Supporting Information

Ruthenium-Catalyzed Alkylation of Oxindole with Alcohols

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I. General methods.

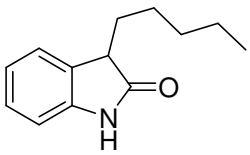
NMR chemical shifts were measured in ppm and coupling constants in Hertz (Hz). The shifts were measured relative to the signals for residual $CHCl_3$ (7.26 ppm), $CDCl_3$ (77.0 ppm), $(CD_2H)SOCD_3$ (2.50 ppm), and $(CD_3)_2SO$ (39.4 ppm). Multiplicities are reported as follows; s = singlet, d = doublet, t = triplet, q = quartet, m = multiplet, bs = broad singlet. All ^{13}C NMR spectra were proton decoupled. Melting points are uncorrected. Thin layer chromatography was performed on aluminum plates precoated with silica gel using the solvent systems indicated. Compounds were visualized by illumination using a UV lamp (254 nm) or by charring after dipping in a solution of anisaldehyde (15 g) in ethanol (250 mL) and concentrated sulfuric acid (2.5 mL). Chromatographic purifications were performed by silica-gel chromatography.[1] All compounds on which HRMS were performed exhibited pure ^1H NMR spectra and showed one spot by TLC analysis. Commercially available reagents were used as received unless otherwise indicated. All solvents were of HPLC grade. Toluene and *p*-dioxane were dried over 4 Å molecular sieves.

II. Experimental Procedures

General Method for 3-Alkylation of Oxindole

$[RuCl_3 \cdot xH_2O]$ (8.3 mg, 0.04 mmol), PPh_3 (21.0 mg, 0.08 mmol), NaOH (8.0 mg, 0.2 mmol), oxindole (266 mg, 2.0 mmol), and the alcohol (2.2 mmol) were placed in a 7-mL thick-walled screw-cap vial. The vial was purged with Ar and sealed with a screw-cap. The mixture was placed in an aluminum block preheated to 110 °C and stirred for 20 h or until ^1H NMR of the crude reaction mixture showed complete consumption of the oxindole. The reaction mixture was allowed to cool to room temperature followed by dilution with CH_2Cl_2 (10 mL). SiO_2 was added and the suspension was concentrated under reduced pressure to afford a powder that was purified by use of silica-gel chromatography (3 × 15 cm SiO_2, 9:1 → 4:1 → 3:7 *n*-Hexane:EtOAc).

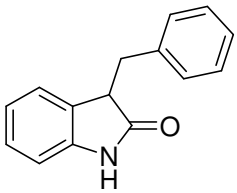
(1) Still, W. C.; Kahn, M.; Mitra, A. *J. Org. Chem.* **1978**, *43*, 2923-2925.



3-Pentyl-1,3-dihydroindol-2-one (3) [Table 3, Entry 1]

Isolated yield: 89%

Colorless oil; R_f = 0.18 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.99 (bs, 1H), 7.26-7.17 (m, 2H), 7.08-6.98 (m, 1H), 6.92 (d, *J* = 7.6 Hz, 1H), 3.48 (t, *J* = 5.9 Hz, 1H), 2.28-1.86 (m, 2H), 1.55-1.16 (m, 6H), 0.88 (t, *J* = 6.9 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.8, 141.6, 129.9, 127.7, 124.1, 122.2, 109.7, 46.1, 31.8, 30.5, 25.4, 22.4, 14.0; IR (Neat) 3211, 3094, 3060, 3031, 2955, 2928, 2858, 1701, 1620, 1470, 1338, 1219, 1100, 749 cm^{-1}; HRMS (ESI+) calcd. for $C_{15}H_{21}N_2O$ ($[M+H+MeCN]^+$) 245.1654, found 245.1649.

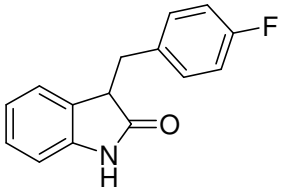


3-Benzyl-1,3-dihydroindol-2-one [Table 3, Entry 2]

Isolated yield: 89%

Pale yellow needles; Mp. 129-130 °C (heptane:EtOAc), Lit.[2] 129-131 °C; R_f = 0.12 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.41 (bs, 1H), 7.30-7.11 (m, 6H), 6.90 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.83 (d, *J* = 7.8 Hz, 1H), 6.75 (d, *J* = 7.4 Hz, 1H), 3.76 (dd, *J* = 9.2, 4.5 Hz, 1H), 3.50 (dd, *J* = 13.7, 4.6 Hz, 1H), 2.95 (dd, *J* = 13.7, 9.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.9, 141.4, 137.8, 129.4, 128.9, 128.3, 127.9, 126.6, 124.8, 122.0, 109.7, 47.5, 36.6; IR (Neat) 3207, 3086, 3028, 2921, 2893, 1701, 1619, 1469, 1402, 1304, 1228, 1154, 749, 697 cm^{-1}; MS: *m/z* 223 [M].

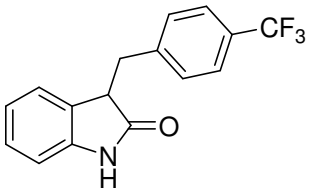
(2) Elliott, I. W.; Rivers, P. *J. Org. Chem.* **1964**, *29*, 2438-2440.



3-(4-Fluoro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 3]

Isolated yield: 83%

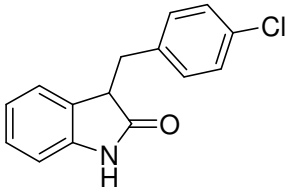
Colorless needles; Mp. 151-152 °C (heptane:EtOAc); R_f = 0.11 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.13 (bs, 1H), 7.17 (ddt, *J* = 7.6, 1.4, 0.8 Hz, 1H), 7.14-7.05 (m, 2H), 6.97-6.86 (m, 3H), 6.86-6.78 (m, 2H), 3.72 (dd, *J* = 8.5, 4.6 Hz, 1H), 3.41 (dd, *J* = 13.8, 4.6 Hz, 1H), 3.01 (dd, *J* = 13.8, 8.5 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.6, 161.7 (d, *J* = 245 Hz), 141.8, 133.2 (d, *J* = 3.2 Hz), 130.8 (d, *J* = 7.9 Hz), 128.6, 128.1, 124.6, 122.1, 115.1 (d, *J* = 21.2 Hz), 109.8, 47.6, 35.6; ^{19}F NMR (282 MHz, $CDCl_3$) δ -116.69 (dd, *J* = 9.0, 4.9 Hz, 1F); IR (Neat) 3210, 3092, 3071, 2927, 2892, 1707, 1620, 1601, 1509, 1471, 1300, 1224, 831, 751 cm^{-1}; HRMS (ESI+) calcd. for $C_{15}H_{13}FNO$ ($[M+H]^+$) 242.0981, found 242.0987.



3-(4-Trifluoromethyl-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 4]

Isolated yield: 86%

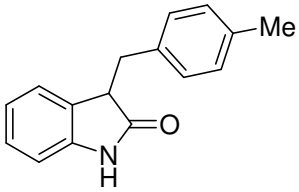
Colorless needles; Mp. 112-113 °C (heptane:EtOAc); R_f = 0.092 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.80 (bs, 1H), 7.49 (d, *J* = 8.0 Hz, 2H), 7.27 (d, *J* = 8.0 Hz, 2H), 7.24-7.14 (m, 1H), 6.95 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.88-6.81 (m, 2H), 3.78 (dd, *J* = 8.5, 4.7 Hz, 1H), 3.49 (dd, *J* = 13.8, 4.7 Hz, 1H), 3.09 (dd, *J* = 13.8, 8.5 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.2, 141.7, 141.4, 129.7, 129.0 (q, *J* = 32.4 Hz), 128.3, 128.3, 125.2 (q, *J* = 3.8 Hz), 124.6, 124.1 (q, *J* = 271.9 Hz), 122.2, 109.9, 47.1, 36.2; ^{19}F NMR (282 MHz, $CDCl_3$) δ -62.82 (s, 3F); IR (Neat) 3207, 3093, 3062, 3031, 2929, 2894, 2839, 1706, 1620, 1471, 1418, 1323, 1230, 1164, 1120, 1109, 1067, 1019, 836, 751 cm^{-1}; HRMS (ESI+) calcd. for $C_{18}H_{16}F_3N_2O$ ($[M+H+MeCN]^+$) 333.1215, found 333.1207.



3-(4-Chloro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 5]

Isolated yield: 89%

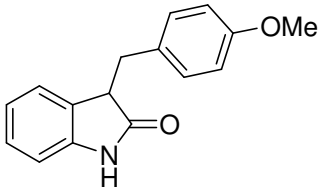
Pale yellow crystals; Mp. 138-140 °C (heptane:EtOAc); R_f = 0.11 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.86 (bs, 1H), 7.20-7.15 (m, 3H), 7.08 (d, *J* = 8.4 Hz, 2H), 6.94 (t, *J* = 7.5 Hz, 1H), 6.84 (d, *J* = 8.0 Hz, 2H), 3.73 (dd, *J* = 8.5, 4.6 Hz, 1H), 3.41 (dd, *J* = 13.8, 4.6 Hz, 1H), 2.99 (dd, *J* = 13.8, 8.5 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.4, 141.4, 136.0, 132.5, 130.7, 128.5, 128.4, 128.1, 124.6, 122.1, 109.8, 47.3, 35.8; IR (Neat) 3211, 3090, 3062, 3030, 2924, 2859, 1704, 1620, 1491, 1470, 1408, 1337, 1302, 1228, 1196, 1155, 1093, 1016, 825 cm^{-1}; HRMS (ESI+) calcd. for $C_{15}H_{13}ClNO$ ($[M+H]^+$) 258.0686, found 258.0681.



3-(4-Methyl-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 6]

Isolated yield: 92%

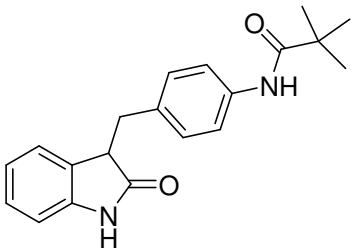
White powder; Mp. 149-150 °C (heptane:EtOAc); R_f = 0.11 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.28 (bs, 1H), 7.16 (ddt, *J* = 7.7, 1.2, 0.8 Hz, 1H), 7.06 (bs, 4H), 6.90 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.84-6.76 (m, 2H), 3.73 (dd, *J* = 9.1, 4.5 Hz, 1H), 3.45 (dd, *J* = 13.7, 4.4 Hz, 1H), 2.91 (dd, *J* = 13.7, 9.1 Hz, 1H), 2.31 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.0, 141.5, 136.1, 134.6, 129.2, 129.1, 129.0, 127.8, 124.8, 121.9, 109.8, 47.6, 36.2, 21.0; IR (Neat) 3204, 3091, 3056, 3024, 2921, 2858, 1702, 1619, 1515, 1485, 1470, 1408, 1228, 1101, 814, 749 cm^{-1}; HRMS (ESI+) calcd. for $C_{16}H_{16}NO$ ($[M+H]^+$) 238.1231, found 238.1232.



3-(4-Methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 7]

Isolated yield: 83%

Colorless needles; Mp. 110-111 °C, Lit.[3] 114 °C; R_f = 0.07 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.34 (bs, 1H), 7.21-7.13 (m, 1H), 7.13-7.02 (m, 2H), 6.91 (dt, *J* = 7.5, 1.1 Hz, 1H), 6.82 (d, *J* = 7.9 Hz, 2H), 6.80-6.72 (m, 2H), 3.77 (s, 3H), 3.71 (dd, *J* = 8.9, 4.5 Hz, 1H), 3.42 (dd, *J* = 13.8, 4.5 Hz, 1H), 2.92 (dd, *J* = 13.8, 8.9 Hz, 1H);^{13}C NMR (75 MHz, $CDCl_3$) δ 180.3, 158.5, 141.8, 130.6, 129.9, 129.3, 128.2, 125.0, 122.2, 113.9, 110.1, 55.4, 48.1, 36.0; IR (Neat) 3194, 3091, 3059, 3032, 3011, 2953, 2932, 2915, 2835, 1703, 1615, 1511, 1470, 1441, 1337, 1301, 1246, 1101, 1034, 828, 750 cm^{-1}; MS: *m/z* 253 [M].



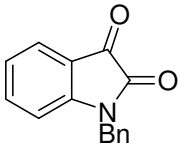
2,2-Dimethyl-*N*-[4-(2-oxo-2,3-dihydro-1*H*-indol-3-ylmethyl)-phenyl]-propionamide [Table 3, Entry 8]

Isolated yield: 74%

White powder; Mp. 212-214 °C (CH_3CN); R_f = 0.48 (CH_2Cl_2:CH_3OH = 9:1);^{1}H NMR (300 MHz, DMSO-d_6) δ 10.28 (bs, 1H), 9.08 (bs, 1H), 7.44 (d, *J* = 8.5 Hz, 2H), 7.08 (t, *J* = 7.5 Hz, 1H), 7.02 (d, *J* = 8.5 Hz, 2H), 6.90 (d, *J* = 7.2 Hz, 1H), 6.83 (t, *J* = 7.4 Hz, 1H), 6.70 (d, *J* = 7.7 Hz, 1H), 3.75 (dd, *J* = 7.5, 5.0 Hz, 1H), 3.25 (dd, *J* = 13.7, 5.0 Hz, 1H), 2.91 (dd, *J* = 13.7, 7.5 Hz, 1H), 1.19 (s, 9H); ^{13}C NMR (50 MHz, DMSO-d_6) δ 178.1, 176.2, 142.6, 137.5, 132.6, 129.2, 128.9, 127.5, 124.3, 120.9, 119.9, 109.1, 46.5, 34.6, 27.2 (one peak under DMSO multiplet); IR (Neat) 3321, 3201, 3108, 3029,

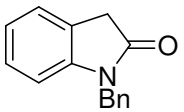
(3) Windaus, A.; Eickel, W. *Chem. Ber.* **1924**, *57*, 1871-1875.

2962, 2923, 2874, 2816, 1698, 1659, 1601, 1514, 1470, 1411, 1322, 1241, 925, 828, 749 cm^{-1}; HRMS (ESI+) calcd. for $C_{20}H_{23}N_2O_2$ ($[M+H]^+$) 323.1752, found 323.1756.



1-Benzyl isatin (SI 1)[4]

Isatin (2.94 g, 20 mmol) was placed in a 250 mL round bottom flask and dissolved in DMF (37 mL). The resulting bright orange solution was cooled to 0 °C by the use an ice/water bath. NaH (55% dispersion in mineral oil, 916 mg, 21 mmol) was added portionwise resulting in a deep purple solution. The solution was stirred until any effervescence had ceased (~15 min). Benzyl bromide (4.10 g, 2.85 mL, 24 mmol) was added in a dropwise manner and the resulting red-brown mixture was stirred for an additional 30 min at 0 °C. H_2O (176 mL) was added to precipitate the product. The product was filtered and recrystallized from EtOH. Yield 3.52 g (74%) of the title product as orange needles: Mp. 129-130 °C (EtOH), Lit.[5] 133-135 °C (EtOH:H_2O); R_f = 0.66 (EtOAc); ^{1}H NMR (300 MHz, $CDCl_3$) 7.62 (ddd, *J* = 7.6, 1.4, 0.6 Hz, 1H), 7.48 (dt, *J* = 7.6, 1.4 Hz, 1H), 7.41-7.27 (m, 5H), 7.09 (dt, *J* = 7.6, 0.8 Hz, 1H), 6.79-6.75 (m, 1H), 4.94 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$ δ 183.2, 158.2, 150.6, 138.3, 134.4, 129.0, 128.1, 127.4, 125.3, 123.8, 117.6, 111.0, 44.0; IR (Neat) 3062, 3031, 2954, 2929, 1736, 1612, 1496, 1470, 1437, 1350, 1177, 1096 cm^{-1}; MS: *m/z* 237 [M].

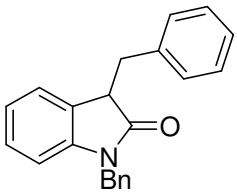


1-Benzyl-1,2-dihydroindol-2-one (SI 2)

1-Benzyl isatin (**SI 1**) (2.37 g, 10 mmol) was suspended in hydrazine hydrate (11 mL) and the mixture was heated to reflux until the gas evolution had stopped (4 h). The reaction mixture went from orange via green to yellow within this time. The reaction mixture was allowed to cool to ambient temperature and extracted with EtOAc (3 x 25 mL). The combined organic phases were dried over Na_2SO_4, filtered,

(4) Marti, C.; Carreira E. M. *J. Am. Chem. Soc.* **2005**, *127*, 11505-11515.
(5) Autrey, R. L.; Tahk, F. C. *Tetrahedron* **1967**, *23*, 901-917

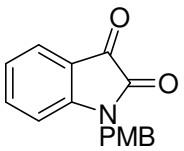
and concentrated under reduced pressure. The crude yellow product was recrystallized from Et_2O. Yield 1.59 g (71%) of the title compound as off-white needles: Mp. 67-68 °C (Et_2O), Lit.[4] 68 °C (Et_2O); R_f = 0.29 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.33-7.24 (m, 6H), 7.22-7.11 (m, 1H), 7.01 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.72 (d, *J* = 7.8 Hz, 1H), 4.92 (s, 2H), 3.63 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 175.1, 144.2, 135.8, 128.7, 127.7, 127.5, 127.3, 124.4, 124.3, 122.3, 109.0, 43.7, 35.7; IR (Neat) 3087, 3057, 3032, 2945, 2918, 1700, 1613, 1487, 1466, 1378, 1225, 1196, 1165, 748, 725 cm^{-1}; MS: *m/z* 223 [M].



1,3-Dibenzyl-1,3-dihydroindol-2-one [Table 3, Entry 9]

Isolated yield: 91%

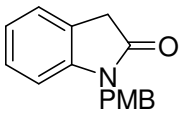
White powder; Mp. 97-98 °C (*n*-Hexane:EtOAc); R_f = 0.36 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.24-7.07 (m, 9H), 7.01-6.88 (m, 4H), 6.55 (d, *J* = 7.7 Hz, 1H), 5.04 (d, *J* = 15.8 Hz, 1H), 4.64 (d, *J* = 15.8 Hz, 1H), 3.86 (dd, *J* = 8.1, 4.3 Hz, 1H), 3.51 (dd, *J* = 13.5, 4.3 Hz, 1H), 3.14 (dd, *J* = 13.5, 8.1 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 176.8, 143.3, 137.3, 135.5, 129.6, 128.6, 128.2, 128.1, 127.9, 127.3, 126.8, 126.6, 124.4, 122.1, 109.0, 47.0, 43.5, 36.4; IR (Neat) 3106, 3086, 3060, 3029, 2919, 1711, 1613, 1489, 1466, 1361, 1187, 751, 698 cm^{-1}; HRMS (ESI+) calcd. for $C_{22}H_{20}NO$ ($[M+H]^+$) 314.1545, found 314.1541.



1-(4-Methoxy-benzyl)-1*H*-indole-2,3-dione (SI 3)

Isatin (2.94 g, 20 mmol) was placed in a 250 mL round bottom flask and dissolved in DMF (37 mL). The resulting bright orange solution was cooled to 0 °C by the use an ice/water bath. NaH (55% dispersion in mineral oil, 916 mg, 21 mmol) was added portionwise resulting in a deep purple solution. The solution was stirred until any effervescence had ceased (~15 min). *para*-Methoxy benzyl bromide

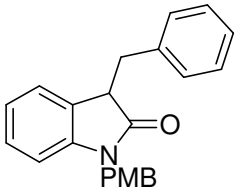
(4.83 g, 3.46 mL, 24 mmol) was added in a dropwise manner and the resulting red-brown mixture was stirred for an additional 30 min at 0 °C. H_2O (176 mL) was added to precipitate the product. The product was filtered and recrystallized from EtOH. Yield 4.55 g (85%) of the title compound as orange needles: Mp. 161-162 °C (EtOH), Lit.[6] 171-172 °C; R_f = 0.65 (EtOAc); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.60 (ddd, *J* = 7.5, 1.3, 0.6 Hz, 1H), 7.48 (dt, *J* = 7.8, 1.4 Hz, 1H), 7.29-7.26 (m, 2H), 7.08 (dt, *J* = 7.6, 0.8 Hz, 1H), 6.90-6.84 (m, 2H), 6.80 (bd, *J* = 8.0 Hz, 1H), 4.87 (s, 2H), 3.78 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 183.3, 159.3, 158.1, 150.7, 138.2, 128.8, 126.4, 125.3, 123.7, 117.6, 114.3, 111.0, 55.2, 43.4; IR (Neat) 3087, 3057, 3032, 2945, 2918, 1700, 1613, 1487, 1466, 1344, 1225, 1196, 1165, 748, 725, 697 cm^{-1}; MS: *m/z* 267 [M].



1-(4-Methoxy-benzyl)-1,3-dihydroindol-2-one (SI 4)

1-(4-Methoxy-benzyl)-1*H*-indole-2,3-dione (**SI 3**) (2.67 g, 10 mmol) was suspended in hydrazine hydrate (11 mL) and the mixture was heated to reflux until the gas evolution had stopped (4 h). The reaction mixture went from orange via green to yellow within this time. The reaction mixture was allowed to cool to ambient temperature and extracted with EtOAc (3 x 25 mL). The combined organic phases were dried over Na_2SO_4, filtered, and concentrated under reduced pressure. The crude yellow product was recrystallized from EtOH. Yield 2.07 g (81%) of the title compound as pale yellow needles: Mp. 105-106 °C (EtOH), Lit.[7] 103-104 °C; R_f = 0.21 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.27-7.22 (m, 4H), 7.21-7.13 (m, 1H), 7.00 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.87-6.80 (m, 1H), 6.75 (d, *J* = 7.8 Hz, 1H), 4.85 (s, 2H), 3.77 (s, 3H), 3.60 (s, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 175.0, 159.0, 144.3, 128.7, 127.9, 127.7, 124.4, 124.3, 122.2, 114.0, 109.0, 55.2, 43.1, 35.7; IR (Neat) 3055, 3036, 2999, 2954, 2932, 2915, 2836, 1698, 1612, 1511, 1487, 1438, 1378, 1276, 1175, 1165, 1031, 748 cm^{-1}; MS: *m/z* 253 [M].

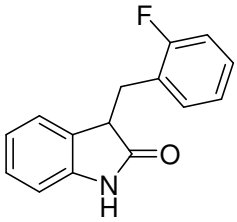
(6) Tacconi, G.; Gamba, A.; Marinone, F.; Desimoni, G. *Tetrahedron* **1971**, *27*, 561-579.
(7) Lee, Y. R.; Suk, J. Y.; Kim, B. S. *Tetrahedron Lett.* **1999**, *40*, 8219-8222.



3-Benzyl-1-(4-methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 10]

Isolated yield: 92%

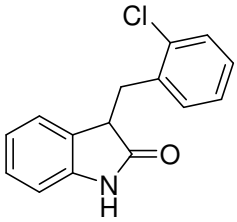
Pale yellow oil; R_f = 0.18 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.24-7.19 (m, 3H), 7.17-7.04 (m, 3H), 6.98-6.85 (m, 4H), 6.79-6.69 (m, 2H), 6.58 (d, *J* = 7.8 Hz, 1H), 4.97 (d, *J* = 15.5 Hz, 1H), 4.59 (d, *J* = 15.5 Hz, 1H), 3.83 (dd, *J* = 8.2, 4.3 Hz, 1H), 3.76 (s, 3H), 3.50 (dd, *J* = 13.6, 4.4 Hz, 1H), 3.11 (dd, *J* = 13.6, 8.2 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 176.8, 158.8, 143.4, 137.4, 129.6, 128.2, 128.2, 127.8, 127.6, 126.5, 124.4, 122.0, 114.0, 109.0, 55.2, 47.0, 42.9, 36.4; IR (Neat) 3058, 3030, 3001, 2929, 2835, 1708, 1612, 1512, 1488, 1466, 1359, 1247, 1177, 1033, 750, 700 cm^{-1}; HRMS (ESI+) calcd. for $C_{23}H_{22}NO_2$ ($[M+H]^+$) 344.1651, found 344.1647.



3-(2-Fluoro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 11]

Isolated yield: 81%

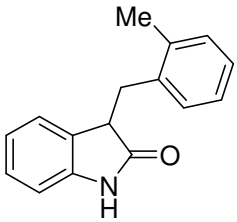
Off-white needles; Mp. 123-124 °C (heptane:EtOAc); R_f = 0.17 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.55 (bs, 1H), 7.36-7.10 (m, 3H), 7.10-7.02 (m, 1H), 7.01 (d, *J* = 8.2 Hz, 1H), 6.89 (dt, *J* = 7.6, 1.1 Hz, 1H), 6.86 (d, *J* = 7.6 Hz, 1H), 6.72 (d, *J* = 7.3 Hz, 1H), 3.80 (dd, *J* = 9.1, 5.2 Hz, 1H), 3.55 (dd, *J* = 13.9, 5.2 Hz, 1H), 2.96 (dd, *J* = 13.9, 9.1 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.0, 161.2 (d, *J* = 245.9 Hz), 141.5, 131.5 (d, *J* = 4.5 Hz), 128.7, 128.5 (d, *J* = 8.1 Hz), 128.0, 125.1 (d, *J* = 15.3 Hz), 124.7, 123.9 (d, *J* = 3.6 Hz), 122.0, 115.3 (d, *J* = 22.1 Hz), 109.8, 46.1 (d, *J* = 1.4 Hz), 30.0 (d, *J* = 1.8 Hz); IR (Neat) 3208, 3087, 3061, 3032, 1700, 1619, 1599, 1490, 1469, 1456, 1337, 1304, 1229, 1185, 1100, 746 cm^{-1}; HRMS (ESI+) calcd. for $C_{15}H_{13}FNO$ ($[M+H]^+$) 242.0981, found 242.0987.



3-(2-Chloro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 12]

Isolated yield: 88%

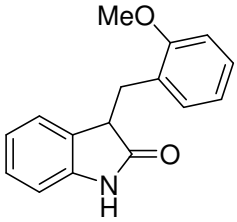
Pale yellow powder; Mp. 89-91 °C (*n*-Hexane:EtOAc); R_f = 0.17 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 9.14 (bs, 1H), 7.33-7.17 (m, 1H), 7.15-6.94 (m, 4H), 6.76 (d, *J* = 7.8 Hz, 1H), 6.70 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.44 (d, *J* = 5.5 Hz, 1H), 3.75 (dd, *J* = 9.9, 5.5 Hz, 1H), 3.47 (dd, *J* = 13.8, 5.5 Hz, 1H), 2.80 (dd, *J* = 13.8, 9.9 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.7, 141.4, 135.9, 134.4, 131.9, 129.7, 128.8, 128.3, 128.0, 126.6, 124.9, 122.0, 109.8, 45.2, 34.8; IR (Neat) 3209, 3060, 2928, 1701, 1619, 1470, 1337, 1229, 1053, 908, 748, 676 cm^{-1}; HRMS (ESI+) calcd. for $C_{15}H_{13}ClNO$ ($[M+H]^+$) 258.0686, found 258.0693.



3-(2-Methyl-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 13]

Isolated yield: 90%

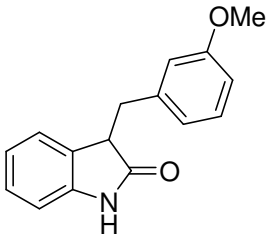
Pale yellow needles; Mp. 106-108 °C (heptane:EtOAc); R_f = 0.21 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 7.67 (bs, 1H), 7.23-7.12 (m, 5H), 6.91-6.77 (m, 2H), 6.54 (d, *J* = 7.3 Hz, 1H), 3.71 (dd, *J* = 10.9, 4.6 Hz, 1H), 3.52 (dd, *J* = 14.0, 4.6 Hz, 1H), 2.82 (dd, *J* = 14.0, 10.9 Hz, 1H), 2.30 (s, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.2, 141.4, 136.7, 136.5, 130.5, 130.0, 129.1, 127.9, 126.8, 125.9, 125.0, 121.9, 109.8, 46.3, 34.3, 19.6; IR (Neat) 3192, 3077, 3061, 3021 2955, 2929, 1705, 1620, 1485, 1470, 1402, 1338, 1307, 1230, 749 cm^{-1}; HRMS (ESI+) calcd. for $C_{16}H_{16}NO$ ($[M+H]^+$) 238.1232, found 238.1227.



3-(2-Methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 14]

Isolated yield: 85%

Colorless needles; Mp. 120-121 °C (heptane:EtOAc); R_f = 0.16 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.21 (bs, 1H), 7.27 (dt, *J* = 7.8, 1.7 Hz, 1H), 7.14 (tt, *J* = 7.7, 1.1 Hz, 1H), 7.11 (dd, *J* = 7.5, 1.7 Hz, 1H), 6.92-6.80 (m, 4H), 6.54 (d, *J* = 7.4 Hz, 1H), 3.92 (dd, *J* = 10.0, 5.1 Hz, 1H), 3.82 (s, 3H), 3.60 (dd, *J* = 13.4, 5.1 Hz, 1H), 2.75 (dd, *J* = 13.4, 10.0 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.7, 157.7, 141.5, 131.4, 129.6, 128.1, 127.6, 126.5, 125.0, 121.6, 120.1, 110.2, 109.6, 55.1, 45.4, 32.2; IR (Neat) 3212, 3081, 3063, 3030, 2938, 2835, 1704, 1620, 1494, 1470, 1438, 1338, 1308, 1245, 1179, 1111, 1052, 1031 749 cm^{-1}; HRMS (ESI+) calcd. for $C_{16}H_{16}NO_2$ ($[M+H]^+$) 254.1181, found 254.1176.



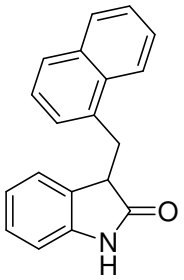
3-(3-Methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 15]

Isolated yield: 84%

White powder; Mp. 87-88 °C (hexane:EtOAc), Lit.[8] 87-88 °C (hexane:EtOAc); R_f = 0.19 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.52 (bs, 1H), 7.17 (t, *J* = 7.9 Hz, 2H), 6.91 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.86-6.70 (m, 5H), 3.75 (dd, *J* = 9.3, 4.4 Hz, 1H), 3.73 (s, 3H) 3.48 (dd, *J* = 13.7, 4.4 Hz, 1H), 2.91 (dd, *J* = 13.7, 9.3 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.9, 159.4, 141.5, 139.3, 129.3, 128.9. 127.9, 124.8, 122.0, 121.7, 114.6, 112.3, 109.8. 55.1, 47.5, 36.6; IR (Neat) 3202, 3090,

(8) Volk, B.; Simig, G. *Eur. J. Org. Chem.* **2003**, 3991-3996.

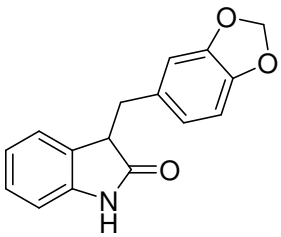
3059, 3029, 2943, 2834, 1700, 1618, 1600, 1486, 1469, 1438, 1336, 1293, 1260, 1228, 1153, 751 cm^{-1}; MS: *m/z* 253 [M].



3-Naphthalen-1-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 16]

Isolated yield: 87%

Yellow needless; Mp. 109-110 °C (hexane:EtOAc); R_f = 0.27 (heptane:EtOAc = 7:3); ^1H NMR (300 MHz, $CDCl_3$) δ 8.89 (bs, 1H), 8.27 (d, *J* = 8.3 Hz, 1H), 7.98-7.91 (m, 1H), 7.85 (d, *J* = 8.2 Hz, 1H), 7.64-7.50 (m, 2H), 7.45 (dd, *J* = 8.2, 7.1 Hz, 1H), 7.32 (d, *J* = 6.9 Hz, 1H), 7.18 (t, *J* = 7.7 Hz, 1H), 6.94 (d, *J* = 7.7 Hz, 1H), 6.81 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.42 (d, *J* = 7.5 Hz, 1H), 4.16 (dd, *J* = 13.9, 3.9 Hz, 1H), 3.92 (dd, *J* = 11.0, 3.9 Hz, 1H), 3.07 (dd, *J* = 13.9, 11.0 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.1, 141.4, 134.2, 134.0, 131.6, 129.4, 129.0, 127.9, 127.9, 127.8, 126.3, 125.8, 125.3, 125.1, 123.6, 121.9, 109.8, 46.3, 34.9; IR (Neat) 3204, 3060, 2945, 2892, 2836, 1700, 1620, 1598, 1469, 1306, 1018, 784, 751 cm^{-1}; HRMS (ESI+) calcd. for $C_{19}H_{16}NO$ ($[M+H]^+$) 274.1232, found 274.1232.

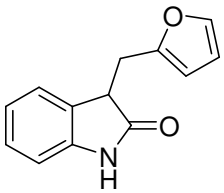


3-Benzo[1,3]dioxol-5-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 17]

Isolated yield: 79%

Pale yellow needles; Mp. 135-136 °C (heptane:EtOAc); R_f = 0.10 (heptane:EtOAc = 7:3); ^1H NMR (300 MHz, $CDCl_3$) δ 9.04 (bs, 1H), 7.18 (ddt, *J* = 7.7, 1.3, 0.8 Hz, 1H), 6.93 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.87 (d, *J* = 7.8 Hz, 1H), 6.82 (d, *J* = 7.3 Hz, 1H), 6.69 (d, *J* = 2.7 Hz, 1H), 6.67 (d, *J* = 3.5 Hz, 1H), 6.61 (dd, *J* = 8.0, 1.6 Hz, 1H), 5.91 (s, 2H), 3.69 (dd, *J* = 9.0, 4.6 Hz, 1H), 3.40 (dd, *J* = 13.8, 4.6 Hz,

1H), 2.88 (dd, J = 13.8, 9.1 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.7, 147.5, 146.2, 141.4, 131.4, 128.8, 127.9, 124.7, 122.5, 122.0, 109.8, 109.6, 108.0, 100.8, 47.7, 36.4; IR (Neat) 3215, 3092, 3062, 3029, 2895, 1705, 1620, 1502, 1489, 1470, 1443, 1337, 1191, 1039, 933, 813, 751 cm^{-1}; HRMS (ESI+) calcd. for $C_{16}H_{14}NO_3$ ($[M+H]^+$) 268.0974, found 268.0967.

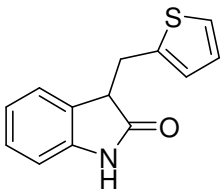


3-Furan-2-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 18]

Isolated yield: 71%

Toluene (1.0 mL) was used as co-solvent.

White powder; Mp. 146-147 °C (*n*-Hexane:EtOAc); R_f = 0.16 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.65 (bs, 1H), 7.34 (dd, J = 1.9, 0.8 Hz, 1H), 7.24-7.15 (m, 1H), 6.94 (dt, J = 7.6, 1.0 Hz, 1H), 6.88 (d, J = 7.8 Hz, 1H), 6.79 (d, J = 7.4 Hz, 1H), 6.29 (dd, J = 3.2, 1.9 Hz, 1H), 6.03 (dd, J = 3.2, 0.8 Hz, 1H), 3.81 (dd, J = 9.5, 4.6 Hz, 1H), 3.48 (dd, J = 15.0, 4.6 Hz, 1H), 2.99 (dd, J = 15.0, 9.5 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.7, 151.9, 141.5, 141.4, 128.7, 128.0, 124.6, 122.2, 110.3, 109.8, 107.3, 45.2, 29.0; IR (Neat) 3182, 3150, 2964, 2902, 2839, 1699, 1619, 1470, 1341, 1263, 1230, 1008, 738 cm^{-1}; HRMS (ESI+) calcd. for $C_{13}H_{12}NO_2$ ($[M+H]^+$) 214.0868, found 214.0867.

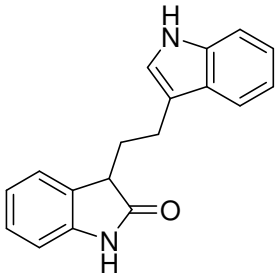


3-Thiophen-2-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 19]

Isolated yield: 81%

Yellow needles; Mp. 154-155 °C (heptane:EtOAc); R_f = 0.22 (heptane:EtOAc = 7:3); ^{1}H NMR (300 MHz, $CDCl_3$) δ 8.23 (bs, 1H), 7.23-7.18 (m, 1H), 7.10 (dd, J = 5.1, 1.1 Hz, 1H), 7.04-6.93 (m, 2H), 6.89-6.74 (m, 3H), 3.76 (dd, J = 8.1, 4.4 Hz, 1H), 3.61 (ddd, J = 14.8, 4.4, 0.8 Hz, 1H), 3.34 (dd, J = 14.8, 8.1 Hz, 1H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 179.8, 142.1, 140.0, 128.9, 128.6, 127.0, 126.8, 125.0,

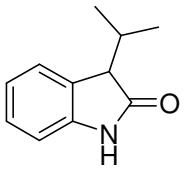
124.7, 122.6, 110.3, 48.1, 31.0; IR (Neat) 3206, 3092, 3030, 2916, 2841, 1701, 1620, 1485, 1470, 1435, 1337, 1186, 750, 697 cm^{-1}; HRMS (ESI+) calcd. for $C_{13}H_{12}NOS$ ($[M+H]^+$) 230.0640, found 230.0638.



3-[2-(1*H*-Indol-3-yl)-ethyl]-1,3-dihydroindol-2-one [Table 3, Entry 20]

Isolated yield: 72%

Pale yellow oil; R_f = 0.47 (CH_2Cl_2:CH_3OH = 9:1); ^1H NMR (300 MHz, $CDCl_3$) δ 8.78 (bs, 1H), 8.02 (bs, 1H), 7.60 (d, *J* = 7.8 Hz, 1H), 7.35-7.32 (m, 1H), 7.29 (d, *J* = 7.4 Hz, 1H), 7.26-7.18 (m, 2H), 7.1 (dt, *J* = 7.6, 1.3 Hz, 1H), 7.06 (dt, *J* = 7.6, 0.9 Hz, 1H), 6.98 (d, *J* = 2.3 Hz, 1H), 6.92 (d, *J* = 7.7 Hz, 1H), 3.59 (t, *J* = 6.0 Hz, 1H), 3.01-2.79 (m, 2H), 2.43-2.35 (m, 2H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.7, 141.6, 136.2, 129.7, 127.8, 127.3, 124.1, 122.3, 121.9, 121.5, 119.2, 118.8, 115.3, 111.0, 109.8, 45.6, 31.0, 21.4; IR (Neat) 3410, 3299, 3058, 2926, 2855, 1697, 1620, 1470, 1338, 1266, 1220, 1101, 909, 740 cm^{-1}; HRMS (ESI+) calcd. for $C_{18}H_{17}N_2O$ ($[M+H]^+$) 277.1341, found 277.1334.



3-Isopropyl-1,3-dihydroindol-2-one [Table 3, Entry 21]

Isolated yield: 73%

10 mmol (5 equiv) isopropyl alcohol was used and the reaction was run for 48 h at 110 ^oC.

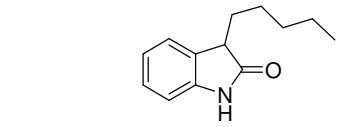
White powder; Mp. 108-109 °C (*n*-Hexane:EtOAc), Lit.[9] 105-106 °C; R_f = 0.23 (heptane:EtOAc = 7:3); ^1H NMR (300 MHz, $CDCl_3$) δ 8.58 (bs, 1H), 7.29-7.17 (m, 2H), 7.01 (dt, *J* = 7.6, 1.0 Hz, 1H), 6.89 (d, *J* = 7.7 Hz, 1H), 3.40 (d, *J* = 3.5 Hz, 1H), 2.59-2.42 (m, 1H), 1.13 (d, *J* = 7.0 Hz, 3H), 0.92 (d,

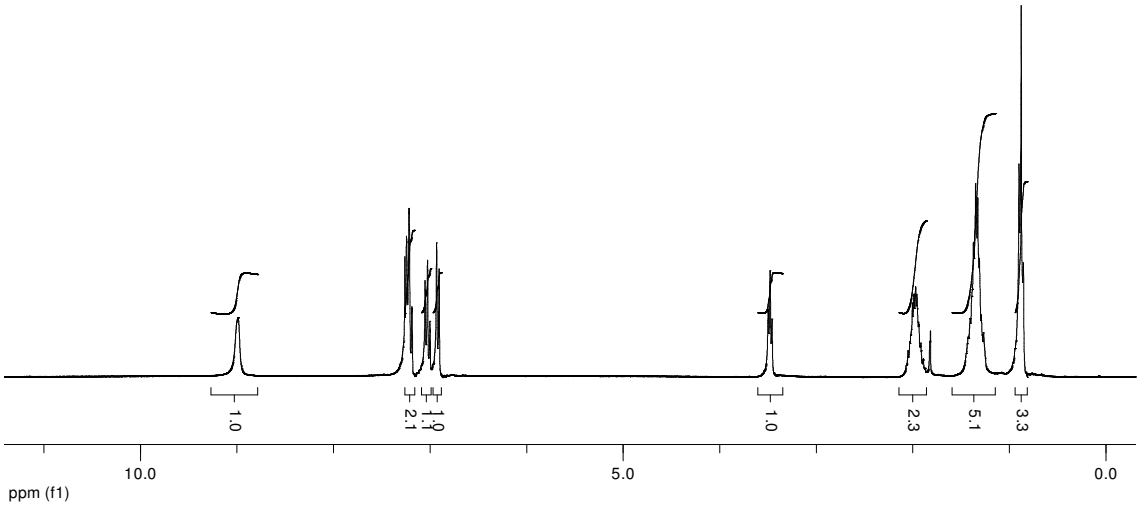
(9) Anthony, W. C. *J. Org. Chem.* **1966**, *31*, 77-81.

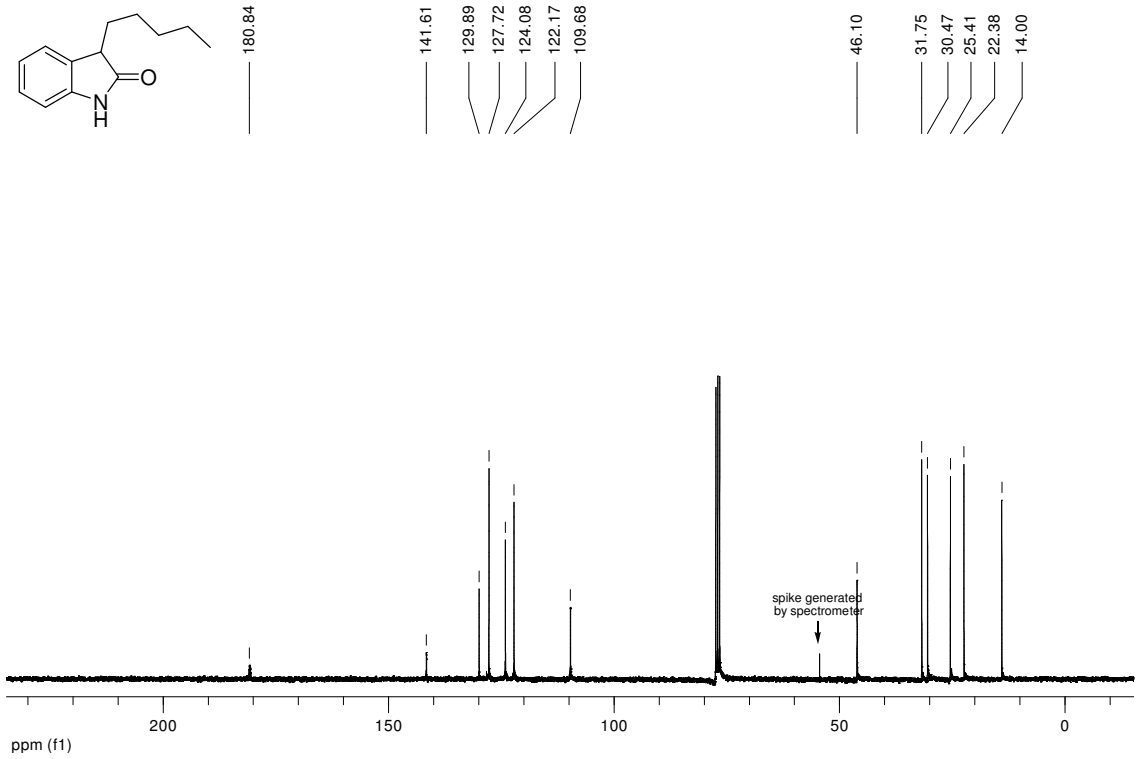
J = 6.8 Hz, 3H); ^{13}C NMR (75 MHz, $CDCl_3$) δ 180.5, 142.1, 128.3, 127.7, 124.5, 122.0, 109.7, 52.2, 30.7, 19.9, 17.8; IR (Neat) 3172, 3139, 3063, 2959, 2872, 1692, 1616, 1470, 1414, 1344, 1297, 1220, 1182, 749 cm^{-1}; MS: *m/z* 175 [M].

III. NMR Spectra

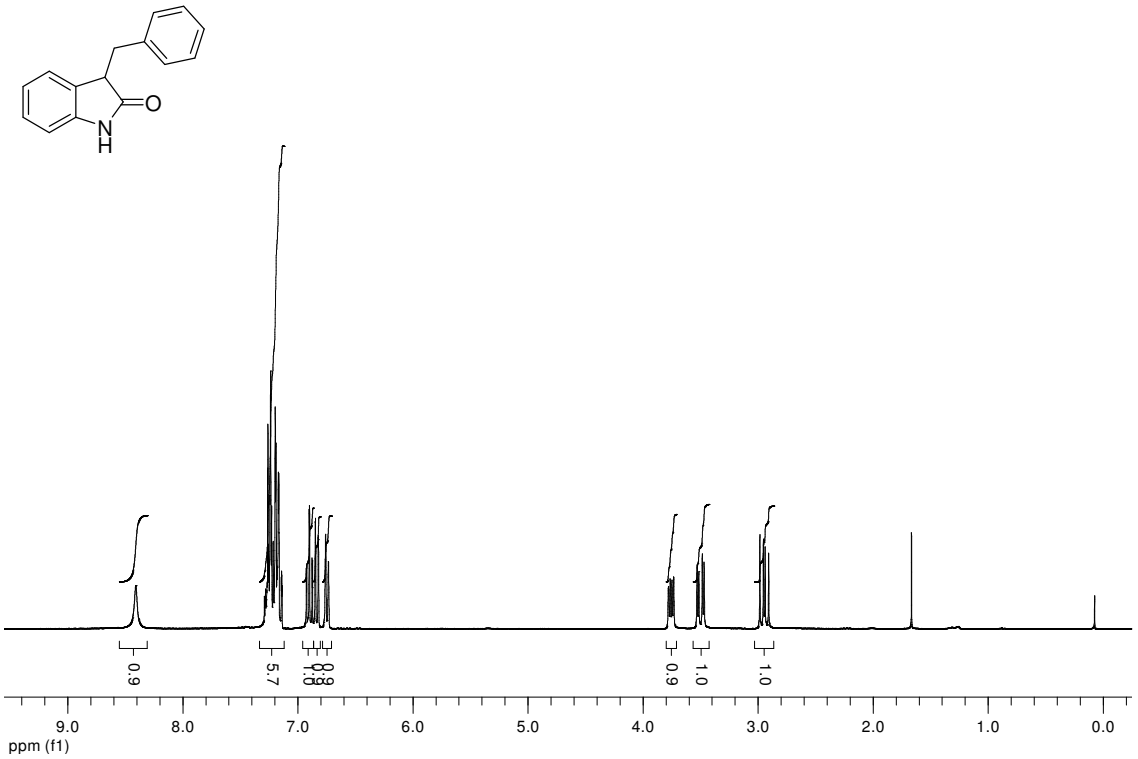
3-Pentyl-1,3-dihydroindol-2-one [Table 3, Entry 1]

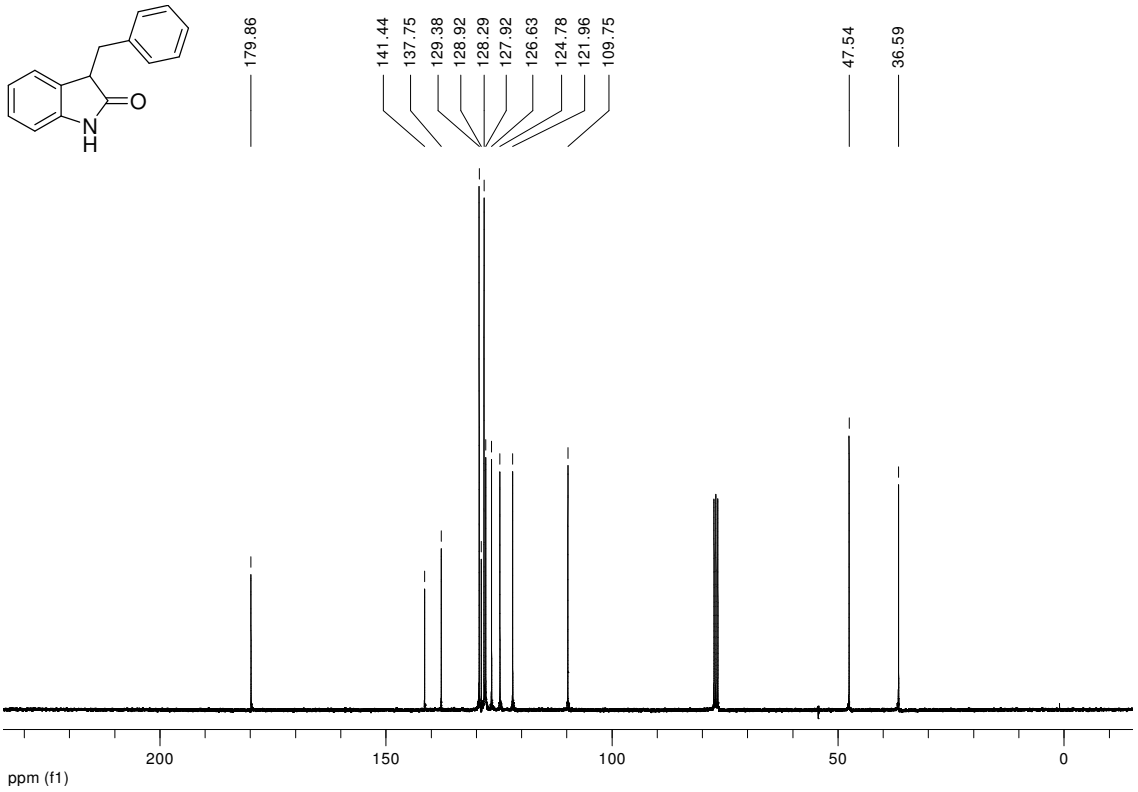




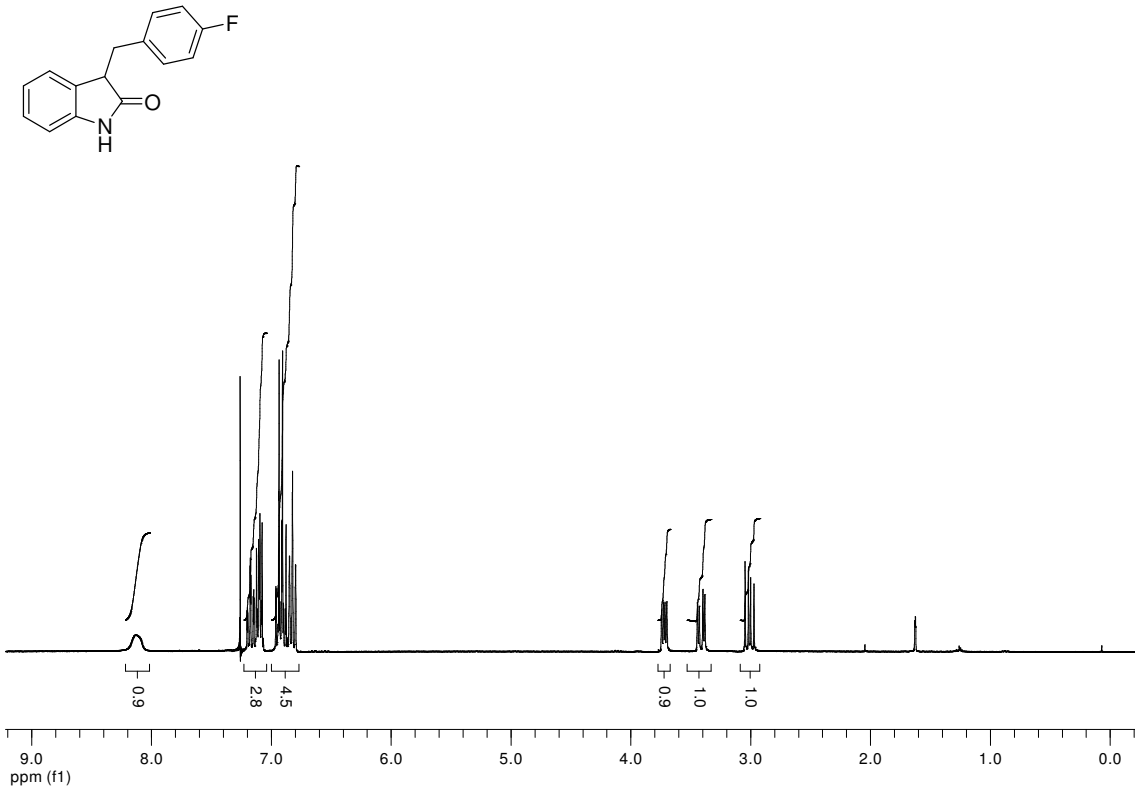


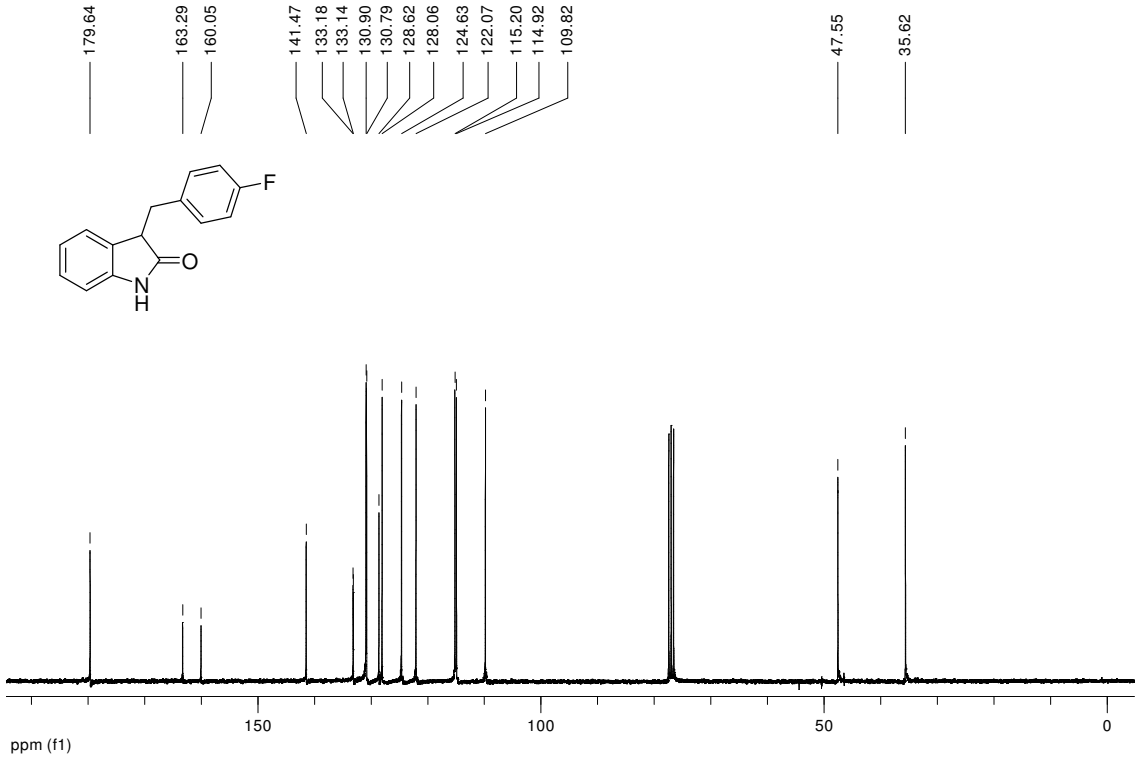
3-Benzyl-1,3-dihydroindol-2-one [Table 3, Entry 2]

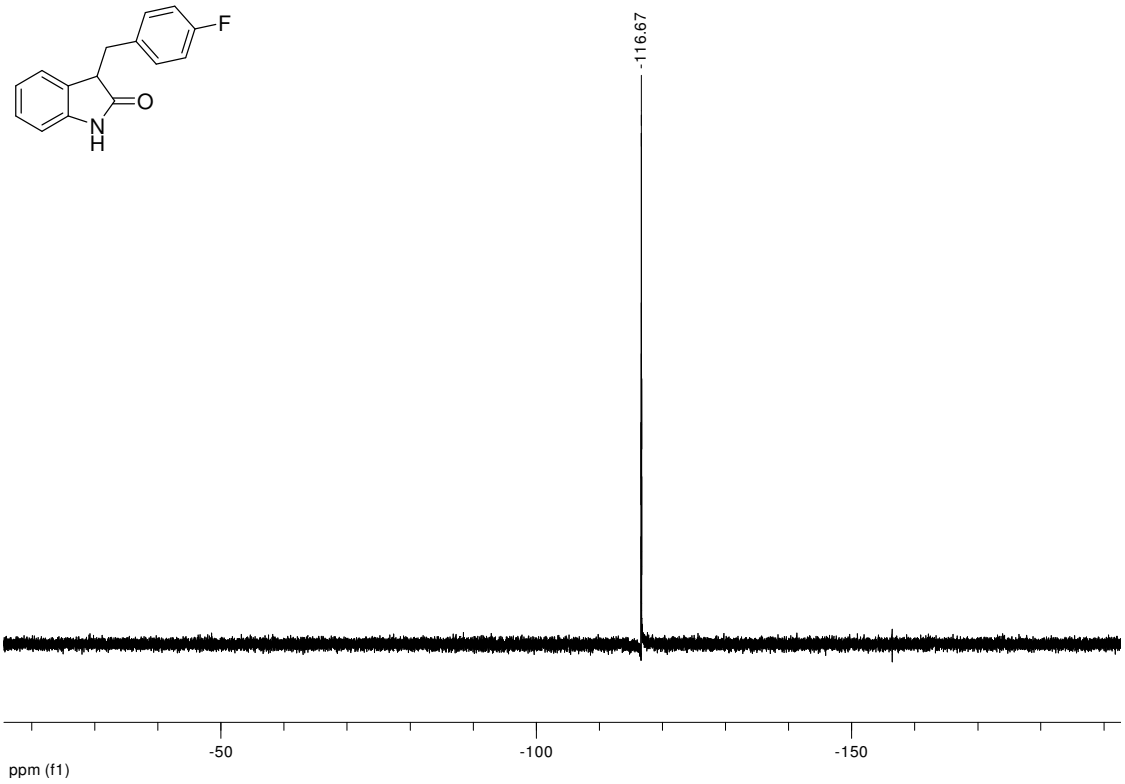




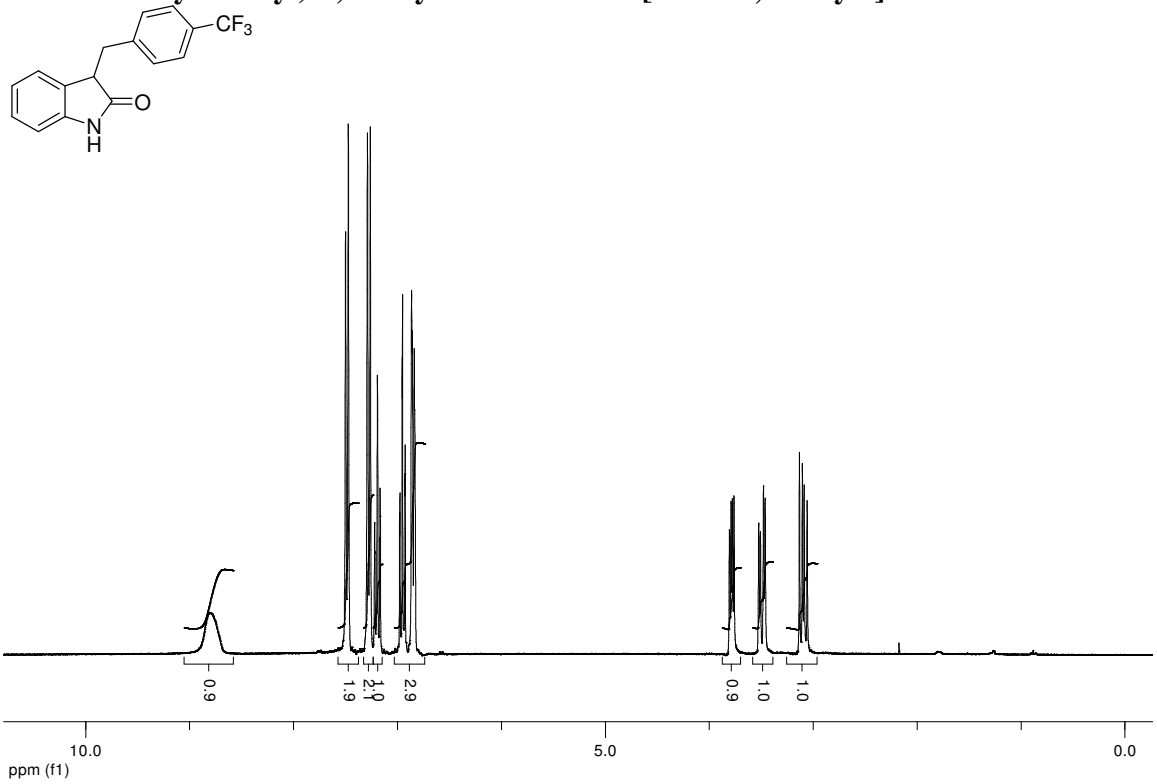
3-(4-Fluoro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 3]

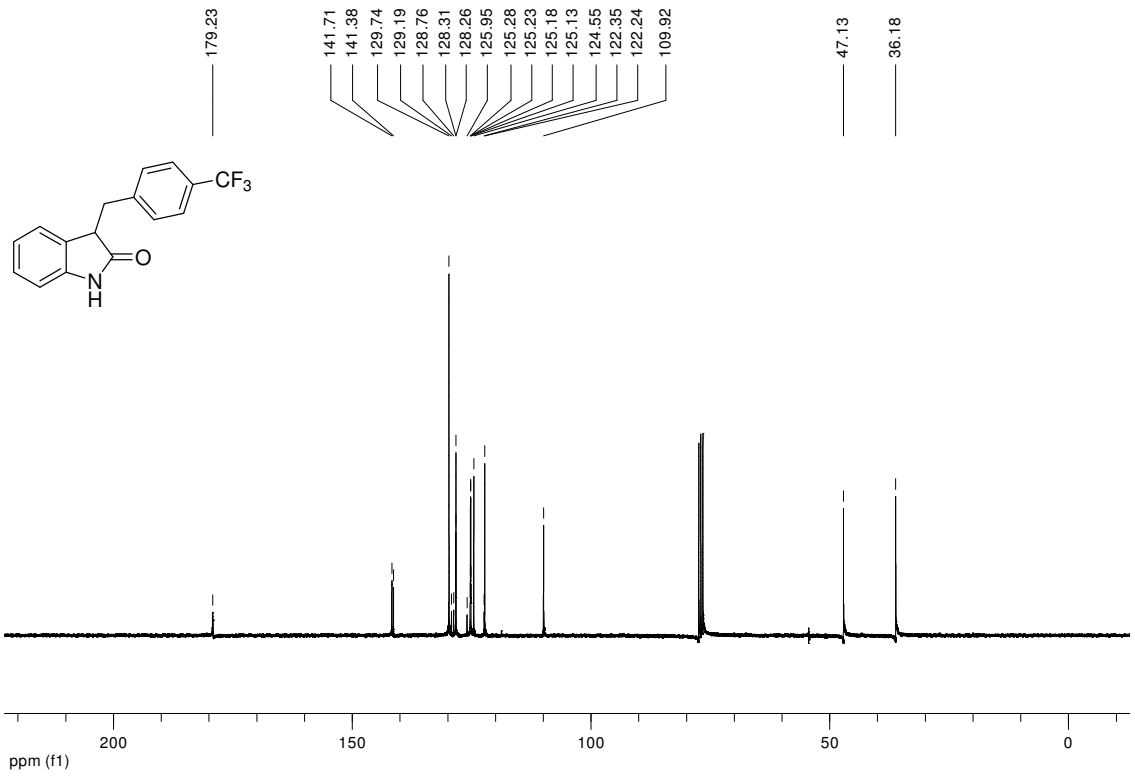






3-(4-Trifluoromethyl-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 4]

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128.31
128.26
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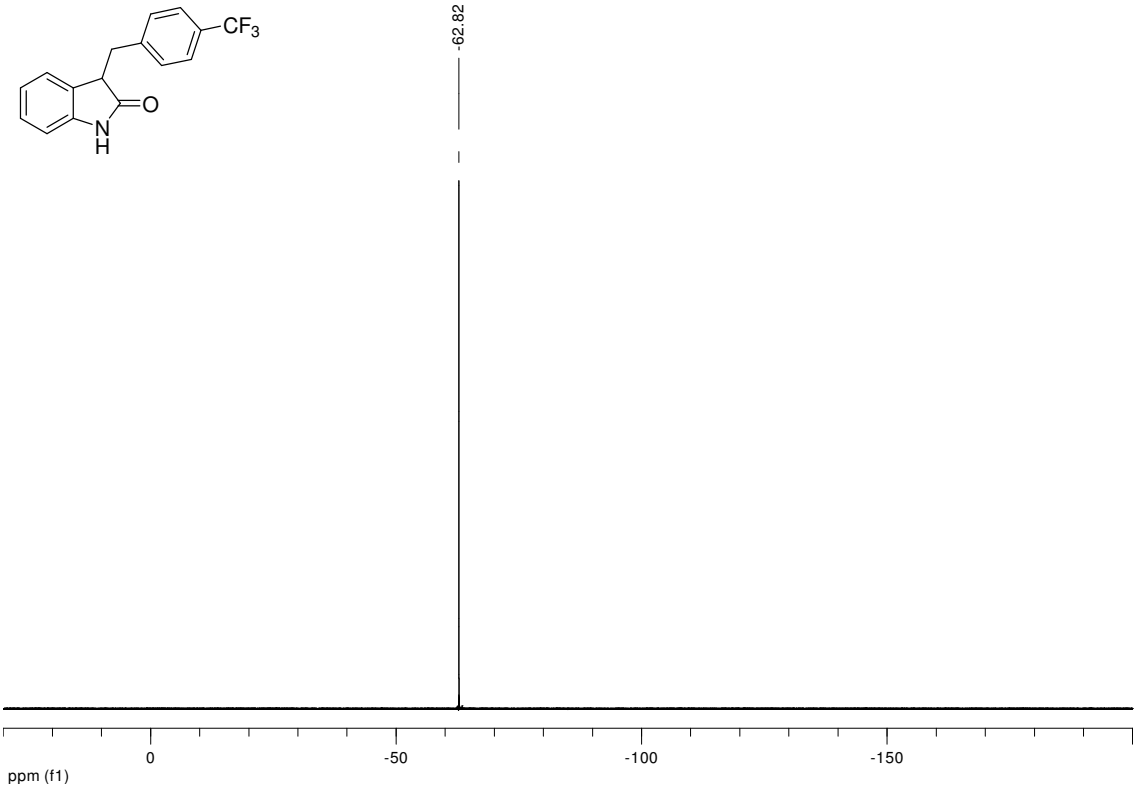
125.28
125.23
125.18
125.13
124.55
122.35
122.24
109.92
47.13
36.18
CF3
O
N
H
200
150
100
50
0
ppm (f1)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CF3
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N
H
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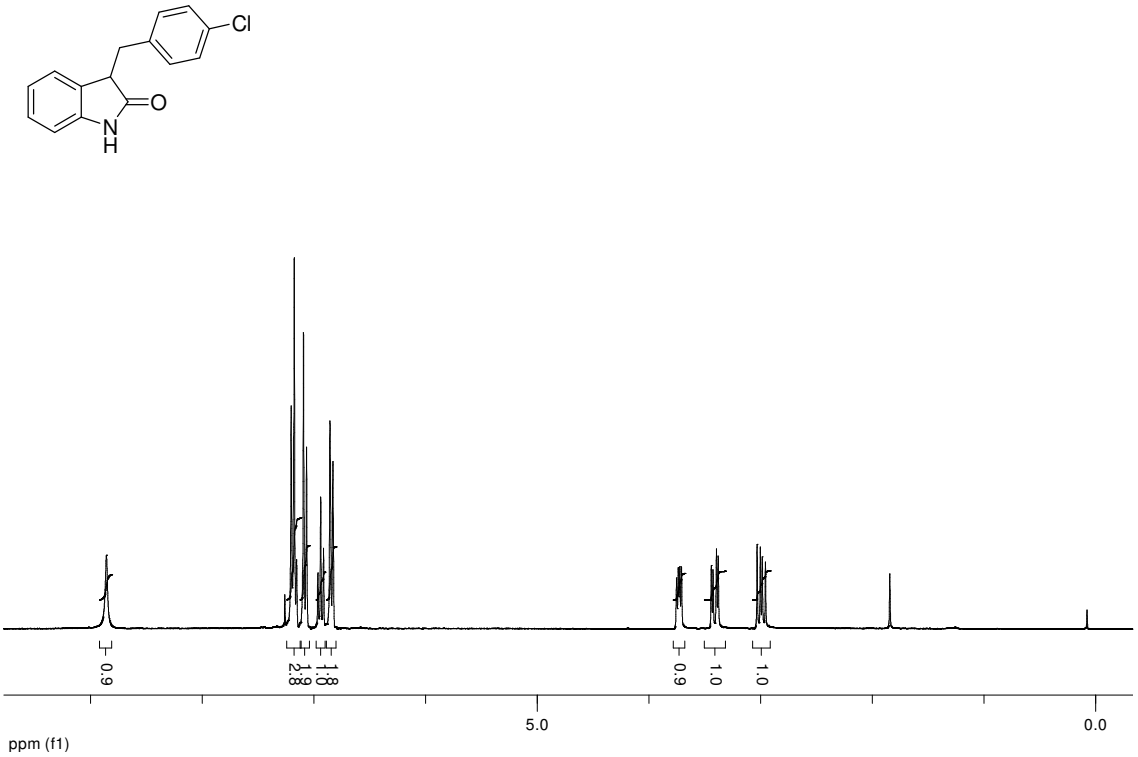
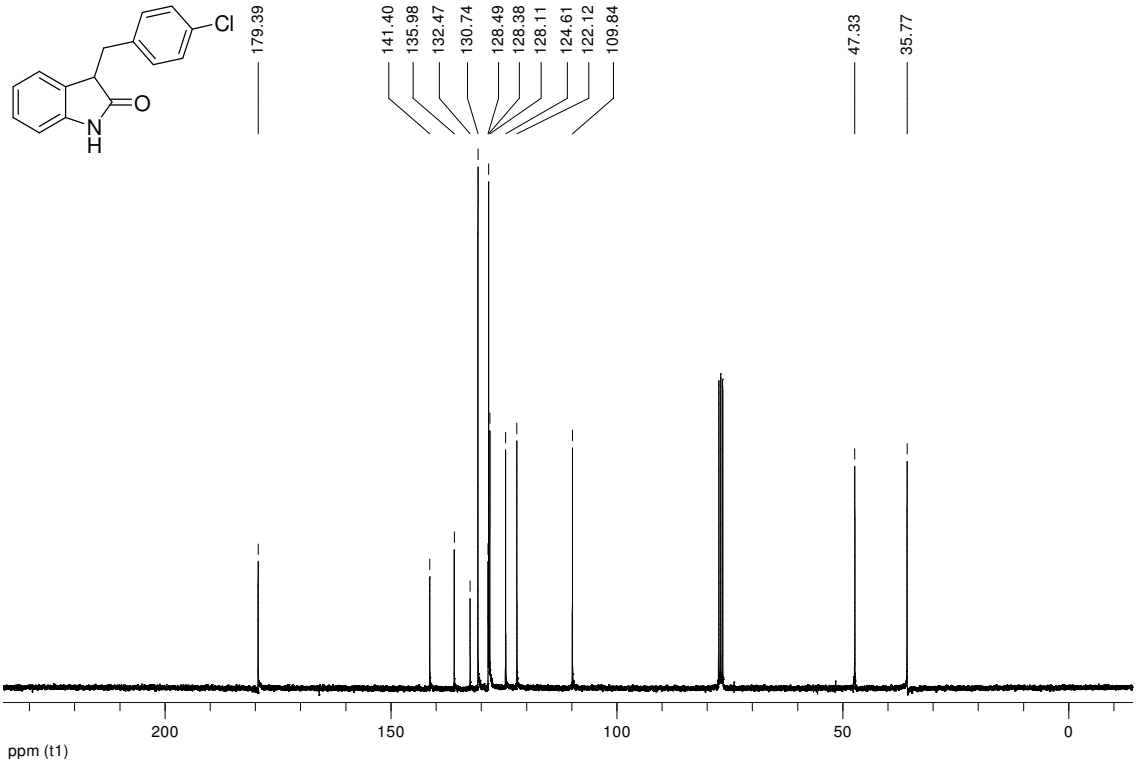
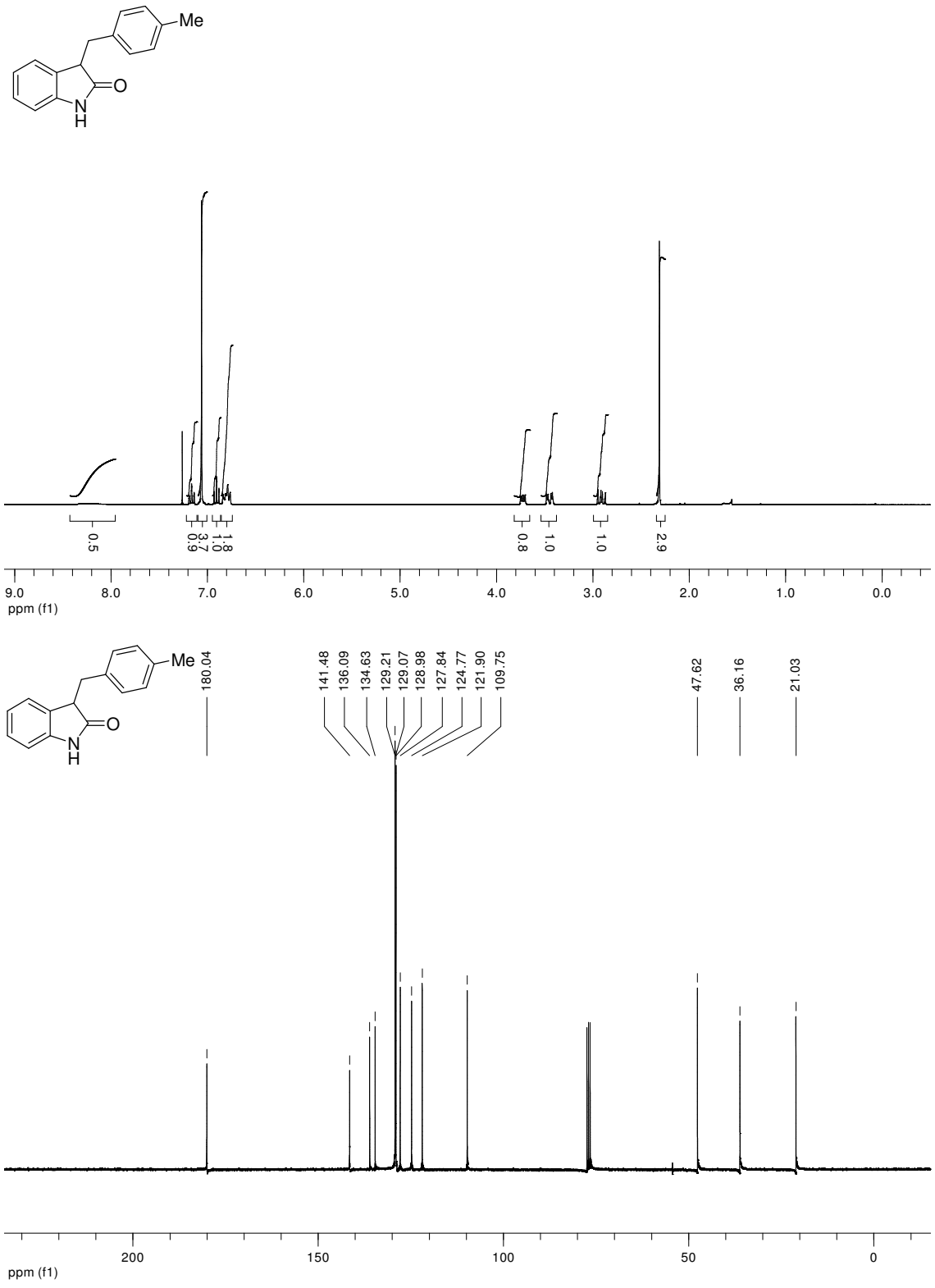
-100
-150
ppm (f1)

3-(4-Chloro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 5]

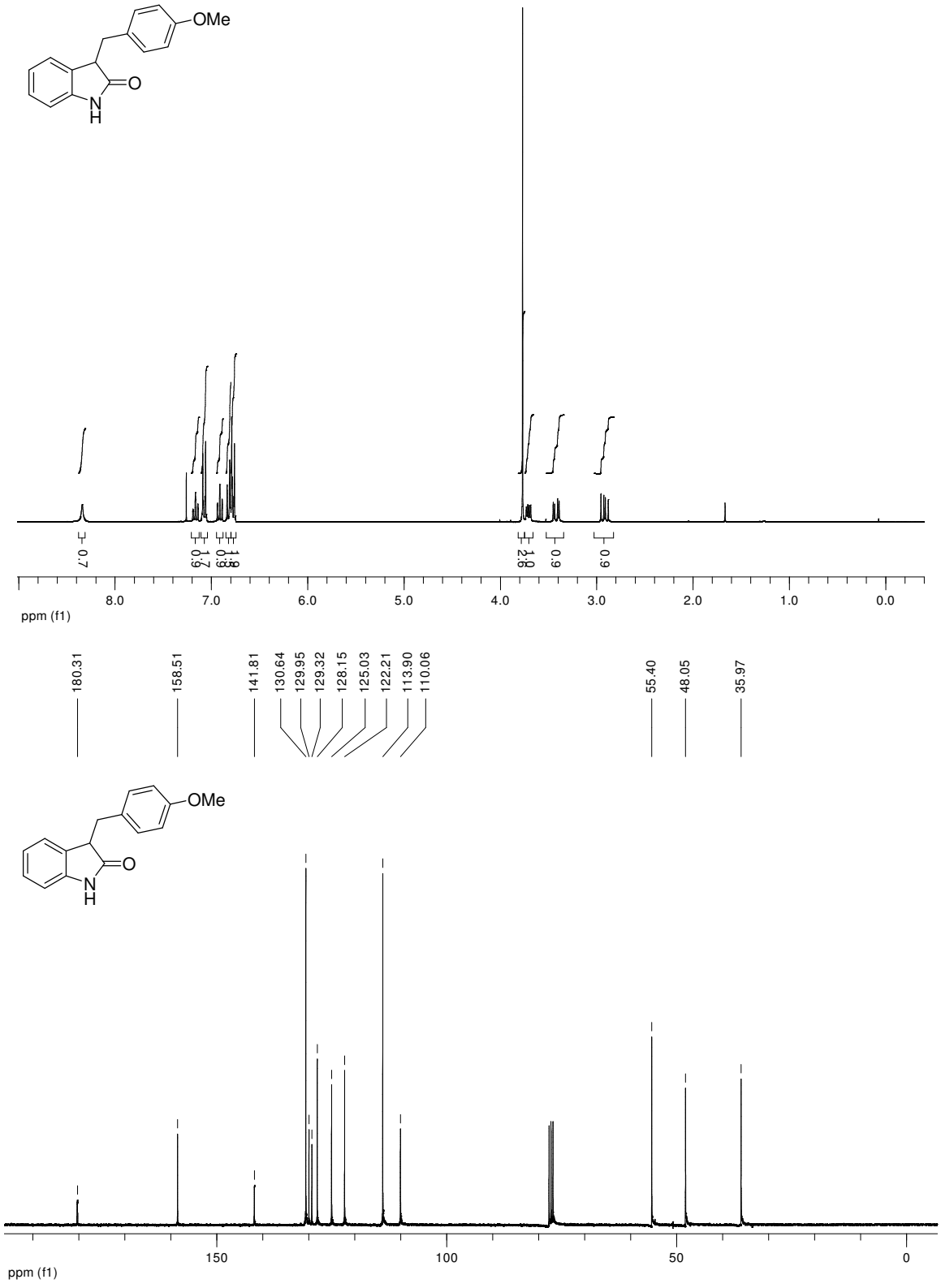




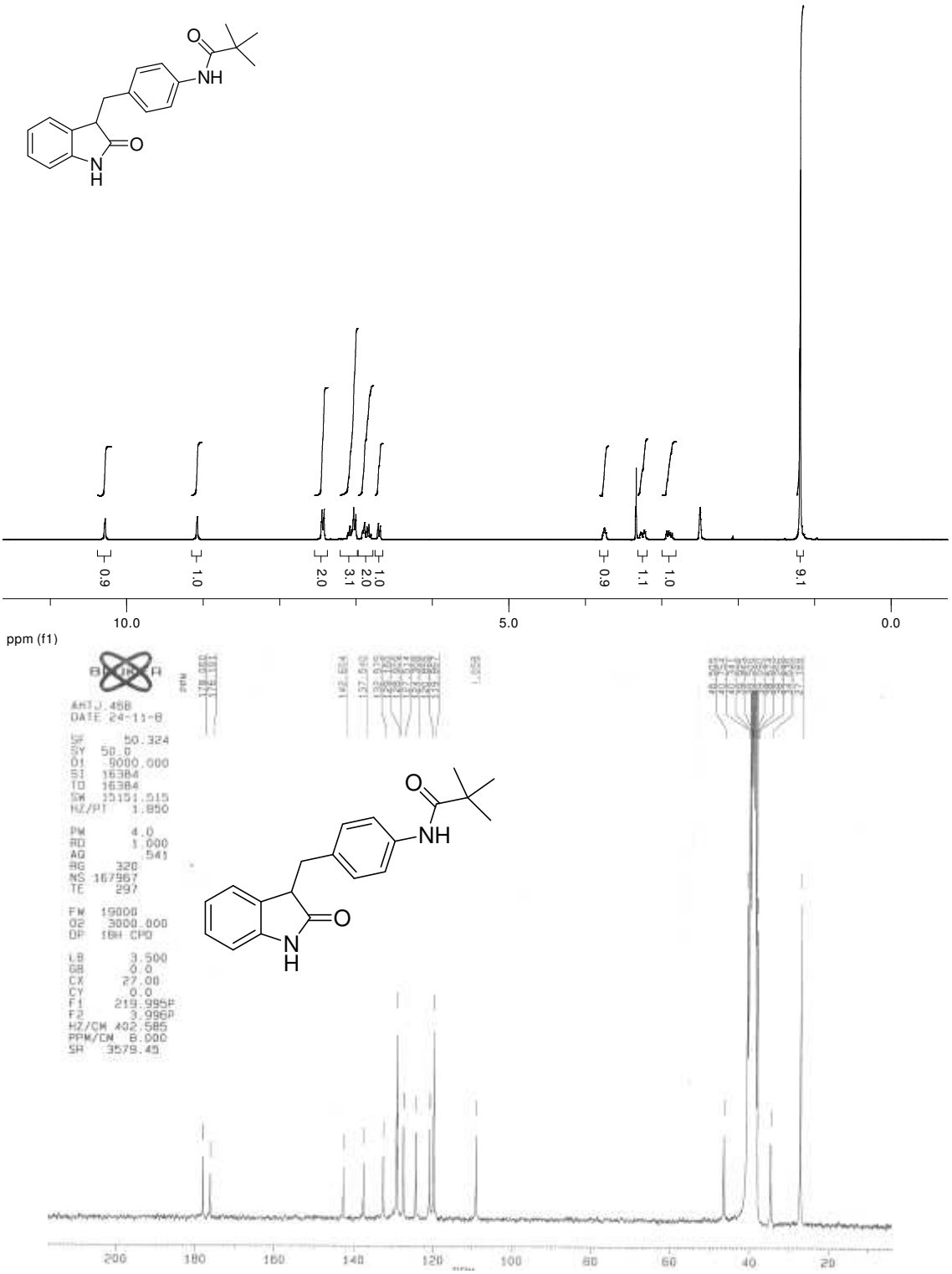
3-(4-Methyl-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 6]



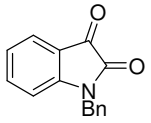
3-(4-Methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 7]

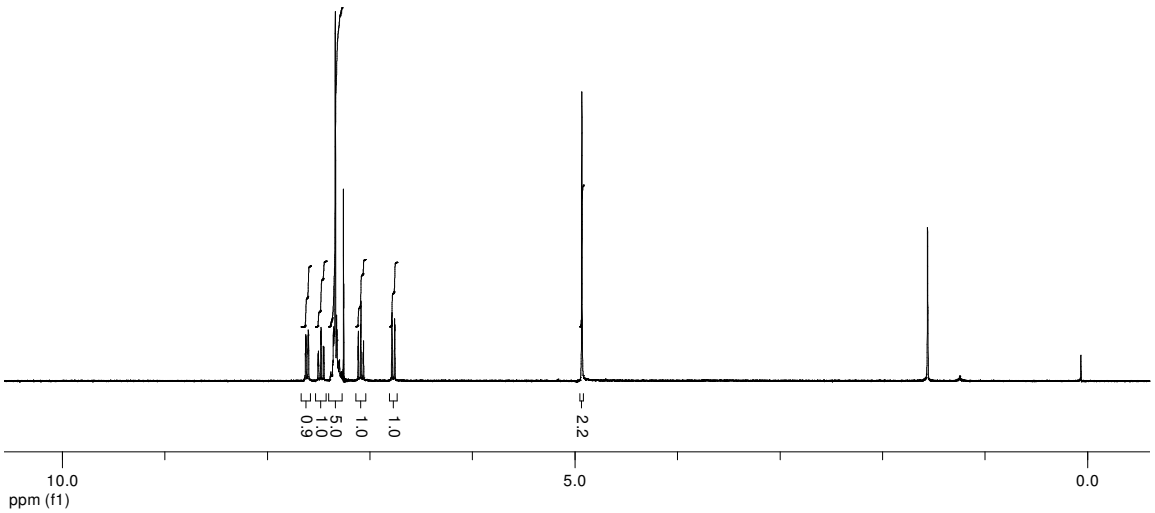


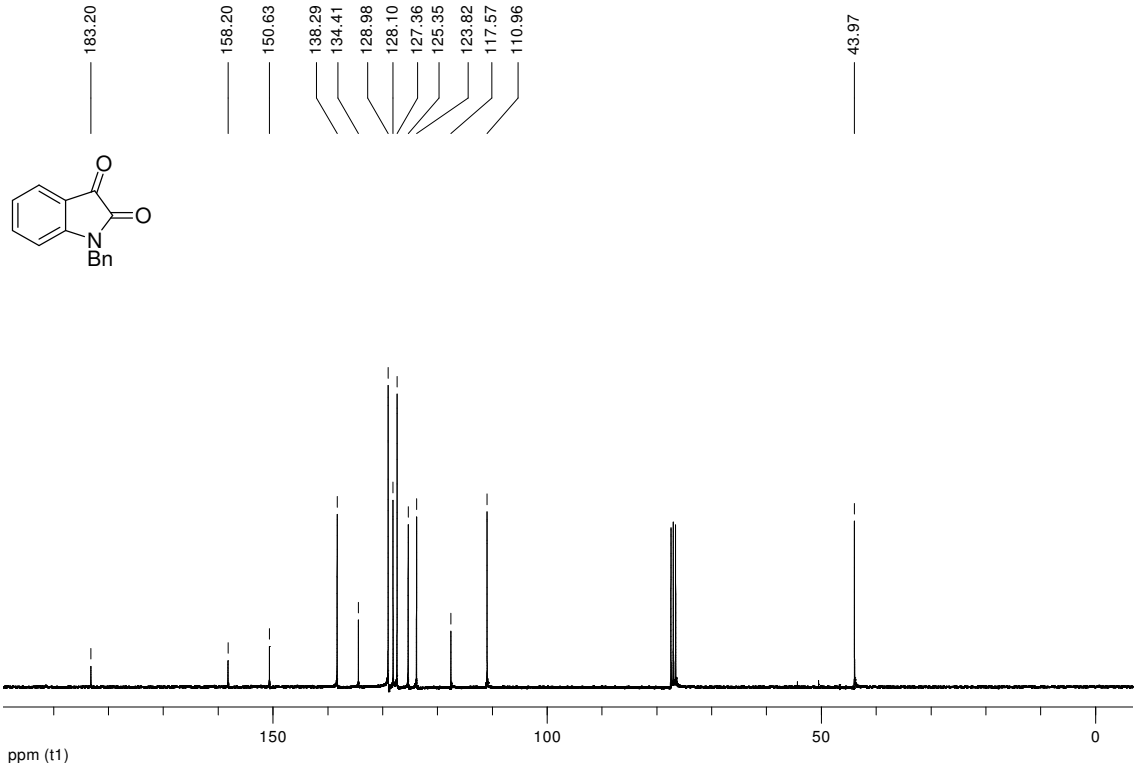
2,2-Dimethyl-*N*-[4-(2-oxo-2,3-dihydro-1*H*-indol-3-ylmethyl)-phenyl]-propionamide [Table 3, Entry 8]



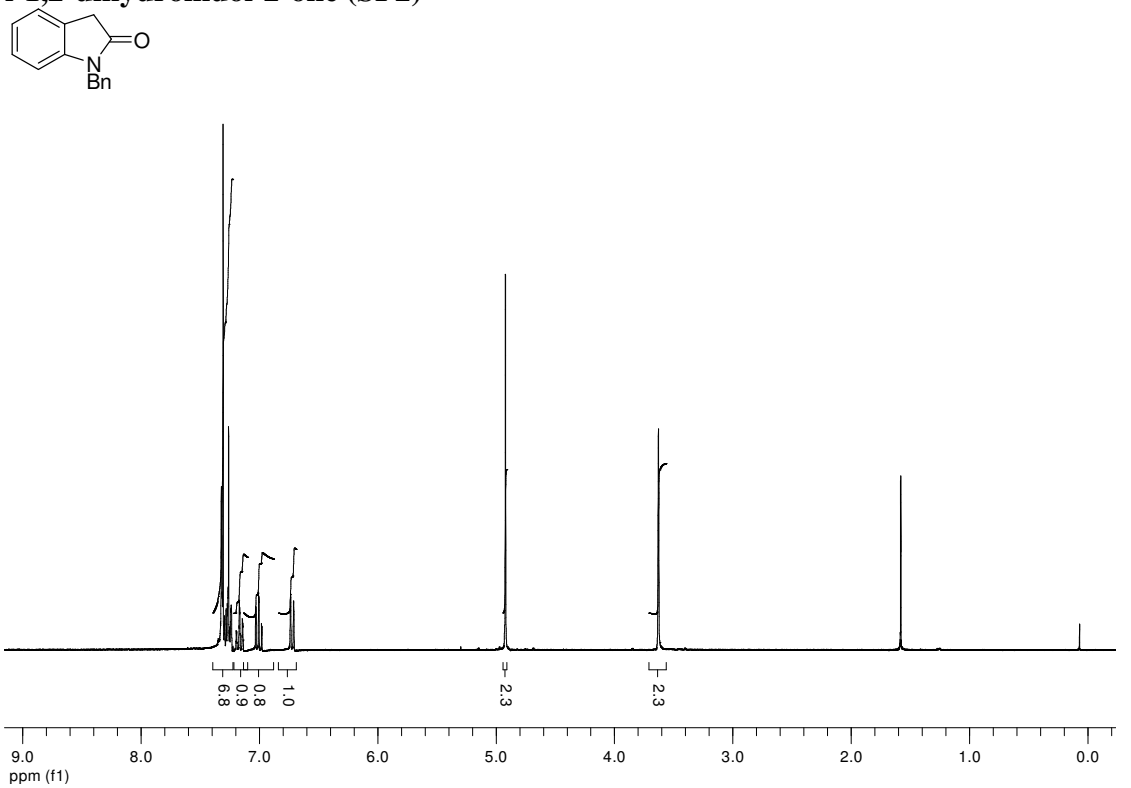
1-Benzyl isatin (SI 1)

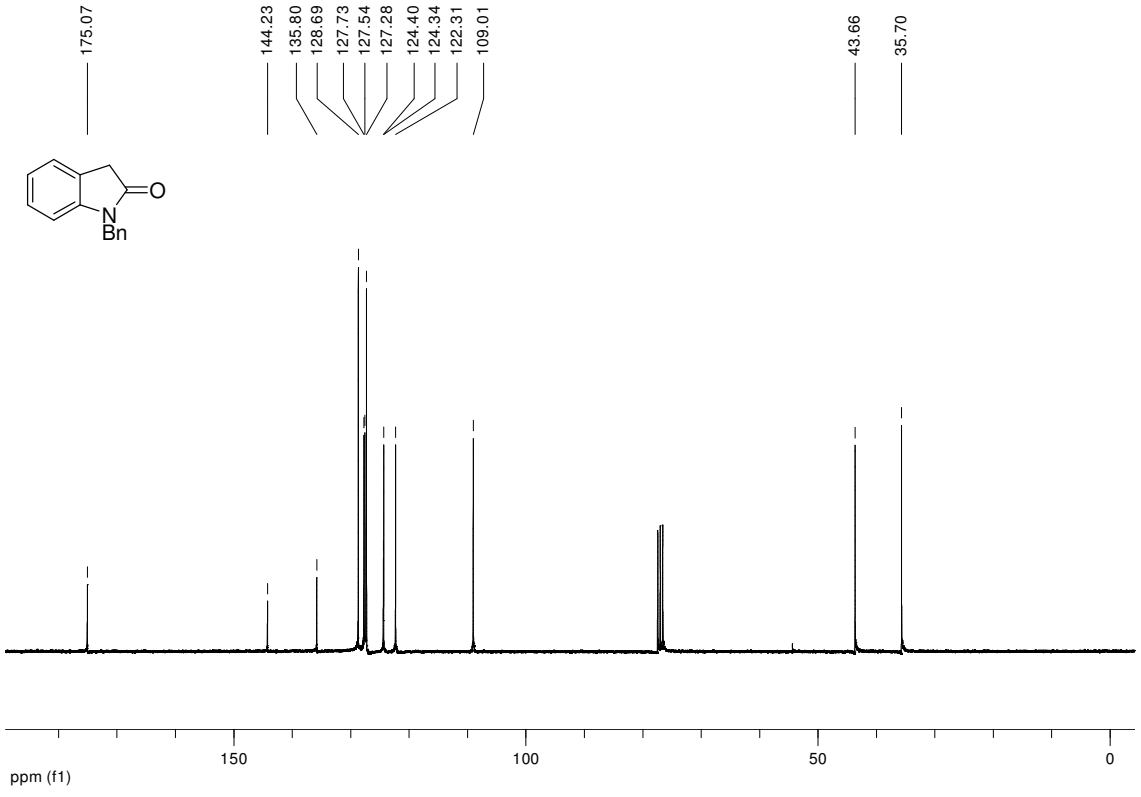




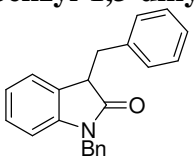


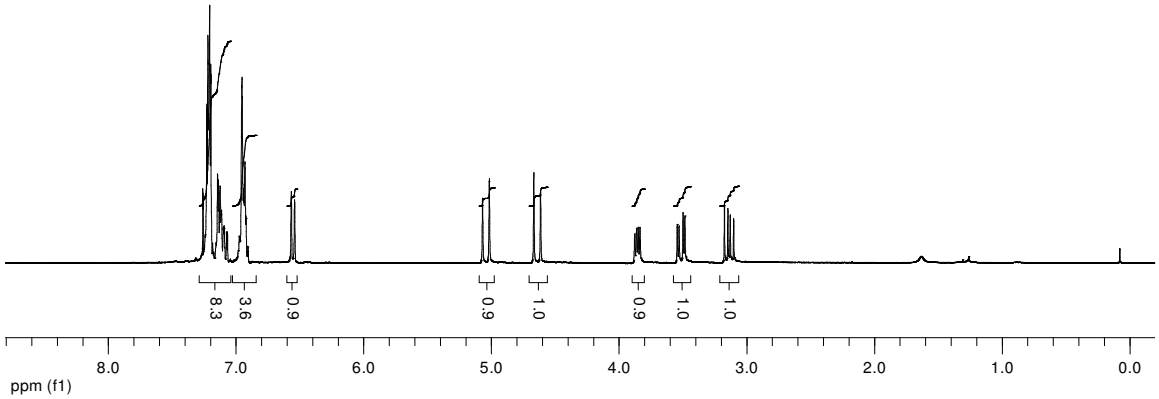
1-Benzyl-1,2-dihydroindol-2-one (SI 2)

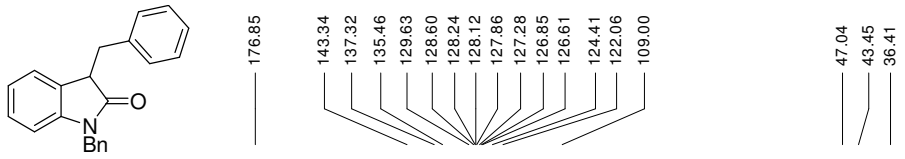


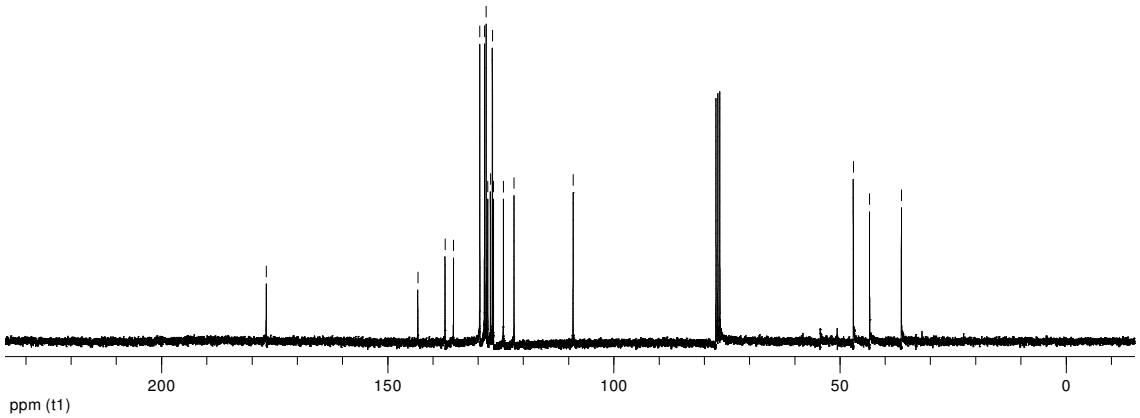


1,3-Dibenzyl-1,3-dihydroindol-2-one [Table 3, Entry 9]

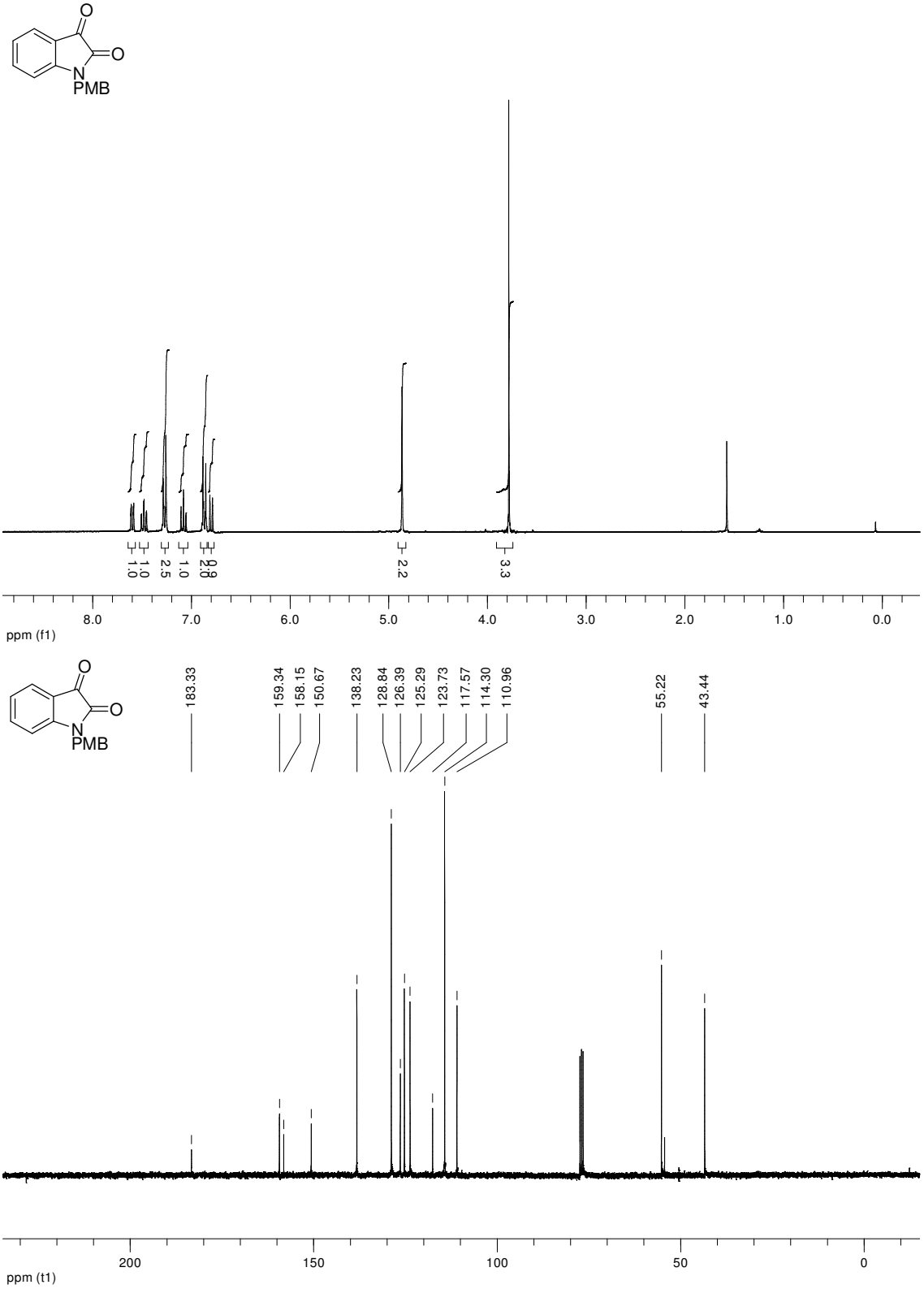




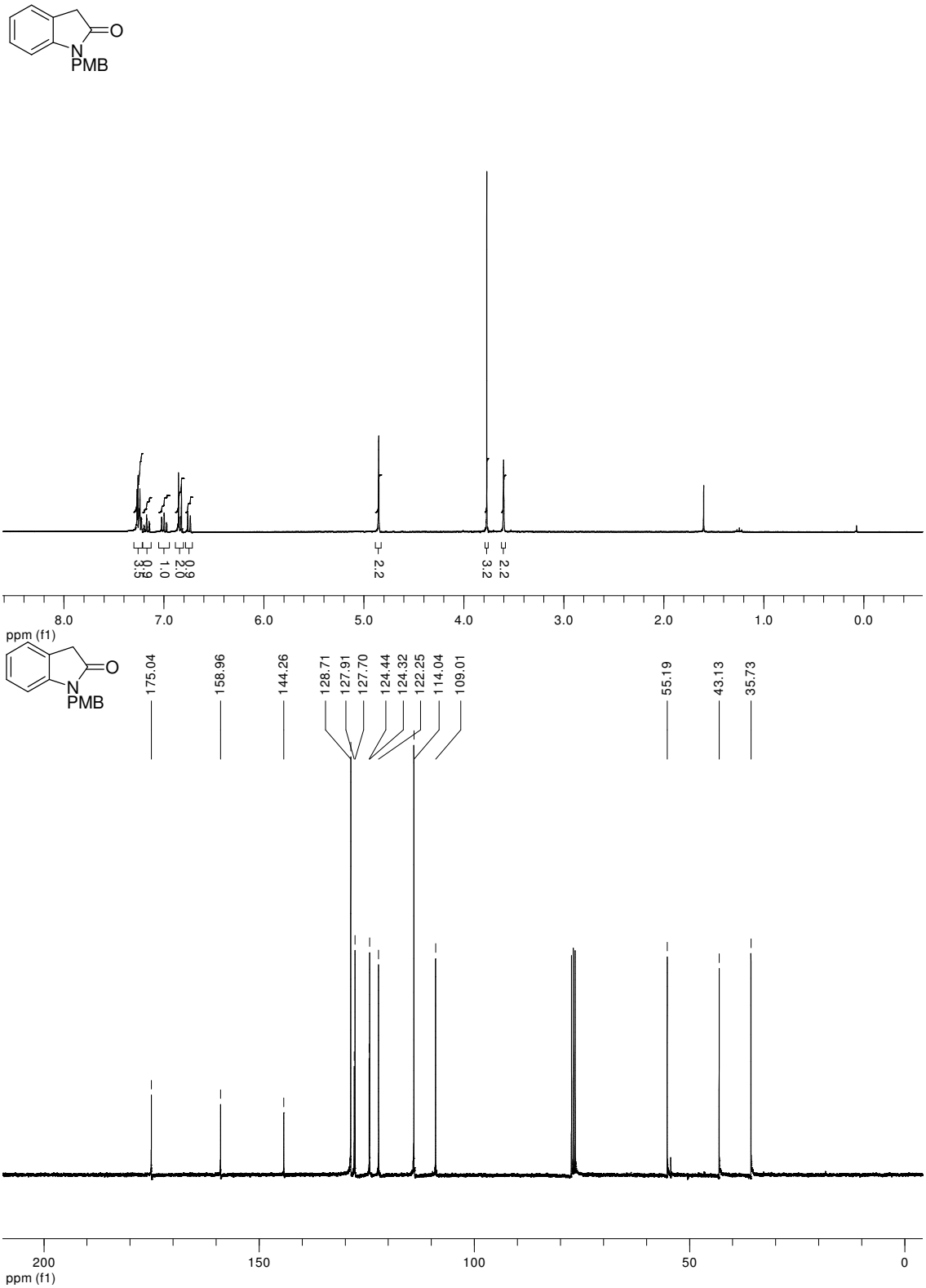




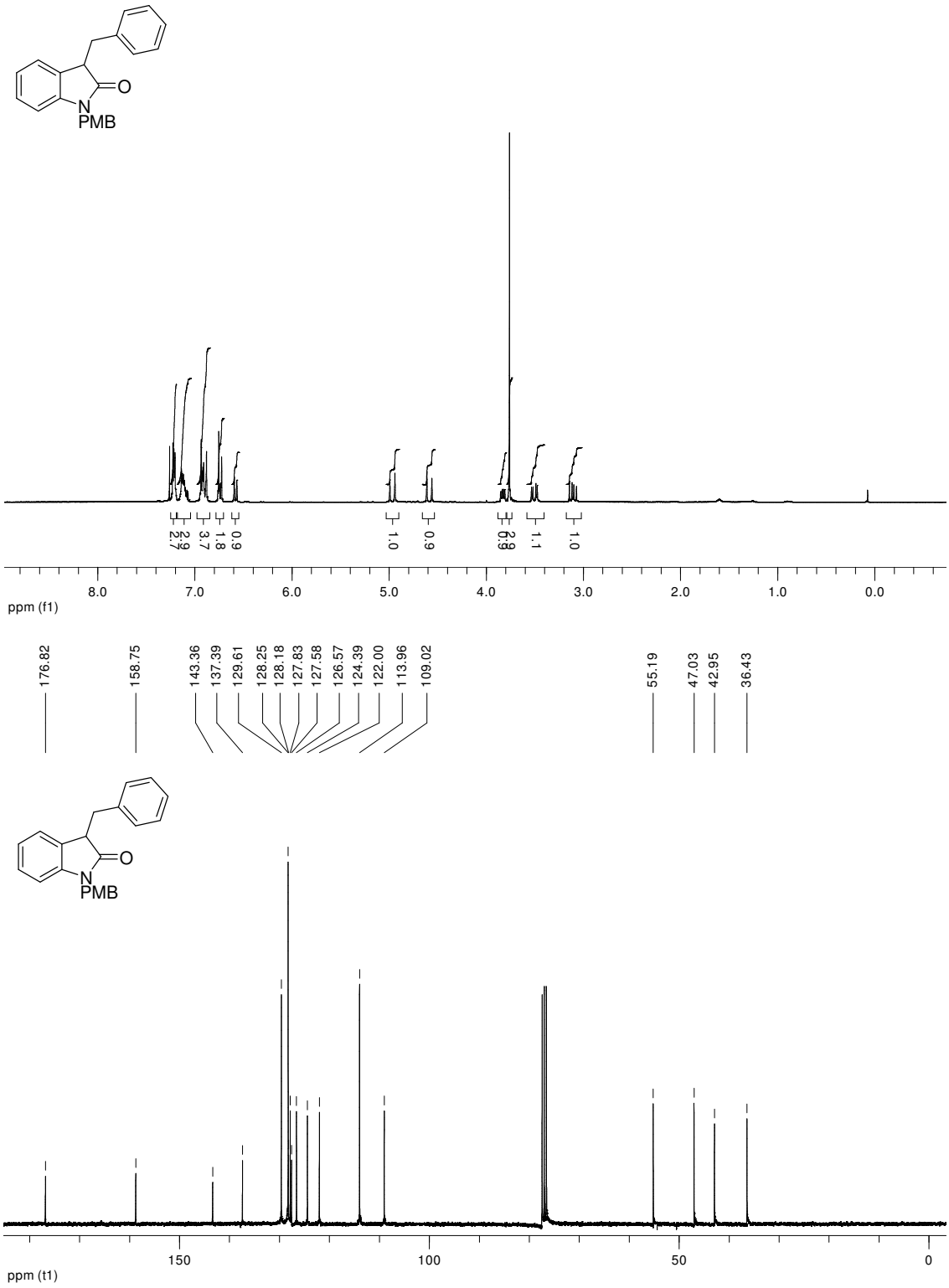
1-(4-Methoxy-benzyl)-1*H*-indole-2,3-dione (SI 3)



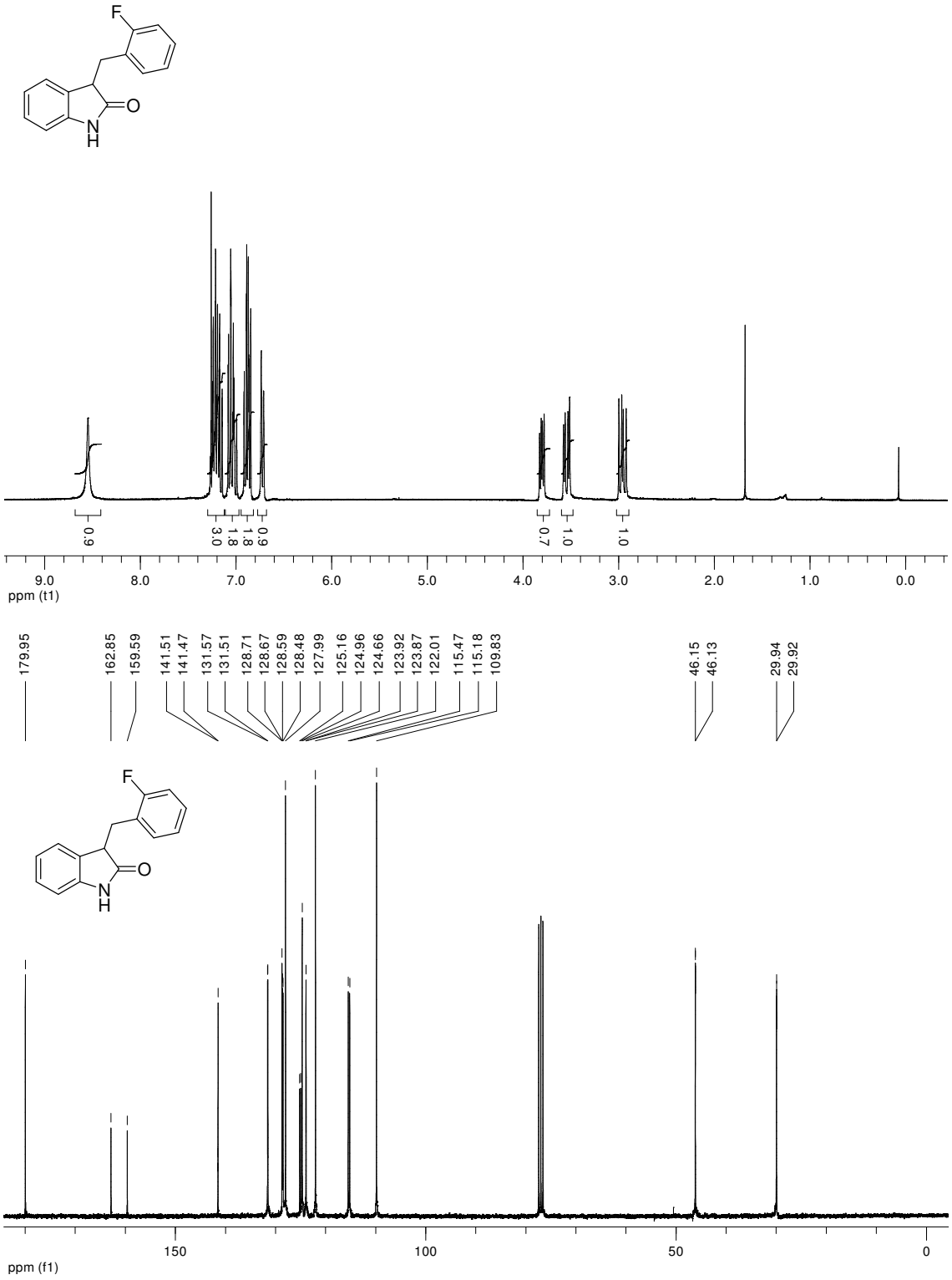
1-(4-Methoxy-benzyl)-1,3-dihydroindol-2-one (SI 4)

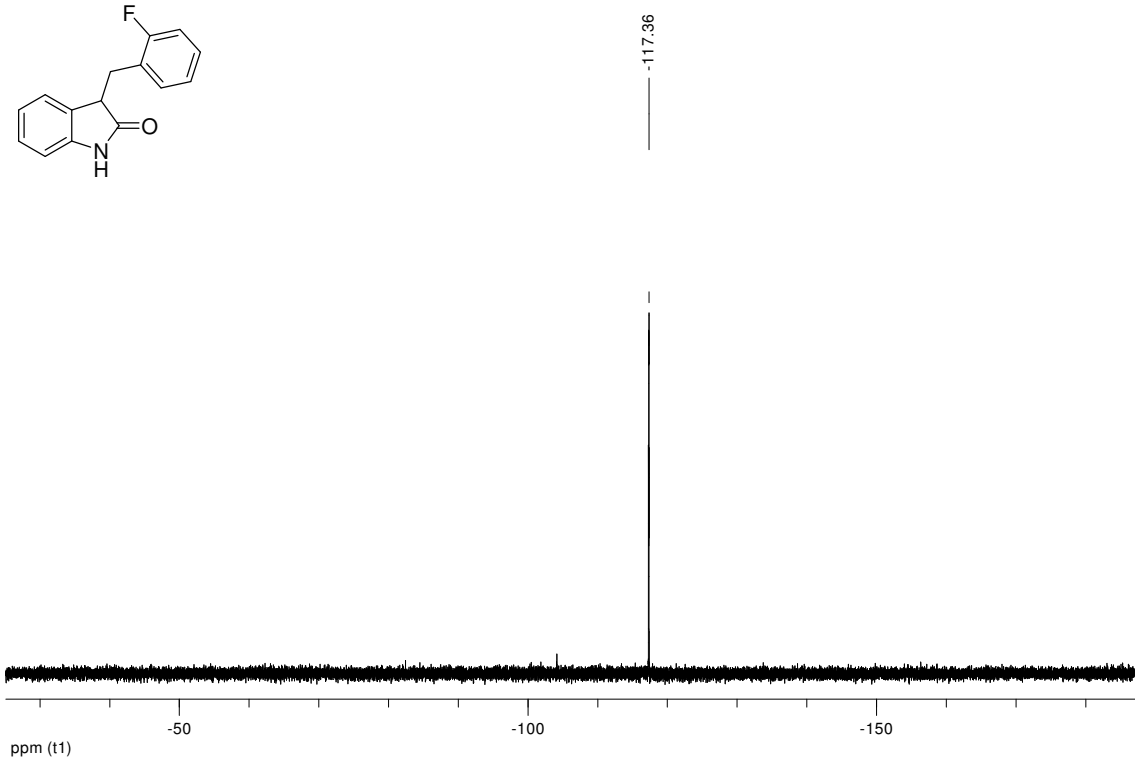


3-Benzyl-1-(4-methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 10]

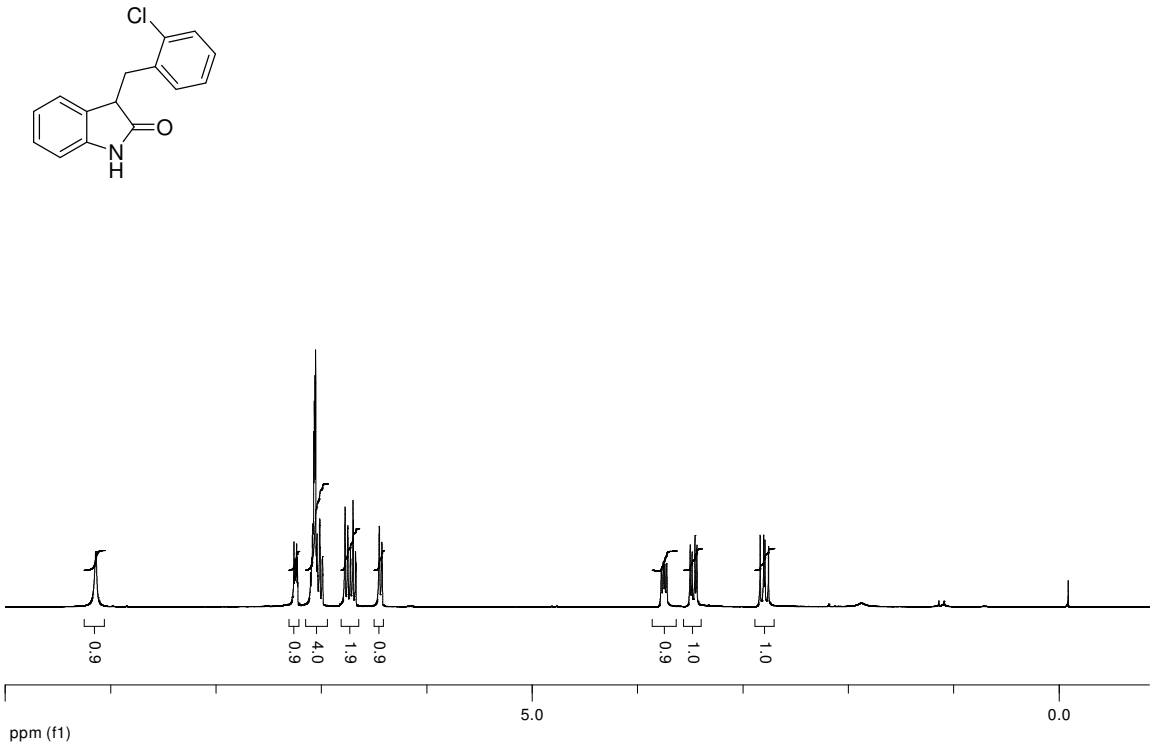


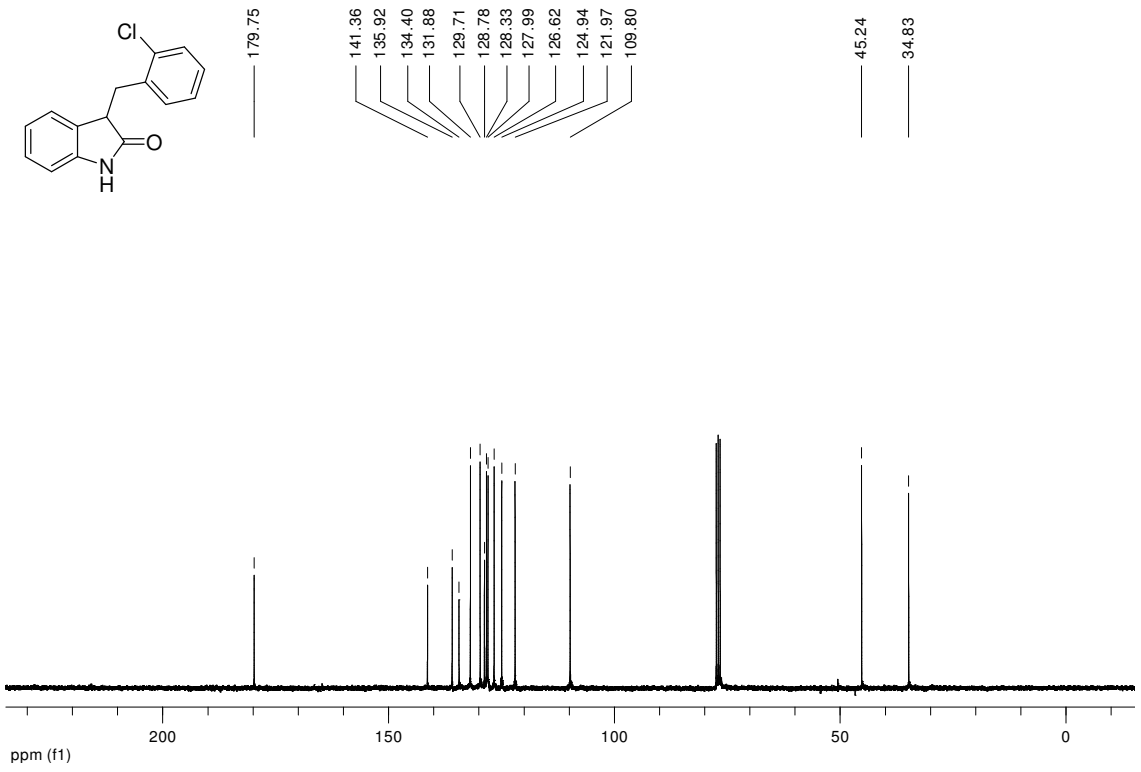
3-(2-Fluoro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 11]



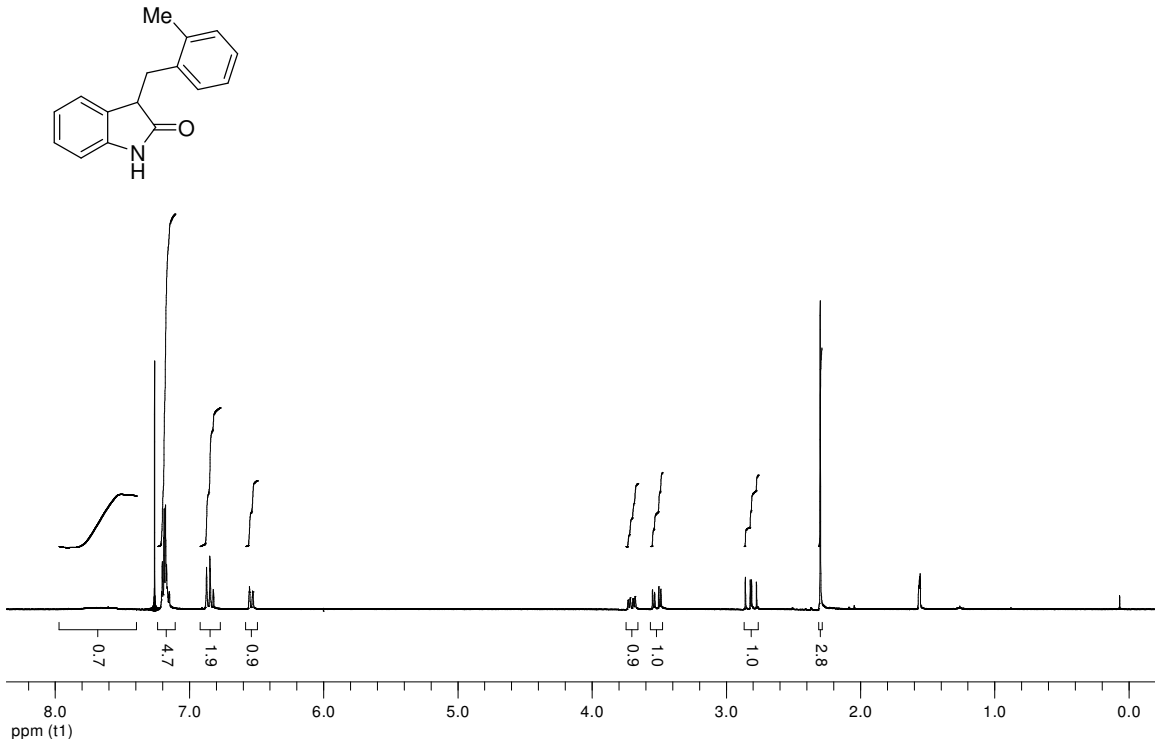


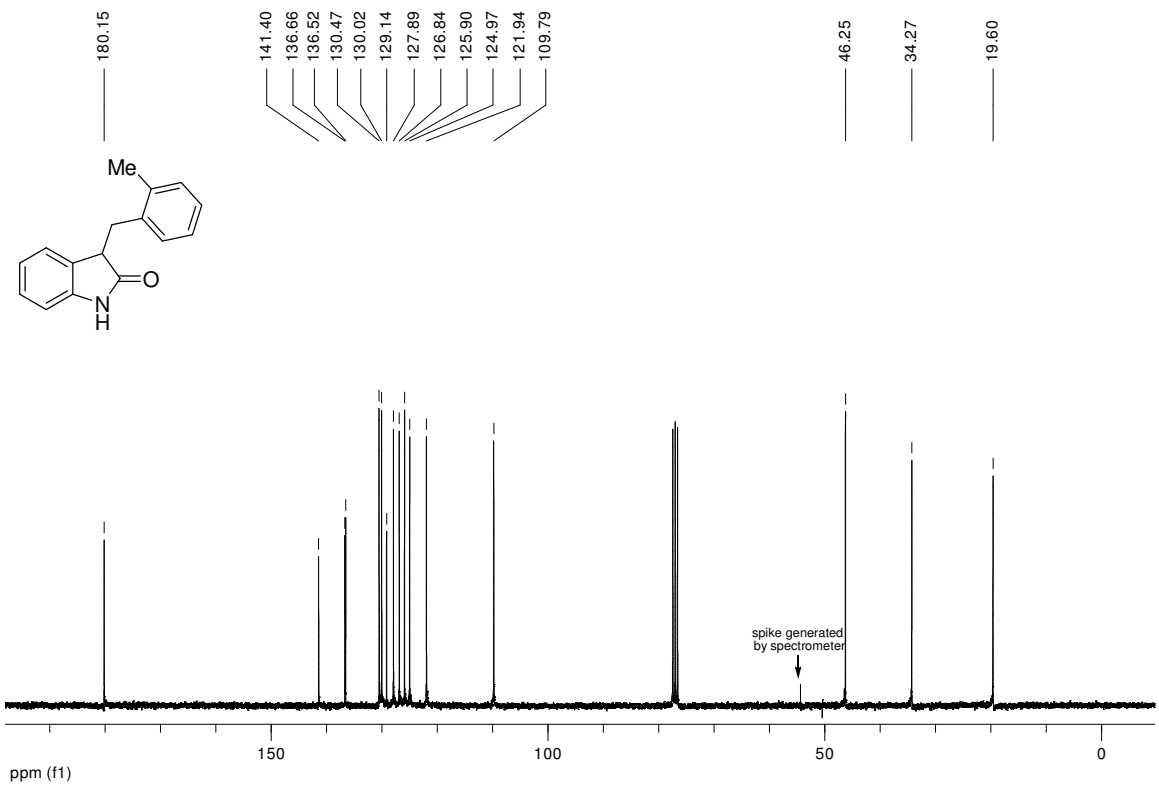
3-(2-Chloro-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 12]



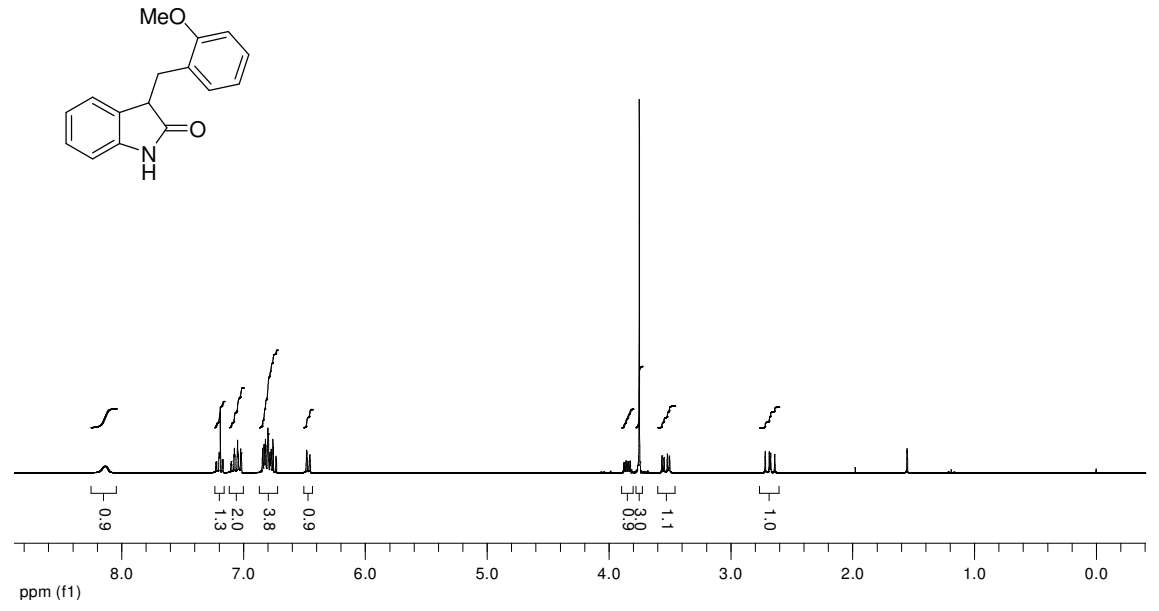


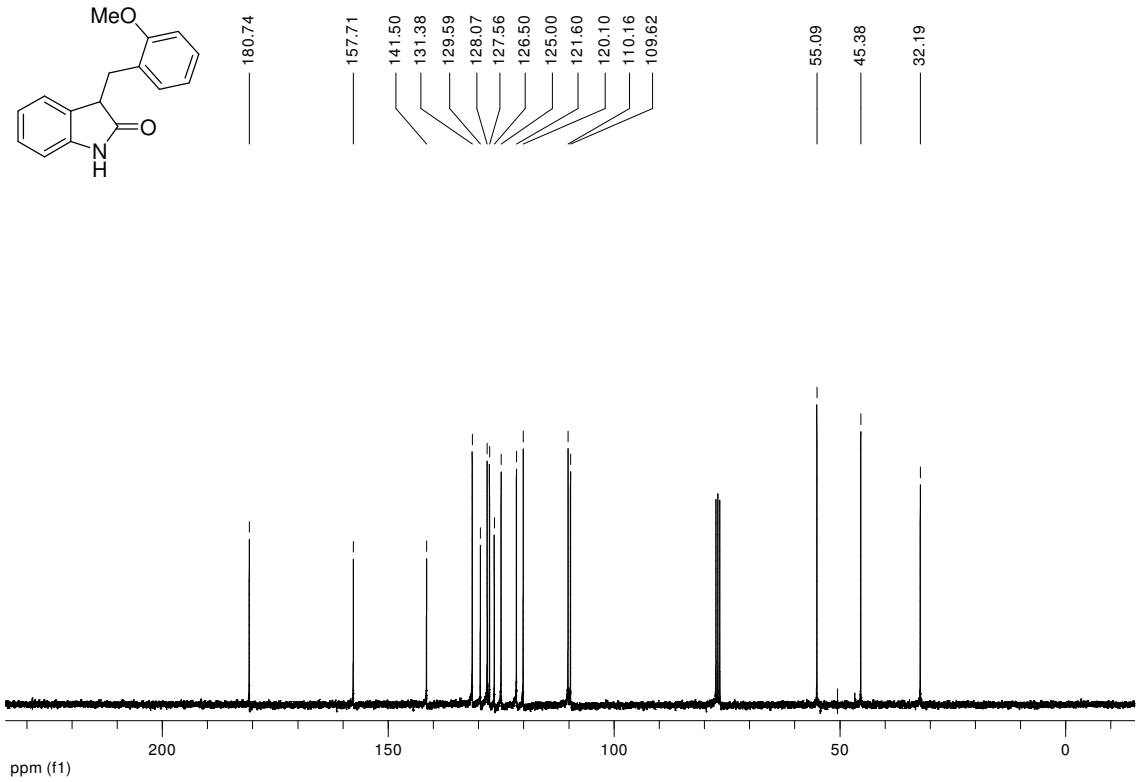
3-(2-Methyl-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 13]



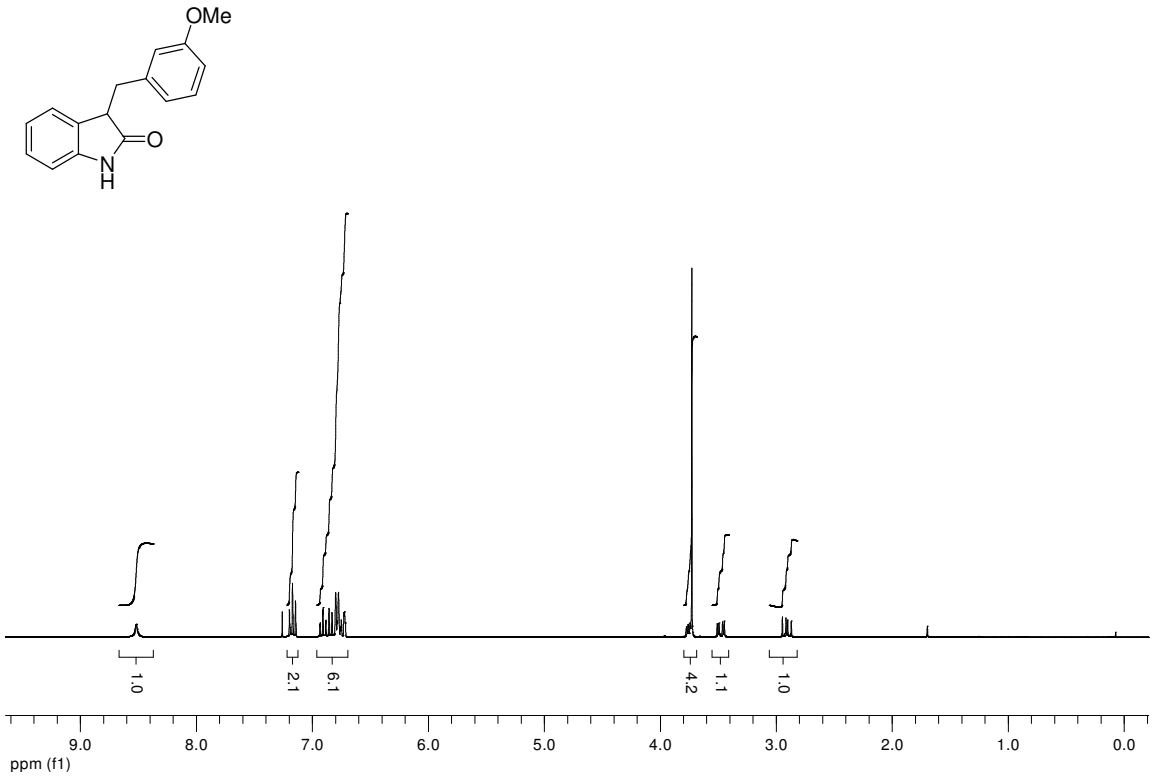


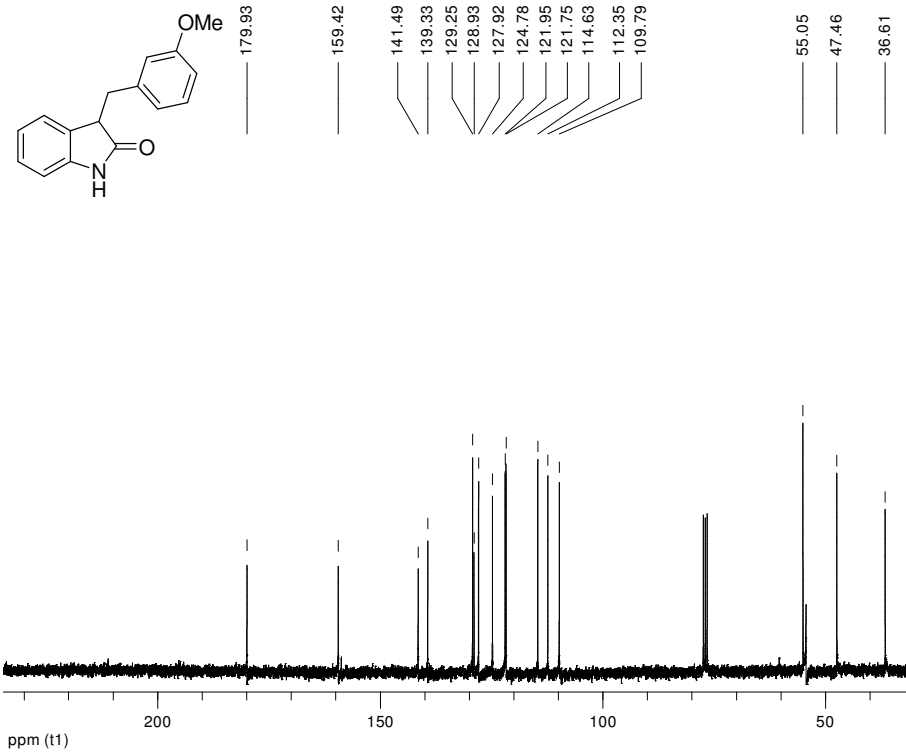
3-(2-Methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 14]



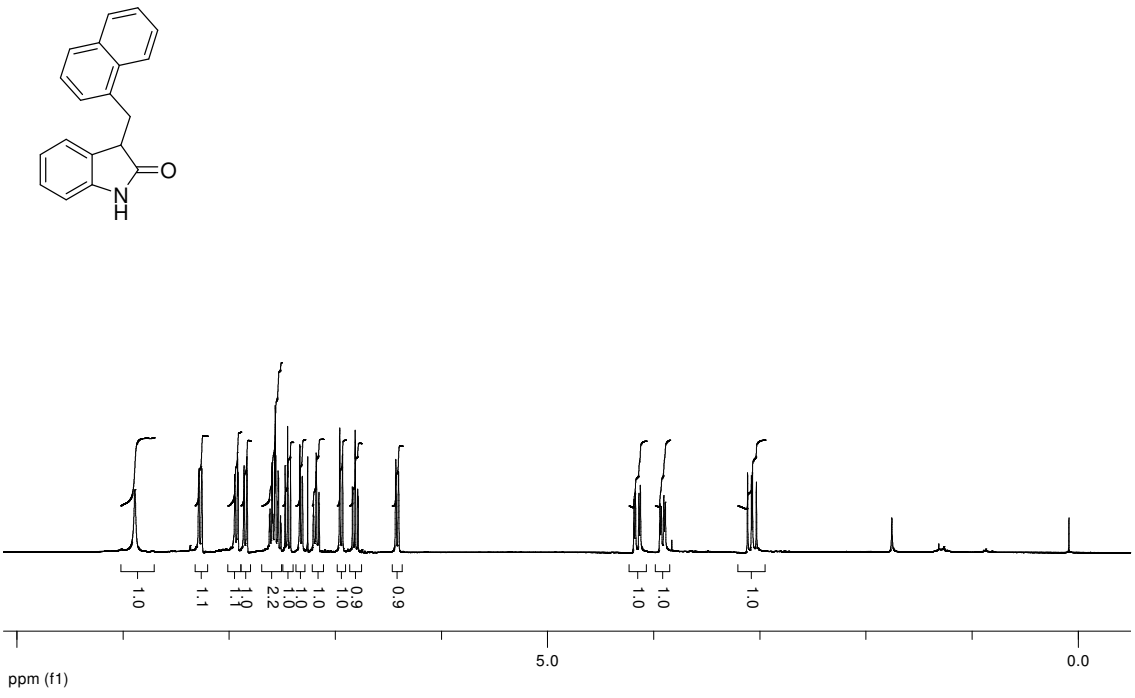


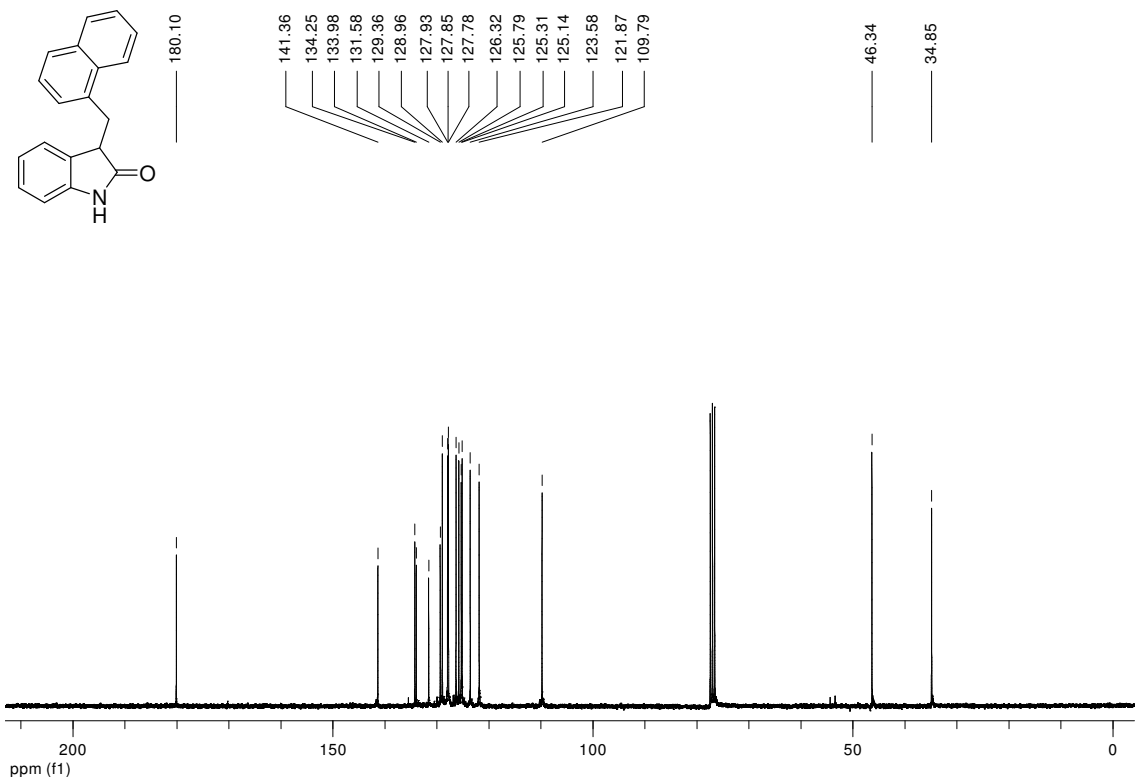
3-(3-Methoxy-benzyl)-1,3-dihydroindol-2-one [Table 3, Entry 15]



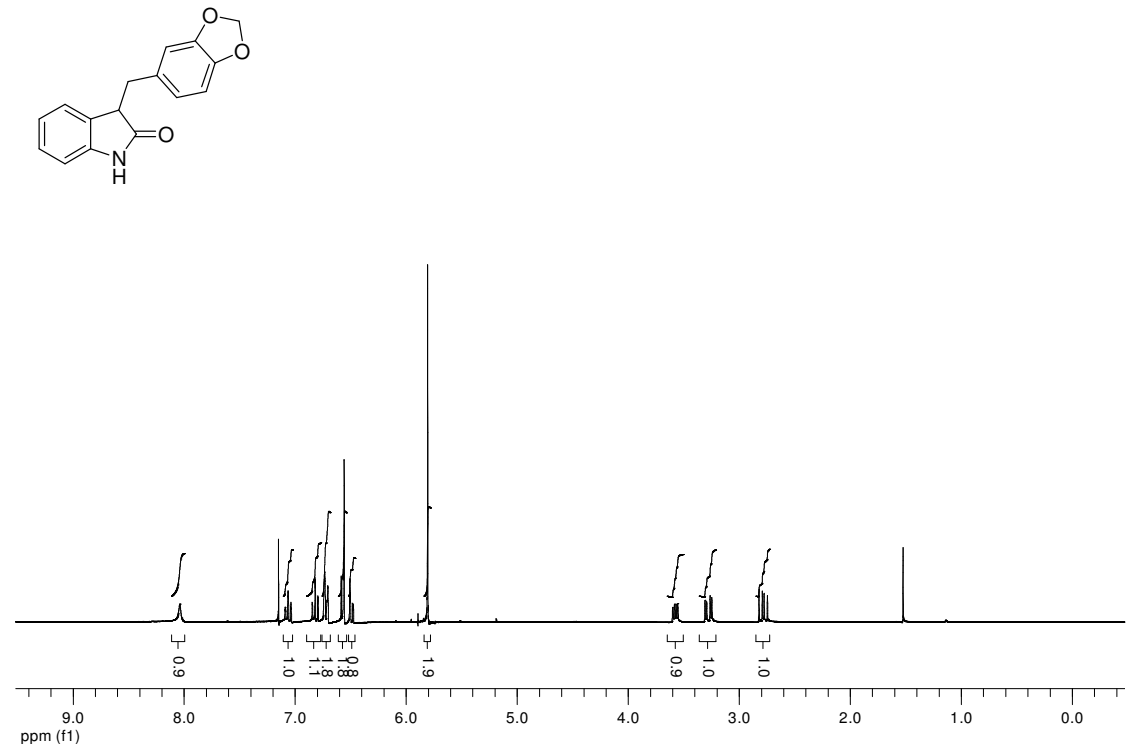


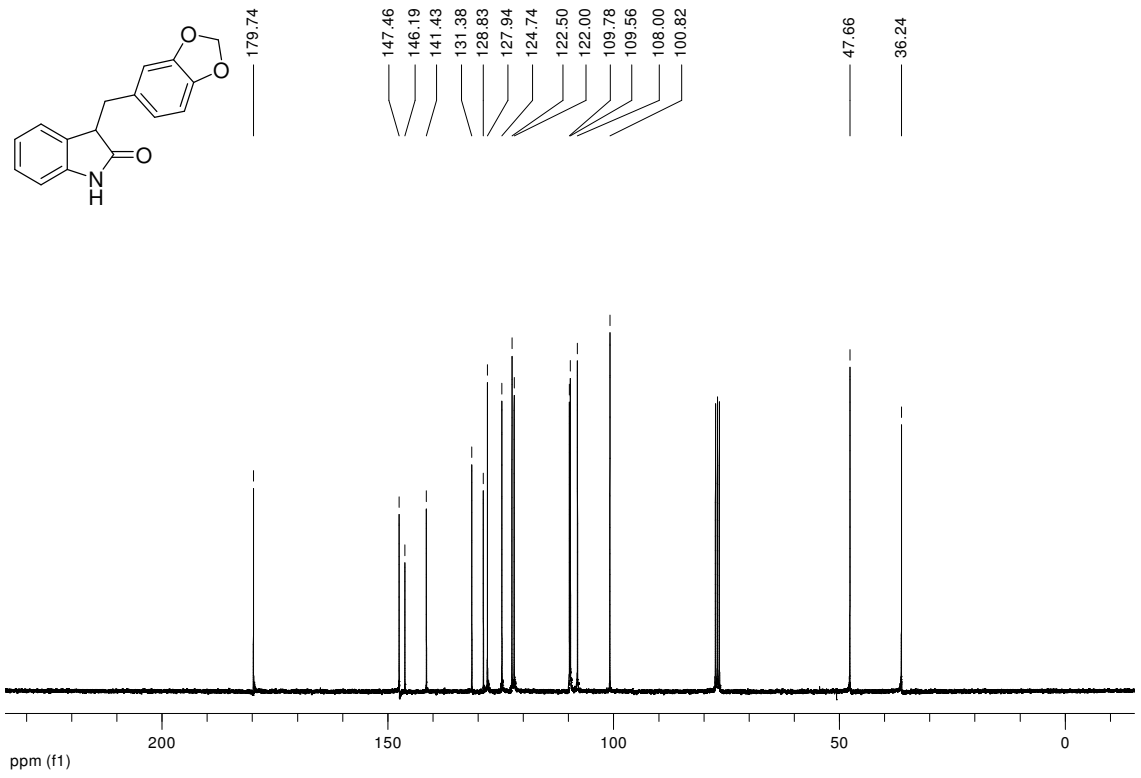
3-Naphthalen-1-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 16]



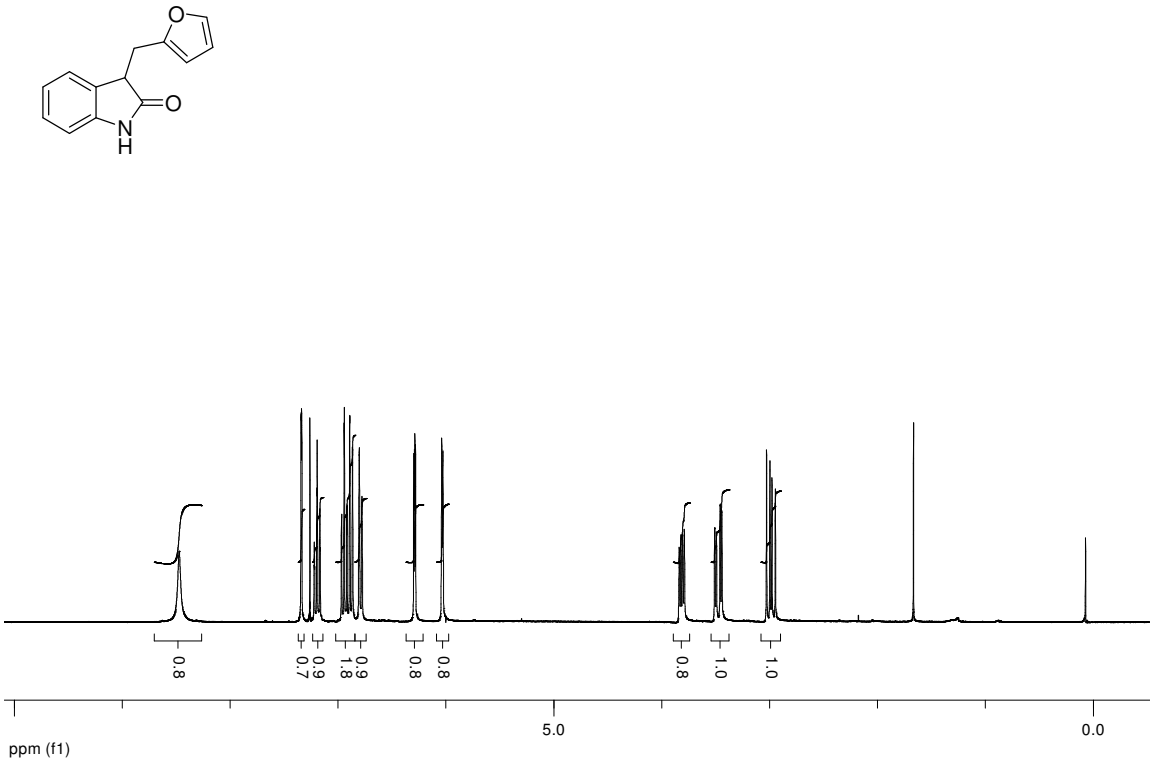


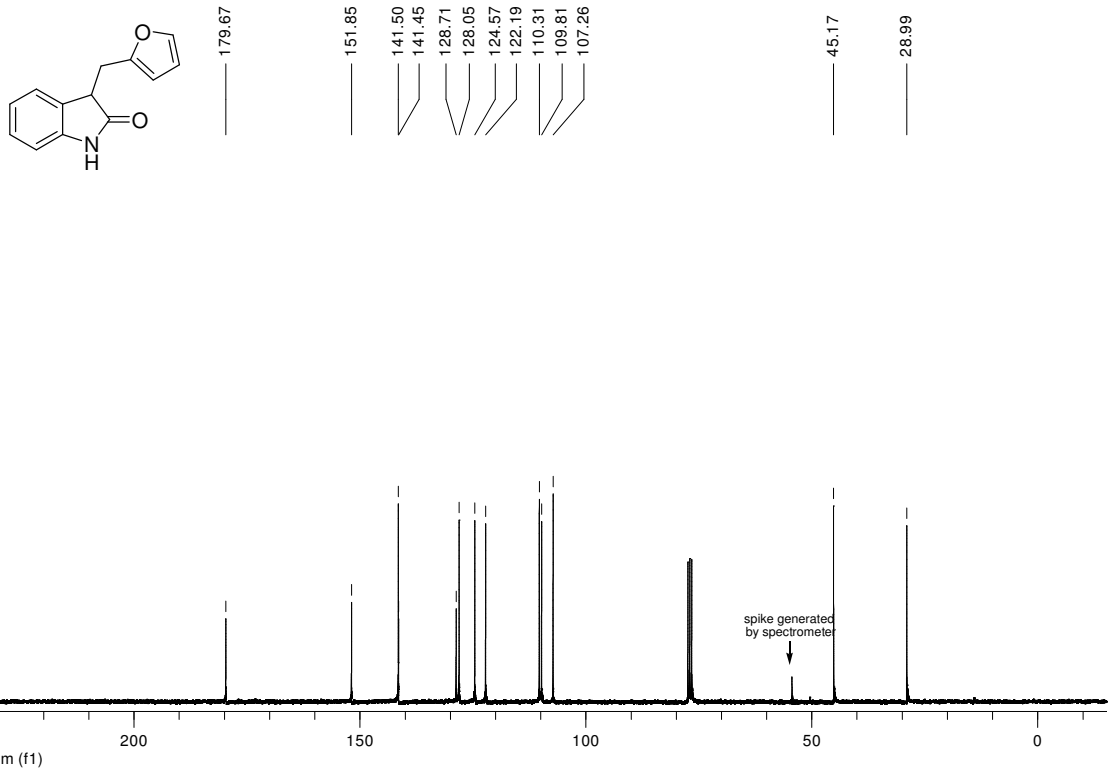
3-Benzo[1,3]dioxol-5-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 17]



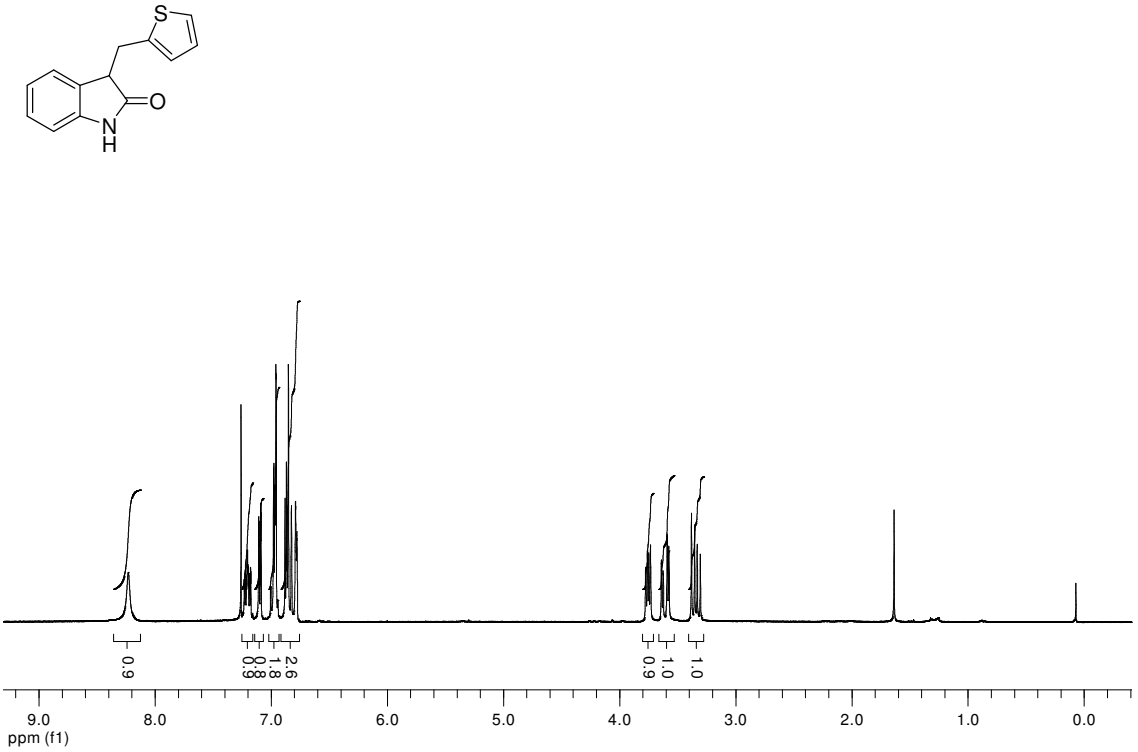


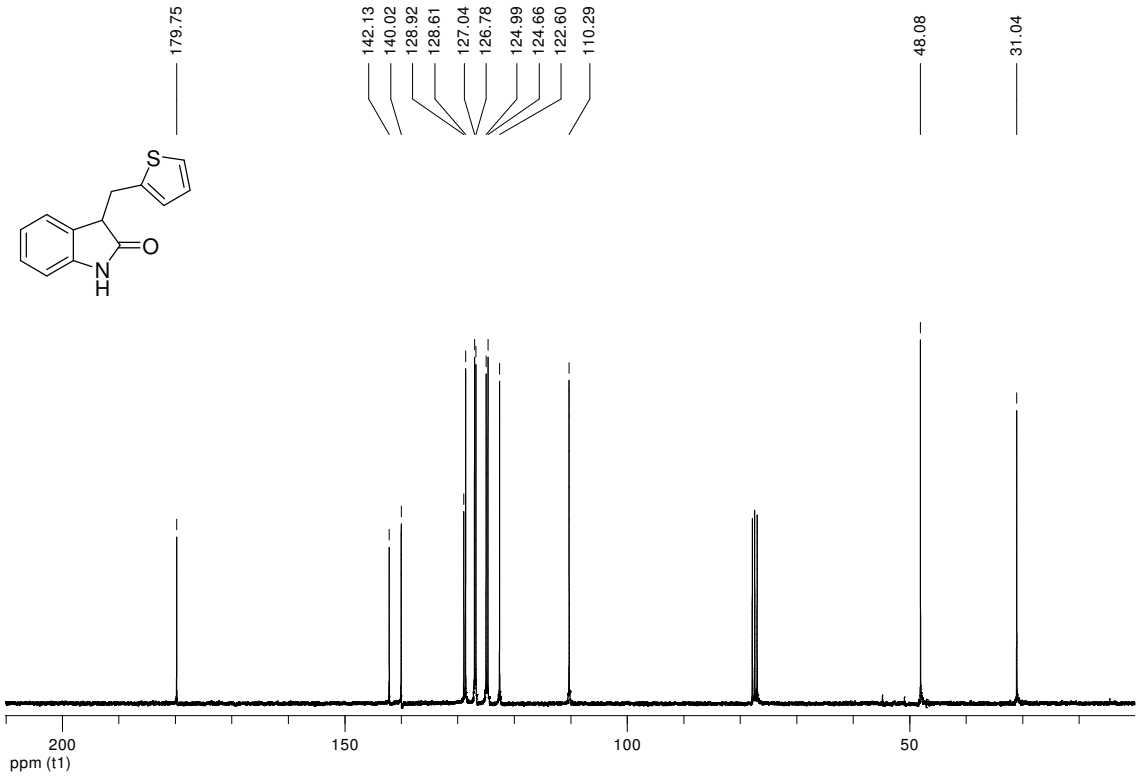
3-Furan-2-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 18]



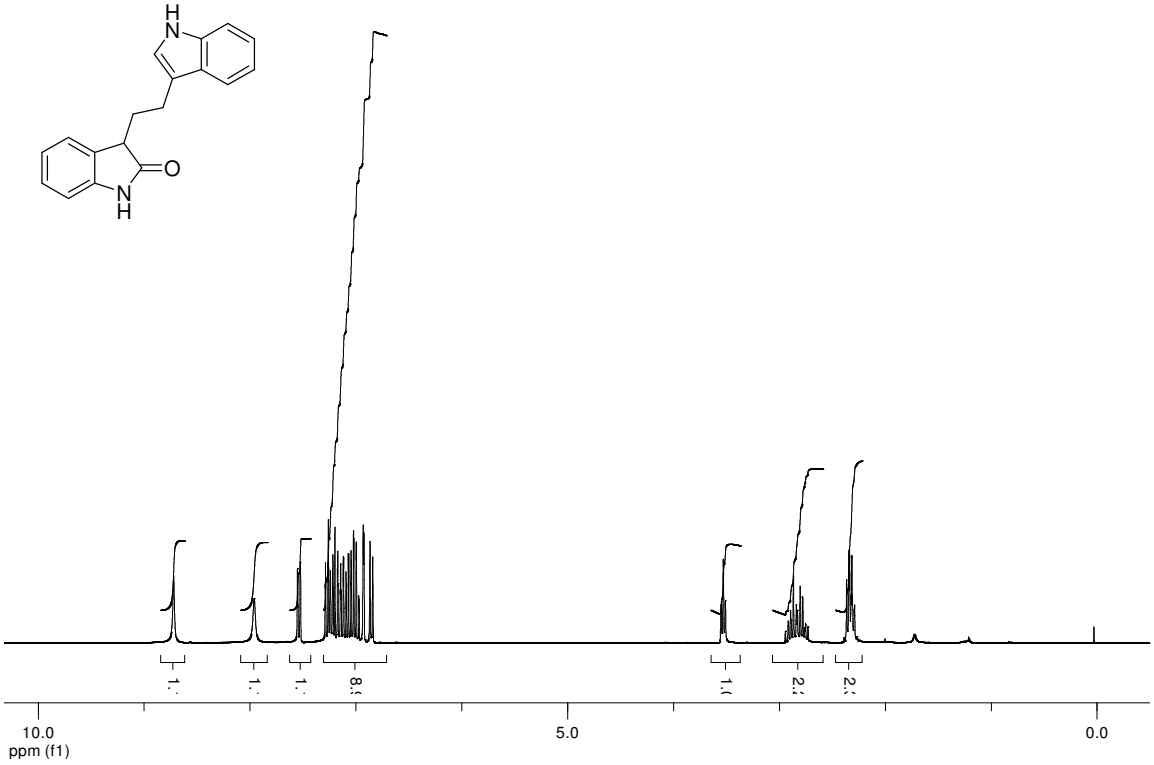


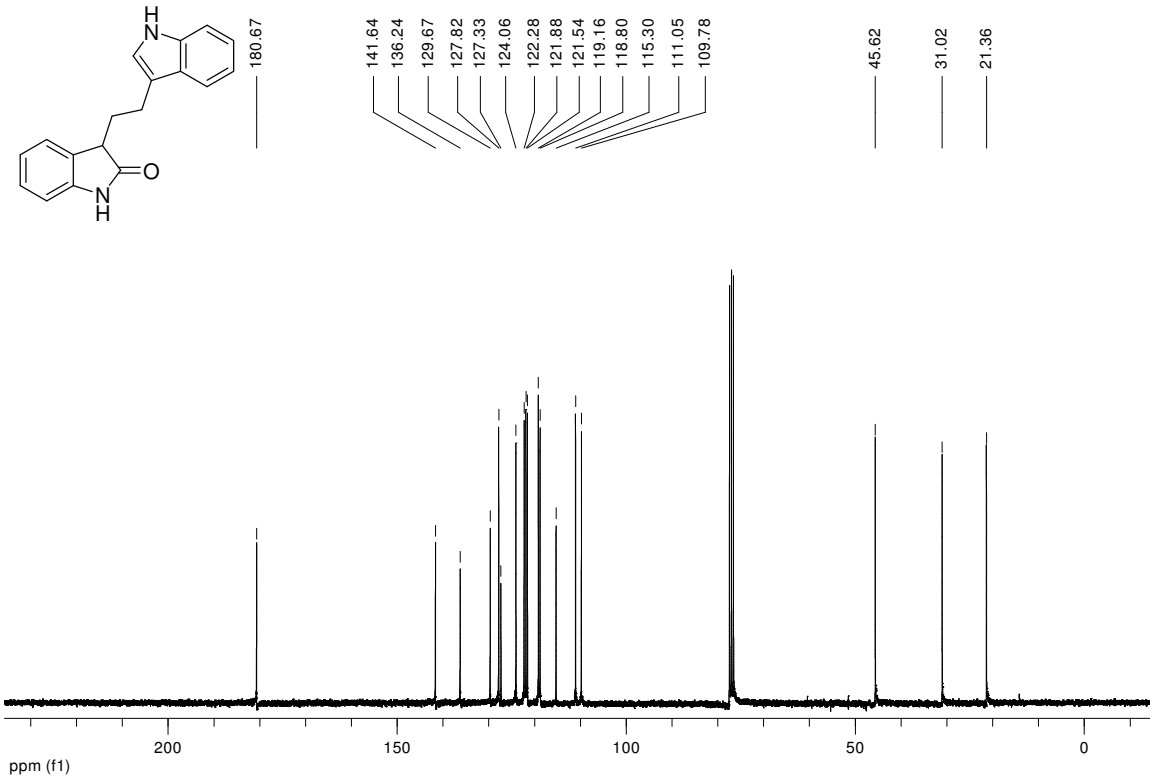
3-Thiophen-2-ylmethyl-1,3-dihydroindol-2-one [Table 3, Entry 19]



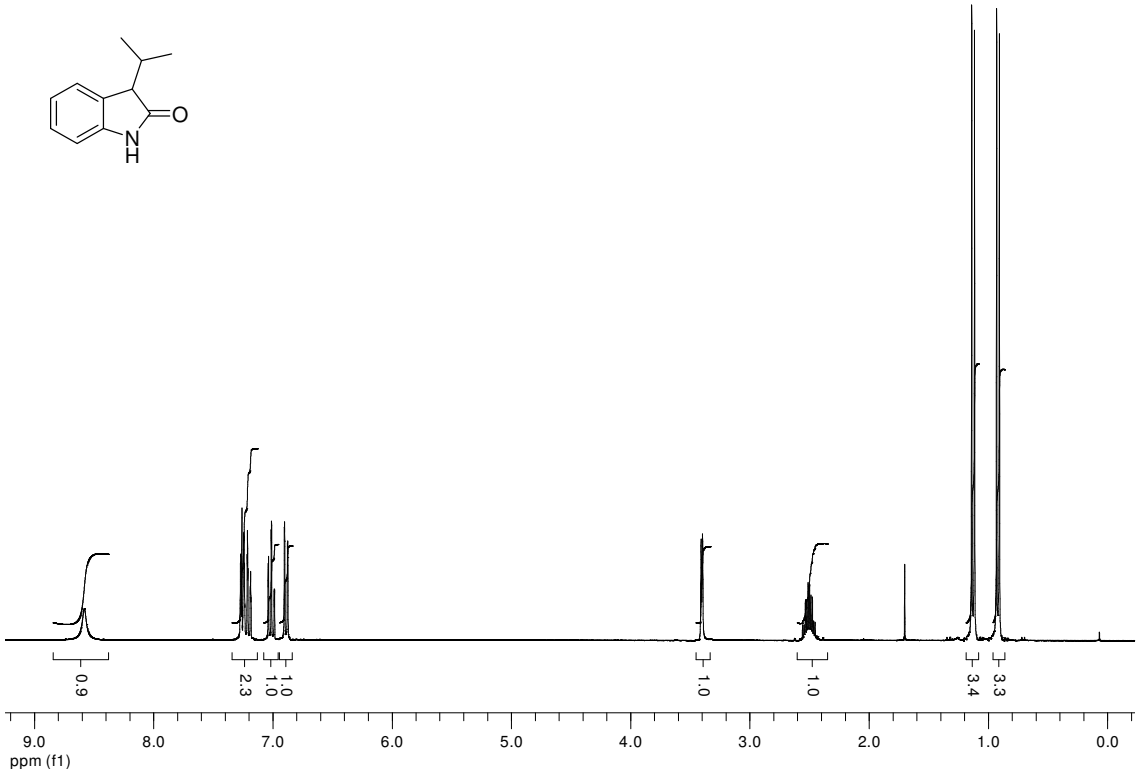


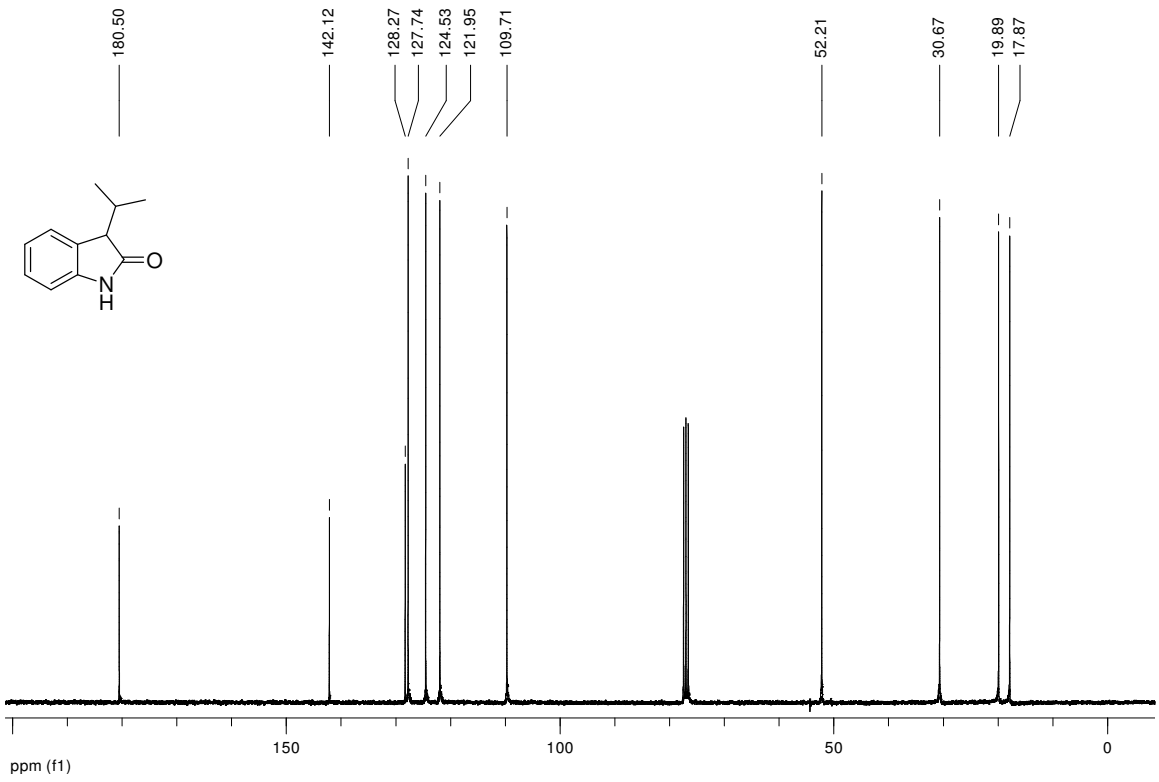
3-[2-(1*H*-Indol-3-yl)-ethyl]-1,3-dihydroindol-2-one [Table 3, Entry 20]





3-Isopropyl-1,3-dihydroindol-2-one [Table 3, Entry 21]

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O
N
H
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100
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0
ppm (f1)