Cambridge O Level Physics – Kinematics (Motion)

1. Key Definitions

Distance: total length of path travelled (scalar).

Displacement: shortest distance from start to end in a given direction (vector).

Speed: distance travelled per unit time.

Velocity: speed in a given direction.
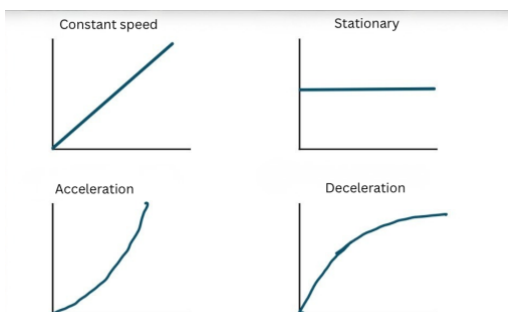
Acceleration: rate of change of velocity.

Uniform acceleration: When the velocity changes by equal amounts in equal intervals of time.

2. Important Formulae

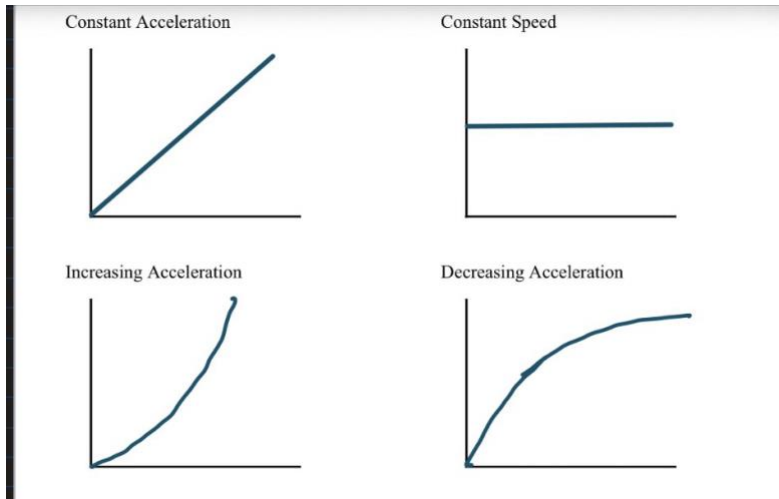| Quantity	Formula
Speed	$v = s / t$. Velocity= speed/time
Acceleration	$a = (v - u) / t$
Average speed	total distance / total time

3. Distance–Time Graphs

The gradient (slope) of a distance–time graph represents speed. A steeper slope means higher speed. A horizontal line means the object is at rest.

4. Speed–Time Graphs

The gradient of a speed–time graph gives acceleration. The area under the graph gives the

Constant Acceleration

Constant Speed

Increasing Acceleration

Decreasing Acceleration

distance travelled.

5. Free Fall

Objects falling freely near the Earth experience a constant acceleration called gravitational acceleration, $g \approx 9.8 \text{ m/s}^2$.

6. Units & Conversions
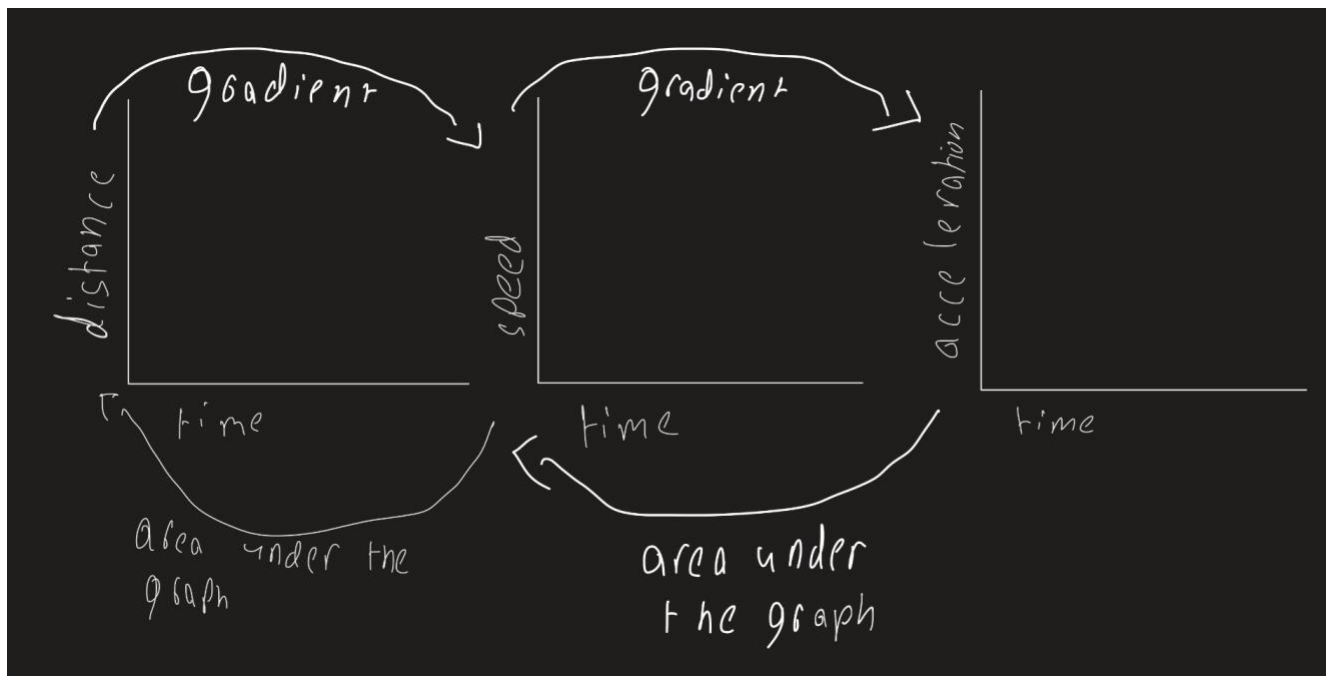
Distance: metre (m)

Time: second (s)

Speed: m/s

Acceleration: m/s^2

To convert km/h to m/s, divide by 3.6

Fact:

1.   Gradient of distance–time graph gives us speed.

2.   Area under the graph of distance–time graph gives us nothing.

3.   Gradient of speed–time graph gives us acceleration.

4.   Area under speed–time graph gives us distance.

FAQ. Describe a parachutist journey. (IMPORTANT)

Ans As the parachutist jumps out of a plane, his speed increases. As his speed increases, air resistance starts to act upon him until the downward force and air resistance are equal. This is when he hits terminal velocity. He then pulls out his parachute; his speed starts to decrease again until, once again, terminal velocity is hit. He then lands with the same terminal velocity.

Q. Calculate the total distance traveled by the Car.

Total distance travelled = Area of triangle 1 + Area of rectangle 2 + Area of triangle 3

$$= \left(\frac{1}{2} \times 10 \times 30\right) + (30 \times 30) + \left(\frac{1}{2} \times 10 \times 30\right)$$

$$= 300 + 900$$

$$= 1200$$