M1.(a) (i) A **and** 3

*accept A **and** 39*

1

anomalous result

independent mark
*accept not close to other two volumes **or** correct comparison using the results*
ignore does not fit the pattern

1

(ii) any **one** from:

- volume of water (used)
  allow amount of water (used)
- time (for water to run through)
  accept rate / speed (at which water runs through)
- temperature
- mass / surface area of pad
  accept amount / size / volume / thickness of pad
- same filter funnel
  ignore other equipment

1

(iii) any **one** from:

ignore human error unqualified

- incorrect / volume / amount of water added
- reading / volume / amount of water collected
- some water does not go through the pad
  allow spillage / poorly placed pad
- not enough time allowed for water to drain through
  accept rate / speed at which water is added
- pads (from one company) not identical / faulty

1

(b) (i) any **two** from:

- it was not the best (at absorbing the water)
  *accept correct descriptions of 'not the best' / third best **or** only better than B*
- (needed) to absorb more (water)
  allow not absorbing enough (water)
- to improve their image / sales
  *accept (needs) to absorb more (water) than A and C for **2** marks*

2

(ii) any **one** from:

- cost (more)
- use (more) resources
- use (more) energy
  must relate to the company

1

[7]

M2. (a) (i) *if (fractional) distillation / hydrogenation mentioned as the method = max 1*

heat / high temperature / hot / vaporise

allow thermal decomposition

ignore evaporation

*do **not** accept 'burns'*

*do **not** accept temperature < 100*

1

catalyst **or** silica / alumina / porous pot

ignore other named catalyst

or steam

*allow heat (the vapour) to a <u>very</u> high temperature / >800°C for **2** marks*

1

(ii) C_2H_3Cl

ignore attempts to balance equation

1

(iii) single bonds between C – H, C – Cl **and** C – C

*do **not** accept symbols outside the bracket*

1

(b) (i) so that the amount of plasticiser / (sample of) PVC is the independent / only variable that affects the bending / flexibility of the samples

allow because different sizes would give different results

accept because size is a control variable

ignore references to reliability / precision etc

1

(ii) to improve the <u>reliability</u> (of the investigation)

accept to calculate a mean

*accept to check for anomalous results **or** to check the range of results*

ignore accuracy / precision etc

1

(iii) 23

*correct answer with or without working = **2** marks*

if answer is incorrect

allow $\frac{22 + 23 + 24}{3}$

***or** 21 for **1** mark*

2

(iv) (PVC) sample had been stretched / used / tested in first three tests

accept higher temperature

*allow worn **or** become weaker*

ignore (human) error

ignore more flexible / softer

ignore intermolecular forces

1

(c) does not bend (easily / much)

ignore non-biodegradable / low maintenance

***or** it is <u>not</u> flexible **or** it is rigid*

ignore sturdy / stronger / harder

1

[10]

M3. *(a) (i) polyethene / poly(ethene)*

accept polythene / polyethylene

1

(ii) needs heat / energy / high temperature / fuel (for cracking)

ignore other processes

1

produces carbon dioxide / CO_2

ignore use of CO_2 ***or*** *'produces carbon'*

1

(b) any ***three*** *from:*

- *use water from local sources* ***or*** *water from close to home*
- *recycle bottles in the UK / close to home*

  accept do not recycle in other countries / Asia
- *(reduction in distance travelled) would reduce CO_2 emitted by transport*

  accept use of transport with low / no carbon dioxide emissions
- *use tap water*
- *use glass bottles / waxed cartons / metal bottles*

  do ***not*** *accept 'do not use plastic bottles' without an alternative material*
- *do not put in landfill* ***or*** *recycle <u>more</u>*
- *reuse / refill plastic bottles*
- *<u>tax</u> imported water / plastic bottles (to offset carbon cost)*
- *make more / all plastic bottles in UK*

  answers must be about the reduction of carbon cost

3

[6]

M4. *(a) not broken down by microorganisms **or** not bio-degradable*

accept alternative answers such as:
do not rot / corrode / fade / react with atmosphere etc
any answers which imply the inertness or non-biodegradability of this plastic
accept they don't react, they are 'inert'
ignore rusting

*do **not** accept weathering*

1

*(b) (i) (have a) double bond **or** do not have maximum number of (hydrogen) atoms attached*

accept can add / react with hydrogen
accept can take part addition reactions

*do **not** accept it is a double bond*
*do **not** accept additional reactions*

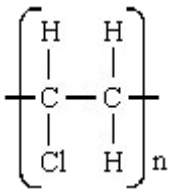
*do **not** accept has 'spare' / 'free' bond*
*do **not** accept alkene alone*

1

(ii) single bond between carbon atoms

1

all atoms correct + 2 'linking' bonds
(linking bonds need not go through bracket)



1

n moved to bottom right of <u>bracket</u> i.e. is below $\frac{1}{2}$ way on the right

first 2 marks are possible for chain structures

accept [– CHCl–CH_2–]$_n$

1

*(iii) many molecules **or** many monomers*

1

*joined / bonded / linked **or** form long chain molecules / large molecules **or** to form a long chain polymer*

*accept many alkenes **or** many (ethene) molecules*

*do **not** accept many ethene alone etc.*

to form a long polymer is not enough for 2nd mark

1

(iv) *no other substances formed (A + B → C)*

allow because double bond breaks so other atoms can add
allow one product only

*do **not** accept saturation occurs*

1

[8]

M5. *(a)* *(i)* *by heating*

pressure is neutral

using a catalyst/pot/ceramic/porcelain/aluminium oxide

1

(ii) *use bromine water/(alkaline) permanganate*

accept bromine

1

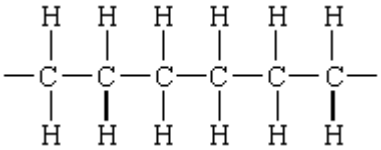
alkene makes bromine go colourless or lose its colour

accept alkane does not change the red/orange colour of bromine

not *change colour/goes clear*

1

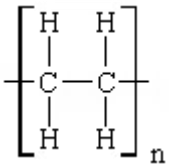
(b) *(i)*



either of these must show bonds at end

1

or



not *H on ends*

allow 3 instead of n ***not*** *any other number*

(ii) *poly(ethene) – brackets not essential*

accept polythene

1

(iii) ***large amount*** *of waste polymer/poly(ethene)/polythene/litter*

accept large amount of crude oil ***or*** *finite resource used*

1

it is not biodegradable

accept it does not

decompose/decay/break down

it causes pollution/it creates toxic

fumes when burnt are neutral

not *it is not recyclable*

2

[8]

M6. *(a) catalyst*

1

*(b) (i) made up of **only** carbon and hydrogen*

1

(ii) C_8H_{18}

1

(c) (i) ethene

1

(ii) polymerisation

1

[5]

M7. *(a) organic*

1

sediment

1

(b) (i) gases

1

(ii) bitumen

1

(c) (i) cracking

accept thermal decomposition

*do **not** accept endothermic*

1

*(ii) many **or** short **or** small (ethene) molecules*

accept monomer

*accept double bonds open up **or** break*

1

join to make larger molecules

accept polymer

accept polymerisation

*accept short chain to long chain (**or** molecules)*

*do **not** accept unsaturated to saturated*

1

(d) poor ventilation

accept limited air supply

accept insufficient oxygen

1

causes incomplete combustion

accept produces CO

1

(fumes contain) carbon monoxide which dangerous

*toxic is **not** awarded a mark*

*do **not** accept harmful or poisonous*

1

[10]

M8. *(a)* C_2H_4

1

H H H
H C C C H
H H H

Accept even if in wrong columns

1

(c) *(i)* *polythene or poly(ethene)*

1

(ii) *addition*

1

[4]