M1 Essentials: *Summary of AQA Mechanics 1 content not provided in the formula book*

Mechanics terminology

Particle *Mass, but no size*	Rigid Body *Mass and size, does not deform*
Rough/Smooth *Friction present/not*	Elastic/Inelastic *Deforms/does not deform*
Light *No mass*	Plane *Flat surface (eg, a slope)*

Vectors & scalars

Vector	Scalar
Displacement	Distance (m)
Velocity	Speed (ms^{-1})
Acceleration	(Magnitude of) acceleration (ms^{-2})
Force	(Magnitude of) force (N)
N/A	Mass (kg)
N/A	Time (s)

Graphs of motion

Displacement-Time	Velocity-Time
$Displacement = Height$	$Displacement = Area$
$Velocity = Gradient$	$Velocity = Height$
	$Acceleration = Gradient$

SUVAT equations (constant acceleration equations)

$s = displacement\ (m)$
$u = initial\ velocity\ (ms^{-1})$
$v = final\ velocity\ (ms^{-1})$
$a = acceleration\ (ms^{-2})$
$t = time\ (s)$

$$v = u + at$$
$$v^2 = u^2 + 2as$$
$$s = \frac{u+v}{2}t$$
$$s = ut + \frac{1}{2}at^2$$

Manipulating vectors

$$\begin{bmatrix} a \\ b \end{bmatrix} \pm \begin{bmatrix} c \\ d \end{bmatrix} = \begin{bmatrix} a \pm c \\ b \pm d \end{bmatrix} \qquad k\begin{bmatrix} a \\ b \end{bmatrix} = \begin{bmatrix} ka \\ kb \end{bmatrix} \qquad \left\|\begin{bmatrix} a \\ b \end{bmatrix}\right\| = \sqrt{a^2 + b^2}$$

Resolving a vector

Eg. A force F acting at $\theta°$ to the horizontal:

$F\cos\theta$ horizontally, $F\sin\theta$ vertically: $\boldsymbol{F} = \begin{bmatrix} F\cos\theta \\ F\sin\theta \end{bmatrix}$

Kinematics in 2 dimensions

Displacement, velocity and acceleration are all vector quantities.
In 1 dimensional problems, direction is given as $+ve$ or $-ve$.
In 2 dimensional problems, direction is defined by the vector.

Equilibrium

A particle in equilibrium has constant velocity (could be at rest), and has a resultant force of $0N$ acting on it (forces are balanced).

Friction

Friction always acts in the opposite direction to motion or potential motion.

Always true	*In motion, or in limiting equilibrium*
$F_r \leq \mu R$	$F_r = \mu R$

Newton's second law

$$F = ma$$

F: $resultant\ force\ (N)$
m: $mass\ (kg)$
a: $acceleration\ (ms^{-2})$

Projectiles

Horizontal:	*Vertical:*
v constant	$a = -9.8$
$v = \frac{x}{t}$	$SUVAT\ equations$

Momentum

Conservation of momentum: $m_1u + m_2u = m_1v + m_2v$