

Uses of nanoparticles

4.2.4.2 · Bonding, structure and the properties of matter · revision notes

Where nanoparticles are used (medicine, electronics, cosmetics and sun creams, deodorants and catalysts), and the benefits and possible risks of using them. You do not need to learn specific examples: questions give you information and ask you to evaluate a use, often for 4 to 6 marks. GCSE Chemistry only, not in Combined Science.

Key facts

- Uses: medicine, electronics, cosmetics and sun creams, deodorants, catalysts
- Sun creams: better UV protection and better skin coverage
- Long-term effects are not yet fully understood
- Advantage: high surface area to volume ratio → more effective → smaller quantities needed
- Risks: may get into the body and cells, possible cell damage, possible harm to the environment
- Evaluate = benefits + risks + a justified judgement

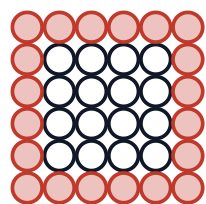
Notes

Where nanoparticles are used

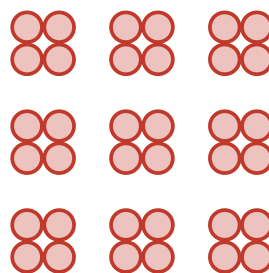
- **Medicine:** for example, carrying drugs to particular places in the body, or killing bacteria.
- **Electronics:** very small components and conducting materials.
- **Cosmetics and sun creams:** nanoparticles in sun creams give better protection from harmful ultraviolet (UV) light and better skin coverage, and they do not leave white marks on the skin.
- **Deodorants:** for example, nanoparticles that kill the bacteria that cause body odour.
- **Catalysts:** the high surface area to volume ratio means more of the catalyst's atoms are at the surface, so less catalyst is needed.
- New uses of nanoparticles are an important area of research.

Advantages

- Their very high surface area to volume ratio makes them very effective, so **smaller quantities** are needed.



one particle
20 of 36 atoms
at the surface



9 small particles
all 36 atoms at the surface

Surface atoms are red. Smaller particles expose more atoms, so less catalyst is needed.

- They can have useful **properties that the bulk material does not have**.
- They are small enough to reach places that larger particles cannot, e.g. inside cells.

Possible risks

- Nanoparticles are so small that they may be **breathed in** or **absorbed through the skin**, and could get into cells or the bloodstream.
- Their different properties mean they might **damage cells** or be toxic, even if the bulk material is harmless.
- They may be washed into the **environment** (e.g. from sun cream) and harm living things there.
- Because nanoparticles are quite new, their **long-term effects** on health and the environment are **not yet fully understood**.

How to evaluate a use

- Give the benefits, using the information in the question.
- Give the risks or disadvantages.
- Make a **judgement** with a reason, e.g. 'the benefits outweigh the risks because...', but more research into safety is needed'.

How to answer each type of question

Give uses of nanoparticles

1 to 2 marks

Grade 4

1. Choose from the five areas: medicine, electronics, cosmetics and sun creams, deodorants, catalysts.
2. Give exactly the number asked for.

Example. Give two uses of nanoparticles.

Model answer. Any two from: medicine / drug delivery (1); electronics (1); cosmetics or sun creams (1); deodorants (1); catalysts (1). [max 2]

Don't lose marks

- ✗ Giving only advantages, or only risks, in an 'evaluate' question.
- ✗ Writing a conclusion with no reason. Say why the benefits do or do not outweigh the risks.
- ✗ Saying nanoparticles are definitely dangerous or poisonous. The risks are possible and not yet fully understood.
- ✗ Ignoring the data in the question. Quote the figures you are given.

More tips

Memory tricks

- Five uses, 'My Electric Sun Deodorant Catalyses': Medicine, Electronics, Sun creams (and cosmetics), Deodorants, Catalysts.
- Evaluate = for, against, verdict. No verdict, no top marks.
- Every advantage comes back to the high surface area to volume ratio; every risk comes back to 'small enough to get into the body, and long-term effects unknown'.

Exam technique

- In 'evaluate' questions, use the information in the question: it is there to be used.
- Explain each point: 'blocks more UV, so less risk of sunburn' scores more than 'it is better'.
- Finish with a judgement that follows from the points you have made.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 4

List the main uses of nanoparticles

Medicine, electronics, cosmetics and sun creams, deodorants, and catalysts.

Grade 5

Give advantages of using nanoparticles

Their high surface area to volume ratio makes them effective, so smaller quantities are needed.

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