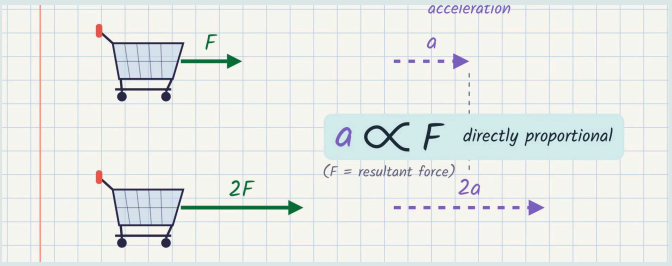
# Newton's Second Law

*force, mass and acceleration; F = m a; estimates; inertial mass*

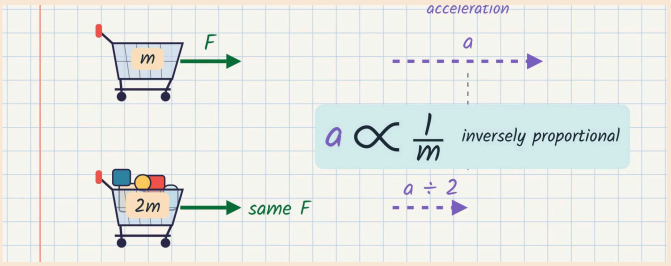
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Summary sheet

## 1 Force and acceleration



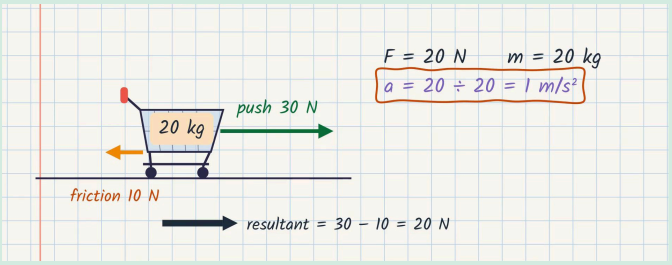

- Push twice as hard and the trolley **accelerates twice as much**.
- **Acceleration is directly proportional to the resultant force**: a bigger resultant force gives a bigger acceleration.

## 2 Mass and acceleration



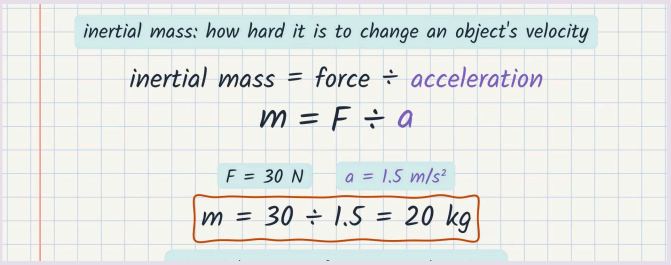

- Keep the force the same and **double the mass**: the acceleration **halves**.
- **Acceleration is inversely proportional to mass**: a bigger mass gives a smaller acceleration for the same force.

## 3 F = m a




- **Resultant force (N) = mass (kg) × acceleration (m/s²)**. Example: 30 N on 20 kg gives a = 30 ÷ 20 = **1.5 m/s²**. With 10 N of friction, F = 30 − 10 = 20 N, so a = **1 m/s²**.
- **Estimates** use round numbers and the ~ sign: a car (m ~ 1000 kg) going 0 to 25 m/s in ~10 s has a ~ 2.5 m/s², so F ~ **2500 N**.

## 4 Inertial mass (Higher)




- **Inertial mass** measures how hard it is to change an object's velocity: to speed it up, slow it down or turn it.
- **Inertial mass = force ÷ acceleration**: 30 N ÷ 1.5 m/s² = **20 kg**.

**F = m a**

*resultant force = mass × acceleration*

**Exam tip**

Use the resultant force in F = m a. If there's friction or drag, subtract it first.

## Check yourself

- 1 What resultant force gives a 50 kg object an acceleration of 4 m/s²?
- 2 The same force acts on a bigger mass. What happens to the acceleration?

Answers: 1. F = 50 × 4 = 200 N 2. It decreases (gets smaller)