

## Mark schemes

Q1.

- (a) limestone 1
- sodium carbonate 1
- (b) (advantage) stronger 1
- (reason) less easily damaged 1
- (c) (advantage) lower density 1
- (reason) lighter (to install) 1
- (d)
- $$\begin{array}{cc}
 \text{H} & \text{Cl} \\
 | & | \\
 \text{C} & = & \text{C} \\
 | & & | \\
 \text{H} & & \text{H}
 \end{array}$$
- 1
- (e) (add damp) litmus paper 1
- (litmus paper) is bleached  
or  
(litmus paper) turns white  
*ignore (litmus paper) turns red* 1
- (f) (polymers)  
last a long time  
*ignore references to cost*  
*allow break down slowly* 1
- (wood)  
renewable  
*allow trees can be replanted*  
*allow aesthetic reasons* 1
- (g) (percentage of aluminium =)  
 $\frac{5.94}{6.00} \times 100$  1

= 99 (%)

1

- (h) (alloy is) harder (than pure aluminium)  
*allow (alloy is) stronger (than pure aluminium)*  
*ignore references to cost*

1

[14]

Q2.

- (a) fuel

1

- (b) propene

1

- (c) (percentage yield =)

$$\frac{380}{400} \times 100$$

1

= 95 (%)

1

- (d) some ethanol changes back into ethene and steam

1

some ethanol escapes from the apparatus

1

- (e)  $C_2H_5OH + 3 O_2 \rightarrow$   
 $3 H_2O + 2 CO_2$

*allow multiples*

1

- (f) (advantages)

(fermentation) low energy usage

1

(fermentation) uses renewable raw materials

1

(disadvantages)

(fermentation) produces impure ethanol

1

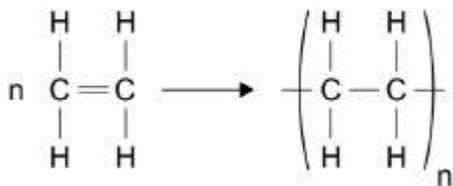
(fermentation) slow rate of reaction

1

[11]

Q3.

(a)



*if equation incorrect  
allow 1 mark for 5 single bonds  
or  
allow 1 mark for n*

2

(b) (poly(ethene)) melts

*allow converse statements about  
thermosetting polymers  
allow thermosoftening polymers melt*

1

(so) can be reshaped (into new products)

1

(c) use different (reaction) conditions

*allow use different temperatures /  
pressures*

1

(d) (in HDPE) polymer chains / molecules are closer together

*allow converse statements about LDPE  
allow (HDPE has) unbranched polymer  
chains / molecules*

1

(so) more atoms per unit volume

*allow (so) more molecules per unit  
volume*

1

(e) circle around HO- or -OH on monomer A

1

(f) H<sub>2</sub>O  
and  
HCl

*must be in this order*

1

[9]

Q4.

(a) disposal at the end of useful life

1

(b) heating in a furnace

	shaping wet clay	1
(c)	polymers	1
	propene	1
	<i>allow (a) monomer</i>	1
(d)	cracking	1
	fractional distillation	1
(e)	covalent	1
(f)	thermosetting	1
(g)	polymer A has crosslinks (between polymer molecules) or polymer B has no crosslinks (between polymer molecules)	1
		[10]

Q5.

(a)	HCOOH	1
	<i>allow HCO<sub>2</sub>H</i>	1
	propanoic acid	1
(b)	incomplete / partial ionisation	1
	<i>allow incomplete / partial dissociation</i>	1
	(because) reaction is reversible	1
	<i>allow (because) reaction is in equilibrium</i>	1
(c)	mass (of flask and contents) decreases	1
	(because) carbon dioxide is produced	1
	(and) carbon dioxide escapes (from the flask)	1
	<i>allow mark for the gas produced escapes (from the flask)</i>	1

- (d) (0.01 mol/dm<sup>3</sup>) methanoic acid has a lower pH  
*allow converse argument for ethanoic acid*  
*allow (0.01 mol/dm<sup>3</sup>) methanoic acid is a stronger acid*

1  
1

(so 0.01 mol/dm<sup>3</sup>) methanoic acid has a higher concentration of hydrogen ions

1

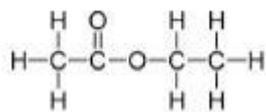
(therefore) more collisions per unit time

1

- (e) ethyl ethanoate

1

- (f)



1

[12]

Q6.

- (a) test: (use a) glowing splint  
*do not accept burning splint*

1

result: relights

*dependent on correct test in MP1*  
*ignore with a pop*

1

- (b) starch

1

cellulose

*allow glycogen*

1

- (c) 2

1

- (d) water

*allow H<sub>2</sub>O*

1

- (e) ammonia

1

nitrogen

*if no other mark awarded, allow 1 mark for NO / NO<sub>2</sub> / N<sub>2</sub>O / NO<sub>x</sub> or equivalent named compounds*

1

- (f) two polymer chains

*allow two polymer strands*

1

four (different) monomers / nucleotides

*allow four (different) bases  
allow cytosine, guanine, adenine and thymine  
allow C G A T*

1

(double) helix

*allow spiral  
if no other mark awarded, allow 1 mark for DNA*

1

[11]

Q7.

- (a) C=C bond in correct position

1

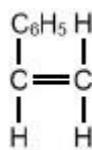
3× C-H and 1× C-C bond in correct positions

*do not accept any additional bonds or atoms*

*ignore brackets and n before and after displayed structural formula*

*an answer of*

1



*scores 2 marks*

- (b) carboxylic acid (group)

*allow carboxyl (group)*

1

- (c) water

*allow H<sub>2</sub>O*

1

- (d) (polyester is) thermosoftening

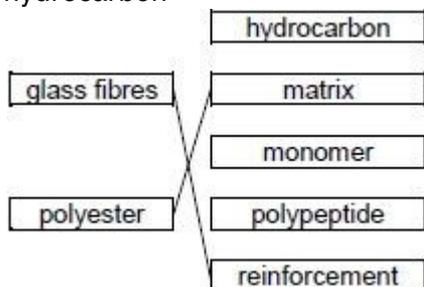
*allow (polyester is) thermoplastic  
ignore thermoforming*

1

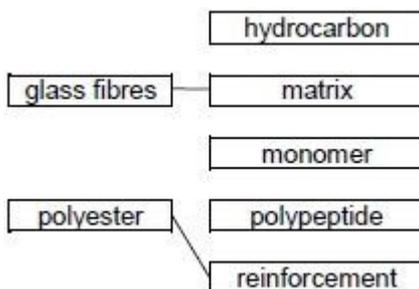
(polyester has) no cross-links  
*allow intermolecular forces are weak*  
*do not accept references to breaking*  
*covalent bonds or breaking chains*

1

(e) hydrocarbon



*allow for 1 mark:*



2

(f) any two from:  
 (to make the board)

- harder
- stronger
- tougher
- more rigid

*must be implied comparative*  
*statements*

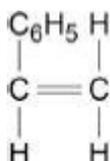
- waterproof

2

[10]

Q8.

(a)



1

(b) polymerisation

1

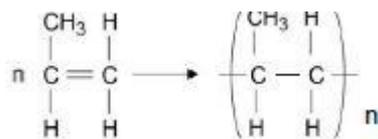
(c) monomers

1

many	1
polymers	1
<i>must be in this order</i>	
(d) Level 2: Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	3-4
Level 1: Relevant features are identified and differences noted.	1-2
Level 1: Relevant features are identified and differences noted.	1-2
No relevant content	0
Indicative content	
for coated paper cups – accept converse for poly(styrene) advantages	
<ul style="list-style-type: none"> <li>• produced from a renewable resource</li> <li>• biodegradable so breaks down</li> </ul>	
disadvantages	
<ul style="list-style-type: none"> <li>• higher energy costs</li> <li>• greater use of fossil fuels and consequent pollution</li> <li>• not recyclable so uses landfill</li> </ul>	
	[9]

Q9.

(a) water	
<i>allow H<sub>2</sub>O</i>	1
<i>allow hydrogen chloride or HCl</i>	1
(b) single C–C bond and nothing added to the trailing bonds	1
3 × H and CH <sub>3</sub> correct	
<i>must be four single bonds</i>	1
n at bottom right	1
<i>must be fully correct to score all 3 marks</i>	
<i>an answer of</i>	



scores 3 marks

(c) any two from:

- poly(propene) comes from a non-renewable source  
*allow poly(propene) will run out*
- poly(propene) requires a lot of energy to make
- poly(propene) is not biodegradable
- a wool carpet needs replacing more often  
*must refer to the carpet, not just the fibre*
- wool requires the use of large areas of land (which could be used to grow food crops)  
*ignore references to cost*  
*ignore pollution*  
*ignore landfill*  
*allow converse arguments*

2

(d) any four from:

advantages of polyester

- better flame resistance (so burns less easily)  
*allow good flame resistance so protects the firefighter*
- higher melting point (so melts less easily)  
*allow high melting point so uniform is not damaged*
- absorbs water so less likely to ignite

disadvantages of polyester:

- high density so uniform is heavy
- absorbs water so firefighter gets wet
- absorbs water so uniform becomes heavy
- justified conclusion

*allow converse arguments throughout.*  
*max 3 marks if only advantages or only disadvantages of one type of fibre*

4

[10]

Q10.

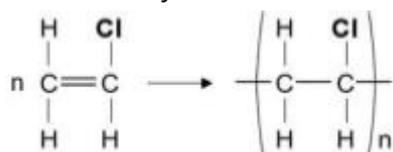
(a) chloroethene 1

(b) double bond in monomer 1

in polymer one C-C bond and two open ended bonds 1

'n' in front of monomer 1

*an answer of:*



*scores 3 marks*

(c) addition 1

(d) -OH 1

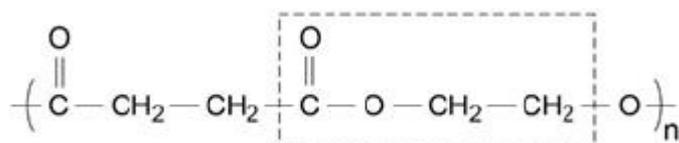
allow alcohol 1

(e) -COOH 1

(f) C=O bond 1

2 × C-O bonds 1

*an answer of:*



*scores 2 marks*

(g) water 1

(h) glucose 1

amino acids 1

(i) any two from:  
 •• two polymer chains  
 double helix

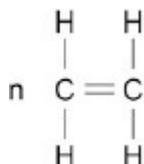
- four different monomers / nucleotides

2

[14]

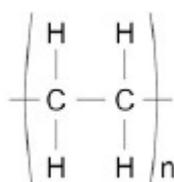
Q11.

(a) (ethene)



1

(polyethene)



1

(b) any four from:

- poly(ethene) produced by addition polymerisation whereas polyester by condensation polymerisation
- poly(ethene) produced from one monomer whereas polyester produced from two different monomers
- poly(ethene) produced from ethene / alkene whereas polyester from a (di)carboxylic acid and a diol / alcohol  
poly(ethene) is the only product formed whereas polyester water also produced
- poly(ethene) repeating unit is a hydrocarbon whereas polyester has an ester linkage

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[6]