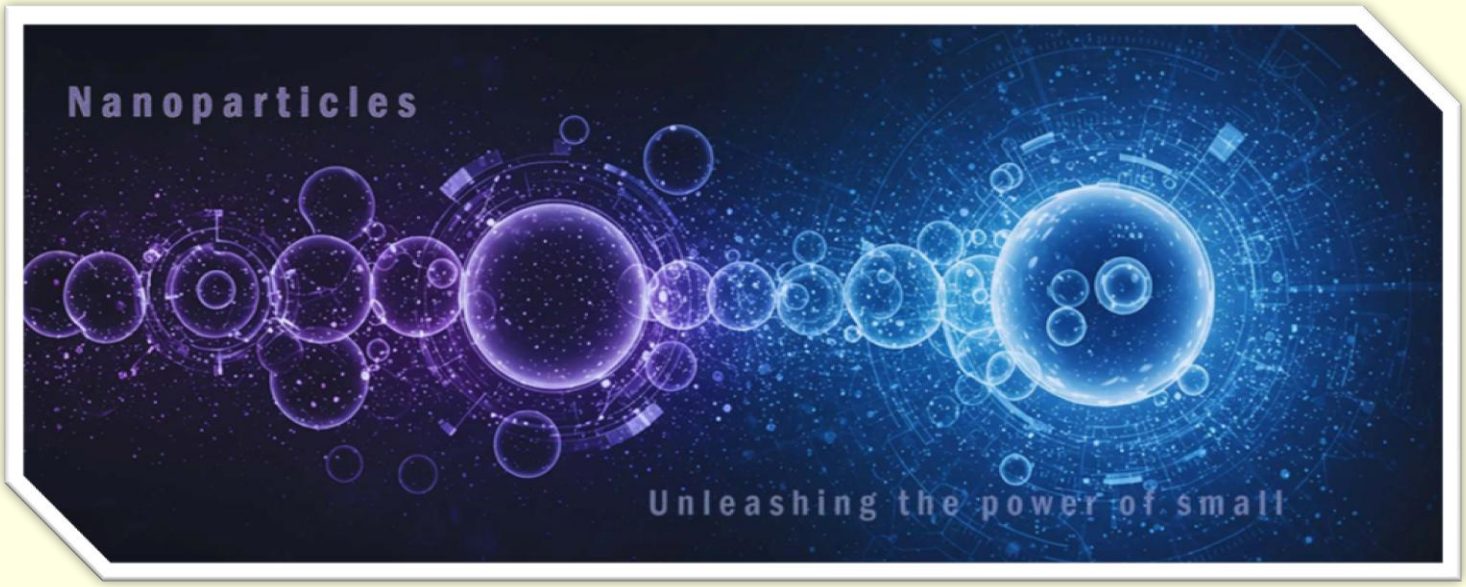


Answer all the questions below then check your answers.

1. What is the typical size range of nanoparticles?

a) 1-100 micrometres b) 1-100 millimetres

c) 1-100 nanometres d) 1-100 picometres

2. Which property of nanoparticles is most responsible for their different properties compared to the same bulk material?

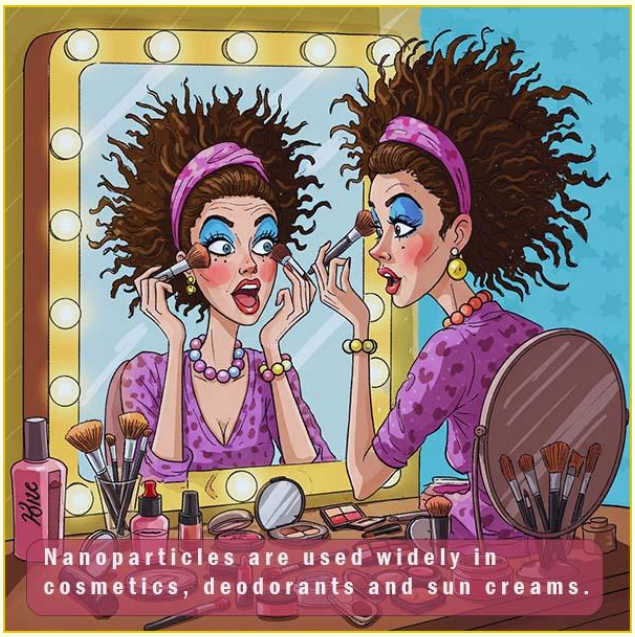
a) Their high density b) Their low melting point

c) Their very large surface area to volume ratio d) Their ability to conduct electricity

3. Titanium dioxide nanoparticles act as a photocatalyst. What activates their catalytic properties?

a) Heat b) Pressure c) Ultraviolet (UV) light d) Visible light

4. In modern sun creams, nanoparticles of titanium dioxide and zinc oxide are used because they:



a) Leave a thick white residue on the skin.

b) Are transparent on the skin.

c) Are much cheaper than larger particles.

d) Do not absorb UV rays.

5. Silver nanoparticles are used in some deodorants due to their:

a) Fragrant smell.

b) Ability to reduce sweat production.

c) Antimicrobial properties.

d) Ability to block pores.

6. What is the name given to the football-shaped carbon nanoparticles being researched for targeted drug delivery?

a) Fullerenes

b) Graphene sheets

c) Carbon nanotubes

d) Quantum dots

7. Which nanoparticles are used in clothing to prevent the build-up of static charge?

a) Silica nanoparticles

b) Silver nanoparticles

c) Zinc oxide or titanium dioxide nanoparticles

d) Carbon nanotubes

8. Quantum dots are used in LED displays to produce:

a) A dimmer image.

b) A black and white image.

c) Purer and more saturated colours.

d) A less energy-efficient display.

9. Which of the following is a potential environmental concern associated with the use of nanoparticles?

a) They are too large to affect ecosystems.

b) They always break down into harmless substances.

c) Their long-term effects on ecosystems are not yet fully known.

d) They improve the quality of soil and water.

10. Explain why using nanoparticles as catalysts can make industrial processes more efficient and cost-effective.

11. Describe how titanium dioxide nanoparticles help to keep the water in a garden pond clean.

12. Explain why the use of nanoparticles has improved the effectiveness and feel of sun creams and cosmetics.

13. Outline one way in which nanoparticles, such as buckyballs, are being developed for use in medicine.

14. Give one example of how nanoparticles are being used to revolutionise the field of electronics.

15. Briefly describe one advantage and one potential health concern associated with nanoparticles.

16. Explain the process of catalytic oxidation in a self-cleaning oven that uses transition metal nanoparticles.

17. Carbon nanotubes can be woven into cotton to create fabrics with new properties. Describe one potential application of such a fabric and explain how the nanoparticles enable this application.

Answers

1. What is the typical size range of nanoparticles?

a) 1-100 micrometres b) 1-100 millimetres

c) 1-100 nanometres d) 1-100 picometres

Answer: c) 1-100 nanometres

2. Which property of nanoparticles is most responsible for their different properties compared to the same bulk material?

a) Their high density b) Their low melting point

c) Their very large surface area to volume ratio d) Their ability to conduct electricity

Answer: c) Their large surface area to volume ratios

3. Titanium dioxide nanoparticles act as a photocatalyst. What activates their catalytic properties?

a) Heat b) Pressure c) Ultraviolet (UV) light d) Visible light

Answer: c) ultraviolet light (UV)

4. In modern sun creams, nanoparticles of titanium dioxide and zinc oxide are used because they:

a) Leave a thick white residue on the skin. b) Are transparent on the skin.

c) Are much cheaper than larger particles. d) Do not absorb UV rays.

Answer: b) Are transparent on the skin.

5. Silver nanoparticles are used in some deodorants due to their:

a) Fragrant smell.

b) Ability to reduce sweat production.

c) Antimicrobial properties.

d) Ability to block pores.

Answer: c) Antimicrobial properties.

6. What is the name given to the football-shaped carbon nanoparticles being researched for targeted drug delivery?

a) Fullerenes

b) Graphene sheets

c) Carbon nanotubes

d) Quantum dots

Answer: a) Fullerenes

7. Which nanoparticles are used in clothing to prevent the build-up of static charge?

a) Silica nanoparticles

b) Silver nanoparticles

c) Zinc oxide or titanium dioxide nanoparticles

d) Carbon nanotubes

Answer: c) Zinc oxide or titanium dioxide nanoparticles

8. Quantum dots are used in LED displays to produce:

a) A dimmer image.

b) A black and white image.

c) Purer and more saturated colours.

d) A less energy-efficient display.

Answer: c) Purer and more saturated colours.

9. Which of the following is a potential environmental concern associated with the use of nanoparticles?

a) They are too large to affect ecosystems.

b) They always break down into harmless substances.

c) Their long-term effects on ecosystems are not yet fully known.

d) They improve the quality of soil and water.

Answer: c) Their long-term effects on ecosystems are not yet fully known.

10. Explain why using nanoparticles as catalysts can make industrial processes more efficient and cost-effective.

Answer: Using nanoparticles as catalysts increases efficiency because their large surface area provides more active sites for reactions to occur. This means less catalyst is needed, making the process more cost-effective, especially when using expensive materials like precious metals.

11. Describe how titanium dioxide nanoparticles help to keep the water in a garden pond clean.

Answer: Titanium dioxide nanoparticles, when exposed to UV light, act as photocatalysts, generating reactive oxygen species. These species break down organic pollutants (like fish waste and algae), control algae growth by damaging algal cells, and reduce harmful microorganisms in the pond water, thus keeping it clean.

12. Explain why the use of nanoparticles has improved the effectiveness and feel of sun creams and cosmetics.

Answer: In sun creams, the tiny size of nanoparticles makes them transparent on the skin while still effectively absorbing and scattering UV rays without leaving a white residue. In cosmetics, nanoparticles provide a much more even and smoother coverage by filling in imperfections and scattering light uniformly.

13. Outline one way in which nanoparticles, such as buckyballs, are being developed for use in medicine.

Answer: One way nanoparticles like buckyballs are being developed for medicine is for targeted drug delivery. Drug molecules can be trapped inside buckyballs, and their surfaces can be modified with molecules that specifically recognise and bind to markers on diseased or cancerous cells, delivering the drug directly to the target.

14. Give one example of how nanoparticles are being used to revolutionise the field of electronics.

Answer: Nanoparticles and nanomaterials like graphene and carbon nanotubes are being used to make transistors in computer chips much smaller. This allows for more transistors to be packed onto a chip, leading to faster processing speeds and more powerful and smaller electronic devices.

15. Briefly describe one advantage and one potential health concern associated with nanoparticles.

Answer: Due to their incredibly small size, nanoparticles might be easily inhaled, swallowed, or absorbed through the skin and could potentially travel to different organs, interacting with cells in ways not yet fully understood, potentially causing inflammation or damage.

16. Explain the process of catalytic oxidation in a self-cleaning oven that uses transition metal nanoparticles.

Answer: In a self-cleaning oven, the liner contains transition metal nanoparticles like manganese oxide or copper oxide. As the oven heats up during cooking, these nanoparticles act as catalysts, speeding up the reaction between oxygen in the air and food residues (grease, fat). This process, called catalytic oxidation, converts the food residues into water and carbon dioxide, which then vent out of the oven, leaving it clean.

17. Carbon nanotubes can be woven into cotton to create fabrics with new properties. Describe one potential application of such a fabric and explain how the nanoparticles enable this application.

Answer: Carbon nanotubes can be woven into cotton to create a fabric that conducts electricity. One potential application is in wearable electronics with sensors embedded in the fabric to monitor vital signs like heart rate or blood pressure. The conductivity of the carbon nanotubes allows the fabric to transmit the electrical signals from the sensors to a monitoring device.