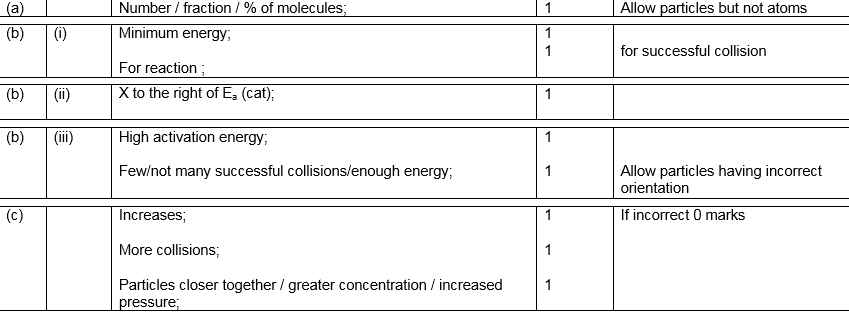
AS-LEVEL PAPER 2 PP18

**1.**



**[9]**

**2.**       (a)     (i)      C4H10 + 6O2 → 4CO2 + 5H2O

*Allow multiples*

**1**

(ii)     insufficient oxygen/low temperature/poor mixing of  
butane and air

*Allow insufficient air  
Allow lack or oxygen/air  
Do not allow no oxygen  
Not incomplete combustion*

**1**

(b)     (i)      Sulfur dioxide/SO2

*Allow sulfur trioxide/SO3*

*(allow spelling of sulphur to be sulphur)*

**1**

(ii)     It is basic/the gas (SO2) is acidic

*Idea of neutralisation  
It = calcium oxide*

**1**

(iii)     bigger surface area to react

*Do not allow cheaper*

**1**

**[5]**

**3.** (a)    Crude oil **OR** petroleum

*Not petrol.*

**1**

Fractional distillation / fractionation

*Not distillation alone.*

**1**

(b)     C12H26 + 12.5O2  12CO + 13H2O

*Allow balanced equations that produce CO2 in addition to CO.*

*Accept multiples.*

**1**

(c)    (i)      M1 Nitrogen and oxygen (from air) react / combine / allow a correct equation

*If nitrogen from petrol / paraffin / impurities CE = 0 / 2.*

**1**

M2 at high temperatures

*Allow temperatures above 1000 °C or spark.*

*Not just heat or hot.*

*M2 dependent on M1.*

*But allow 1 mark for nitrogen and oxygen together at high temperatures.*

**1**

(ii)     2NO + O2  2NO2

*Allow multiples.*

**1**

(iii)    4NO2 + 2H2O + O2  4HNO3

*Allow multiples.*

**1**

(d)     (i)      CnH2n+2

*Allow CxH2x+2*

CnH2n+2

*Allow CxH2x+2*

**1**

(ii)     C12H26  C6H14 + C6H12

*Only.*

**1**

C3H7

*Only.*

**1**

Zeolite / aluminosilicate(s)

*Ignore aluminium oxide.*

**1**

(iii)    Larger molecule / longer carbon chain / more electrons / larger surface area

**1**

More / stronger van der Waals’ forces between molecules

*Allow dispersion forces / London forces / temporary induced dipole-dipole forces between molecules.*

*If breaking bonds, CE = 0 / 2.*

**1**

(e)     2,2,3,3,4,4-hexamethylhexane

*Only.*

*Ignore punctuation.*

**1**

Chain

*Ignore branch(ed).*

**1**

(f)     Cl2

*Only.*

Cl–Cl

*Not CL2 or Cl2 or CL2 or Cl2 or CL2.*

*Ignore Chlorine.*

**1**

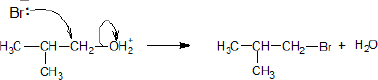
**[16]**

**4.** (a)     (i)      **M1** double-headed curly arrow from the lone pair of the bromide ion to the C atom of the CH2

*Penalise additional arrows.*

**M2**    double-headed arrow from the bond to the O atom

As follows



**2**

(ii)     **M1**    nucleophilic substitution

***M1*** *both words needed (allow phonetic spelling).*

**M2**    1-bromo(-2-)methylpropane

***M2*** *Require correct spelling in the name but ignore any hyphens or commas.*

**2**

(b)     **M1**    hydrolysis

*For* ***M1*** *give credit for ‘hydration’ on this occasion only.*

**M2**    C≡N with absorption range 2220–2260 (cm−1)

*Credit 1 mark from* ***M2*** *and* ***M3*** *for identifying C≡N* ***and*** *either O–H(acids)* ***or*** *C=O* ***or*** *C–O without reference to wavenumbers or with incorrect wavenumbers.*

**M3**    O–H(acids) with absorption range 2500–3000 (cm−1)

**OR**

C=O with absorption range 1680–1750 (cm−1)

**OR**

C–O with absorption range 1000–1300 (cm−1)

*Apply the list principle to* ***M3***

**3**

(c)     (i)      **M1** Yield / product **OR** ester increases / goes up / gets more

***M2*** *(By Le Chatelierߣs principle) the position of equilibrium is driven / shifts / moves to the right / L to R / in the forward direction / to the product(s)*

***M3 – requires a correct statement in M2***

*(The position of equilibrium moves)*

*to oppose the increased concentration of ethanol*

*to oppose the increased moles of ethanol*

*to lower the concentration of ethanol*

*to oppose the change and decrease the ethanol*

*If no reference to* ***M1****, marks* ***M2*** *and* ***M3*** *can still score BUT if* ***M1*** *is incorrect CE=0*

*If there is reference to ‘pressure’ award* ***M1*** *ONLY.*

***3***

*(ii)****M1***

*Catalysts provide an alternative route / pathway / mechanism*

***OR***

*surface adsorption / surface reaction occurs*

*For* ***M1****, not simply ‘provides a surface’ as the only statement.*

***M1*** *may be scored by reference to a specific example.*

***M2***

*that has a lower / reduced activation energy*

***OR***

*lowers / reduces the activation energy*

*Penalise* ***M2*** *for reference to an increase in the energy of the molecules.*

*For* ***M2****, the student may use a definition of activation energy without referring to the term.Reference to an increase in successful collisions in unit time alone is not sufficient for* ***M2*** *since it does not explain why this has occurred.*

***2***

***[12]***

**5.**      (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)     CnH2n+2

Formula only  
CxH2x+2

1

(b)     (i)      C5H12 + 8O2 → 5CO2 + 6H2O

Accept multiples  
Ignore state symbols

1

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

Allow CO2 or water is greenhouse gas/causes global warming  
Acid rain/ozone CE = 0

1

(c)     carbon

Allow C  
Allow soot

1

(d)     (i)      C9H20 → C5H12 + C4H8

OR

C9H20 → C5H12 + 2C2H4

Accept multiples

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

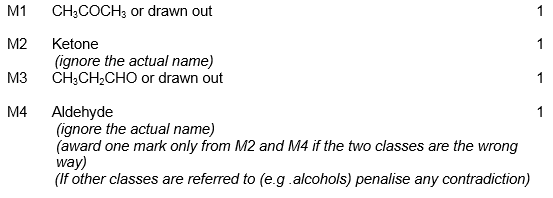
(ii)     Chain/position/positional

Not structural or branched alone

1

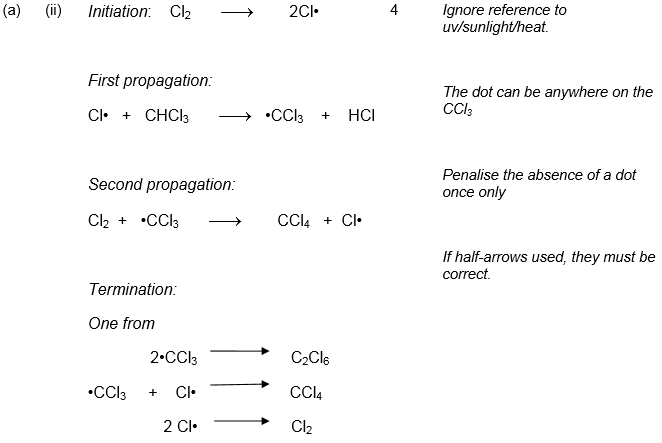
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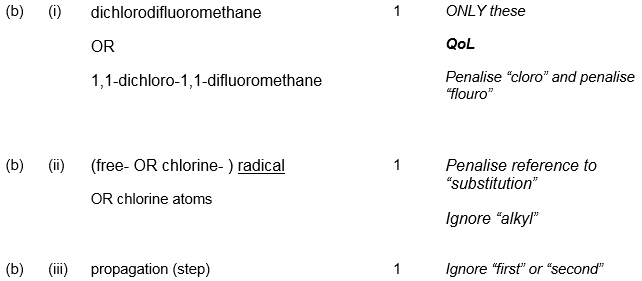
**6.**

**[4]**

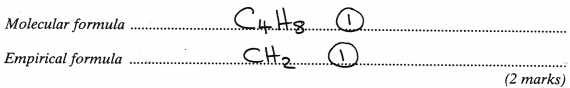
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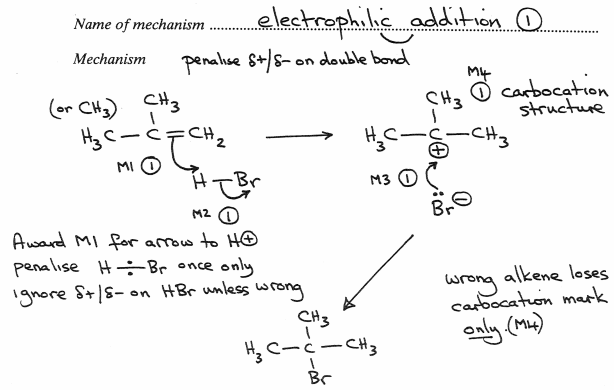


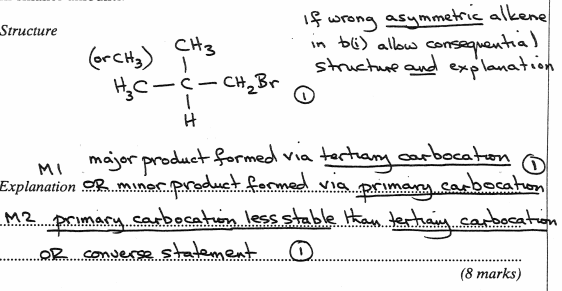


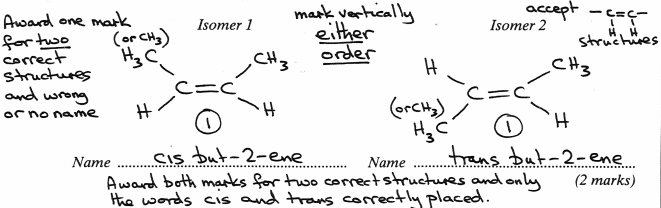
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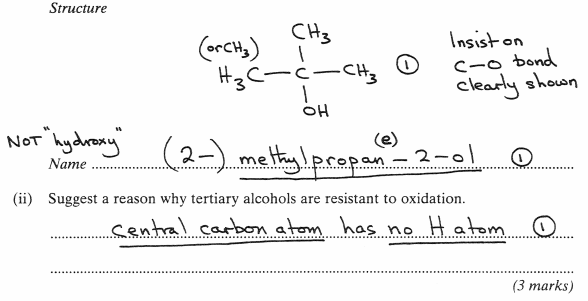
**8.**









**[15]**