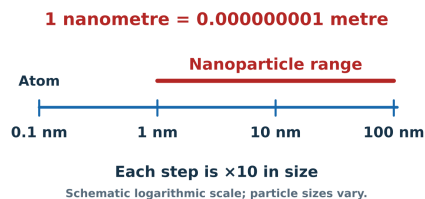


C2 Nanoparticles

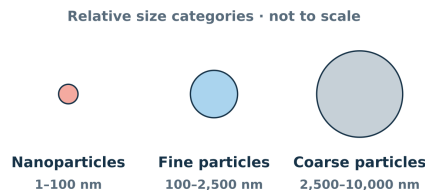
AQA Separate Chemistry 8462 | Paper 1 extras | Foundation + Higher

1 The nanoscale



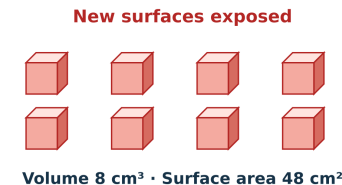
Nanoparticles: **1–100 nm**.
1 nm = 10^{-9} m (one billionth of a metre).
They contain many atoms. They are larger than individual atoms.
 $50 \text{ nm} = 5 \times 10^{-8} \text{ m}$.

2 Particle size categories



Fine particles: 100–2,500 nm.
Coarse particles (dust): about 2,500–10,000 nm.
Nano < fine < coarse.
Compare dimensions in the same units; each factor of 10 is an order of magnitude.

3 Surface area to volume



Splitting a solid exposes more surface. Its **total volume stays the same**.
Smaller particles have a **larger SA:V**.
A larger proportion of atoms is at the surface, which can change properties compared with the bulk material.

4 Cube calculations



Side = a: **SA = $6a^2$; V = a^3** .
2 cm cube: SA = 24 cm^2 ; V = 8 cm^3 ; SA:V = **3:1**.
1 cm cube: SA:V = **6:1**.
Divide side length by 10 → multiply SA:V by 10.

5 Applications

Medicine / electronics Tiny structures	Sun creams / cosmetics Useful optical properties
Deodorants Some antimicrobial uses	Catalysts Large exposed surface

Applications include medicine, electronics, cosmetics, sun creams, deodorants and catalysts.
High SA:V can make small amounts effective.
Use the properties and evidence supplied for an unfamiliar application.

6 Benefits and possible risks

Possible benefits Effective in small amounts Useful size / properties Application-specific	Questions to investigate Effects on cells? Exposure and dose? Environmental effects?
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Use evidence for the particular material.

Weigh benefits against possible effects on cells and the environment. Consider material, particle size, dose and exposure.
Further testing may be needed. Avoid claiming all nanoparticles are safe or all are harmful.
AQA section 4.2.4.