

INKPHYSICS FLASHCARDS

Gravitational fields

Year 13 · 28 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: Force field.

THE FIELD CONCEPT

RECALL

State the origins of the three force fields.

THE FIELD CONCEPT

RECALL

State what field-line spacing shows.

THE FIELD CONCEPT

RECALL

State the appearance of a uniform field on a field-line diagram.

THE FIELD CONCEPT

SPOT THE ERROR

Say what is wrong with this claim:

Forces need contact.

THE FIELD CONCEPT

DEFINITION

Define: Gravitational field strength.

NEWTON'S LAW OF GRAVITATION

DEFINITION

Define: Newton's law of gravitation.

NEWTON'S LAW OF GRAVITATION

RECALL

State where r is measured from in the inverse square law.

NEWTON'S LAW OF GRAVITATION

RECALL

Gravitational fields arise from mass, electric fields from static charge, and magnetic fields from moving charge.

THE FIELD CONCEPT

DEFINITION

A region in which a body experiences a non-contact force.

THE FIELD CONCEPT

RECALL

Parallel, equally spaced field lines.

THE FIELD CONCEPT

RECALL

The closer together the field lines, the stronger the field.

THE FIELD CONCEPT

DEFINITION

The force per unit mass on a small test mass placed in the field: $g = F/m$, in N kg^{-1} .

NEWTON'S LAW OF GRAVITATION

SPOT THE ERROR

Gravitational, electric and magnetic forces act without contact. Each is described by a field: a region in which a body experiences a force without touching anything.

THE FIELD CONCEPT

RECALL

From the centre of the mass, never from its surface.

NEWTON'S LAW OF GRAVITATION

DEFINITION

Two point masses attract with a force $F = Gm_1m_2/r^2$.

NEWTON'S LAW OF GRAVITATION

RECALL

State the effect on g of doubling the distance from the centre.

NEWTON'S LAW OF GRAVITATION

SPOT THE ERROR

Say what is wrong with this claim:

There's no gravity in space.

NEWTON'S LAW OF GRAVITATION

DEFINITION

Define: Gravitational potential.

GRAVITATIONAL POTENTIAL

RECALL

State the sign of gravitational potential.

GRAVITATIONAL POTENTIAL

RECALL

State the equation for gravitational potential in a radial field.

GRAVITATIONAL POTENTIAL

RECALL

State how to find gravitational field strength from a V against r graph.

GRAVITATIONAL POTENTIAL

RECALL

State how to find the change in potential from a g - r graph.

GRAVITATIONAL POTENTIAL

SPOT THE ERROR

Say what is wrong with this claim:

It takes energy to move anywhere in a gravitational field.

GRAVITATIONAL POTENTIAL

SPOT THE ERROR

Gravity follows an inverse square law and never reaches zero; at the ISS it is about 90% of surface g . Astronauts float because they and the station free-fall together.

NEWTON'S LAW OF GRAVITATION

RECALL

g falls to one quarter, because g follows an inverse-square law.

NEWTON'S LAW OF GRAVITATION

RECALL

Gravitational potential is zero at infinity and negative everywhere else, because gravity is attractive.

GRAVITATIONAL POTENTIAL

DEFINITION

The work done per unit mass to move a small test mass from infinity to that point.

GRAVITATIONAL POTENTIAL

RECALL

g is the negative of the gradient of the graph of V against r .

GRAVITATIONAL POTENTIAL

RECALL

$V = -GM/r$, with r measured from the centre of the mass.

GRAVITATIONAL POTENTIAL

SPOT THE ERROR

Only moving to a different potential costs or releases energy. Moving along an equipotential, at constant r , needs no work; work done equals mass times the change in potential.

GRAVITATIONAL POTENTIAL

RECALL

The magnitude of ΔV is the area under the field strength against distance graph between the two distances.

GRAVITATIONAL POTENTIAL

DEFINITION

Define: Geostationary orbit.

ORBITS AND SATELLITES

RECALL

State the defining property of a geostationary satellite.

ORBITS AND SATELLITES

DEFINITION

Define: Escape velocity.

ORBITS AND SATELLITES

DEFINITION

Define: Kepler's third law for circular orbits.

ORBITS AND SATELLITES

RECALL

State the radius of the geostationary orbit.

ORBITS AND SATELLITES

RECALL

State the effect of dropping to a lower orbit on a satellite.

ORBITS AND SATELLITES

RECALL

State Kepler's first two laws of planetary motion.

ORBITS AND SATELLITES

RECALL

Explain why a planet moves fastest at perihelion.

ORBITS AND SATELLITES

RECALL

A geostationary satellite remains above the same point on the Earth's equator.

ORBITS AND SATELLITES

DEFINITION

A circular orbit above the equator with a period of 24 hours, travelling in the direction of the Earth's spin.

ORBITS AND SATELLITES

DEFINITION

The square of the orbital period is proportional to the cube of the orbital radius: $T^2 \propto r^3$.

ORBITS AND SATELLITES

DEFINITION

The minimum launch speed at which an object escapes to infinity from a body's gravitational field without further propulsion.

ORBITS AND SATELLITES

RECALL

The satellite speeds up, even though its total energy decreases.

ORBITS AND SATELLITES

RECALL

About 4.2×10^7 m from the Earth's centre, roughly 36 000 km above the surface.

ORBITS AND SATELLITES

RECALL

By Kepler's second law the Sun-planet line sweeps equal areas in equal times. Near the Sun that line is short, so the planet must swing through a wider angle to cover the same area, and it therefore travels fastest at its closest approach and slowest at its furthest.

ORBITS AND SATELLITES

RECALL

First, every planet moves in an ellipse with the Sun at one focus, the other focus being empty. Second, the line joining a planet to the Sun sweeps out equal areas in equal times.

ORBITS AND SATELLITES

EQUATION · NOT ON THE AQA DATA SHEET

Orbit condition: gravity as the centripetal force:

$$(GMm)/(r^2) = ?$$

ORBITS AND SATELLITES

EQUATION · NOT ON THE AQA DATA SHEET

Kepler's third law, from Newton:

$$T^2 = ?$$

ORBITS AND SATELLITES

EQUATION · NOT ON THE AQA DATA SHEET

Escape velocity:

$$v_{\text{esc}} = ?$$

ORBITS AND SATELLITES

SPOT THE ERROR

Say what is wrong with this claim:

A satellite needs its engines running to stay in orbit.

ORBITS AND SATELLITES

EQUATION · NOT ON THE AQA DATA SHEET

$$T^2 = (4\pi^2)/(GM) r^3$$

ORBITS AND SATELLITES

EQUATION · NOT ON THE AQA DATA SHEET

$$(GMm)/(r^2) = (mv^2)/(r)$$

ORBITS AND SATELLITES

SPOT THE ERROR

An orbit is free fall: gravity alone provides the centripetal force, and with no drag nothing slows the satellite, so no engine thrust is needed to stay in orbit.

ORBITS AND SATELLITES

EQUATION · NOT ON THE AQA DATA SHEET

$$v_{\text{esc}} = \sqrt{((2GM)/(r))}$$

ORBITS AND SATELLITES