# 1 Circular motion

## 1.1 Circular acceleration

### 1.1.1 Relations

$$a_c = \omega^2 r = \frac{v^2}{r} = \frac{4\pi^2 r}{T^2} = \omega v$$

$$\omega = \frac{2\pi}{T}$$

$$v = \omega r = \frac{2\pi r}{T}$$

## 1.2 Angular velocity

### 1.2.1 Definition

*Angular displacement swept out by radius, per unit time.*

# 2 Gravitational field & Electric field

## 2.1 Electric field

### 2.1.1 Definitions

- **A field of force**: *region of space where a particle experiences a force*

## 2.2 Gravitational field

### 2.2.1 Definition

- **A line of force in a gravitational field**: *Tangent to line gives direction of force on a mass*
- **A line of force in a electric field**: *Tangent to line gives direction of force on a positive charge*

### 2.2.2 Difference between gravitation field and electric field

- Gravitational force always attractive
- Electric field forces are attractive or repulsive

# 3 Capacitor

## 3.1 Capacitor

### 3.1.1 Function of capacitor

- Storage of energy
- Smoothing
- Blocking of direct current
- Producing of electrical oscillation

### 3.1.2 Why capacitor stores energy, no charge

- Positive and negative charges are separated, work done to achieve this, so stores energy
- The two plates have equal and opposite charges, so resultant charge is zero

## 3.2 Capacitance

### 3.2.1 Definition

*Charge / Potential difference. [1]*
*The ratio of charge on one plate to the potential difference between plates. [2]*

$$Q = CV$$

### 3.2.2 Capacitance is a property

$$C = \frac{\epsilon_0 A}{d}$$

where A is the area of one of the plates, and d is the plate separation.

### 3.2.3 Capacitance of a parallel capacitor

*The ratio of charge on one plate to the potential difference between plates.*

## 3.3 Energy stored in capacitors

$$U_c = \frac{1}{2}QV = \frac{1}{2}CV^2 = \frac{1}{2}\frac{Q^2}{C}$$

### 3.3.1 The [?, half] comes in because

When the first change flows onto the capacitor plates, there is no p.d. opposing the flow.
As more charge flows, the p.d. increases, so more work is done
The average p.d. is equal to half the maximum p.d.

## 3.4 Parallel and series

### 3.4.1 Capacitor in parallel

$V$ is constant, therefore $C_{total} = \sum_i^n C_i$

### 3.4.2 Capacitor in series

$Q$ is constant, therefore $\frac{1}{C_{total}} = \sum_i^n \frac{1}{C_i}$