

**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  $1 \times 10^{-9} \text{ m} - 1 \times 10^{-7} \text{ m}$  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]

<b>M3.(a)</b>	(i)	high	1
	(ii)	hundred	1
(b)		hard	1
(c)	(i)	carbon	1
	(ii)	four	1
	(iii)	covalent	1
	(iv)	all	1
			<b>[7]</b>

**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 1  
*accept adsorption or 'increases concentration at the surface'*  
*ignore absorption*

(that has) lower activation energy 1  
*allow weakens bonds*  
*allow idea of increased successful collisions*  
*max 1 mark for incorrect chemistry eg increased energy of*  
*particles*

[5]

<b>M6.</b>	(a)	79	1
		79	1
	(b)	hundred	1
	(c)	(i) electron(s)	1
		(ii) three	1
	(d)	changes rate of reaction <i>accept lowers activation energy</i>  <b>or</b> speeds up / slows down reaction <i>accept reduces costs</i>	1
	(e)	(i) melt	1
		(ii) crosslinking <i>allow answers on diagram</i>  <b>or</b> (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 1  
*allow 2NO*  
*ignore nitrogen oxide*  
*do **not** allow equations*
- (ii) harmful / poisonous (owtte) 1  
*allow dangerous*  
*ignore reference to pollution / global warming*  
*do **not** accept references to ozone layer*
- (c) a catalyst can speed up a chemical reaction 1
- different reactions need different catalysts 1
- (d) (i) smaller 1  
*accept less / tiny / very small*  
*allow 10<sup>9</sup>*  
*do **not** allow small unless qualified*
- (ii) reduce cost (owtte) **or**

*ignore references to energy*

save resources / raw materials (owtte)

1

[8]

M9. (a) kills bacteria

*allow destroys bacteria*

*ignore attacks / reacts with bacteria*

*ignore 'traps the smell'*

**or**

stops growth of bacteria

*ignore microbes*

1

(b) smaller / very 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) larger*

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]**