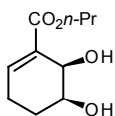


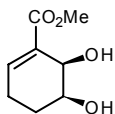
6-Carboxyethyl-(1S,2S)-1,2-dihydroxycyclohex-3-ene (11).

(378 mg, 84%) colorless crystals; m.p. 91-92 °C (ethyl acetate/hexanes); R_f 0.29 (1:1 ethyl acetate/hexanes); $[\alpha]_D^{23}$ -53.3 (c 1.6, CHCl_3); IR (film) ν 3400, 2981, 2937, 2909, 1731, 1647, 1372, 1251, 1105, 1073, 993, 921, 878, 761, 670 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.09 (t, $J = 4.1$ Hz, 1H), 4.50 (d, $J = 3.8$ Hz, 1H), 4.22 (q, $J = 7.2$ Hz, 2H), 3.81-3.93 (m, 1H), 3.51 (s, 1H), 2.69 (s, 1H), 2.37-2.50 (m, 1H), 1.79-1.94 (m, 1H), 1.66-1.75 (m, 1H), 1.29 (t, $J = 7.2$ Hz, 3H) ppm; ^{13}C NMR (75 MHz, CDCl_3) δ 167.1, 143.1, 130.1, 67.7, 65.7, 60.9, 25.0, 23.9, 14.2 ppm; MS (EI) m/z (%): 186(M^+ , 1), 143(12), 142(90), 105(12), 97(16), 96(100), 68(38), 67(10), 41(12); HRMS calcd for $\text{C}_9\text{H}_{14}\text{O}_4$ 186.0892, found 186.0892; *Anal.* calcd: C 58.05; H 7.58. found C 57.97; H 7.51.



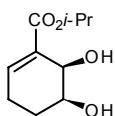
6-Carboxypropyl-(1S,2S)-1,2-dihydroxycyclohex-3-ene (13).

(276 mg, 91%) colourless crystals; m.p. 73-75 °C; R_f 0.15 (1:1 ethyl acetate/hexanes); $[\alpha]_D^{20}$ -50.85 (c 1.5, CHCl_3); IR (film) ν 3406, 2966, 2934, 2876, 1707, 1648, 1247 cm^{-1} ; ^1H NMR (300 MHz, CDCl_3) δ 7.14 (t, $J = 3.4$ Hz, 1H), 4.55 (d, $J = 3.4$ Hz, 1H), 4.16 (t, $J = 6.6$ Hz, 2H), 3.92 (br s, 1H), 3.93 (m, 1H), 3.28 (br s, 1H), 3.56-2.54 (m, 1H), 2.31-2.16 (m, 1H), 1.98-1.85 (m, 1H), 1.81-1.69 (m, 1H), 1.73 (qt, $J = 7.4$, $J = 6.6$ Hz, 2H), 1.00 (t, $J = 7.4$ Hz, 1H) ppm; ^{13}C NMR (75 MHz, CDCl_3) δ 167.0, 143.0, 130.5, 68.3, 66.4, 65.1, 24.53, 24.49, 21.9, 10.4 ppm; MS (EI) m/z (%): 200(M^+ , 3), 156($\text{M}^+ - \text{C}_2\text{H}_4\text{O}$, 68), 141(17), 114(80), 96(100); HRMS (EI) calcd for $\text{C}_{10}\text{H}_{16}\text{O}_4$: m/z 200.1048; found: 200.1052. *Anal.* Calcd. for $\text{C}_{10}\text{H}_{16}\text{O}_4$: C, 59.98; H, 8.05. Found: C, 59.87; H, 8.04.



6-Carboxymethyl-(1*S*,2*S*)-1,2-dihydroxycyclohex-3-ene (14).

(848 mg, 84%), colorless oil; R_f 0.29 (1:1 ethyl acetate/hexanes); $[\alpha]_D^{23}$ -52.9 (*c* 2.9, CHCl₃); IR (film) ν 3411, 2998, 2951, 2668, 1703, 1648, 1437, 1370, 1254, 1210, 1160, 1108, 1073, 1041, 995, 963, 920, 878, 852, 757 670 cm⁻¹; ¹H NMR (300 MHz, CDCl₃) δ 7.02 (dd, $J = 4.4$, $J = 3.3$ Hz, 1H), 4.46 (d, $J = 3.1$ Hz, 1H), 4.05 (s, 1H), 3.70 (m, 4H), 3.52 (s, OH), 2.42-2.30 (m, 1H), 2.21-2.09 (m, 1H), 1.18-1.61 (m, 1H) ppm; ¹³C NMR (75 MHz, CDCl₃) δ 161.2, 143.3, 130.4, 68.5, 64.8, 51.8, 24.7, 24.4 ppm; MS (EI) m/z (%): 172(M⁺, 3), 129(11), 128(100), 97(70), 68(30); HRMS calcd for C₈H₁₂O₄ 172.0731, found 172.0730.



6-Carboxyisopropyl-(1*S*,2*S*)-1,2-dihydroxycyclohex-3-ene (15).

(203 mg, 56%) pale yellow oil; $R_f = 0.31$ (6:4 ethyl acetate/hexane); $[\alpha]_D^{20}$ -44.74 (*c* 1.3, CHCl₃); ¹H NMR (300 MHz, CDCl₃) δ 7.08 (t, $J = 3.9$ Hz, 1H), 5.11 (hept, $J = 6.3$ Hz, 1H), 4.51 (br s, 1H), 4.48 (br m, 1H), 3.94-3.84 (m, 1H), 3.59 (d, $J = 2.6$ Hz, 1H), 2.7 (d, $J = 5.7$ Hz, 1H), 2.52-2.38 (m, 1H), 2.67-2.12 (m, 1H), 1.95-1.81 (m, 1H), 1.77-1.66 (m, 1H), 1.29 (d, $J = 6.3$ Hz, 3H), 1.28 (d, $J = 6.3$ Hz, 3H) ppm; ¹³C NMR (75 MHz, CDCl₃) δ 166.6, 142.7, 130.4, 68.4, 67.7, 65.7, 25.1, 23.8, 21.9, 21.8 ppm; IR (film) ν 3403, 2980, 1706, 1260 cm⁻¹; MS (EI) m/z (%): 156(M⁺-C₂H₄O, 50), 141(18), 114(100), 96(94); HRMS (EI) calcd for C₁₀H₁₆O₄: m/z 200.1049; found: 200.1054.