GCSE Chemistry

Nanoparticles

Mark Scheme

Time available: 45 minutes
Marks available: 42 marks

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1. (a) (i) giant lattice

allow each carbon atom is joined to three others

1

atoms in graphene are covalently bonded

*max. **2** marks if any reference to wrong type of bonding*

1

and covalent bonds are strong **or** need a lot of energy to be broken

allow difficult to break

1

(ii) because graphene has delocalised electrons

allow each carbon atom has one free electron

1

which can move throughout the structure

*do **not** accept just electrons can move.*

1

(b) because there are weak forces between molecules

allow no bonds between the layers

1

so layers / molecules can slip / slide.

1

[7]

2. (a) a layer a few hundred atoms thick

1

(b) any **two** from:

*any **two** ideas*

- less materials or save resources
- less energy
- less fuel
- less pollution / greenhouse effect / global warming
- less waste

ignore references to cost / recycling

2

[3]

3. (a) (i) In suntan creams

1

(ii) Much smaller

1

(b) (i) have a high surface area to volume ratio

1

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(ii) because a catalyst provides an alternative / different pathway / mechanism / reaction route

accept adsorption or 'increases concentration at the surface' ignore absorption

1

(that has) lower activation energy

allow weakens bonds

allow idea of increased successful collisions

*max **1** mark for incorrect chemistry eg increased energy of particles*

1

[5]

4. (a) (i) *mention of molecules / intermolecular / ionic / covalent = **max 2***

atoms / positive ions

1

any **two** from:

- (atoms / positive ions) in regular pattern / lattice / layer / giant structure (or diagram)
- delocalised electrons

  accept electrons move within / through the structure

  allow free (moving) electrons

  allow sea of electrons
- (atoms / positive ions) held together by strong / electrostatic attractions

  allow strong (metallic) bonds

2

(ii) delocalised electrons

accept electrons move within / through the structure

allow free electrons

1

(b) (i) smaller / very small

accept converse

accept 1 - 100 nanometres in size

accept a few hundred atoms

*accept larger surface area **or***

large surface area for their size

1

(ii) nanoparticles / more can fit into (tiny) gaps

allow nanosize particles have large(r) surface area

1

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[6]

5. (a) kills <u>bacteria</u>

allow destroys bacteria

ignore attacks / reacts with bacteria

ignore 'traps the smell'

or

stops growth of <u>bacteria</u>

ignore microbes

1

(b) small<u>er</u> / <u>very</u> small / tiny

assume they are referring to nanoparticles unless they state otherwise

accept 1 - 100nm in size

accept a few hundred atoms in size

accept normal size particles are (much) larg<u>er</u>

1

(c) any **one** from:

- big(ger) surface area
- react fast(er)

accept more reactive

ignore kill faster

1

(d) so they do not get released during washing
or so they do not get into rivers / ecosystem / environment

1

because this could harm fish / aquatic life
or so the socks keep their odour-preventing properties (owtte)

1

[5]

6. (a) the diameter of the tube is very small

1

(b) (i) three

1

(ii) covalent

1

(iii) bonds

1

[4]

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7. (a) nanoparticles / they are small(er)

accept 1–100 nm or a few atoms in size

1

so can easily pass through pores / skin / cell / membranes / arteries / veins / capillaries / into blood stream owtte

must be a comparative statement

can be inferred from smaller particles

allow absorbed for pass through

1

(b) any **one** from:

- may be toxic (to cells / specific cells)

  *allow may harm / damage / kill cells / organs / tissues **or** may cause cancer*

- to ensure safety **or** reduce risk **or** risk of litigation

  allow may cause allergies / side effects

  ignore harmful / dangerous unqualified eg harmful to body / people

- nanoparticles may have different properties

- to see if they pass into the body

1

(c) any **two** sensible ideas from eg:

- testing is expensive **or** testing costs money

  allow it costs money

  ignore litigation

- testing is time consuming

- don't see any reason to test since normal sized particles (of titanium oxide) do not cause harm

  *accept normal sun cream does **not** cause harm owtte*

- don't want to risk not producing a popular product (owtte)

  *eg if unsafe will have to stop production **or** have to remove product if toxic*

- testing process / unfavourable results might cause alarm / reduce sales / reduce profit (less money)

- do not want to be seen doing animal testing

2

[5]

8. (a) (i) high **1**

(ii) hundred **1**

(b) hard **1**

(c) (i) carbon **1**

(ii) four **1**

(iii) covalent **1**

(iv) all **1**

[7]

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