

GRADE 10 | 2024

Physical Sciences: Vectors and Motion

Physical Sciences

CAPS ALIGNED

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1. Scalars and Vectors

- Scalar: has magnitude only (speed, distance, mass, time, temperature)
- Vector: has both magnitude and direction (velocity, displacement, force, acceleration)

2. Representing Vectors

Vectors are drawn as arrows. The length of the arrow represents magnitude; the direction of the arrow represents direction.

Adding Vectors

Vectors in the same direction: add magnitudes. Vectors in opposite directions: subtract magnitudes and keep the direction of the larger.

FORMULA: Resultant vector: the single vector that has the same effect as all the original vectors combined.

3. Motion in One Dimension

FORMULA: $v = u + at$ (v = final velocity, u = initial velocity, a = acceleration, t = time)

$s = ut + (1/2)at^2$ (s = displacement)

$v^2 = u^2 + 2as$

$s = (u + v)t/2$

EXAMPLE: Equations of motion

A car starts from rest and accelerates at 2 m/s^2 for 5 seconds.

$u = 0$, $a = 2$, $t = 5$

$v = 0 + 2(5) = 10 \text{ m/s}$

$s = 0 + (1/2)(2)(5)^2 = 25 \text{ m}$

4. Gravitational Acceleration

FORMULA: $g = 9.8 \text{ m/s}^2$ (downward, approximately 10 m/s^2)

For free fall: $u = 0$, $a = g$

Time to fall height h : $h = (1/2)g t^2$

KEY POINT: Displacement can be positive or negative depending on direction. Choose a positive direction at the start and be consistent.