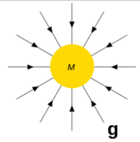
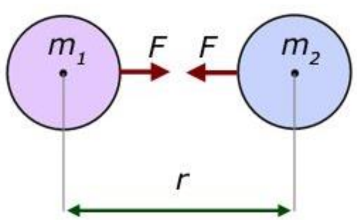
Subject: A-level Physics	Topic: Gravitational Fields	Year Group: 13

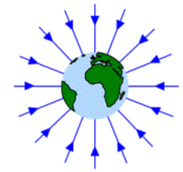
Fields

1	A force field can be represented as a vector	
2	Force fields arise from the interaction of mass, of static charge and between moving charges	
3	There are similarities between Gravitational and Electric Fields e.g. inverse square force laws, field lines, equipotentials. There are also differences between Gravitational and Electric Fields e.g. masses always attract, but charges can attract or repel	

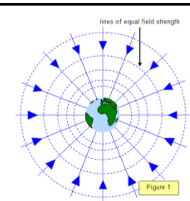
Newton's Law of Gravitation

1	Gravity is a universal attractive force between all matter
2	Equation for Newton's law of gravitation: $F = \frac{Gm_1m_2}{r^2}$
3	
4	The gravitational force between any two bodies is proportional to the produce of their masses and inversely proportional to the square of their separations

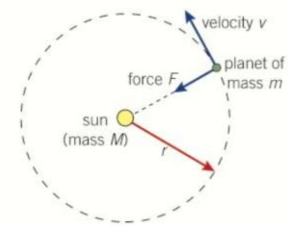
Gravitational Field Strength

1	Use field lines (with arrows) to represent the gravitational field	
2	g is the force per unit mass:	$g = \frac{F}{m}$
3	g can be calculated using:	$g = \frac{GM}{r^2}$

Gravitational Potential

1	The gravitational potential, V, is zero at infinity, and increases as you move away from an object. This means the values are always negative	
2	Work is done in moving a mass higher up in the field	
3	No work is done when you move along an equipotential	
4	In a radial field,	$V = -\frac{GM}{r}$
5	The area under a graph of g against r gives ΔV	$g = -\frac{\Delta V}{\Delta r}$

Orbits

1	Gravity provides the centripetal force to keep an object in orbit	
2	Relationship between Period time, T, and radius of orbit	$T^2 \propto r^3$
3	The radius of a geostationary satellite can be found using this equation. T = 24 hrs = 24x60x60 seconds	$\frac{r^3}{T^2} = \frac{GM}{4\pi^2}$
4	Total energy of an orbiting satellite = GPE + KE	$E = -\frac{GMm}{2r}$

Key Vocabulary

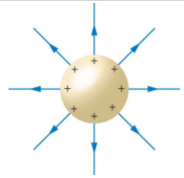
1	Field	A region in which an object experiences a non-contact force
2	Gravitational potential	The energy or work done per unit mass to move an object in a field
3	Field strength	The force per unit mass exerted by a field

Subject: A-level Physics	Topic: Electric Fields	Year Group: 13

Electrostatic charges

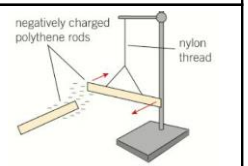
1 Electric fields are brought about by the interaction between positive and negative charges

For a charged sphere, we consider the charge to be at the centre



2 Like charges repel

Opposite charges attract



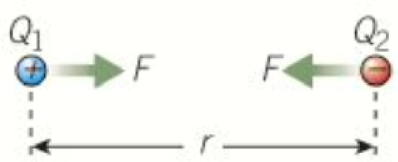
Coulomb's Law

1 The permittivity of free space, ε_0, is the constant of proportionality for electric fields

2 The force between two point charges in a vacuum:

$$F = \frac{1}{4\pi\varepsilon_0}\frac{Q_1Q_2}{r^2}$$

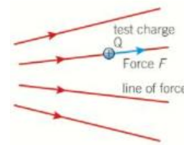
3



4 The electrostatic force between two point charges in a vacuum is directly proportional to the product of their charges and inversely proportional to the square of their separation

Radial Fields

1 Use field lines (with arrows) to represent the electric fields. The arrows point in the direction a small positive test charge would experience a force



2 E is the force per unit charge:

$$E = \frac{F}{Q}$$

3 E can be calculated using:

$$E = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r^2}$$

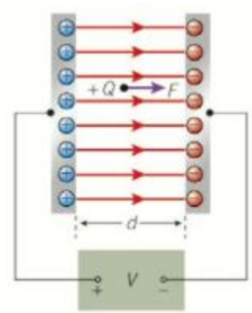
Uniform Fields

1 In a uniform field:

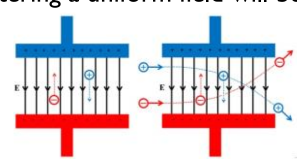
$$E = \frac{V}{d}$$

2 Work done moving a charge between the plates:

$$Fd = Q\Delta V$$

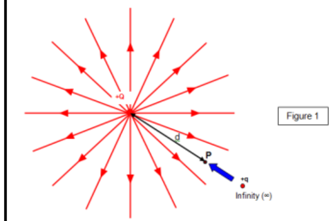


3 Particles entering a uniform field will be deflected:



Electric Potential

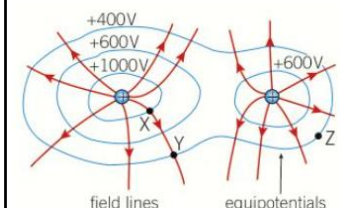
1 Absolute electric potential has a value of zero at infinity



2 The work done in moving a charge Q in an electric field:

$$\Delta W = Q\Delta V$$

3 No work is done when moving a charge around an equipotential in an electric field



4 The magnitude of V in a radial field is given by:

$$V = \frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$$

Key Vocabulary

1	Absolute electric potential	The work done per unit positive charge when it is moved from infinity to that position in the field.
2	Electric potential difference	The work done per unit positive charge when moving between two points in the field