INKPHYSICS FLASHCARDS

Periodic motion

Year 13 · 26 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: The radian.

CIRCULAR MOTION

DEFINITION

Define: Angular speed.

CIRCULAR MOTION

RECALL

State the direction of the centripetal acceleration.

CIRCULAR MOTION

RECALL

State what provides the centripetal force.

CIRCULAR MOTION

RECALL

State the path of an object when the centripetal force is removed.

CIRCULAR MOTION

RECALL

State how the centripetal acceleration formula is derived from a vector diagram.

CIRCULAR MOTION

SPOT THE ERROR

Say what is wrong with this claim:

You're flung outwards by centrifugal force.

CIRCULAR MOTION

DEFINITION

Define: Simple harmonic motion.

SIMPLE HARMONIC MOTION

DEFINITION

The angle swept out per unit time: $\omega = \theta/t = 2\pi f$, in rad s^{-1}.

CIRCULAR MOTION

DEFINITION

The angle subtended at the centre of a circle by an arc equal in length to the radius.

CIRCULAR MOTION

RECALL

A real named force such as tension, gravity, friction or a normal reaction, never a new force of its own.

CIRCULAR MOTION

RECALL

Towards the centre of the circle, at right angles to the velocity.

CIRCULAR MOTION

RECALL

Two velocities an angle $\Delta\theta$ apart have equal length but differ in direction. Drawn from a common tail their difference is $\Delta v = v\Delta\theta$, pointing along the inward radius at the middle of the arc; dividing by $\Delta t = \Delta\theta/\omega$ gives $a = v\omega$, and then $v = \omega r$ gives $v^2/r = \omega^2 r$.

CIRCULAR MOTION

RECALL

A straight line along the tangent to the circle, by Newton's first law.

CIRCULAR MOTION

DEFINITION

Oscillation in which the acceleration is proportional to the displacement from equilibrium and directed towards it: $a = -\omega^2 x$.

SIMPLE HARMONIC MOTION

SPOT THE ERROR

There is no outward centrifugal force. Your inertia carries you straight on while the car turns; the resultant of the real forces acts towards the centre of the circle.

CIRCULAR MOTION

RECALL

State where the speed in SHM is greatest.

SIMPLE HARMONIC MOTION

RECALL

State where the acceleration in SHM is greatest.

SIMPLE HARMONIC MOTION

RECALL

State the phase of velocity relative to displacement in SHM.

SIMPLE HARMONIC MOTION

SPOT THE ERROR

Say what is wrong with this claim:

Bigger swings take longer.

SIMPLE HARMONIC MOTION

DEFINITION

Define: Damping.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

State the condition for a simple pendulum to move with SHM.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

State the frequency of the energy variation in SHM.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

State the effect of light damping on the period.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

At the extremes of the motion, where the displacement is at a maximum.

SIMPLE HARMONIC MOTION

RECALL

At the equilibrium position, where the displacement is zero.

SIMPLE HARMONIC MOTION

SPOT THE ERROR

In SHM the period is independent of amplitude. A larger swing travels further, but the restoring force and speed grow in proportion, so the period stays the same.

SIMPLE HARMONIC MOTION

RECALL

Velocity leads displacement by a quarter of a cycle (90°).

SIMPLE HARMONIC MOTION

RECALL

The amplitude of the swings must be small.

SHM SYSTEMS: PENDULUMS AND SPRINGS

DEFINITION

The loss of energy from an oscillating system to resistive forces, reducing the amplitude over time.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

Almost none: the amplitude decays but the period is nearly unchanged.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

Kinetic and potential energy each vary at twice the frequency of the oscillation.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

State the total energy of a simple harmonic oscillator.

SHM SYSTEMS: PENDULUMS AND SPRINGS

SPOT THE ERROR

Say what is wrong with this claim:

Heavier pendulums swing slower.

SHM SYSTEMS: PENDULUMS AND SPRINGS

DEFINITION

Define: Natural frequency.

FORCED VIBRATIONS AND RESONANCE

DEFINITION

Define: Resonance.

FORCED VIBRATIONS AND RESONANCE

RECALL

State the energy transfer at resonance.

FORCED VIBRATIONS AND RESONANCE

RECALL

State the frequency of forced vibrations.

FORCED VIBRATIONS AND RESONANCE

RECALL

State the effect of increased damping on the resonance curve.

FORCED VIBRATIONS AND RESONANCE

RECALL

State the phase lag of a driven oscillator at its natural frequency.

FORCED VIBRATIONS AND RESONANCE

SPOT THE ERROR

A pendulum's period is independent of mass: $T = 2\pi\sqrt{(L/g)}$ depends only on length and g. Mass appears in the period only for a mass on a spring.

SHM SYSTEMS: PENDULUMS AND SPRINGS

RECALL

For a mass-spring system $E = \frac{1}{2}kA^2$; equivalently, for any simple harmonic oscillator, $E = \frac{1}{2}m\omega^2x_0^2$, where x_0 is the amplitude. The two are the same expression, since $\omega^2 = k/m$.

SHM SYSTEMS: PENDULUMS AND SPRINGS

DEFINITION

The large-amplitude oscillation of a system when the driving frequency equals its natural frequency. That is the lightly damped case; heavier damping moves the peak slightly below the natural frequency.

FORCED VIBRATIONS AND RESONANCE

DEFINITION

The frequency at which a system oscillates freely after a single displacement, with no driving force.

FORCED VIBRATIONS AND RESONANCE

RECALL

A driven system oscillates at the driving frequency, not at its natural frequency.

FORCED VIBRATIONS AND RESONANCE

RECALL

At resonance, energy is transferred from the driver to the oscillating system at the maximum rate.

FORCED VIBRATIONS AND RESONANCE

RECALL

The oscillator lags the driver by a quarter of a cycle (90°), and by exactly that whatever the damping. The amplitude peak can sit a little below the natural frequency; the quarter-cycle lag does not move.

FORCED VIBRATIONS AND RESONANCE

RECALL

The amplitude peak becomes lower and broader, and moves to a slightly lower frequency.

FORCED VIBRATIONS AND RESONANCE

RECALL

Explain how plastic deformation reduces the amplitude of an oscillation.

FORCED VIBRATIONS AND RESONANCE

SPOT THE ERROR

Say what is wrong with this claim:

Pushing harder is all that matters.

FORCED VIBRATIONS AND RESONANCE

SPOT THE ERROR

Driving frequency decides the magnification, not the size of the response on its own. Double the driving force at any frequency and you double the amplitude; what matching the natural frequency buys you is the factor by which that push is magnified, which is why a small push at the right frequency beats a large one at the wrong one.

FORCED VIBRATIONS AND RESONANCE

RECALL

A ductile part taken past its yield point on each swing keeps a permanent set, so the work done deforming it is not returned to the oscillation but goes to moving dislocations and warming the metal. Energy leaves the system every cycle, so the amplitude falls.

FORCED VIBRATIONS AND RESONANCE