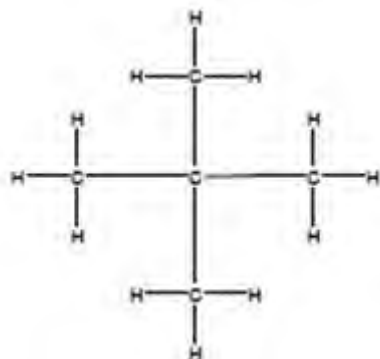


M1. (a)  $C_n H_{2n+2}$

*Allow x in place of n*

1

(b)



Chain

*Must show every bond*

*Allow branched chain*

2

(c)  $C_9H_{20}$

*Only*

1

To break the (C-C and/or C-H) bonds

*M2=0 if break C=C*

1

To make products which are in greater demand / higher value / make alkenes

*Not more useful products*

*Allow specific answers relating to question*

1

(d)  $C_5H_{12} + 3O_2 \rightarrow 5C + 6H_2O$

*Allow other balanced equations which give C and CO/CO<sub>2</sub>*

1

Causes global dimming / exacerbates asthma / causes breathing problems / makes visibility poor / smog

*Apply list principle*

*Ignore causes cancer / toxic*

1

(e)  $\frac{106.5}{143} \times 100$

1

74.48%

*Allow 74.5%*

1

3

*Only*

1

(f) 2,3-dichloro-3-methylpentane  
*Ignore punctuation*

1

C<sub>8</sub>H<sub>6</sub>Cl

*Only*

1

[13]

**M2.** (a) (i) single (C-C) bonds only/no double (C=C) bonds

1

*Allow all carbon atoms bonded to four other atoms*

*Single C-H bonds only = 0*

*C=H CE*

*C and H (atoms) only/purely/solely/entirely*

*Not consists or comprises*

*Not completely filled with hydrogen*

*CH molecules = CE*

*Element containing C and H = CE*

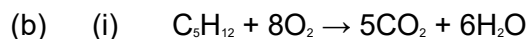
1

(ii) C<sub>n</sub>H<sub>2n+2</sub>

*Formula only*



1



*Accept multiples*  
*Ignore state symbols*

1

- (ii) gases produced are greenhouse gases/contribute to Global warming/effect of global warming/climate change

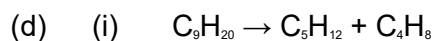
*Allow CO<sub>2</sub> or water is greenhouse gas/causes global warming*  
*Acid rain/ozone CE = 0*

1

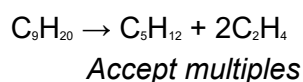
- (c) carbon

*Allow C*  
*Allow soot*

1



**OR**



1

- (ii) Plastics, polymers

*Accept any polyalkene/haloalkanes/alcohols*

1

- (iii) so the bonds break **OR** because the bonds are strong

*IMF mentioned = 0*

1

- (e) (i) 1,4-dibromo-1-chloropentane/1-chloro-1,4-dibromopentane

*Ignore punctuation*

1

(ii) Chain/position/positional  
*Not structural or branched alone*

1

[11]

**M3.** (a) Single bonds only /no double or multiple bonds;

1

Contains carbon and hydrogen only;  
*C and H only*  
*not C and H molecules*

1

Alkanes;

1

(b) (1) Fractions or hydrocarbons or compounds have different boiling points/ separation depends on bp;

*Ignore mp and vdw*

1

(2) bp depends on size/ *M*/ chain length;

*If refer to bond breaking/cracking/ blast furnace/oxygen/air 2 max*

1

(3) Temp gradient in tower or column / cooler at top of column or vice versa;

QWC

1

(4) Higher bp / larger or heavier molecules at bottom (of column) or vice versa;

*Not increasing size of fraction*  
*Not gases at top*

1

(c) Large molecules or compounds or long chain hydrocarbons (broken) into smaller molecules or compounds or smaller chain hydrocarbons;

QWC

1

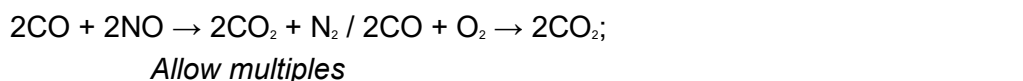
Zeolite or aluminosilicate (catalyst); 1



Smaller chain molecules are in more demand or have higher value or vice versa;  
*Insufficient to say more useful/have more uses* 1



Rh/ Pd/Pt/Ir or in words;  
*Penalise contradiction of name and symbol* 1



Greenhouse gas/ absorbs infrared radiation; 1

(e) car less powerful/ car stops/ reduced performance/ won't run smoothly/ can't accelerate;  
*Not incomplete combustion or bad effect on engine*  
*Not doesn't go as far.* 1

Test it (before sale) /Quality control etc; 1

(f) (compounds with) same molecular formula / same no and type of atoms;  
*Not atoms/elements with same molecular formula.*  
*If same chemical formula, can allow M2* 1

And different structure/ structural formula;  
*M2 consequential on M1*  
*Allow displayed formula for M2* 1

2,2,4-trimethylpentane;  
*Only (but allow numbers in any order)* 1

- M4.**
- (a) (i) fractional distillation or fractionation 1
- (ii)  $C_9H_{20}$  only 1
- (iii)  $C_{11}H_{24} + 17O_2 \rightarrow 11CO_2 + 12H_2O$  1
- (iv)  $C_{11}H_{24} + 6O_2 \rightarrow 11C + 12H_2O$  1
- (b) (i)  $C_{10}H_{22} \rightarrow C_3H_6 + C_7H_{16}$  1
- (ii) correctly drawn structure of methylpropene  
(insist on clearly drawn C-C and C=C bonds) 1
- (c) Any two from
- o chemically similar or chemically the same or react in the same way
  - o same functional group
  - o same general formula
  - o differ by  $CH_2$   
(penalise same molecular formula or same empirical formula)
- 2