INKPHYSICS FLASHCARDS

Engineering physics

Year 13 · 21 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 mark-scheme wording, the equations that are not on the AQA data sheet, each lesson's check question, and the misconceptions that lose marks. The same cards run on the website with spaced-repetition scheduling, at inkphysics.co.uk/physics/flashcards.

DEFINITION

Define: Angular velocity.

ROTATIONAL MOTION AND MOMENT OF INERTIA

DEFINITION

Define: Moment of inertia.

ROTATIONAL MOTION AND MOMENT OF INERTIA

RECALL

State how the distribution of mass changes the moment of inertia.

ROTATIONAL MOTION AND MOMENT OF INERTIA

RECALL

Explain why a flywheel carries its mass at the rim.

ROTATIONAL MOTION AND MOMENT OF INERTIA

EQUATION · NOT ON THE AQA DATA SHEET

Acceleration along the arc at radius r:

a = ?

ROTATIONAL MOTION AND MOMENT OF INERTIA

SPOT THE ERROR

Say what is wrong with this claim:

How hard something is to set spinning depends only on its mass.

ROTATIONAL MOTION AND MOMENT OF INERTIA

DEFINITION

Define: Torque.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

DEFINITION

Define: Angular momentum.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

DEFINITION

The sum of mr^2 taken over every particle of a body: its resistance to angular acceleration about that axis, in kg m^2.

ROTATIONAL MOTION AND MOMENT OF INERTIA

DEFINITION

The rate of change of angular displacement: $\omega = \Delta\theta/\Delta t$, measured in rad s^{-1}.

ROTATIONAL MOTION AND MOMENT OF INERTIA

RECALL

r^2 rewards distance, so rim mass maximises I and with it the energy $\frac{1}{2}I\omega^2$ stored at a given spin rate.

ROTATIONAL MOTION AND MOMENT OF INERTIA

RECALL

Mass concentrated far from the axis gives a large I and mass hugging the axis a small one, because every contribution counts the distance squared.

ROTATIONAL MOTION AND MOMENT OF INERTIA

SPOT THE ERROR

Mass alone does not decide it. The moment of inertia sums mr^2, so where the mass sits counts squared: a light hoop with everything at the rim can resist spin-up more than a heavier disc whose mass hugs the axis.

ROTATIONAL MOTION AND MOMENT OF INERTIA

EQUATION · NOT ON THE AQA DATA SHEET

$$a = \alpha r$$

ROTATIONAL MOTION AND MOMENT OF INERTIA

DEFINITION

The product of moment of inertia and angular velocity, $I\omega$, in kg m^2 s^{-1}.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

DEFINITION

The turning effect of a force about an axis: $T = Fr$ for a force applied tangentially at radius r, in N m.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

RECALL

State the principle of conservation of angular momentum.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

RECALL

Explain why a skater speeds up as she pulls her arms in.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

SPOT THE ERROR

Say what is wrong with this claim:

A skater pulling in her arms spins faster because her muscles give her an extra twist.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

RECALL

State the first law of thermodynamics.

THE FIRST LAW OF THERMODYNAMICS

DEFINITION

Define: Isothermal change.

THE FIRST LAW OF THERMODYNAMICS

DEFINITION

Define: Adiabatic change.

THE FIRST LAW OF THERMODYNAMICS

RECALL

State how work done is found from a p-V diagram.

THE FIRST LAW OF THERMODYNAMICS

SPOT THE ERROR

Say what is wrong with this claim:

Heating a gas always makes it hotter.

THE FIRST LAW OF THERMODYNAMICS

RECALL

Her mass moves towards the axis, so I falls; with no external torque $I\omega$ is fixed, so ω rises. Her muscles do work pulling inward, so the kinetic energy rises as well.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

RECALL

With no external torque acting, the total angular momentum $I\omega$ of a system stays constant.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

RECALL

$Q = \Delta U + W$, where Q is the heat supplied to the gas, ΔU the increase in its internal energy and W the work done by the gas.

THE FIRST LAW OF THERMODYNAMICS

SPOT THE ERROR

No extra twist is added, and none could be: internal forces cannot change angular momentum. Pulling her arms in cuts I, and because $I\omega$ is conserved ω must rise. Her muscles supply work, which is why the kinetic energy rises, not momentum.

TORQUE, ANGULAR MOMENTUM AND ROTATIONAL POWER

DEFINITION

A change with no heat entering or leaving: $Q = 0$, pV^{γ} = constant, and $\Delta U = -W$.

THE FIRST LAW OF THERMODYNAMICS

DEFINITION

A change at constant temperature: pV = constant and $\Delta U = 0$, so $Q = W$.

THE FIRST LAW OF THERMODYNAMICS

SPOT THE ERROR

Heat raises the temperature only if it stays as internal energy. In an isothermal expansion $\Delta U = 0$, so $Q = W$: every joule supplied leaves again as work and the temperature never moves.

THE FIRST LAW OF THERMODYNAMICS

RECALL

It is the area under the curve between the two volumes; at constant pressure that area is the rectangle $p\Delta V$.

THE FIRST LAW OF THERMODYNAMICS

RECALL

State the efficiency of a heat engine.

HEAT ENGINES AND HEAT PUMPS

RECALL

State the maximum theoretical efficiency of a heat engine.

HEAT ENGINES AND HEAT PUMPS

RECALL

Explain why no heat engine can be 100% efficient.

HEAT ENGINES AND HEAT PUMPS

DEFINITION

Define: Indicated power.

HEAT ENGINES AND HEAT PUMPS

SPOT THE ERROR

Say what is wrong with this claim:

A perfect engine would turn all the fuel's heat into useful work.

HEAT ENGINES AND HEAT PUMPS

RECALL

$(T_H - T_C)/T_H$, with both temperatures in kelvin.

HEAT ENGINES AND HEAT PUMPS

RECALL

efficiency = $W/Q_H = (Q_H - Q_C)/Q_H$.

HEAT ENGINES AND HEAT PUMPS

DEFINITION

The power developed by the gas inside the cylinders: the area of the p-V loop × cycles per second × the number of cylinders.

HEAT ENGINES AND HEAT PUMPS

RECALL

The working substance must be returned to its starting state to repeat the cycle, which means rejecting heat Q_C to a colder sink, so W is always less than Q_H.

HEAT ENGINES AND HEAT PUMPS

SPOT THE ERROR

Even a perfect engine must dump heat. The working substance has to be returned to its starting state each cycle, so heat Q_C is rejected to a colder sink and the efficiency is capped at $(T_H - T_C)/T_H$, below 1 for any real pair of temperatures.

HEAT ENGINES AND HEAT PUMPS