Edexcel Physics A-Level

Topic 12 - Gravitational Fields

Flashcards

What does Newton's Law of Gravitation state?

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The gravitational force between two point masses is proportional to the product of their masses and is inversely proportional to the square of the separation of their centres.

State the defining equation for Newton's Law of Gravitation.

State the defining equation for Newton's Law of Gravitation.

$$F = \frac{-GMm}{r^2}$$

What does ‘G’ represent?

What does ‘G’ represent?

The universal gravitational constant, which is equal to 6.67×10^{-11} N m^2 kg^{-2}.

What is always true about the gravitational force between two masses?

What is always true about the gravitational force between two masses?

It is always an attractive force.

What is a gravitational field?

What is a gravitational field?

A region in which any object with mass will experience a non-contact force.

What is gravitational field strength?

What is gravitational field strength?

The force per unit mass felt by the object.

What is the unit for gravitational field strength?

What is the unit for gravitational field strength?

Nkg^{-1}

State the equation for gravitational field strength.

State the equation for gravitational field strength.

$$g = \frac{GM}{r^2} \quad \text{or} \quad g = \frac{F}{m}$$

What is the gravitational potential at a point?

What is gravitational potential at a point?

The energy transferred per unit mass when moving an object from infinity to that point.

State the equation for gravitational potential.

State the equation for gravitational potential.

$$V = \frac{-GM}{r}$$

State the equation for gravitational potential energy.

State the equation for gravitational potential energy.

$$E = \frac{-GMm}{r}$$

What is an equipotential?

What is an equipotential?

A plane in which all points have the same potential.

What is true when a mass moves along an equipotential?

What is true when a mass moves along an equipotential?

No work is done when moving along an equipotential.

What does the area under a force-separation graph represent?

What does the area under a force-separation graph represent?

Energy

What is gravity?

What is gravity?

Gravity is the universal attractive force which acts between all matter.

What can field lines tell you about a field?

What can field lines tell you about a field?

The direction of the arrows show the direction of the field. The strength of the field is represented by the density of the field lines.

What is gravitational potential?

What is gravitational potential?

The potential energy per unit mass, at any point in the field. Zero potential is defined at infinity, hence at a point close to a mass the potential of an object would be negative.

How do you calculate the work done by moving a mass in a field?

How do you calculate the work done by moving a mass in a field?

Work Done = Mass x Change in Gravitational Potential

What is gravitational potential difference?

What is gravitational potential difference?

Gravitational potential difference is the difference in the gravitational potentials of two points in a gravitational field.

How much work is done per unit distance when you move along an equipotential?

How much work is done per unit distance when you move along an equipotential?

No work is done when moving across equipotentials, as the potential at each point is the same.

Why is gravitational potential a negative value?

Why is gravitational potential a negative value?

Work needs to be done to move an object from the inside the field to outside the field. Since outside the field's potential is defined as zero then the potential inside the field must be negative.

How is the orbital period related to the radius of a circular orbit?

How is the orbital period related to the radius of a circular orbit?

$$T^2 \propto R^3$$

Compare the PE and KE of a lower orbit to a higher one.

Compare the PE and KE of a lower orbit to a higher one.

A lower orbit (smaller m) has less potential energy and more kinetic energy than a higher orbit (bigger r).

What is the period of a geosynchronous orbit?

What is the period of a geosynchronous orbit?

Geosynchronous orbits have a period of one day.

What type of matter is affected by a gravitational field?

What type of matter is affected by a gravitational field?

Any object or matter with mass will experience an attractive force.

What is a point mass?

What is a point mass?

A point mass is a theoretical object that has a mass but no dimensions. This means that all of its mass acts at a single point.

What is the relationship between the field strength and the field lines that represent it?

What is the relationship between the field strength and the field lines that represent it?

The closer the lines are together, the stronger the gravitational field strength. The further apart the lines are, the weaker the field strength.