2020 molecule solutions

|  |  |
| --- | --- |
| **element** | **mass g** |
| carbon | 2.983 |
| hydrogen  | 0.622 |
| oxygen  | 0.995 |

**1. a**. 2.98 g 1 mark

 **b**. =4:10:1 C4H10O 2 marks

**2**. **a**. C4H10O 1 mark

 **b**.  6 marks

 butan-2-ol butan-1-ol 2-methylpropan-1-ol (methylpropan-1-ol)



 other possibilities

**3**. a. Broad absorption at 3300 cm-1 matches an alcohol group as each possibility above has. No c=O 3 marks

1. This molecule does not have an O-H but the spectrum shows -OH

**4**. **a**. 4 1 mark

**b**. the third isomer, methylpropan-1-ol can be ruled out as it has 3 environments. The other two have 4

like the spectrum.

 2 marks

5. 4 marks



triplet, low shift: quintet: singlet sextet doublet

 oxygen shield

Both of these have 5 proton environments matching the spectrum so it requires an inspection of splitting to pick the difference. The circled methyl group is a point of difference – it has one proton neighbour so it will form a doublet. The other isomer has no doublet so molecule is butan-2-ol.

**6**. Butene can undergo addition with steam and phosphoric acid to form a mixture of both forms of butanol – they would need to be separated using fractional distillation to get butan-2-ol.

 C4H8 🡪 C4H10O(g) 3 marks

 H3PO4/H2O

**7**. Butan-2-ol can be oxidised with acidic Cr2O72- to butanone 2 marks

8. Yes – but not through the broad -OH, rather by differences in the fingerprint region 2 marks

 9. Many examples propanone 2 marks