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Answers

Practice exam questions

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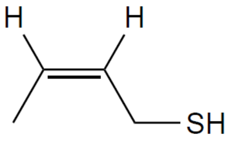
Check your answers to the questions in this issue.

The smells of sulfur (pp. 2–6)

1



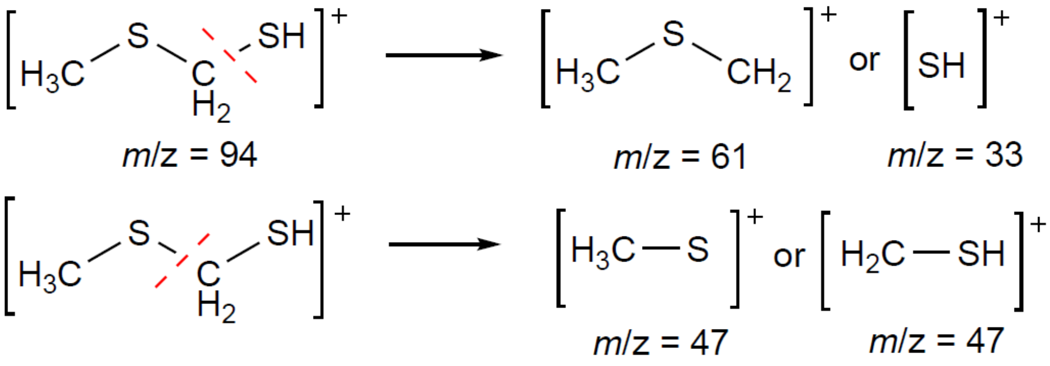
(*Z*)-but-2-ene-1-thiol

2 The peak with $m/z = 47$ is due to two ions, $[CH_3S]^+$ and $[CH_2SH]^+$ (providing either ion as an answer will gain the mark).

The peak with $m/z = 61$ is due to $[CH_3SCH_2]^+$ (or $[C_2H_5S]^+$).

The peak with $m/z = 94$ is due to the molecular ion, $[CH_3SCH_2SH]^+$ (or $[C_2H_6S_2]^+$).

The most abundant sulfur isotope is ^{32}S (94.93%), but the next most abundant is ^{34}S (4.29%), so $[C_2H_6{}^{32}S^{34}S]^+$ has $m/z = 96$.

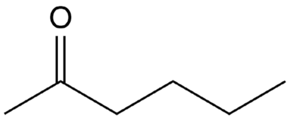


3 **a** $C_6H_{14}OS$.

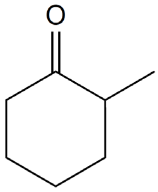
b The peak with $m/z = 134$ is due to the molecular ion, $[C_6H_{14}OS]^+$. The peak at 116 (M – 18) is due to the loss of an H_2O molecule (as loss of H and OH), forming $[C_6H_{12}S]^+$. The peak at 100 (M – 34) is due to the loss of a H_2S molecule (as loss of H and SH), forming $[C_6H_{12}O]^+$.

Food for thought: vegetables as reagents (pp. 8–13)

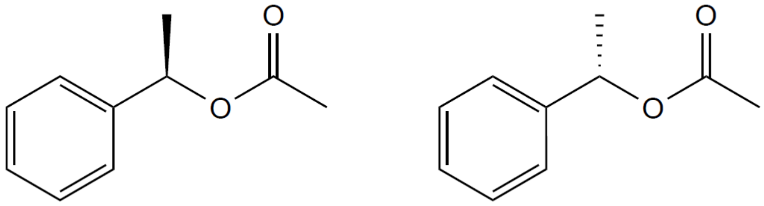
1 **a** 2-hexanone



b 2-methylcyclohexanone



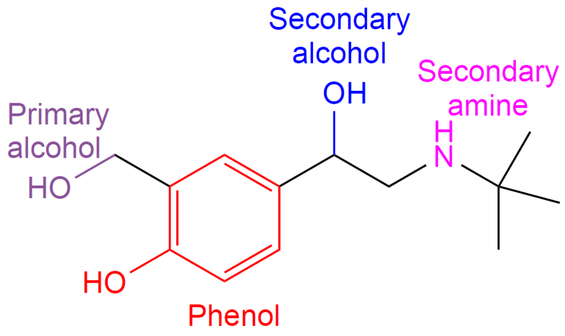
2 The two enantiomers of PhCH(Me)OCOCH$_3$



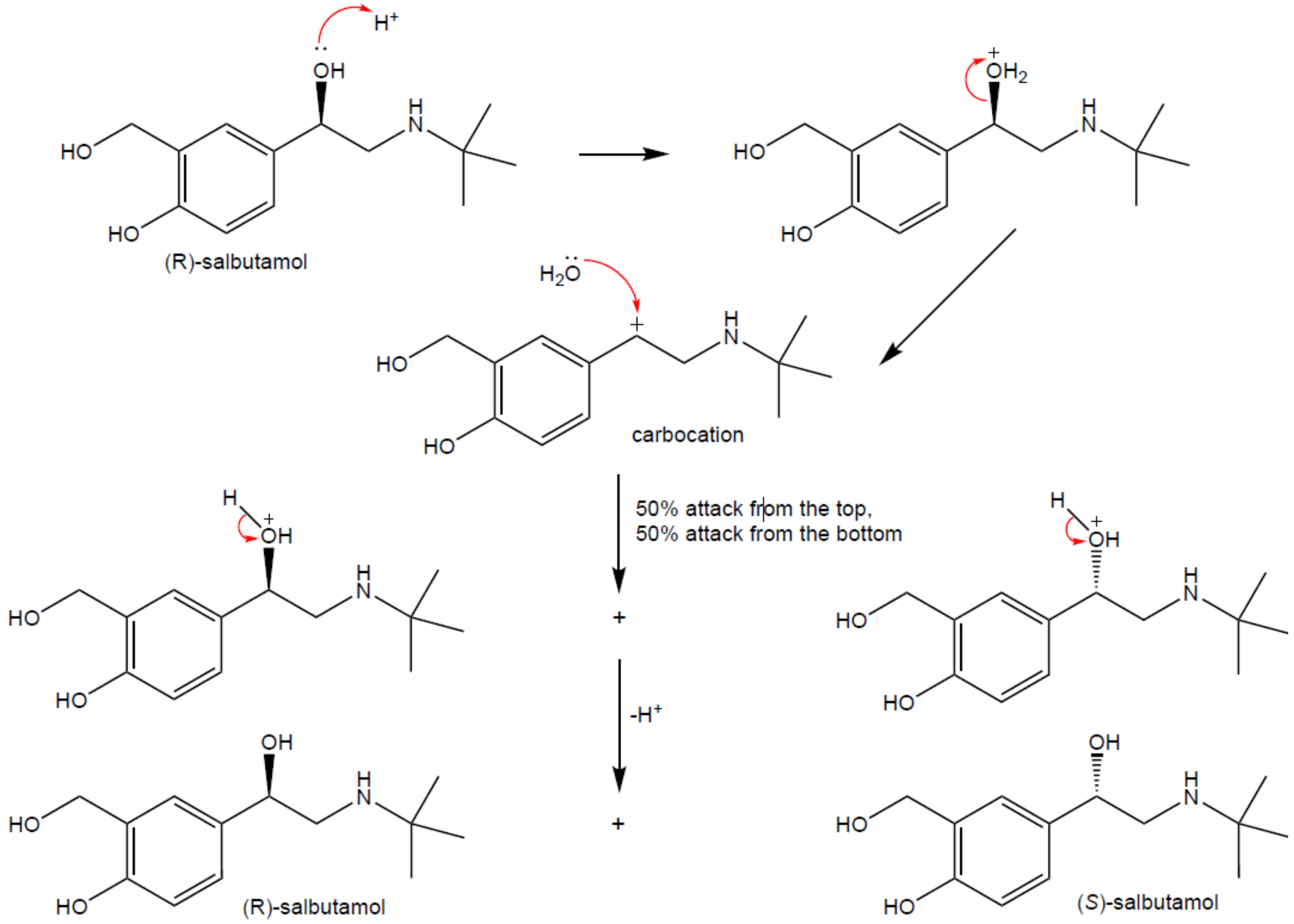
3 In the infrared spectrum, as the reduction reaction proceeds, the absorption band due to the C=O stretching vibration of 1-phenylethanone (acetophenone), around 1685 cm^{-1}, will reduce in intensity. Also, a broad absorption band between 3600 cm^{-1} and 2500 cm^{-1}, due to the O–H bond in the secondary alcohol, will appear.

4 The optical rotation value of the alcohol could be compared with that of an enantiomerically pure sample (measured under the same conditions, for example, using the same solvent and concentration). Alternatively, chiral high-performance liquid chromatography (HPLC) could be used to separate the individual enantiomers and their ratio calculated from the peak areas.

5 The functional groups in salbutamol:



6 A proposed reaction mechanism for the conversion of the *R*-enantiomer of salbutamol into a racemic mixture on heating with aqueous acid.

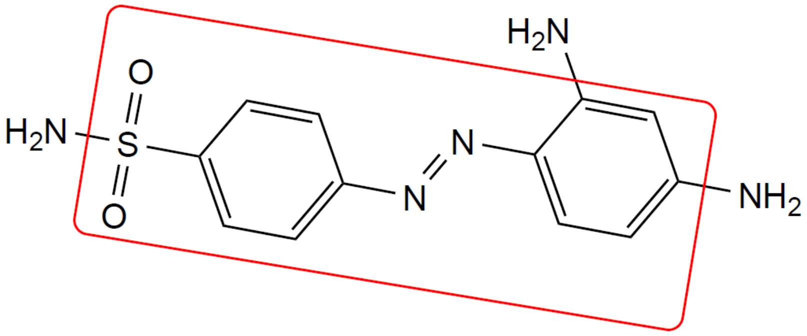


Lab page: ultraviolet-visible spectroscopy (pp. 14–18)

1 0.08 mol dm^{-3}

2 **a** Prontosil is red. It absorbs light from the ultraviolet, blue and green parts of the spectrum, while the red parts of the spectrum are reflected to our eyes.

b

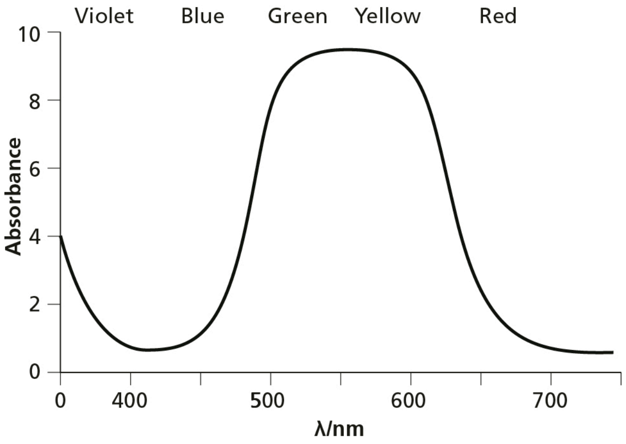


c The molecule has a conjugated system of alternating double and single bonds. The electrons in the pi orbitals of these bonds are delocalised over the whole conjugated system. These electrons absorb energy from wavelengths of light in the UV–vis part of the electromagnetic spectrum.

3 **a** Barium chromate gives rise to spectrum A, as it absorbs light of all the colours except the wavelengths responsible for yellow light (around 580 nm), which it reflects. Conversely, the pigment that produced spectrum B absorbs yellow light and reflects the wavelengths of blue, green and red light.

b The solution appears green, because the violet and red wavelengths are absorbed. The light that is transmitted through the solution are the blue, green and yellow wavelengths, which together we see as green.

c



Note that the blue and red parts of the spectrum are not absorbed, so are transmitted to our eyes, we interpret this combination of colours as purple.