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Exam Preparation and Free Resources

**Name of the Student**:_____

**Max. Marks : 17 Marks** **Time : 17 Minutes**

Mark Schemes

Q1.

B

*Its $^{13}C$ NMR spectrum has 3 peaks.*

**[1]**

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Q2.

(a) **M1** Amount $CO_2 = {}^{1.89}/_{44} = 0.043$ = mol C

**1**

**M2** Amount $H_2O = {}^{0.643}/_{18} = 0.0357$ mol

**1**

**M3** Amount H = 0.036 x 2 = 0.0714 mol

**1**

**M4** Amount O = ${}^{0.913}/_{16} = 0.057$ mol

**1**

| | C | H | O |
|---|---|---|---|
| | 0.043 | 0.0714 | 0.057 |
| **M5** | 1 | 1.66 | 1.33 |
| | 3 | 5 | 4 |

**1**

*Alternate method*

***M1*** *mass C = 1.89 – (1.89 x* $\frac{32}{44}$*) = 0.515 g*
***M2*** *mass H = 1.5 – (0.515 + 0.913)*
***M3*** *= 0.0715 g*

*OR mass* ***M2*** *H = 0.643 – (0.643 x* $\frac{16}{18}$*)*
***M3*** *= 0.0714 g C H O*

| | C | H | O |
|---|---|---|---|
| **M4** | $\frac{0.515}{12} = 0.043$ | $\frac{0.0715}{1} = 0.0715$ | $\frac{0.913}{16} = 0.057$ |
| **M5** | 1 | 1.66 | 1.33 |
| | 3 | 5 | 4 |

(b) **M1** Amount $H_2O = {}^{0.26}/_{18} = 0.014$ mol

**1**

**M2** Amount $H_3Y.xH_2O = {}^{3}/_{210} = 0.014$ mol
or
Amount of $H_3Y = 2.74/192 = 0.014$ mol
(hence ratio 1:1)

**1**

*Common alternate method*
***M1*** *Amount* $H_3Y\ .xH_2O = {}^{3}/_{210} = 0.0143$ *mol*
***M2*** $M_r\ xH_3Y = \frac{2.74}{0.0143} = 192$
$M_r\ H_2O = 210 - 192 = 18$
*(hence x= 1)*

(c) 2(-) Hydroxy

**1**

(d) Number of peaks = 4
*Allow Four*

**1**

**[9]**

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Q3.

(a) Cyclopentanone

*Allow cyclopentan -1-one but no other numbers*

*Ignore spaces, commas and hyphens*

**1**

(b)

| This question is marked using Levels of Response. Refer to the Mark Scheme Instructions for Examiners for guidance. | |
|---|---|
| **Level 3**<br>**5-6 marks** | **All stages are covered and each stage is generally correct and virtually complete.**<br>Answer is well structured with no repetition or irrelevant points. Accurate and clear expression of ideas with no errors in use of technical terms. |
| **Level 2**<br>**3-4 marks** | **All stages are covered but stage(s) may be incomplete or may contain inaccuracies OR two stages are covered and are generally correct and virtually complete.**<br>Answer shows some attempt at structure Ideas are expressed with reasonable clarity with, perhaps, some repetition or some irrelevant points.<br>Some minor errors in use of technical terms |
| **Level 1**<br>**1-2 marks** | **Two stages are covered but stage(s) may be incomplete or may contain inaccuracies OR only one stage is covered but is generally correct and virtually complete.**<br>Answer includes isolated statements and these are presented in a logical order.<br>Answer may contain valid points which are not clearly linked.<br>Errors in the use of technical terms. |
| **0 marks** | Insufficient correct chemistry to gain a mark. |

**Indicative Chemistry content**

**Stage 1**: boiling points
1a) **Y** has a higher bp
1b) **Y** has H-bonds between molecules and **X** has dip-dip imf
1c) More energy required to overcome H-bonds

*Mention of covalent bond breaking loses 1c*

**Stage 2**: $^{13}C$ NMR
2a) Both have 3 peaks/absorptions in their $^{13}C$ NMR
2b) **X** has peaks at 20-50 **OR** 190-220ppm
2c) **Y** has peaks at 50-90 **OR** 90-150ppm

*(Ignore peaks at 5-40ppm - present in both)*

**Stage 3**: ir
3a) **X** has a peak (for C=O) at 1680-1750 $cm^{-1}$
3b) **Y** has peak (for O−H) at 3230-3550 $cm^{-1}$
**OR** peak (for C=C) at 1620-1680 $cm^{-1}$
3c) They would have different fingerprint regions (below 1500 $cm^{-1}$)

**6**

**[7]**

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