INKPHYSICS FLASHCARDS

Mechanics

Year 12 · 82 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: Scalar.

SCALARS AND VECTORS

DEFINITION

Define: Vector.

SCALARS AND VECTORS

RECALL

Explain how to add two perpendicular vectors.

SCALARS AND VECTORS

RECALL

State the components of a vector F at angle θ to an axis.

SCALARS AND VECTORS

RECALL

State the condition for equilibrium of coplanar forces at a point.

SCALARS AND VECTORS

RECALL

State the weight components on a slope at angle θ.

SCALARS AND VECTORS

RECALL

Explain how to subtract one vector from another.

SCALARS AND VECTORS

RECALL

State how to find a change in a vector quantity.

SCALARS AND VECTORS

DEFINITION

A quantity with both magnitude and direction, such as velocity, displacement, force or momentum.

SCALARS AND VECTORS

DEFINITION

A quantity with magnitude only, such as speed, distance, energy or temperature.

SCALARS AND VECTORS

RECALL

$F \cos \theta$ along the axis and $F \sin \theta$ perpendicular to it.

SCALARS AND VECTORS

RECALL

Pythagoras gives the magnitude of the resultant and $\tan \theta$ gives its direction.

SCALARS AND VECTORS

RECALL

$W \sin \theta$ acts down the slope and $W \cos \theta$ presses perpendicular into the surface.

SCALARS AND VECTORS

RECALL

The resultant force is zero: drawn tip to tail, the forces form a closed triangle.

SCALARS AND VECTORS

RECALL

Subtract the initial vector from the final one, $\Delta v = v - u$, treating both as vectors, so a straight rebound at unchanged speed gives a change of twice the speed.

SCALARS AND VECTORS

RECALL

Reverse the second and add it: $A - B$ means $A + (-B)$, joined tip to tail. Drawn from a common starting point, $A - B$ runs from the tip of B to the tip of A.

SCALARS AND VECTORS

SPOT THE ERROR

Say what is wrong with this claim:

Adding forces means adding the numbers.

SCALARS AND VECTORS

DEFINITION

Define: Moment of a force.

MOMENTS AND EQUILIBRIUM

DEFINITION

Define: Couple.

MOMENTS AND EQUILIBRIUM

DEFINITION

Define: Centre of mass.

MOMENTS AND EQUILIBRIUM

RECALL

State the unit of the moment of a force.

MOMENTS AND EQUILIBRIUM

DEFINITION

Define: Principle of moments.

MOMENTS AND EQUILIBRIUM

DEFINITION

Define: Moment of a couple.

MOMENTS AND EQUILIBRIUM

RECALL

State where the centre of mass of a uniform regular solid lies.

MOMENTS AND EQUILIBRIUM

DEFINITION

The force multiplied by the perpendicular distance from the line of action of the force to the pivot.

MOMENTS AND EQUILIBRIUM

SPOT THE ERROR

Forces are vectors, so magnitudes cannot simply be added: the resultant depends on the angle between them. Only forces, or components, along the same line add as plain numbers.

SCALARS AND VECTORS

DEFINITION

The single point at which the whole mass of an object can be taken to be concentrated.

MOMENTS AND EQUILIBRIUM

DEFINITION

A pair of equal and opposite coplanar forces whose lines of action do not coincide.

MOMENTS AND EQUILIBRIUM

DEFINITION

For a body in equilibrium, the sum of clockwise moments about any point equals the sum of anticlockwise moments about that point.

MOMENTS AND EQUILIBRIUM

RECALL

The newton metre, N m.

MOMENTS AND EQUILIBRIUM

RECALL

It lies at the geometric centre of the solid.

MOMENTS AND EQUILIBRIUM

DEFINITION

One of the two forces multiplied by the perpendicular distance between their lines of action.

MOMENTS AND EQUILIBRIUM

DEFINITION

Define: Centre of gravity.

MOMENTS AND EQUILIBRIUM

DEFINITION

Define: Describe how to find the centre of gravity of an irregular lamina.

MOMENTS AND EQUILIBRIUM

RECALL

Explain why a suspended body hangs with its centre of gravity below the pivot.

MOMENTS AND EQUILIBRIUM

SPOT THE ERROR

Say what is wrong with this claim:

If the forces are equal, it balances.

MOMENTS AND EQUILIBRIUM

RECALL

State what the gradient of a displacement-time graph represents.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

State what the gradient of a velocity-time graph represents.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

State what the area under a velocity-time graph represents.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

State what the area under an acceleration-time graph represents.

MOTION GRAPHS AND THE SUVAT EQUATIONS

DEFINITION

Hang it freely from a hole near the edge, hang a plumb line from the same pin and rule the line it marks; repeat from a second hole. The centre of gravity is where the lines cross.

MOMENTS AND EQUILIBRIUM

DEFINITION

The single point at which the whole weight of a body may be taken to act; where the gravitational field is uniform across the body it coincides with the centre of mass.

MOMENTS AND EQUILIBRIUM

SPOT THE ERROR

Equal forces can still turn an object: a couple has zero resultant force and a definite moment. Balance needs both resultant force and resultant moment to be zero.

MOMENTS AND EQUILIBRIUM

RECALL

In any other position the weight has a moment about the pivot, which turns the body until that moment is zero, and it is zero only when the two are vertically in line.

MOMENTS AND EQUILIBRIUM

RECALL

The acceleration.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

The velocity; the gradient of the tangent at a point is the instantaneous velocity.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

The change in velocity.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

The displacement, with area below the time axis counting as negative.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

State how the four constant-acceleration equations are derived.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

Explain where the constant-acceleration condition enters the SUVAT derivation.

MOTION GRAPHS AND THE SUVAT EQUATIONS

SPOT THE ERROR

Say what is wrong with this claim:

SUVAT always works.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

State the velocity of a projectile at the top of its arc.

PROJECTILE MOTION

RECALL

State the quantity shared by the two motions of a projectile.

PROJECTILE MOTION

RECALL

State the effect of air resistance on a projectile.

PROJECTILE MOTION

SPOT THE ERROR

Say what is wrong with this claim:

Something must keep pushing a projectile forwards.

PROJECTILE MOTION

DEFINITION

Define: Newton's first law.

NEWTON'S LAWS AND THE RESULTANT FORCE

RECALL

At the step that sets the average velocity equal to $\frac{1}{2}(u + v)$. That is true only while the velocity climbs at a steady rate, which is why the four fail the moment the acceleration varies.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

From $a = (v - u)/t$, which gives $v = u + at$, and from s = average velocity × $t = \frac{1}{2}(u + v)t$. Substituting the first into the second gives $s = ut + \frac{1}{2}at^2$; eliminating t between them gives $v^2 = u^2 + 2as$.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

The vertical component is zero but the horizontal component remains, so the speed is not zero.

PROJECTILE MOTION

SPOT THE ERROR

The SUVAT equations are derived assuming constant acceleration, so that is the only place they apply. When acceleration varies, the graphs still work: gradient and area never stop being true.

MOTION GRAPHS AND THE SUVAT EQUATIONS

RECALL

It lowers the maximum height, shortens the range and makes the descent steeper than the ascent.

PROJECTILE MOTION

RECALL

Time: found from one direction, it is spent in the other.

PROJECTILE MOTION

DEFINITION

An object remains at rest or continues at constant velocity unless a resultant external force acts on it.

NEWTON'S LAWS AND THE RESULTANT FORCE

SPOT THE ERROR

Nothing pushes a projectile along. With air resistance neglected the only force is gravity, straight down, so horizontal velocity stays constant. Motion needs no force to continue, only to change.

PROJECTILE MOTION

DEFINITION

Define: Newton's second law.

NEWTON'S LAWS AND THE RESULTANT FORCE

DEFINITION

Define: Newton's third law.

NEWTON'S LAWS AND THE RESULTANT FORCE

DEFINITION

Define: Resultant force.

NEWTON'S LAWS AND THE RESULTANT FORCE

SPOT THE ERROR

Say what is wrong with this claim:

Weight and the normal force are an action-reaction pair.

NEWTON'S LAWS AND THE RESULTANT FORCE

DEFINITION

Define: Mass.

MASS AND WEIGHT

RECALL

State the unit of mass.

MASS AND WEIGHT

RECALL

State whether mass changes with location.

MASS AND WEIGHT

DEFINITION

Define: Weight.

MASS AND WEIGHT

DEFINITION

When body A exerts a force on body B, body B exerts a force on A of equal magnitude, opposite direction and the same type.

NEWTON'S LAWS AND THE RESULTANT FORCE

DEFINITION

The resultant force on an object equals the rate of change of its momentum; for constant mass this becomes $F = ma$.

NEWTON'S LAWS AND THE RESULTANT FORCE

SPOT THE ERROR

Weight and the normal force act on the same body, so they are not a third-law pair. The partner of your weight is your gravitational pull on the Earth; third-law pairs act on different bodies.

NEWTON'S LAWS AND THE RESULTANT FORCE

DEFINITION

The single force equivalent to the vector sum of all the forces acting on an object.

NEWTON'S LAWS AND THE RESULTANT FORCE

RECALL

The kilogram, kg.

MASS AND WEIGHT

DEFINITION

A measure of an object's resistance to acceleration: its inertia.

MASS AND WEIGHT

DEFINITION

The gravitational force acting on an object's mass: $W = mg$, a vector.

MASS AND WEIGHT

RECALL

An object's mass is unchanged by location: it is the same anywhere in the universe.

MASS AND WEIGHT

RECALL

State the unit of weight.

MASS AND WEIGHT

DEFINITION

Define: Gravitational field strength g.

MASS AND WEIGHT

RECALL

State what a balance measures.

MASS AND WEIGHT

RECALL

State what a newton meter measures.

MASS AND WEIGHT

EQUATION · NOT ON THE AQA DATA SHEET

Weight from mass:

W = ?

MASS AND WEIGHT

SPOT THE ERROR

Say what is wrong with this claim:

Mass and weight are two words for the same thing.

MASS AND WEIGHT

DEFINITION

Define: Drag.

DRAG AND TERMINAL SPEED

RECALL

State how drag depends on speed.

DRAG AND TERMINAL SPEED

DEFINITION

The gravitational force per unit mass at a point: $g = W/m$, in $N\ kg^{-1}$.

MASS AND WEIGHT

RECALL

The newton, N, because weight is a force.

MASS AND WEIGHT

RECALL

It measures force directly through a stretched spring, so it reads weight and its reading changes with g.

MASS AND WEIGHT

RECALL

It compares the object with standard masses, so it reads mass and gives the same result anywhere.

MASS AND WEIGHT

SPOT THE ERROR

Mass and weight are different quantities. Mass, in kilograms, is the same everywhere; weight is the gravitational force on that mass, $W = mg$, in newtons, so it changes with g.

MASS AND WEIGHT

EQUATION · NOT ON THE AQA DATA SHEET

$W = mg$

MASS AND WEIGHT

RECALL

Drag increases with speed: the faster an object moves through a fluid, the larger the resistive force.

DRAG AND TERMINAL SPEED

DEFINITION

The resistive force on an object moving through a fluid, acting opposite to the motion.

DRAG AND TERMINAL SPEED

DEFINITION

Define: Terminal speed.

DRAG AND TERMINAL SPEED

DEFINITION

Define: Lift.

DRAG AND TERMINAL SPEED

DEFINITION

Define: Friction.

DRAG AND TERMINAL SPEED

RECALL

State the condition at a vehicle's maximum speed.

DRAG AND TERMINAL SPEED

RECALL

State the initial gradient of the velocity-time graph for an object dropped from rest.

DRAG AND TERMINAL SPEED

SPOT THE ERROR

Say what is wrong with this claim:

Falling objects just keep speeding up.

DRAG AND TERMINAL SPEED

DEFINITION

Define: Momentum.

MOMENTUM AND IMPULSE

DEFINITION

Define: Impulse.

MOMENTUM AND IMPULSE

DEFINITION

The component of the force from a fluid on an object that acts perpendicular to the direction of flow.

DRAG AND TERMINAL SPEED

DEFINITION

The constant speed a falling object reaches when the resistive forces have grown to equal its weight.

DRAG AND TERMINAL SPEED

RECALL

The driving force equals the total resistive force, so the resultant force and the acceleration are zero.

DRAG AND TERMINAL SPEED

DEFINITION

The resistive force between solid surfaces in contact that opposes relative motion, or attempted motion, between them.

DRAG AND TERMINAL SPEED

SPOT THE ERROR

Drag grows with speed, so a falling object cannot speed up forever: eventually drag equals weight, the resultant force is zero, and the object continues at that terminal speed.

DRAG AND TERMINAL SPEED

RECALL

It equals g, because at zero speed there is no drag and the resultant force is the full weight.

DRAG AND TERMINAL SPEED

DEFINITION

The product of a force and the time for which it acts: impulse = $F\Delta t$.

MOMENTUM AND IMPULSE

DEFINITION

The product of an object's mass and its velocity: $p = mv$, a vector.

MOMENTUM AND IMPULSE

RECALL

State the relationship between impulse and momentum change.

MOMENTUM AND IMPULSE

DEFINITION

Define: Elastic collision.

MOMENTUM AND IMPULSE

RECALL

State the unit of momentum.

MOMENTUM AND IMPULSE

DEFINITION

Define: Inelastic collision.

MOMENTUM AND IMPULSE

RECALL

State what the area under a force-time graph represents.

MOMENTUM AND IMPULSE

RECALL

Explain why crumple zones reduce injury.

MOMENTUM AND IMPULSE

RECALL

State the kinetic energy of a particle in terms of its momentum.

MOMENTUM AND IMPULSE

RECALL

Explain how conservation of momentum is applied in two dimensions.

MOMENTUM AND IMPULSE

DEFINITION

A collision in which kinetic energy is conserved as well as momentum.

MOMENTUM AND IMPULSE

RECALL

The impulse of a force equals the change in momentum it produces: $F\Delta t = \Delta(mv)$.

MOMENTUM AND IMPULSE

DEFINITION

A collision in which momentum is conserved but some kinetic energy is transferred to other forms, such as internal energy.

MOMENTUM AND IMPULSE

RECALL

The kilogram metre per second, kg m s^{-1}, equivalent to the newton second, N s.

MOMENTUM AND IMPULSE

RECALL

They increase the time taken for the momentum change, so the average force $F = \Delta(mv)/\Delta t$ is smaller.

MOMENTUM AND IMPULSE

RECALL

The impulse of the force, equal to the change in momentum it produces.

MOMENTUM AND IMPULSE

RECALL

Momentum is a vector, so resolve every momentum into components and conserve it along each axis separately: one equation for the x-components and one for the y-components.

MOMENTUM AND IMPULSE

RECALL

$E_k = p^2/(2m)$. Substituting $v = p/m$ into $\frac{1}{2}mv^2$ gives it in two lines, and being built on $\frac{1}{2}mv^2$ it holds only at non-relativistic speeds.

MOMENTUM AND IMPULSE

EQUATION · NOT ON THE AQA DATA SHEET

Momentum:

p = ?

MOMENTUM AND IMPULSE

SPOT THE ERROR

Say what is wrong with this claim:

When something stops, its momentum simply vanishes.

MOMENTUM AND IMPULSE

DEFINITION

Define: Work.

WORK, ENERGY AND POWER

DEFINITION

Define: Power.

WORK, ENERGY AND POWER

RECALL

State the unit of power.

WORK, ENERGY AND POWER

DEFINITION

Define: Efficiency.

WORK, ENERGY AND POWER

RECALL

State what the area under a force-displacement graph represents.

WORK, ENERGY AND POWER

RECALL

State the work done by a force perpendicular to the motion.

WORK, ENERGY AND POWER

SPOT THE ERROR

Momentum does not vanish when something stops; it is transferred to another body. Momentum is conserved: only an external force can change the total momentum of a system.

MOMENTUM AND IMPULSE

EQUATION · NOT ON THE AQA DATA SHEET

$p = mv$

MOMENTUM AND IMPULSE

DEFINITION

The rate of doing work, equivalently the rate of energy transfer: $P = \Delta W/\Delta t$.

WORK, ENERGY AND POWER

DEFINITION

Energy transferred by a force: the force multiplied by the distance moved in the direction of the force, $W = Fs\cos\theta$.

WORK, ENERGY AND POWER

DEFINITION

The ratio of useful output power (or energy) to total input power (or energy); it can never exceed 1.

WORK, ENERGY AND POWER

RECALL

The watt, W: one joule of energy transferred per second.

WORK, ENERGY AND POWER

RECALL

Zero: $W = Fs\cos\theta$ and $\cos 90° = 0$, so no energy is transferred.

WORK, ENERGY AND POWER

RECALL

The work done by the force, valid however the force varies.

WORK, ENERGY AND POWER

RECALL

State how $P = Fv$ is derived from $W = Fs$.

WORK, ENERGY AND POWER

SPOT THE ERROR

Say what is wrong with this claim:

Work means effort.

WORK, ENERGY AND POWER

DEFINITION

Define: Principle of conservation of energy.

CONSERVATION OF ENERGY

DEFINITION

Define: Kinetic energy.

CONSERVATION OF ENERGY

RECALL

State how to find the change in gravitational potential energy.

CONSERVATION OF ENERGY

RECALL

State the effect on kinetic energy of doubling the speed.

CONSERVATION OF ENERGY

RECALL

State the energy budget when resistive forces act.

CONSERVATION OF ENERGY

RECALL

State how the gravitational potential energy formula is derived.

CONSERVATION OF ENERGY

SPOT THE ERROR

Effort is not work. Work is done only when a force moves its point of application through a distance in the direction of the force; with no displacement, no work is done.

WORK, ENERGY AND POWER

RECALL

Divide the work done by the time taken: $P = W/t = Fs/t$, and s/t is the speed v.

WORK, ENERGY AND POWER

DEFINITION

The energy of a moving object: $E_k = ½mv^2$.

CONSERVATION OF ENERGY

DEFINITION

Energy cannot be created or destroyed, only transferred from one form to another.

CONSERVATION OF ENERGY

RECALL

It quadruples, because kinetic energy is proportional to the square of the speed.

CONSERVATION OF ENERGY

RECALL

$\Delta E_p = mg\Delta h$, where Δh is the vertical height change.

CONSERVATION OF ENERGY

RECALL

Raising a mass at constant speed needs an upward force mg acting along the displacement Δh, so $W = Fs$ gives the work as $mg\Delta h$, and that is what the store gains.

CONSERVATION OF ENERGY

RECALL

The initial energy equals the final useful energy plus the work done against resistive forces.

CONSERVATION OF ENERGY

RECALL

State how the kinetic energy formula is derived.

CONSERVATION OF ENERGY

SPOT THE ERROR

Say what is wrong with this claim:

Energy gets used up.

CONSERVATION OF ENERGY

SPOT THE ERROR

Energy is never used up; it is transferred, usually ending as internal energy spread into the surroundings. Dissipated energy is not destroyed, just no longer usefully collected.

CONSERVATION OF ENERGY

RECALL

$W = Fs$ with $F = ma$ gives $W = mas$; $v^2 = u^2 + 2as$ starting from rest makes $as = ½v^2$, so the work done is $½mv^2$.

CONSERVATION OF ENERGY