Mark schemes

Q1.

D

•CH_3 + Cl_2 → CH_3Cl + Cl•

[1]

Q2.

A

It can be removed from car exhaust gases by a catalytic converter.

[1]

Q3.

C

C-C bonds are broken

[1]

Q4.

D

CH_3Cl and HCl

[1]

Q5.

(a) C_8H_{18} + 12.5 O_2 → 8 CO_2 + 9 H_2O

Allow multiples

Ignore state symbols

1

(b) 2 NO + 2 CO → N_2 + 2 CO_2 ***or***
25 NO + C_8H_{18} → 12.5 N_2 + 9 H_2O + 8 CO_2

Allow multiples

Ignore state symbols

Allow 2NO → N_2 + O_2 (or multiples)

1

(c)

M1 moles $SO_2 = \frac{6\,490\,000 \times 10^6}{64.1}$ $\left(= \frac{6.49 \times 10^{12}}{64.1} = 1.012 \times 10^{11}\right)$

1

M2 mass CaO $= \left(\frac{1.012 \times 10^{11} \times 56.1}{1000}\right) = 5.68 \times 10^9$ (kg)

1

M2 *must be in standard form*

Correct answer in standard form scores 2 marks (allow 5.6 – 5.7 × 10^9). Answer to at least 2sf.

Correct answer in non-standard form scores 1 mark

Answers that are 5.6 – 5.7 × 10^n score 1 mark

*For other answers, allow ECF from **M1** to **M2** (but answer must be in standard form for **M2** to score)*

Alternative

M1 mass CaO = $\frac{6\,490\,000\ x\ 10^6}{64.1}\ x\ 56.1$

= 5.68 million tonnes

M2 *5.68 × 10^9 (kg)*

(7.4.. × 10^9 would score 1 mark due to use of $\frac{64.1}{56.1}$*)*

[4]

Q6.

D

CH_3Cl + Cl• CH_2Cl• + HCl

[1]

Q7.

B

[1]

Q8.

D

[1]

Q9.

(a) $C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

allow fractions / multiples

allow any correct structural representation of molecules

ignore state symbols

1

(b) **M1** working that leads to n = 13

e.g. $-6650 = -(496\mathbf{n} + 202)$

and/or $496\mathbf{n} = 6650 - 202$

and/or $496\mathbf{n} = 6448$

($\mathbf{n} = 13$)

1

M2 $C_{13}H_{28}$

*$C_{13}H_{28}$ scores **M1** and **M2** if some correct working shown*

*$C_{13}H_{28}$ with no working scores **M2** only*

*allow error carried forward for **M2** for a correct formula of an alkane from the value of **n** worked out for **M1** (but there must be some working shown leading to this incorrect value of **n**); for example, allow $C_{14}H_{30}$ if error in **M1** stemming from error in rearranging equation*

1

(c) Idea that

- alkane is not gaseous or
- equation relates to gaseous alkanes or
- it takes energy to convert it into a gas or
- that water / alkane / substances are gaseous in calculations using bond enthalpies

ignore references to heat loss, incomplete combustion, loss of evaporation, not being in standard conditions or that it is not standard state

1

(d) **M1** plotting the four values correctly (allow one error where point is ±1 square out)

*If plotted points for wrong number of C atoms for two or more compounds, cannot score **M1** or **M2**, but could score **M3** if read value off for 3C atoms*

1

M2 smooth best fit curve

M2 *best fit curve for their four points for the correct number of C atoms*

1

M3 value from their best fit line for 3 C atoms (allow ± 1 square)

M3 *need – sign (but ignore units);*

*cannot score **M3** unless there is a line on the graph*

1

(e) **M1** mass of isooctane = 692 (g)

*correct answer scores **M1** and **M2***

1

M2 3.31×10^4 or 33100 (kJ) (**3sf only**)

M2 *correct value to incorrect number of sig figs is 1 mark;*

ignore sign ;

*no error carried forward for **M2***

1

[9]

Q10.

D

[1]

Q11.

C

[1]

Q12.

D

[1]

Q13.

C

[1]

Q14.

C

[1]

Q15.

D

[1]

Q16.

C

[1]