INKMATHS FLASHCARDS

Mechanics essentials

15 cards · fronts and backs

Print double-sided, flipping on the long edge, and each answer lands behind its question. Cut along the card borders.

Definitions in precise wording, the standard results the formulae booklet does not print, a check-yourself question per topic, and the slips that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/maths/flashcards.

STANDARD RESULT

Weight:

W = ?

MECHANICS ESSENTIALS

STANDARD RESULT

Moments:

moment = ?

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STANDARD RESULT

The friction law:

F ? μR

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STANDARD RESULT

Projectile components:

u at angle θ ⇒ ?

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STANDARD RESULT

Weight on a slope:

components of mg on a slope at θ: ?

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STANDARD RESULT

Variable acceleration:

from displacement x: v = ?, a = ?

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RECALL

State what each modelling word removes.

MECHANICS ESSENTIALS

DEFINITION

Define: Limiting equilibrium.

MECHANICS ESSENTIALS

STANDARD RESULT

moment = force × perpendicular distance

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STANDARD RESULT

W = mg, with g = 9.8 m s^{-2}

MECHANICS ESSENTIALS

STANDARD RESULT

u cos θ across, u sin θ up

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STANDARD RESULT

F ≤ μR, equality only at the limit or when sliding

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STANDARD RESULT

v = (dx)/(dt), a = (dv)/(dt), and back by integrating

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STANDARD RESULT

mg sin θ along, mg cos θ into

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DEFINITION

The state in which an object is still in equilibrium but on the point of slipping, so friction has reached its maximum value μR.

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RECALL

A particle has no size, so no moments and no spin; air resistance is a separate assumption. Light means no mass, so a string keeps the same tension all along and a rod has no weight. Smooth means no friction. Inextensible means the string cannot stretch, so while it is taut both ends move together along it, sharing one speed and one acceleration in the set-ups the course uses. Quote the word the question used.

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DEFINITION

Define: Uniform beam.

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CHECK YOURSELF

A 5 kg crate is pulled by 30 N against 10 N of resistance. Find its acceleration.

MECHANICS ESSENTIALS

CHECK YOURSELF

Masses of 7 kg and 3 kg hang over a smooth pulley. Write the two equations of motion.

MECHANICS ESSENTIALS

SPOT THE ERROR

Say what is wrong with this claim:

At the top of its flight, a projectile's acceleration is zero.

MECHANICS ESSENTIALS

SPOT THE ERROR

Say what is wrong with this claim:

A moving object must have a force pushing it along.

MECHANICS ESSENTIALS

RECALL

State the method for a particle in equilibrium.

MECHANICS ESSENTIALS

SPOT THE ERROR

Say what is wrong with this claim:

A block resting on a rough slope has friction of size μR.

MECHANICS ESSENTIALS

CHECK YOURSELF

Resultant 20 N, so a = 20/5 = 4 m s^{-2}. F = ma takes the resultant along the direction of motion, never one force on its own.

MECHANICS ESSENTIALS

DEFINITION

A beam whose mass is evenly spread, so its whole weight can be modelled as acting at its midpoint.

MECHANICS ESSENTIALS

SPOT THE ERROR

Only the vertical velocity is zero at the apex. Gravity acts all flight long, so the acceleration is 9.8 m s^{-2} downwards there, the same as everywhere else.

MECHANICS ESSENTIALS

CHECK YOURSELF

7g - T = 7a for the falling mass and T - 3g = 3a for the rising one. Adding eliminates T and gives a = 0.4g, which is 3.92 m s^{-2}.

MECHANICS ESSENTIALS

RECALL

Resolve in two perpendicular directions and set each total to zero. Choose the directions to kill an unknown, so along and perpendicular to a slope rather than horizontal and vertical. Two equations, two unknowns, and no acceleration term anywhere.

MECHANICS ESSENTIALS

SPOT THE ERROR

Newton's first law says the opposite. With no resultant force the motion simply continues. Forces change velocity, they are not needed to keep it. What slows a real object is a real backward force, friction or air resistance.

MECHANICS ESSENTIALS

SPOT THE ERROR

μR is the most friction the surface can supply, not the amount it is supplying. Sitting still on a slope at 10° when it could hold 30°, friction is only mg sin 10°. Write F = μR only when the question says on the point of slipping, in limiting equilibrium, or moving.

MECHANICS ESSENTIALS