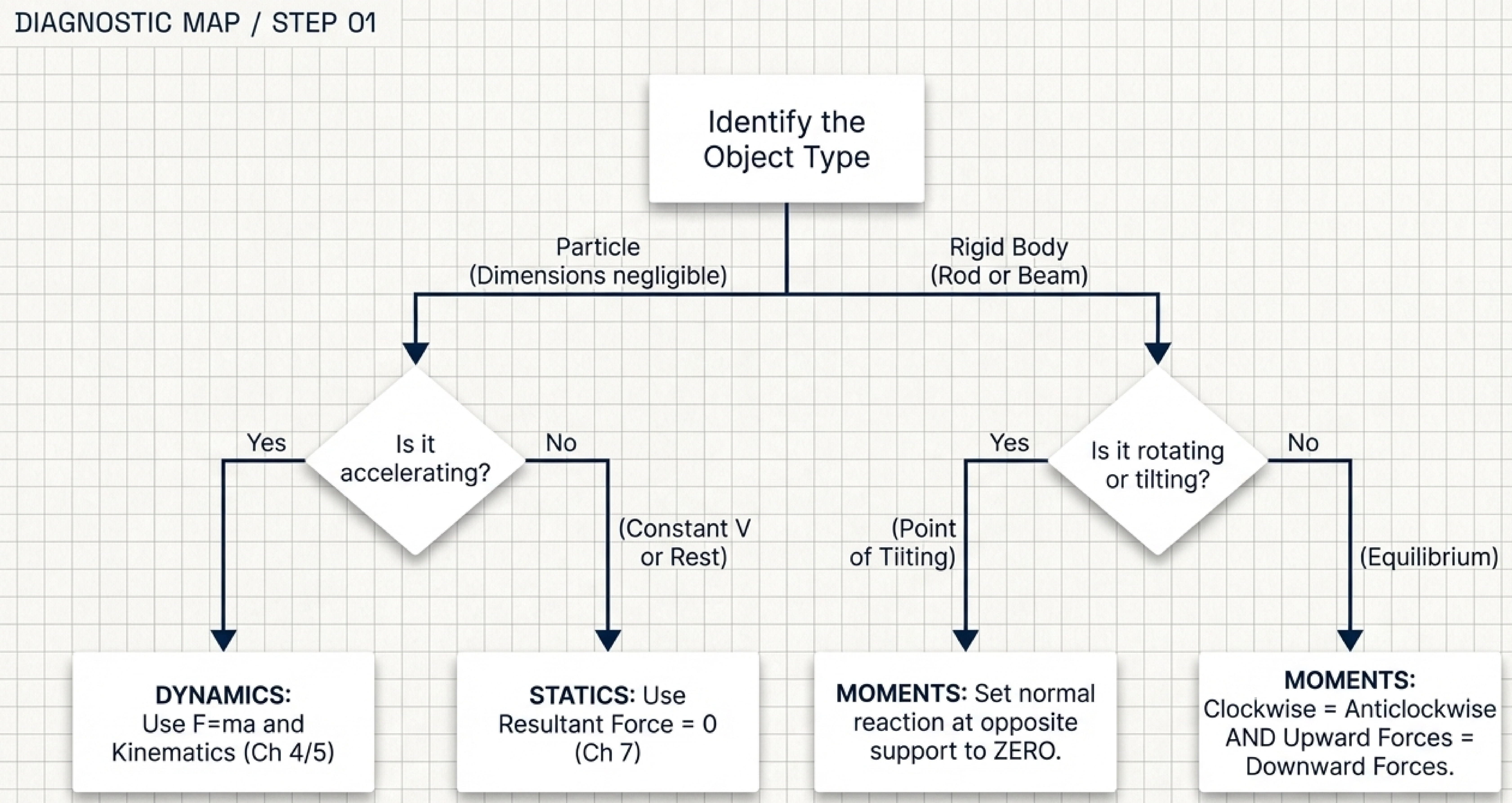


3. Solve

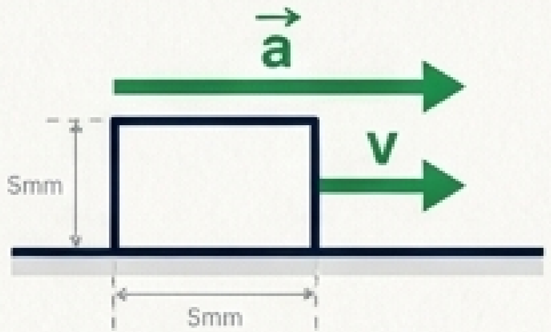
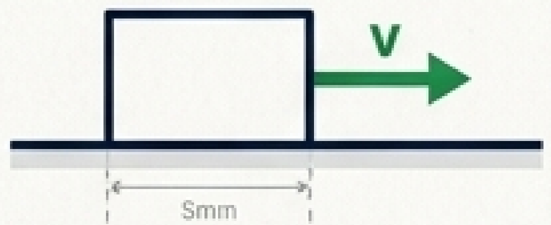
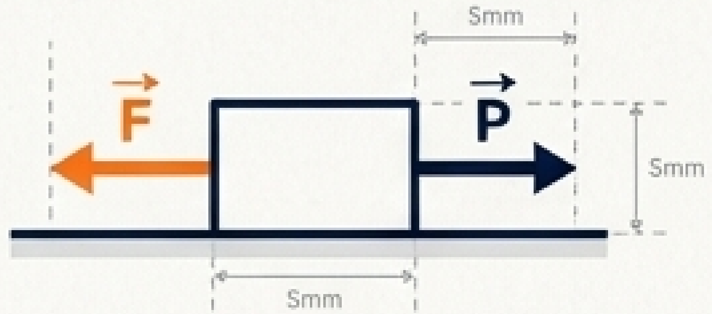
Execute the algebra to isolate the unknown variable.

Every problem in Mechanics 1—Forces, Momentum, or Statics—runs on this exact same engine.

Exam questions are just ph… st task is to draw the map.

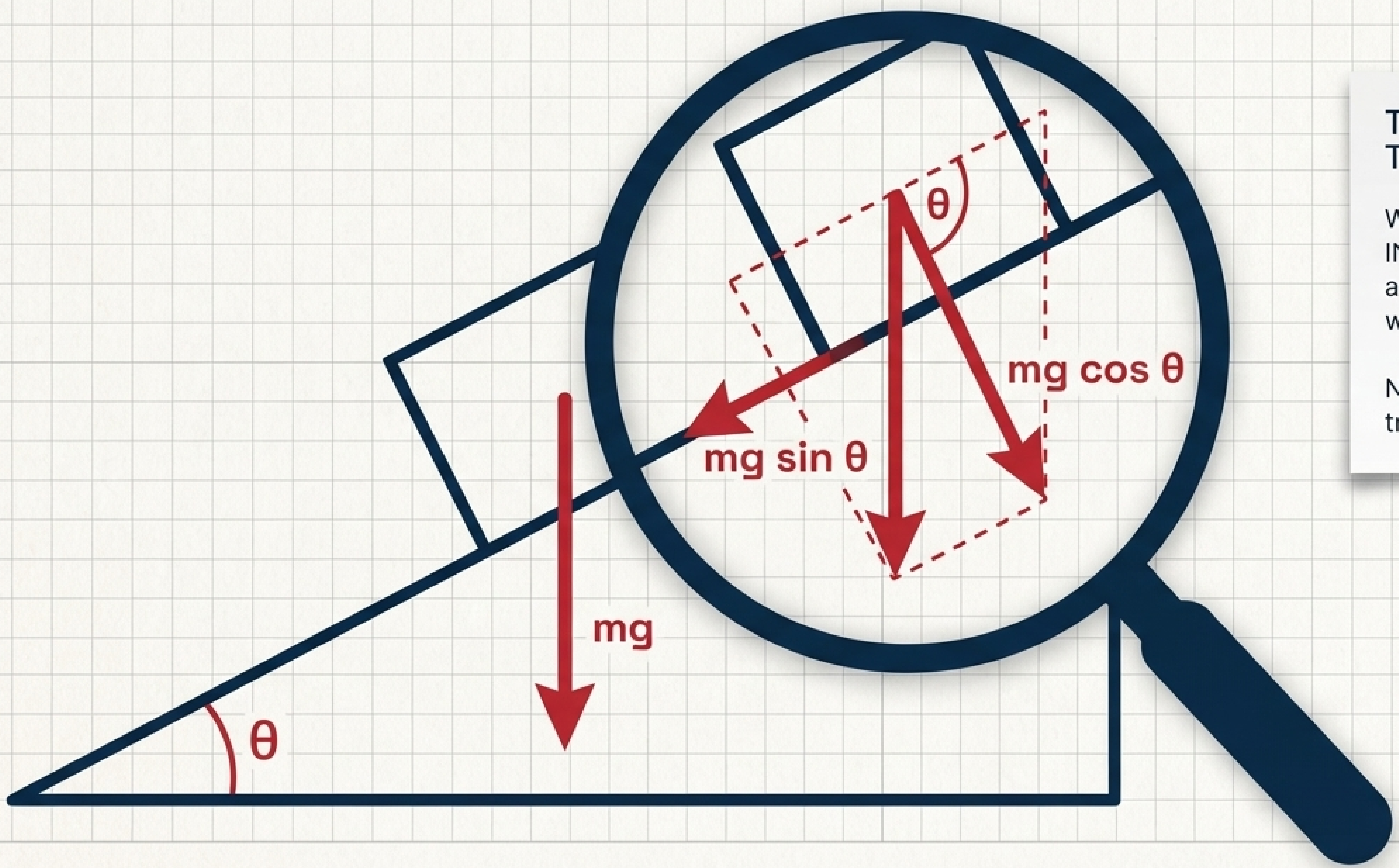

DIAGNOSTIC MAP / STEP 01
Identify the Object Type
Particle
(Dimensions negligible)
Rigid Body
(Rod or Beam)
Is it accelerating?
Yes
No
(Constant V or Rest)
Is it rotating or tilting?
Yes
(Point of Tiiting)
No
(Equilibrium)
DYNAMICS: Use F=ma and Kinematics (Ch 4/5)
STATICS: Use Resultant Force = 0 (Ch 7)
MOMENTS: Set normal reaction at opposite support to ZERO.
MOMENTS: Clockwise = Anticlockwise AND Upward Forces = Downward Forces.

State of Motion Diagnostic Table

	Moving & Accelerating	Moving at Constant Velocity	Resting in Limiting Equilibrium
Visual Indicator			
Keyword in Text	Accelerates at [X] m s^{-2}	Constant velocity	Point of moving / limiting equilibrium
Resultant Force (R)	$\vec{R} = m\vec{a}$	$\vec{R} = 0$	$\vec{R} = 0$
Friction State	$\vec{F} = \mu R$ (if rough)	$\vec{F} = \mu R$ (Maximal)	$\vec{F} = \mu R$ (Maximal)

CRITICAL HACK: If a particle is stationary but NOT at the point of moving, Friction $\mathbf{F < \mu R}$. You cannot use the formula $\mathbf{F = \mu R}$ here!

RESOLVING FORCES ON AN INCLINED PLANE



THE RESOLVING TRIANGLE

Weight always pushes INTO the slope with Cosine, and slides DOWN the slope with Sine.

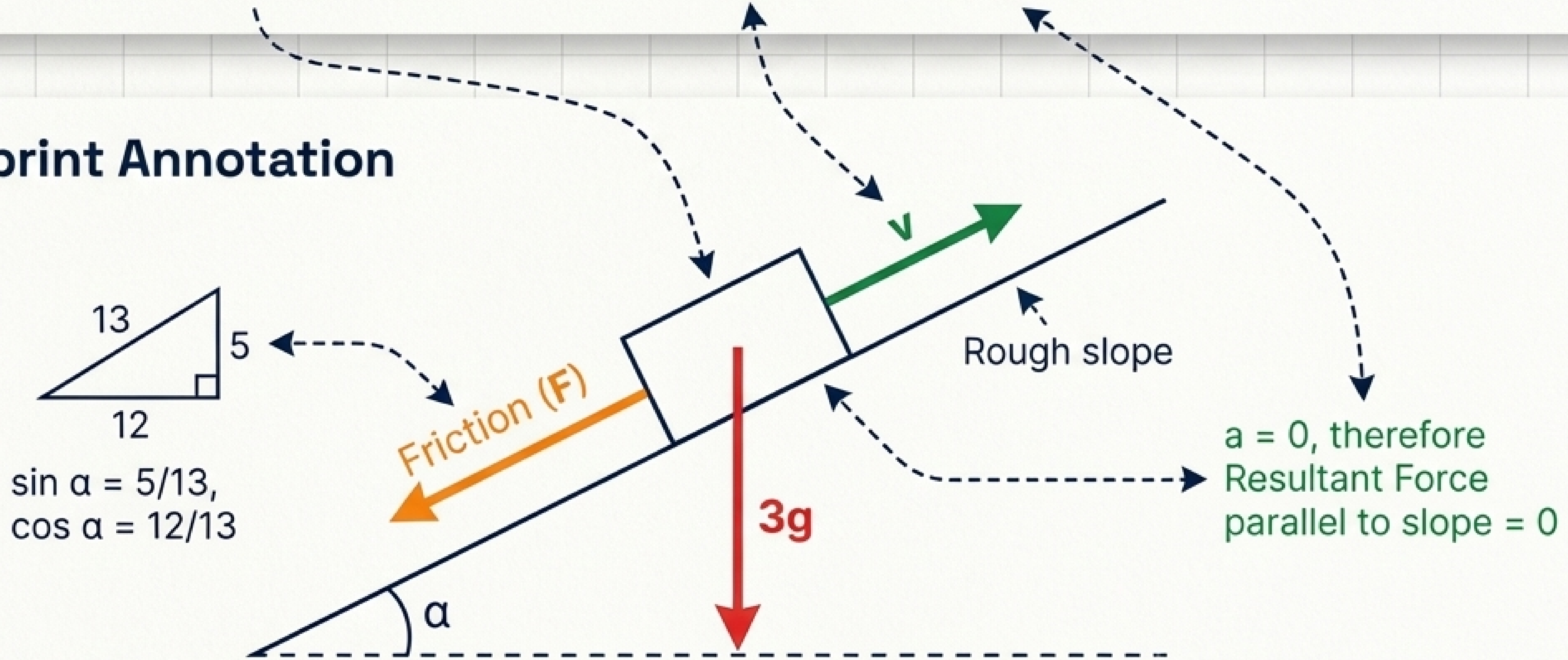
Never memorize; draw the triangle.

Problem Anatomy

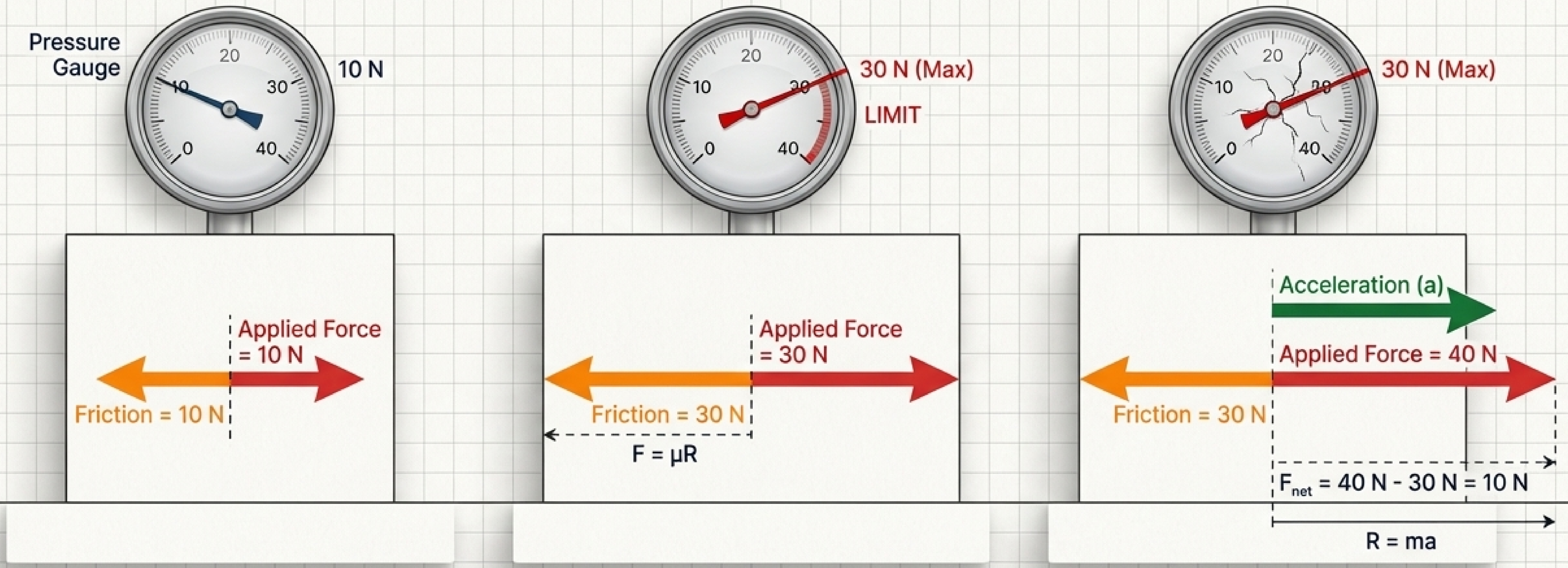
The Raw Text

A particle of mass 3 kg is moving up a rough slope that is inclined at an angle α to the horizontal **where tan α = 5/12** ... constant velocity.

The Blueprint Annotation



The Mechanics of Limiting Friction



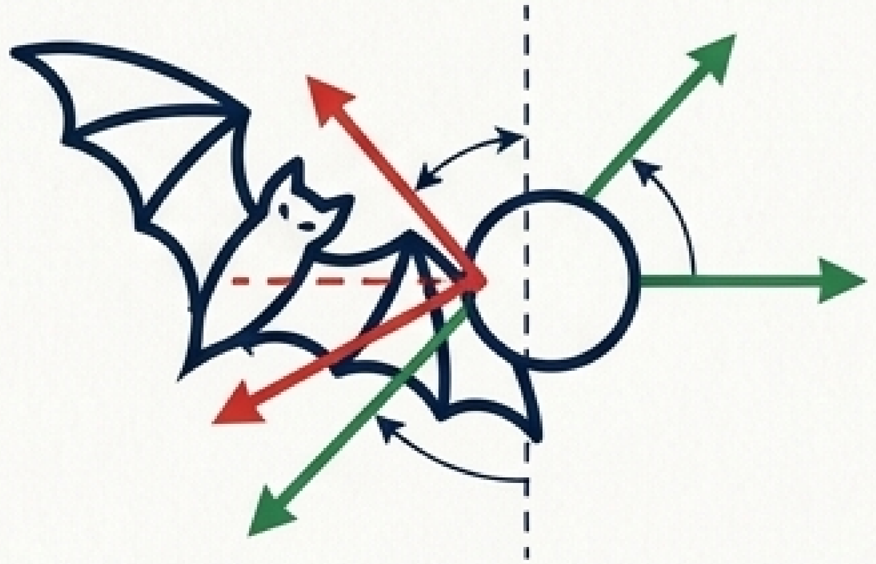
STATIC.
Friction is smart; it only gives exactly what is needed to resist motion.

LIMITING EQUILIBRIUM.
The absolute verge of slipping. F is perfectly equal to μR.

OVERPOWERED.
Force exceeds μR. Acceleration begins and R = ma takes over.

The Momentum Matrix

Single Particle (Impulse)



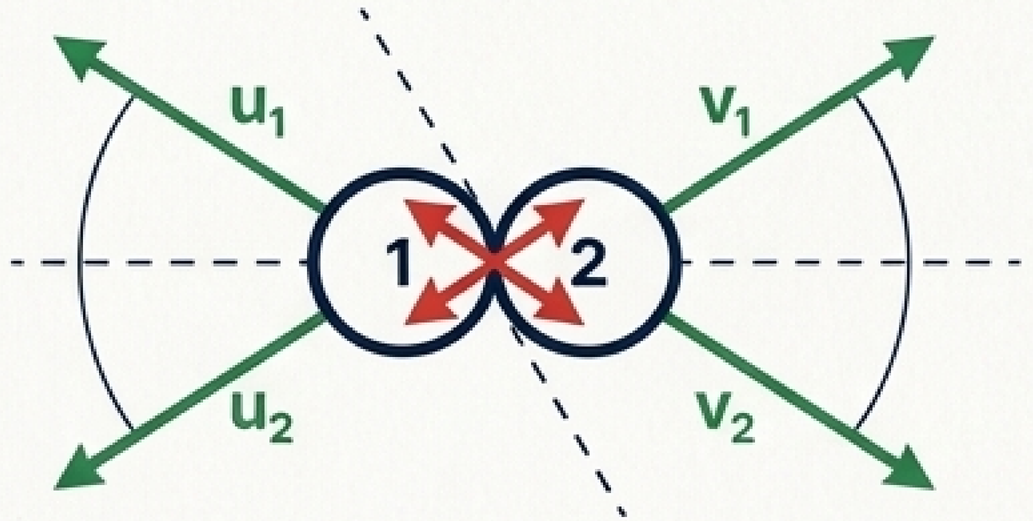
Impulse (I) = Change in Momentum

$$I = mv - mu$$

Tactical — Micro typy Inter

Use this to isolate the exact force or impulse exerted ON a specific object. The positive/negative direction of your vectors is critical here.

System of Particles (Conservation)



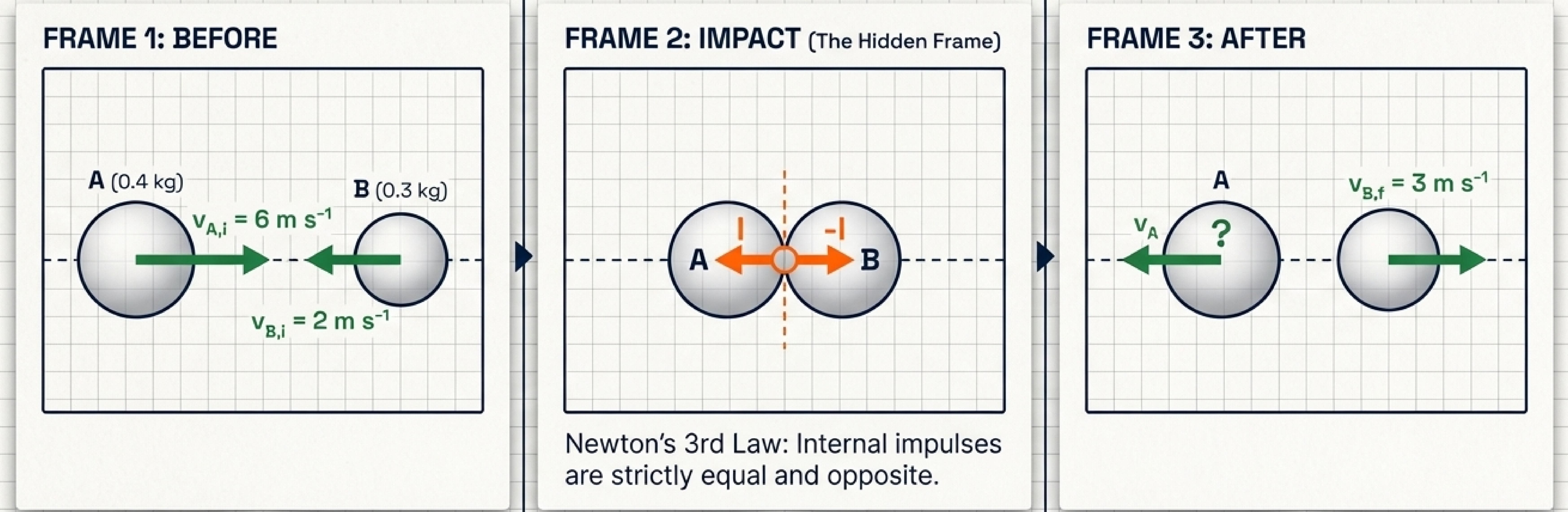
Total Momentum Before = Total Momentum After

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

Tactical — Micro typy Inter

Use this to find unknown velocities after a crash. Internal impulses cancel each other out, so you analyze the entire system as one.

The Collision Time-Lapse



Newton's 3rd Law: Internal impulses are strictly equal and opposite.

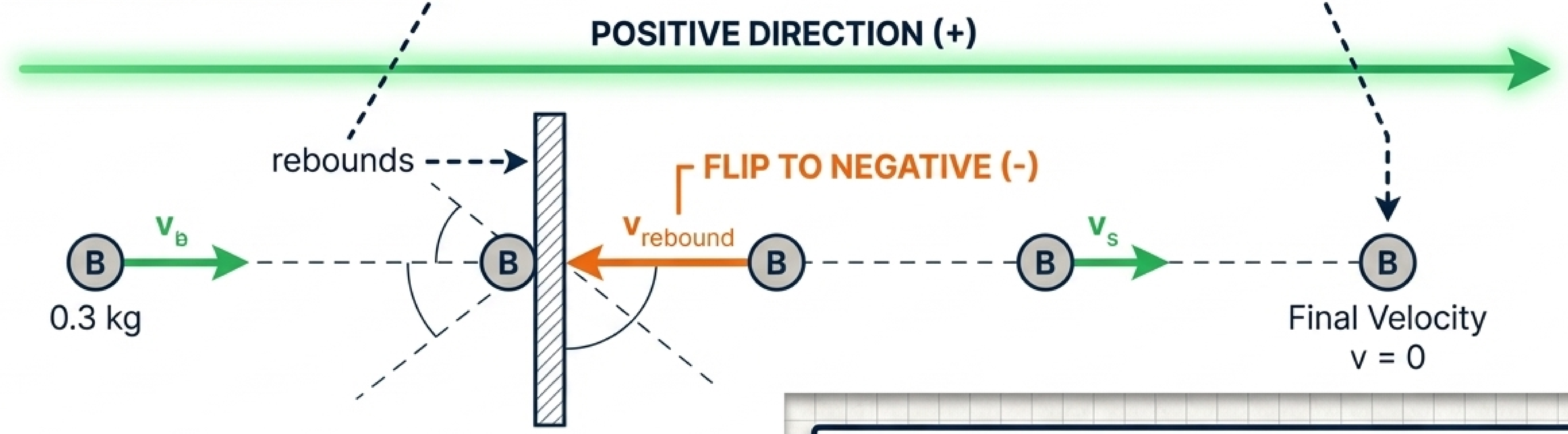
Execution: $(0.4 \times 6) + (0.3 \times -2) = (0.4 \times v_A) + (0.3 \times 3)$

PROBLEM ANATOMY: SUCCESSIVE COLLISIONS (Q8)

Raw Text

Two particles A and B... After the collision A and B are moving in the same direction... Particle B later hits an obstacle and **rebounds**... and **comes to rest**.

THE BLUEPRINT ANNOTATION



THE RIGOR OF VECTORS: If your positive direction is defined as right, a rebound to the left MUST be inputted as a negative number in your impulse equation.

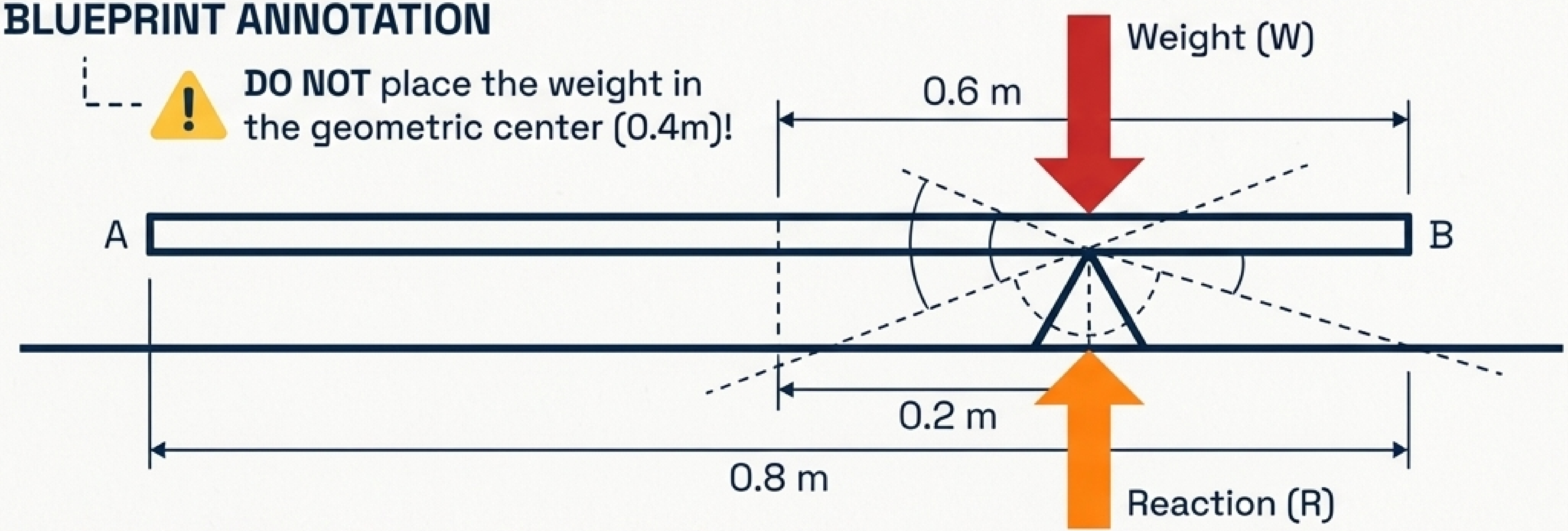
PROBLEM ANATOMY: MOMENTS (Q17)

Raw Text

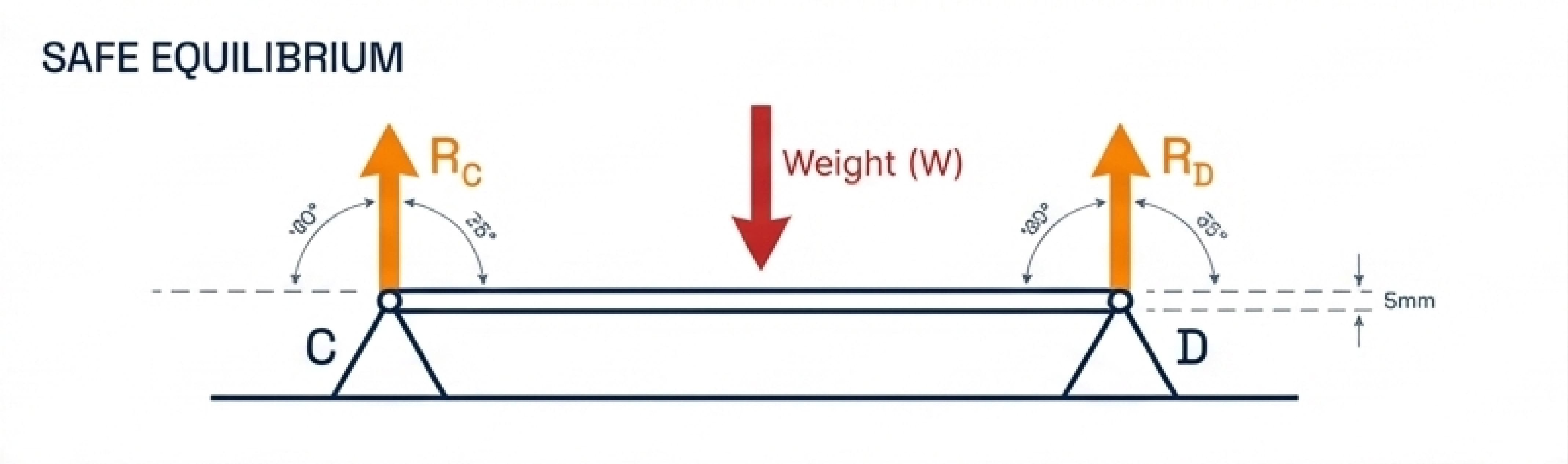
A non-uniform rod AB, of length 0.8 m, rests on the edge of a table as shown in the diagram. The centre of mass of the rod is at a point 0.6 m from A… point of tipping.

THE BLUEPRINT ANNOTATION

DO NOT place the weight in the geometric center (0.4m)!

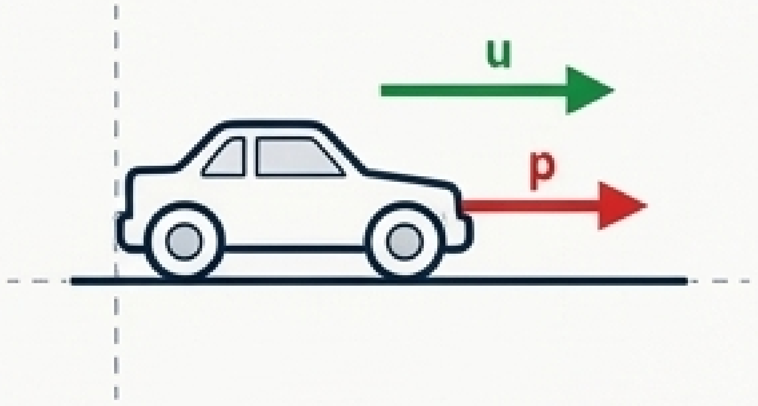


THE ANATOMY OF A TILT



THE TIPPING POINT AXIOM: When a rigid body is on the absolute verge of tilting about a specific pivot, the normal reaction force at any other support instantaneously becomes ZERO.

THE GRAND SYNTHESIS

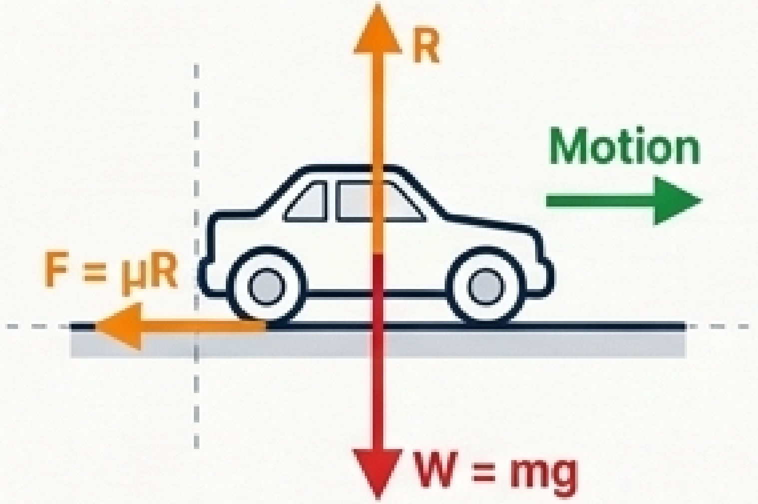


CH 6: MOMENTUM (The Start)

Initial momentum = 2 Ns,
Mass = 0.25 kg.

p = mv → 2 = 0.25u → **u = 8 m s⁻¹**

Output: Initial Velocity (u) = 8 m s⁻¹

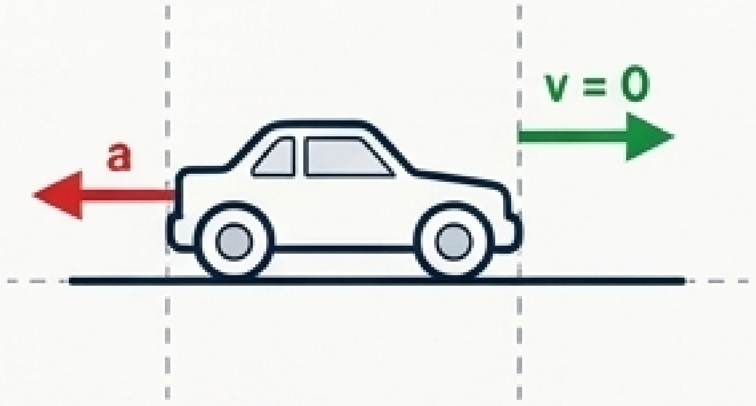


CH 5: FORCES & FRICTION (The Journey)

Rough surface, μ = 0.2

Vertical: R = 0.25g.
Horizontal: -F = ma (where F = 0.2R).
Solve to find deceleration a.

Output: Deceleration (a)



CH 2: KINEMATICS (The End)

Car comes to rest (v = 0).

Input v=0, u=8, and a=[calculated].
Use $v^2 = u^2 + 2as$ to find the total distance s.

Complex exam questions do not require complex mathematics. They simply require linking basic mathematics together in sequence.

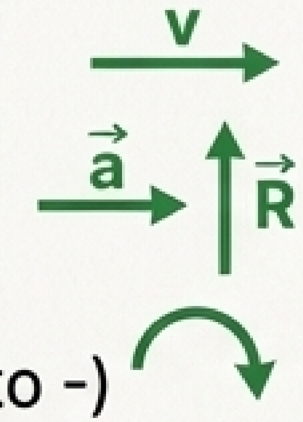
THE TRANSLATOR'S TOOLKIT

MOTION WORDS

Comes to rest → $\vec{v} = 0$

Constant velocity → $\vec{a} = 0$, $\vec{R} = 0$

Rebounds → Reverse the velocity sign (+ to -)

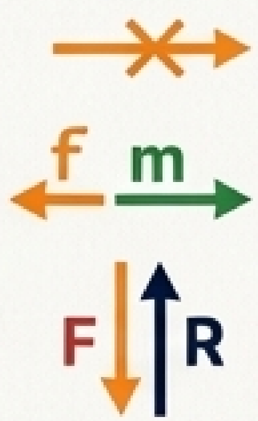


SURFACE WORDS

Smooth → Friction = 0

Rough → Friction force opposes motion

Limiting equilibrium → $F = \mu R$ exactly

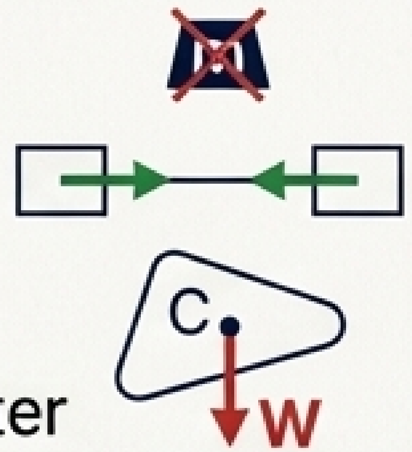


MATERIAL WORDS

Light → Mass = 0

Inextensible → Accelerations are exactly equal

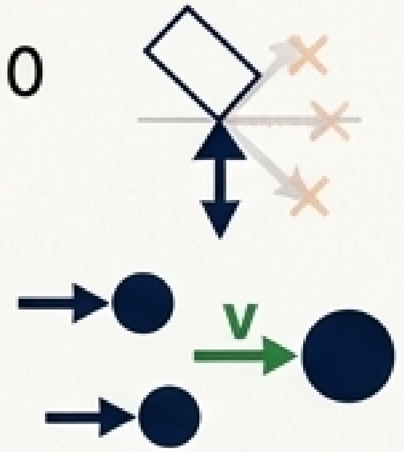
Non-uniform → Weight is NOT in the geometric center



SYSTEM WORDS

Point of tilting → Other reactions = 0

Coalesce → Combine masses, use a common velocity v



DRAW THE MAP. OBEY THE VECTORS. TRUST THE ALGEBRA.