M1.(a) any **one** from:

- there was a flame
- energy was given out
- a new substance was formed
- the magnesium turned into a (white) powder

answers must be from the figure

1

(b) Magnesium oxide

1

(c) The reaction has a high activation energy

1

(d) 9

1

(e) They have a high surface area to volume ratio

1

(f) any **one** from:

- Better coverage
- More protection from the Sun's ultraviolet rays

1

(g) any **one** from:

- Potential cell damage to the body
- Harmful effects on the environment

1

(h) indication of $\frac{1}{1.6}$ = 0.625

and

use of indices $10^{-9} - 10^{-6} = 10^{3}$

Both steps must be seen to score first mark

1

$0.625 \times 1000 = 625$ (times bigger)

1

[9]

M2.(a) (i) Filtration

1

(ii) Chlorine

1

(b) (i) nanoparticles are small / smaller / much smaller / tiny

*allow any in range 1–100 nm or 1×10^{-9} m – 1×10^{-7} m **or** a few hundred atoms in size*

ignore numbers if stated smaller

1

(ii) they have a high surface area to volume ratio

reference to surface area without volume ratio is insufficient

*allow nanoparticles are very reactive **or** nanoparticles are more reactive than normal particles.*

1

(c) (sodium hydroxide) produces a white precipitate

accept solid / suspension or ppt or ppte for precipitate.

ignore cloudy / milky

1

which (then) dissolves / disappears (in excess sodium hydroxide)

M2 cannot be awarded unless a solid of some sort has been made

ignore names or formulae of compounds

1

[6]

M3.(a) (i) high

1

(ii) hundred

1

(b) hard

1

(c) (i) carbon

1

(ii) four

1

(iii) covalent

1

(iv) all

1

[7]

M4.(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]

M5.(a) (i) In suntan creams

1

(ii) Much smaller

1

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

1

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

accept adsorption or 'increases concentration <u>at the surface</u>'
ignore absorption

1

(that has) <u>lower</u> <u>activation energy</u>

allow weakens bonds

allow idea of increased successful collisions

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

1

[5]

M6. (a) 79

1

79

1

(b) hundred

1

(c) (i) electron(s)

1

(ii) three

1

(d) changes rate of reaction

accept lowers activation energy

or

speeds up / slows down reaction

accept reduces costs

1

(e) (i) melt

1

(ii) crosslinking

allow answers on diagram

or

(covalent) bonds between polymers / chains

allow bonds between layers
*do **not** allow intermolecular*

1

[8]

M7. (a) carbon

1

(b) each atom is joined to four other atoms

1

It has a giant structure

1

(c) very small

1

[4]

M8. (a) (i) increase

1

(ii) energy is given out to the surroundings

1

(b) (i) NO

allow 2NO

ignore nitrogen oxide

*do **not** allow equations*

1

(ii) harmful / poisonous (owtte)

allow dangerous

ignore reference to pollution / global warming

*do **not** accept references to ozone layer*

1

(c) a catalyst can speed up a chemical reaction

1

different reactions need different catalysts

1

(d) (i) smaller

accept less / tiny / very small

allow 10^{-9}

*do **not** allow small unless qualified*

1

(ii) reduce cost (owtte) **or**

ignore references to energy

save resources / raw materials (owtte)

1

[8]

M9. (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]

M10. (a) the diameter of the tube is very small

1

(b) (i) three

1

(ii) covalent

1

(iii) bonds

1

[4]