

GCSE Chemistry

Worksheet: Uses of nanoparticles

TIME 25 min	TOTAL 24 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Uses of nanoparticles

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Nanoparticles are used in a wide range of modern products.

0 1 . 1

Which of these products often contains nanoparticles?

Tick (✓) **one** box.

Sun cream

☐

Table salt

☐

Drinking glasses

☐

Untreated cotton fabric

☐

[1 mark]

0 2

Nanoparticles have many applications.

0 2 . 1

Give **two** areas in which nanoparticles are used.

.....

.....

.....

.....

[2 marks]

0 2 . 2

Silver nanoparticles are added to some wound dressings.
Suggest why.

.....

.....

[1 mark]

0 2 . 3

Give **one** possible risk of using nanoparticles.

.....

.....

[1 mark]

0 3

Gold nanoparticles used for drug delivery cost £2000 per gram. Each gram provides a surface area of 40 m^2 for attaching drug molecules. One treatment needs a total surface area of 0.020 m^2 .

0 3 . 1

Calculate the cost of the gold nanoparticles needed for one treatment.

.....

.....

.....

.....

.....

Cost = £

[3 marks]

.....

0 4

Self-cleaning window glass has a very thin, transparent coating of titanium dioxide nanoparticles. In sunlight, the nanoparticles catalyse the breakdown of dirt on the glass.

0 4 . 1

Suggest why the titanium dioxide is used as nanoparticles rather than as larger particles.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Suggest **one** possible risk of using this coating.

.....

.....

[1 mark]

0 5

Table 1 shows the results of a test comparing bacterial growth on plain cotton fabric and on cotton fabric treated with silver nanoparticles, after two days.

Table 1

Fabric sample	Number of bacterial colonies
Plain cotton	480
Cotton with silver nanoparticles	15

0 5 . 1

Calculate the percentage decrease in the number of bacterial colonies on the fabric treated with silver nanoparticles.
Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage decrease = %

[2 marks]

0 5 . 2

Suggest **one** possible risk of adding silver nanoparticles to clothing.

.....

.....

[1 mark]

.....

0 6

Some sun creams contain nanoparticles of titanium dioxide. The nanoparticles absorb or reflect harmful ultraviolet (UV) light. Older sun creams contained larger particles of titanium dioxide, which left a white layer on the skin.

0 6 . 1

Suggest **two** advantages of using nanoparticles of titanium dioxide in sun cream.

[2 marks]

0 6 . 2

Suggest **two** reasons why some people are concerned about using nanoparticles in sun cream.

[2 marks]

0 6 . 3

Explain why a smaller mass of titanium dioxide is needed when it is used as nanoparticles.

[1 mark]

0 7

Scientists are developing gold nanoparticles that carry anti-cancer drugs to tumours. The drug molecules are attached to the surface of the nanoparticles. The nanoparticles collect in the tumour, where the drug is released. Some of the nanoparticles collect in the liver and stay in the body for many months.

0 7 . 1

Suggest why attaching the drug to nanoparticles means that a smaller dose of the drug is needed.

[1 mark]

0 7 . 2

Suggest why nanoparticles can carry a large amount of drug for their mass.

[1 mark]

0 7 . 3

Give **one** possible risk of this treatment.

[1 mark]

0 7 . 4

Suggest why new uses of nanoparticles must be tested carefully before they are used widely.

[1 mark]

0 7 . 5

The gold particles have a diameter of 30 nm.
Explain whether they are nanoparticles.

[1 mark]

END OF QUESTIONS

Mark scheme

GCSE Chemistry · Worksheet: Uses of nanoparticles · 24 marks

Question 1 (1 mark)

01.1 [1 mark]

Correct: Sun cream

Question 2 (4 marks)

02.1 [2 marks]

Answer: e.g. medicine; sun creams

- medicine (1)
- electronics (1)
- cosmetics (1)
- sun creams (1)
- deodorants (1)
- catalysts (1)

Any 2 of the points above.

02.2 [1 mark]

Answer: They kill bacteria.

- they kill bacteria / are antibacterial / prevent infection (1)
-

02.3 [1 mark]

Answer: They may be absorbed into the body and harm cells; their long-term effects are not known.

- may be breathed in / absorbed into the body or cells and cause harm / long-term effects are unknown / may harm the environment (1)
-

Question 3 (3 marks)

03.1 [3 marks]

Answer: £1.00

- mass needed = $0.020 \div 40 = 0.00050$ (g) (1)
 - cost = 0.00050×2000 (1)
 - £1.00 (1)
-

Question 4 (3 marks)

04.1 [2 marks]

Answer: Nanoparticles have a much higher surface area to volume ratio, so a thin coating has a large surface for catalysis, and the particles are too small to make the coating visible.

- nanoparticles have a (much) higher surface area to volume ratio, so more titanium dioxide is at the surface to catalyse the breakdown of dirt (1)
- the coating can be very thin / transparent, so it does not affect the look of the window (1)

04.2 [1 mark]

Answer: Nanoparticles worn off the glass could be breathed in or enter the environment, with effects that are not fully known.

- nanoparticles worn / washed off the glass could be breathed in or enter the environment, and their effects are not fully known (1)

Question 5 (3 marks)

05.1 [2 marks]

Answer: 96.9%

- $(480 - 15) \div 480 \times 100$ (1)
- 96.9 (%) (1)

Notes: An answer of 96.875 (not 3 significant figures) scores 1 mark.

05.2 [1 mark]

Answer: Nanoparticles may be washed out into rivers and harm living organisms.

- e.g. nanoparticles washed out of the fabric may harm organisms in rivers / may pass through the skin, with effects on health that are not fully known (1)
-

Question 6 (5 marks)

06.1 [2 marks]

Answer: Better skin coverage and more effective protection from UV; the cream does not leave a white layer.

- better skin coverage (1)
- more effective protection from UV light / less needed (1)
- does not leave a white layer / is invisible on the skin (1)

Any 2 of the points above.

06.2 [2 marks]

Answer: The nanoparticles might pass through the skin into cells, their long-term effects are unknown, and they may harm the environment when washed off.

- nanoparticles may pass through the skin / into the body or cells (1)
- long-term health effects are not yet known (1)
- nanoparticles washed off into the sea / water may harm organisms / the environment (1)

Any 2 of the points above.

06.3 [1 mark]

Answer: Nanoparticles have a much higher surface area to volume ratio.

- nanoparticles have a (much) higher surface area to volume ratio (1)
-

Question 7 (5 marks)

07.1 [1 mark]

Answer: The drug is delivered directly to the tumour, so less is wasted in healthy tissue.

- the drug is delivered (directly) to the tumour / less drug goes to healthy tissue (1)
-

07.2 [1 mark]

Answer: They have a high surface area to volume ratio, so there is a large surface for drug molecules to attach to.

- high surface area to volume ratio, so there is a large surface to attach drug molecules (1)
-

07.3 [1 mark]

Answer: Nanoparticles stay in the liver for a long time and their long-term effects are unknown.

- nanoparticles collect in the liver / stay in the body and could cause harm / long-term effects are unknown (1)
-

07.4 [1 mark]

Answer: Nanoparticles can behave differently from the bulk material, so their effects on health and the environment may be unexpected.

- their properties / effects can differ from the bulk material, so risks to health or the environment may be unknown (1)
-

07.5 [1 mark]

Answer: Yes, because 30 nm is within the range 1–100 nm.

- yes, 30 nm is between 1 and 100 nm (1)
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