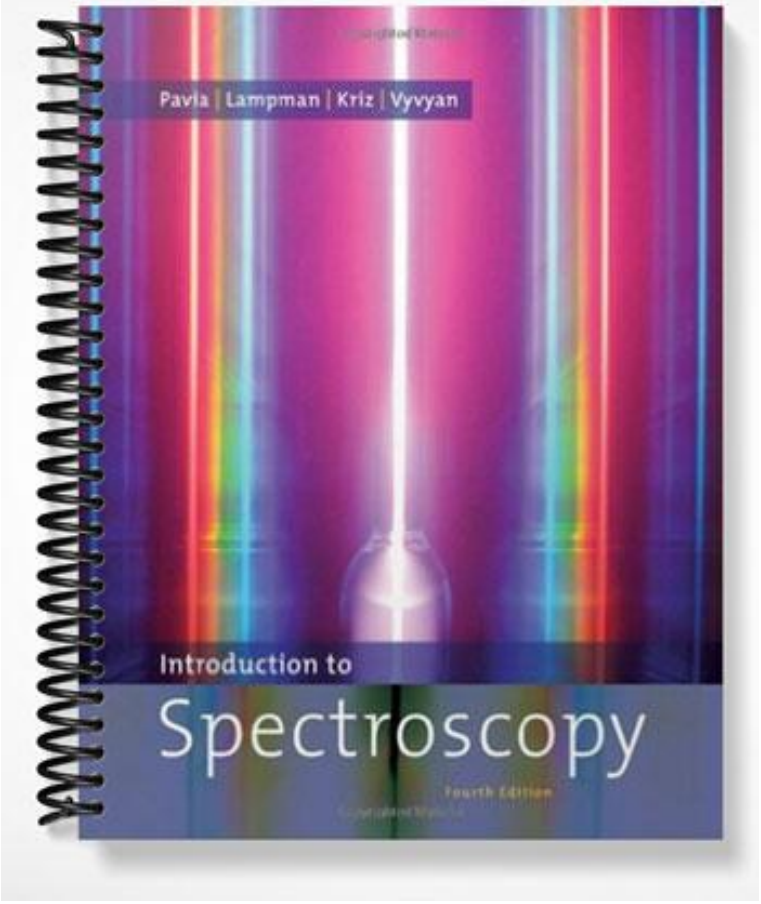
SOLUTIONS MANUAL



Answers to Problems
Introduction to Spectroscopy, 4th edition

Pavia, Lampman, Kriz, Vyvyan

CHAPTER 1

1. (a) 90.50% carbon; 9.50% hydrogen (b) C_4H_5

2. 32.0% carbon; 5.4% hydrogen; 62.8% chlorine; $C_3H_6Cl_2$

3. $C_2H_5NO_2$

4. 180.2 = molecular mass. Molecular formula is $C_9H_8O_4$.

5. Equivalent weight = 52.3

6. (a) 6 (b) 1 (c) 3 (d) 6 (e) 12

7. The index of hydrogen deficiency = 1. There cannot be a triple bond, since the presence of a triple bond would require an index of hydrogen deficiency of at least 2.

8. (a) 59.96% carbon; 5.75% hydrogen; 34.29% oxygen (b) $C_7H_8O_3$
   (c) $C_{21}H_{24}O_9$ (d) A maximum of two aromatic (benzenoid) rings

9. (a) $C_8H_8O_2$ (b) $C_8H_{12}N_2$ (c) $C_7H_8N_2O$ (d) $C_5H_{12}O_4$

10. Molecular formula = $C_8H_{10}N_4O_2$; index of hydrogen deficiency = 6

11. Molecular formula = $C_{21}H_{30}O_2$; index of hydrogen deficiency = 7

12. For the hydrolysis product: molecular formula = $C_6H_{12}O_6$; index of hydrogen deficiency = 1

    For the original carbohydrate: molecular formula = $C_{12}H_{22}O_{11}$; index of hydrogen deficiency = 2

CHAPTER 2

1. (a) Propargyl chloride (3-chloropropyne)
   (b) *p*-Cymene (4-isopropyltoluene)

(c) *m*-Toluidine (3-methylaniline)
(d) *o*-Cresol (2-methylphenol)
(e) *N*-Ethylaniline
(f) 2-Chlorotoluene
(g) 2-Chloropropanoic acid
(h) 3-Methyl-1-butanol
(i) 5-Hexen-2-one
(j) 1,2,3,4-Tetrahydronaphthalene
(k) 3-(Dimethylamino)propanenitrile
(l) 1,2-Epoxybutane

2. Citronellal

3. *trans*-Cinnamaldehyde (*trans*-3-phenyl-2-propenal)

4. Upper spectrum, *trans*-3-hexen-1-ol; Lower spectrum, *cis*-3-hexen-1-ol

5. (a) Structure B (ethyl cinnamate)
(b) Structure C (cyclobutanone)
(c) Structure D (2-ethylaniline)
(d) Structure A (propiophenone)
(e) Structure D (butanoic anhydride)
(f) Structure C (Carvone)
(g) Structure B (undecylenic aldehyde)
(h) Structure D (2-ethyl-*trans*-2-hexenal)
(i) Structure B (*N*-methylcyclohexylamine)
(j) Structure B (1-hexanethiol)

6. Poly(acrylonitrile-styrene); poly(methyl methacrylate); polyamide (nylon)

7. Propyl acetate, allyl acetate, and ethyl acrylate

8. 2-Ethyl-δ-valerolactone, 3,4-dihydro-6-methyl-2*H*-pyran-2-one, and 5,6-dihydro-2*H*-pyran-2-one

9. α-Methylene-γ-butyrolactone, γ–methylene-γ-butyrolactone, and γ-valerolactone

10. 4-Penten-1-ol, 3-methyl-2-buten-1-ol, and 3-methyl-3-buten-1-ol

11. Resonance effect: the amino group pushes electron density into the ring and into the carbonyl group resulting in a lower frequency carbonyl group (more single bond character). A nitro group withdraws electrons resulting in higher frequency carbonyl absorption (more double bond character).