AS-LEVEL PAPER 2 PP4 MS

**1.**      (a)     The molecular ion is

•        The molecule with one/an electron knocked off/lost

*Ignore the highest or biggest m/z peak*

***OR***

•        The molecule with a (single) positive charge

***OR***

•        the ion with/it has the largest/highest/biggest m/z (value/ratio)

*Ignore “the peak to the right”*

***OR***

•        the ion with/it has an m/z equal to the *M*r

*Ignore “compound”*

**1**

(b)     (i)      2(14.00307) + 15.99491 = 44.00105

*A sum is needed to show this*

**1**

(ii)     Propane/C3H8 and carbon dioxide/CO2 (and N2O) or  
they or both the gases/molecules or all three gases/molecules  
have an (imprecise) *M*r of 44.0 (OR 44)

***OR***

they have the same ***M*r** or molecular mass (to one d.p)

*This could be shown in a calculation of relative masses for propane and carbon dioxide*

**1**

(iii)     By definition

***OR***

The standard/reference (value/isotope)

*Ignore “element”*

*Ignore “atom”*

**1**

(c)     (i)      **M1 (could be scored by a correct mathematical expression)**

ΔH = ΣΔHproducts – ΣΔHreactants

OR a correct cycle of balanced equations

**M1 and M2 can be scored with correct moles as follows**Δ*H* + 2(– 46) = +82 + 3(– 286)

Δ*H* – 92 = – 776

Δ*H* = 92 – 776 OR 92 + 82 – 858

**M3**Δ*H* = – 684 (kJ mol–1) (This is worth 3 marks)

**Award 1 mark ONLY for + 684**

*Full marks for correct answer.*

*Ignore units.*

*Deduct one mark for an arithmetic error.*

**3**

(ii)     The value is quoted at a pressure of 100 kPa OR 1 bar or 105 Pa

***OR***

All reactants and products are in their standard states/their normal  
states at 100 kPa or 1 bar

*Ignore 1 atmosphere/101 kPa*

*Ignore “constant pressure”*

**1**

**[8]**

**2.**      (a)     **M1** The activation energy is the minimum / least / lowest energy

*Mark independently*

*Ignore “heat” and ignore “enthalpy”*

**M2** (energy) for a reaction to occur / to go / to start

OR (energy) for a successful / effective collision

*Ignore “breaking the bonds”*

**2**

(b)     **M1** Catalysts provide an alternative route OR an  
alternative mechanism OR alternative / different path(way)

**M2** Lowers the activation energy

*Mark independently*

*Ignore reference to “surface”*

**2**

(c)     (i)      Stay(s) the same

**1**

(ii)     Increases

*Credit “increase” or “increased”*

**1**

(iii)     Increases

*Credit “increase” or “increased”*

**1**

(iv)    Stay(s) the same

**1**

(d)     (i)      **M1** yeast or zymase

**M2** ethanol

*Ignore “enzyme”*

*In M2, ignore “alcohol” and ignore any formula*

**2**

(ii)     **M1** (Concentrated) H3PO4 OR (Concentrated) H2SO4

**M2** butan-2-ol

*Credit correct names*

*Ignore “hydrogenphosphate or hydrogensulfate”*

*Ignore “dilute” or “aq”*

*Do not penalise absence of hyphens in name.*

*In M2, ignore any formula*

**2**

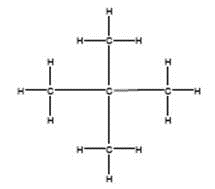
**[12]**

**3.**      (a)     Cn H2n+2

*Allow x in place of n*

**1**

(b)



Chain

*Must show every bond*

*Allow branched chain*

**2**

(c)     C9H20

*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)     C5H12 + 3O2 → 5C + 6H2O

*Allow other balanced equations which give C and CO/CO2*

**1**

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

*Apply list principle*

*Ignore causes cancer / toxic*

**1**

(e)      (x 100)

**1**

74.48%

*Allow 74.5%*

**1**

3

*Only*

**1**

(f)      2,3-dichloro-3-methylpentane

*Ignore punctuation*

**1**

C3H6Cl

*Only*

**1**

**[13]**

**4.**       (a)     Compounds with the same molecular formula

**1**

but different structures due to different positions of the  
same functional group on the same carbon skeleton/chain

**1**

(b)     Compound A is butan-1-ol only

**1**

Compound C is butanone or butan-2-one

*(penalise but-1-ol, but allow repeat error for but-2-one)  
(credit butane-1-ol)*

**1**

(c)     (i)      oxidation or redox

**1**

(ii)     K2Cr2O7 or potassium dichromate(VI)

*(penalise the dichromate ion or incorrect oxidation state,   
but mark on)*

**1**

         acidified or H2SO4 (or other identified strong acid)

*(penalise H+)*

*(do not credit the acid unless M1 has been correctly attempted)*

**1**

(iii)     (heat under) reflux

OR use excess oxidising agent

**1**

(iv)    correctly drawn structure of 2-methylpropan-2-ol

*(insist on clearly drawn C-C and C-0 bonds)*

**1**

(v)     correctly drawn structure of methanoic acid

*(insist on C-0 and C=O displayed in the formula)*

**1**

(d)     (i)      Tollens’ reagent or this whole reagent specified  
(ammoniacal silver nitrate)  
OR Fehling’s solution  
OR acidified potassium dichromate(VI)

**1**

(ii)     correctly drawn structure of methylpropanal

*(insist on C-H and C=O of aldehyde displayed in the formula)*

**1**

**[12]**

|  |  |  |
| --- | --- | --- |
| **5.** | (a) |  |
|  | (b)  (c)  (d)  (e) |  |
|  | (f) |  |

|  |  |  |
| --- | --- | --- |
|  |  |  |
|  | (g) |  |
|  | (h) |  |
|  | (i) |  |
|  | (j) |  |
| **6.** |  | |
|  |  | |

|  |  |
| --- | --- |
|  |  |

**7.** C

**8.** C

**9.** B

**10.** A

**11.** D

**12.** B

**13.** C

**14.** C

**15.** C

**16.** D

**17.** C

**18.** A

**19.** D

**20.** A

**21.** B