**3-4. Constant Acceleration Formulae (SUVAT Equations)**

These formulae are used to solve problems where the object is moving in a **straight line with constant acceleration for a specific period of time**. You should memorise these and know how to derive them.



$$Acceleration=\frac{change in velocity}{time} $$

 $v= $

(Equation 1)

For uniform acceleration, the average velocity is the average of v and u. Using the area of the graph (which we know gives distance):

$$s= $$

(Equation 2)

Eliminating v - sub for v from equation 1 into equation 2:

$$s= $$

(Equation 3)

Eliminating t - sub for t from equation 1 into equation 2:

$$v^{2}= $$

(Equation 4)

Eliminating u – sub for u from equation 1 into equation 2:

$$s=$$

(Equation 5)

* Work out what you know
* Work out what you need
* Choose the appropriate equation
* Diagrams help!
* Work out which direction will be positive
* Check that your units are consistent

**Example**

A stone slides in a straight line across a horizontal sheet of ice. It passes a point, A with velocity 14ms-1 and a point, B 2.5 seconds later. Assuming the deceleration is uniform and that AB = 30m, find:

a) The deceleration

b) The velocity at B

c) How long after passing A the stone comes to rest

**Example – Deceleration Leading to a Change in Direction**

A particle travels with uniform deceleration 2ms-2 in a horizontal line. The points A and B lie on the line and AB = 32m. At time t = 0, the particle passes through A with velocity 12ms-1 in the direction AB. Find:

a) The values of t when the particle is at B

b) The velocity of the particle for each of these values of t.

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**5. Vertical Motion Under Gravity**

The downwards acceleration under gravity is $g=9.8 $ms-2.

ALWAYS state the positive direction in your calculations.

Quote final answers to 2 or 3 s.f. – you may be penalised if you quote more.

**Example**

A ball is thrown vertically upwards with a velocity of 14.7ms-1 from a platform 19.6m above the ground. Find:

a) The time taken for the ball to reach the ground

b) The velocity of the ball when it hits the ground

**Example**

A ball is projected vertically upwards from ground level at a speed of 20 ms-1.

Determine the amount of time the ball is at least 10m above ground level.

**Example – When Two Particles are in Motion**

Two stones are thrown from the same point at the same time - one vertically upwards with speed 30ms-1 and one vertically downwards at 30ms-1. Find how far apart the stones are after 3 seconds.

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