Electronic Supplementary Material (ESI) for Organic & Biomolecular Chemistry.

Supplementary Information

Reductive Cross-Coupling of *N*-Acyl Pyrazole and Nitroarene using tetrahydroxydiboron: Synthesis of Secondary Amides

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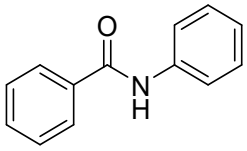
1. General Information

All reagents were purchased and used without further purification. ^{1}H NMR spectra were recorded in $CDCl_3$ or $(CD_3)_2SO$ on 500 MHz NMR spectrometers and data are reported as follows: chemical shift, multiplicity [singlet (s), doublet (d), triplet (t), quartet (q), quintet (quin), heptet (hept), doublet of doublets (dd), triplet of triplet (tt) and multiplet (m)], coupling constants (Hz) and integration. ^{13}C NMR spectra were recorded in $CDCl_3$ or $(CD_3)_2SO$ on 126 MHz NMR spectrometers and resonances (δ) are given in ppm. Starting materials of amides were synthesized according to corresponding literature.[1]

2. General procedure for the synthesis of products

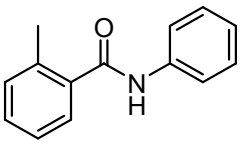
N-Acyl pyrazole (1 mmol, 1,0 equiv), nitroarene (1.0 mmol, 1.0 equiv), $B_2(OH)_4$ (269 mg, 3.0 mmol, 3.0 equiv) were dissolved in DMF (5 mL, 0.2M). The resulting solution was stirred at 100 ^{o}C for 24 h. The rection was diluted with ethyl acetate, then washed with brine. The organic layer was dried over $MgSO_4$, filtered, and concentrated under vacuum. The crude product was purified by silica gel column chromatography with ethyl acetate/hexane (1:9).

3. Characterization Data for the Products



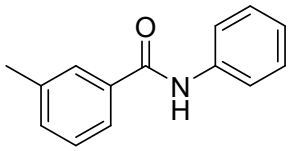
***N*-Phenylbenzamide (3aa)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3aa** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (171 mg, 0.87 mmol, 87%).
m.p. 162-163 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.27 (s, 1H), 7.99 – 7.97 (m, 2H), 7.82 – 7.80 (m, 2H), 7.61 – 7.57 (m, 1H), 7.55 – 7.52 (m, 2H), 7.38 – 7.34 (m, 2H), 7.10 (tt, *J* = 7.4, 1.25 Hz, 1H);
^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.58, 139.20, 135.02, 131.52, 128.59, 128.36, 127.66, 123.65, 120.38;
MS (EI) m/z = 197.08 (M^+).



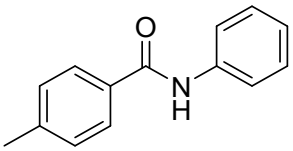
2-Methyl-*N*-phenylbenzamide (3ba)[2]

According to the general procedure using (1H-pyrazol-1-yl)(*o*-tolyl)methanone (186 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ba** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (160 mg, 0.76 mmol, 76%).
m.p. 126-127 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 7.95 (s, 1H), 7.68 (s, 1H), 7.66 – 7.62 (m, 3H), 7.38 – 7.33 (m, 4H), 7.16 – 7.13 (m, 1H), 2.41 (s, 3H);
^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 166.01, 138.69, 138.01, 134.99, 132.58, 129.08, 128.64, 127.82, 124.51, 123.98, 120.23, 21.39;
MS (EI) m/z = 211.10 (M^+).



3-Methyl-*N*-phenylbenzamide (3ca)[2]

According to the general procedure using (1H-pyrazol-1-yl)(*m*-tolyl)methanone (186 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ca** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (116 mg, 0.55 mmol, 55%).
m.p. 125-126 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.21 (s, 1H), 7.81 (d, *J* = 3.3 Hz, 1H), 7.80 – 7.78 (m, 2H), 7.76 (d, *J* = 6.3 Hz, 1H), 7.43 – 7.38 (m, 2H), 7.37 – 7.34 (m, 2H), 7.10 (tt, *J* = 7.4, 1.2 Hz, 1H), 2.40 (s, 3H);
^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.67, 139.24, 137.67, 135.02, 132.09, 128.57, 128.26, 128.13, 124.81, 123.58, 120.33, 20.96;
MS (EI) m/z = 211.10 (M^+).

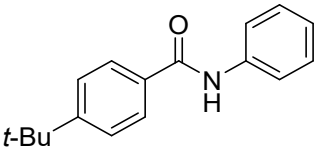


4-Methyl-*N*-phenylbenzamide (**3da**)[2]

According to the general procedure using (1H-pyrazol-1-yl)(*p*-tolyl)methanone (186 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3da** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (148 mg, 0.73 mmol, 73%).
m.p. 145-146 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.15 (s, 1H), 7.89 – 7.87 (m, 2H), 7.79 – 7.77 (m, 2H), 7.36 – 7.32 (m, 4H), 7.09 (tt, *J* = 7.4, 2.5 Hz , 1H), 2.39 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.33, 141.53, 139.24, 132.08, 128.88, 128.56, 127.68, 123.52, 120.34, 21.00;

MS (EI) m/z = 211.10 (M^+).

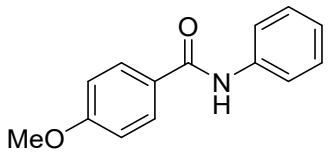


4-(*tert*-Butyl)-*N*-phenylbenzamide (**3ea**)[2]

According to the general procedure using (4-(*tert*-butyl)phenyl)(1H-pyrazol-1-yl)methanone (228 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ea** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (197 mg, 0.78 mmol, 78%).
m.p. 123-125 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.17 (s, 1H), 7.90 – 7.88 (m, 2H), 7.79 – 7.77 (m, 2H), 7.55 – 7.53 (m, 2H), 7.36 – 7.33 (m, 2H), 7.09 (tt, *J* = 7.4, 1.2 Hz, 1H), 1.32 (s, 9H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.49, 154.36, 139.27, 132.30, 128.56, 127.51, 125.12, 123.50, 120.25, 34.66, 30.93;

MS (EI) m/z = 253.15 (M^+).



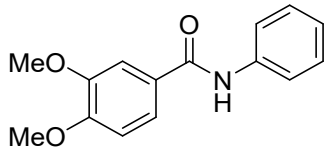
4-Methoxy-*N*-phenylbenzamide (**3fa**)[2]

According to the general procedure using (4-methoxyphenyl)(1H-pyrazol-1-yl)methanone (202 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3fa** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (3:1) and obtained as a white solid (173 mg, 0.76 mmol, 76%).
m.p. 160-161 °C;

^{1}H NMR (500 MHz, $CDCl_3$) δ 7.84 (m, 3H), 7.63 (d, *J* = 8.0 Hz, 2H), 7.35 (t, *J* = 7.8 Hz, 2H), 7.13 (t, *J* = 7.4 Hz, 1H), 6.93 (d, *J* = 8.3 Hz, 2H), 3.86 (s, 3H);

^{13}C NMR (126 MHz, $CDCl_3$) δ 165.42, 162.60, 138.25, 129.19, 129.07, 127.27, 124.48, 120.34, 114.10, 55.62;

MS (EI) m/z = 227.09 (M^+).

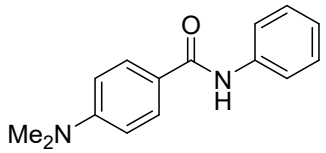


3,4-Dimethoxy-*N*-phenylbenzamide (**3ga**)[3]

According to the general procedure using (3,4-dimethoxyphenyl)(1H-pyrazol-1-yl)methanone (232 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ga** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (3:1) and obtained as a white solid (184 mg, 0.72 mmol, 72%).
m.p. 174-175 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.06 (s, 1H), 7.77 – 7.75 (m, 2H), 7.63 (dd, *J* = 8.4, 2.1 Hz, 1H), 7.54 (d, *J* = 2.2 Hz, 1H), 7.35 (t, *J* = 7.9 Hz, 2H), 7.10 – 7.07 (m, 2H), 3.85 (s, 3H), 3.84 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.88, 151.61, 148.29, 139.27, 128.53, 126.99, 123.46, 121.00, 120.46, 111.04, 110.88, 55.66, 55.62;

MS (EI) m/z = 257.11 (M^+).

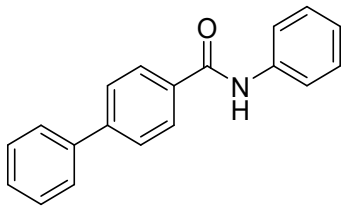


4-(Dimethylamino)-*N*-phenylbenzamide (3ha)[4]

According to the general procedure using (4-(dimethylamino)phenyl)(1H-pyrazol-1-yl)methanone (215 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ha** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (154 mg, 0.64 mmol, 64%).
m.p. 181-182 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.85 (s, 1H), 7.89 – 7.86 (m, 2H), 7.78 – 7.76 (m, 2H), 7.33 – 7.29 (m, 2H), 7.05 (tt, *J* = 7.4, 1.2 Hz, 1H), 6.77 – 6.74 (m, 2H), 3.00 (s, 6H);

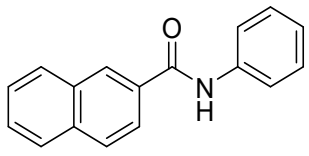
^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.19, 152.37, 139.71, 129.12, 128.45, 122.96, 121.08, 120.18, 110.75, 39.69;

MS (EI) m/z = 240.13 (M^+).



***N*-Phenyl-(1,1'-biphenyl)-4-carboxamide (3ia)**[2]

According to the general procedure using [1,1'-biphenyl]-4-yl(1H-pyrazol-1-yl)methanone (248 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ia** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (207 mg, 0.76 mmol, 76%).
m.p. 222-223 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.30 (s, 1H), 8.09 – 8.06 (m, 2H), 7.85 – 7.81 (m, 4H), 7.77 – 7.75 (m, 2H), 7.53 – 7.49 (m, 2H), 7.44 – 7.41 (m, 1H), 7.38 – 7.35 (m, 2H), 7.11 (tt, *J* = 7.4, 2.5 Hz, 1H);
^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.18, 143.10, 139.21, 139.12, 133.73, 129.07, 128.62, 128.38, 128.15, 126.92, 126.59, 123.67, 120.39;
MS (EI) m/z = 273.12 (M^+).

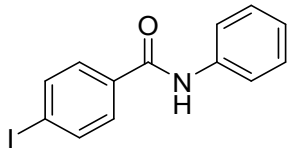


***N*-Phenyl-2-napthamide (3ja)**[2]

According to the general procedure using naphthalen-2-yl(1H-pyrazol-1-yl)methanone (222 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ja** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (217 mg, 0.88 mmol, 88%).
m.p. 168-169 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.43 (s, 1H), 8.59 (s, 1H), 8.10 – 8.01 (m, 4H), 7.85 – 7.83 (m, 2H), 7.67 – 7.61 (m, 2H), 7.40 – 7.36 (m, 2H), 7.12 (tt, *J* = 7.4, 1.2 Hz, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.59, 139.24, 134.26, 132.29, 132.08, 128.94, 128.64, 128.00, 127.95, 127.80, 127.67, 126.84, 124.46, 123.68, 120.37;

MS (EI) m/z = 247.10 (M^+).

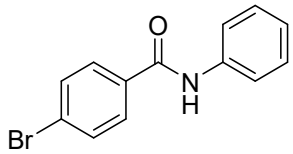


4-Iodo-*N*-phenylbenzamide (3ka)[4]

According to the general procedure using (4-iodophenyl)(1H-pyrazol-1-yl)methanone (298 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ka** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (239 mg, 0.74 mmol, 74%).
m.p. 205-207 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.28 (s, 1H), 7.93 – 7.91 (m, 2H), 7.77 – 7.74 (m, 4H), 7.37 – 7.33 (m, 2H), 7.11 (tt, *J* = 7.4, 2.5 Hz, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.79, 138.96, 137.24, 134.31, 129.61, 128.61, 123.79, 120.40, 99.24;

MS (EI) m/z = 322.98 (M^+).

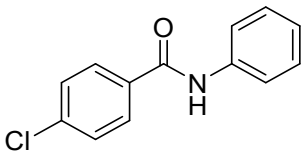


4-Bromo-*N*-phenylbenzamide (3la)[4]

According to the general procedure using (4-bromophenyl)(1H-pyrazol-1-yl)methanone (251 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3la** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (183 mg, 0.78 mmol, 78%). m.p. 202-203 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.31 (s, 1H), 7.92 – 7.91 (m, 2H), 7.77 – 7.74 (m, 4H), 7.36 (t, *J* = 7.5 Hz, 2H), 7.11 (t, *J* = 7.4 Hz, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.53, 138.95, 134.01, 131.38, 129.79, 128.62, 125.30, 123.82, 120.41;

MS (EI) m/z = 274.99 (M^+).

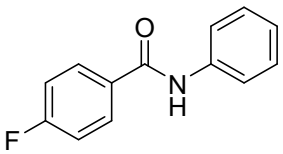


4-Chloro-*N*-phenylbenzamide (**3ma**)[4]

According to the general procedure using (4-chlorophenyl)(1H-pyrazol-1-yl)methanone (207 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ma** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (208 mg, 0.90 mmol, 90%).
m.p. 199-201 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.30 (s, 1H), 8.00 – 7.97 (m, 2H), 7.77 – 7.75 (m, 2H), 7.62 – 7.59 (m, 2H), 7.38 – 7.34 (m, 2H), 7.13 – 7.09 (m, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.42, 138.96, 136.37, 133.65, 129.62, 128.62, 128.45, 123.82, 120.41;

MS (EI) m/z = 231.05 (M^+).

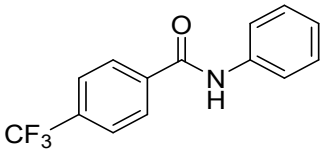


4-Fluoro-*N*-phenylbenzamide (**3na**)[2]

According to the general procedure using (4-fluorophenyl)(1H-pyrazol-1-yl)methanone (190 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3na** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (183 mg, 0.85 mmol, 85%).
m.p. 183-185 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.26 (s, 1H), 8.06 – 8.02 (m, 2H), 7.78 – 7.75 (m, 2H), 7.39 – 7.33 (m, 4H), 7.10 (tt, J = 7.4, 1.2 Hz, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.43, 164.06(d, J = 249.5 Hz), 139.07, 131.40 (d, J = 3.8 Hz), 130.39 (d, J = 8.8 Hz), 128.60, 123.72, 120.41, 115.31 (d, J = 21.4 Hz);

MS (EI) m/z = 215.07 (M^+).m

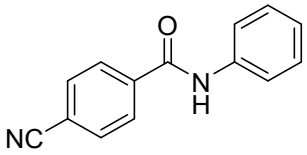


***N*-Phenyl-4-(trifluoromethyl)benzamide** (**3oa**)[2]

According to the general procedure using (1H-pyrazol-1-yl)(4-(trifluoromethyl)phenyl)methanone (240 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3oa** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (215 mg, 0.81 mmol, 81%).
m.p. 197-199 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.46 (s, 1H), 8.16 – 8.14 (m, 2H), 7.92 – 7.90 (m, 2H), 7.80 – 7.77 (m, 2H), 7.39 – 7.33 (m, 2H), 7.15 – 7.11 (m, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.39, 138.83, 138.80, 131.36 (q, J = 31.5 Hz), 128.68, 128.59, 125.38 (q, J = 3.8 Hz), 124.02, 123.94 (q, J = 273.4 Hz), 120.46;

MS (EI) m/z = 265.07 (M^+).

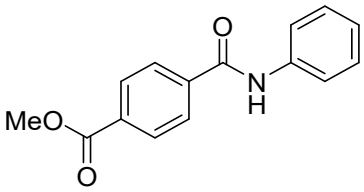


4-Cyano-*N*-phenylbenzamide (3pa)[2]

According to the general procedure using 4-(1H-pyrazole-1-carbonyl)benzonitrile (197 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3pa** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (195 mg, 0.88 mmol, 88%).
m.p. 175-177 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.47 (s, 1H), 8.11 (d, J = 8.5 Hz, 2H), 8.02 (d, J = 8.3 Hz, 2H), 7.78 (d, J = 7.6 Hz, 2H), 7.39 – 7.35 (t, J = 7.4 Hz, 2H), 7.13 (t, J = 7.4 Hz, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 164.13, 138.98, 138.75, 132.44, 128.68, 128.53, 124.09, 120.46, 118.32, 113.84;

MS (EI) m/z = 222.08 (M^+).

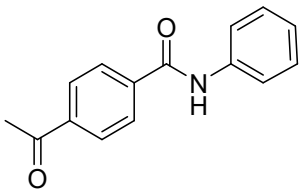


Methyl-4-(phenylcarbamoyl)benzoate (3qa)[5]

According to the general procedure using methyl 4-(1H-pyrazole-1-carbonyl)benzoate (230 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3qa** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (196 mg, 0.77 mmol, 77%).
m.p. 185-187 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.43 (s, 1H), 8.11 – 8.06 (m, 4H), 7.79 – 7.78 (m, 2H), 7.39 – 7.35 (m, 2H), 7.12 (tt, J = 7.3, 1.2 Hz, 1H), 3.90 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.69, 164.69, 139.07, 138.89, 132.01, 129.17, 128.65, 128.07, 123.95, 120.44, 52.42;

MS (EI) m/z = 255.09 (M^+).

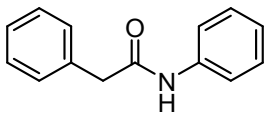


4-Acetyl-*N*-phenylbenzamide (**3ra**)[4]

According to the general procedure using 4-(1H-pyrazole-1-carbonyl)benzonitrile (214 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ra** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (177 mg, 0.74 mmol, 74%).
m.p. 125-127 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.41 (s, 1H), 8.10 – 8.06 (m, 4H), 7.80 – 7.78 (m, 2H), 7.39 – 7.35 (m, 2H), 7.14 – 7.11 (m, 1H), 2.64 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 197.70, 164.75, 138.92, 138.83, 138.76, 128.65, 128.17, 128.01, 123.93, 120.45, 26.99;

MS (EI) m/z = 239.09 (M^+).

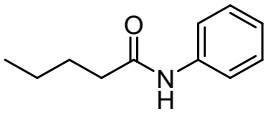


***N*,2-Diphenylacetamide** (**3sa**)[3]

According to the general procedure using 2-phenyl-1-(1H-pyrazol-1-yl)ethan-1-one (186 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3sa** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (156 mg, 0.74 mmol, 74%).
m.p. 118-119 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.17 (s, 1H), 7.63 (dd, J = 8.7, 1.2 Hz, 2H), 7.37 – 7.27 (m, 6H), 7.25 – 7.22 (m, 1H), 7.05 – 7.01 (m, 1H), 3.66 (s, 2H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 169.10, 139.25, 136.03, 129.10, 128.70, 128.29, 126.51, 123.20, 119.13, 43.37;

MS (EI) m/z = 211.10 (M^+).

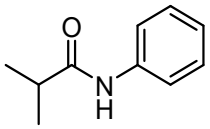


***N*-Phenylpentanamide (3ta)**[6]

According to the general procedure using 1-(1H-pyrazol-1-yl)pentan-1-one (152 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ta** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (110 mg, 0.62 mmol, 62%).
m.p. 94-96 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.84 (s, 1H), 7.61 – 7.59 (m, 2H), 7.29 – 7.25 (m, 2H), 7.01 (tt, *J* = 7.4, 1.2 Hz, 1H), 2.30 (t, *J* = 7.4 Hz, 2H), 1.61 – 1.55 (m, 2H), 1.36 – 1.29 (m, 2H), 0.89 (t, *J* = 7.3 Hz, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 171.23, 139.38, 128.58, 122.85, 119.01, 36.14, 27.27, 21.84, 13.72;

MS (EI) m/z = 177.12 (M^+).

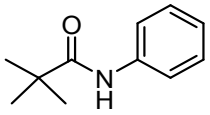


***N*-Phenyllisobutyramide (3ua)**[4]

According to the general procedure using 2-methyl-1-(1H-pyrazol-1-yl)propan-1-one (138 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3ua** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (112 mg, 0.69 mmol, 69%).
m.p. 112-114 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.80 (s, 1H), 7.63 – 7.61 (m, 2H), 7.30 – 7.26 (m, 2H), 7.01 (tt, *J* = 7.5, 1.2 Hz, 1H), 2.59 (hept, *J* = 6.8 Hz, 1H), 1.10 (d, *J* = 6.7 Hz, 6H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 175.17, 139.46, 128.58, 122.87, 119.11, 34.91, 19.49;

MS (EI) m/z = 163.10 (M^+).

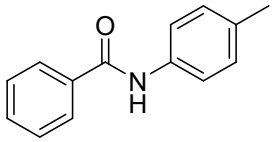


***N*-Phenylpivalamide (3va)**[4]

According to the general procedure using 2,2-dimethyl-1-(1H-pyrazol-1-yl)propan-1-one (152 mg, 1.0 mmol) and nitrobenzene (123 mg, 1.0 mmol), the product **3va** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (101 mg, 0.57 mmol, 57%).
m.p. 132-134 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.17 (s, 1H), 7.65 – 7.62 (m, 2H), 7.30 – 7.26 (m, 2H), 7.03 (tt, *J* = 7.3, 1.3Hz, 1H), 1.23 (s, 9H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 176.38, 139.36, 128.35, 123.10, 120.23, 39.11, 27.20;

MS (EI) m/z = 177.12 (M^+).

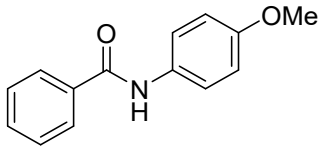


***N*-(p-Tolyl)benzamide (3ab)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-methyl-4-nitrobenzene (137 mg, 1.0 mmol), the product **3ab** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (146 mg, 0.69 mmol, 69%).
m.p. 154-156 °C;
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.85 (dd, *J* = 8.3, 1.4 Hz, 2H), 7.54 – 7.51 (m, 3H), 7.46 – 7.43 (m, 2H), 7.15 (d, *J* = 8.3 Hz, 2H), 2.34 (s, 3H);

^{13}C NMR (126 MHz, $CDCl_3$) δ 165.84, 135.50, 135.20, 134.34, 131.83, 129.68, 128.84, 127.14, 120.47, 21.03;

MS (EI) m/z = 211.10 (M^+).

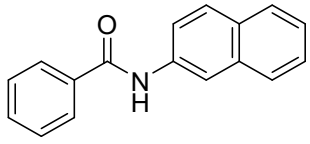


***N*-(4-Methoxyphenyl)benzamide (3ac)**[2]

According to the general procedure, using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol), and 1-methoxy-4-nitrobenzene (153 mg, 1.0 mmol), the product **3ac** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (3:1) and obtained as a white solid (143 mg, 0.63 mmol, 63%).
m.p. 163-164 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.13 (s, 1H), 7.96 – 7.94 (m, 2H), 7.70 – 7.67 (m, 2H), 7.57 (m, 1H), 7.52 (m, 2H), 6.95 – 6.91 (m, 2H), 3.75 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.09, 155.54, 135.05, 132.23, 131.36, 128.33, 127.54, 121,97, 113.72, 55.17;

MS (EI) m/z = 227.09 (M^+).

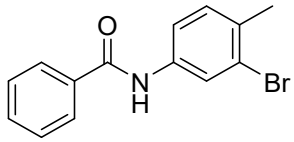


***N*-(Naphthalen-2-yl)benzamide (3ad)**[7]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 2-nitronaphthalene (173 mg, 1.0 mmol), the product **3ad** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (146 mg, 0.59 mmol, 59%).
m.p. 158-159 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.44 (s, 1H), 8.11 – 8.09 (m, 2H), 8.01 – 7.97 (m, 2H), 7.87 (dd, *J* = 8.2, 1.4 Hz, 1H), 7.65 – 7.61 (m, 2H), 7.59 – 7.53 (m, 5H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 166.16, 134.45, 133.85, 133.76, 131.66, 129.23, 128.45, 128.07, 127.79, 126.28, 126.06, 125.97, 125.54, 123.92, 123.33;

MS (EI) m/z = 247.10 (M^+).

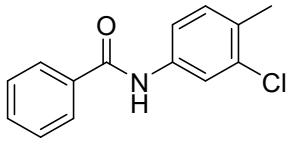


***N*-(3-Bromo-4-methylphenyl)benzamide** (3**ae**)[8]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 2-bromo-1-methyl-4-nitrobenzene (216 mg, 1.0 mmol), the product **3ae** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (237 mg, 0.82 mmol, 82%).
m.p. 135-137 °C;
^{1}H NMR (500 MHz, $CDCl_3$) δ 7.93 (s, 1H), 7.88 (d, *J* = 2.2 Hz, 1H), 7.84 (dd, *J* = 8.4, 1.3 Hz, 2H), 7.55 – 7.52 (m, 1H), 7.48 – 7.44 (m, 3H), 7.18 (dd, *J* = 8.2, 0.9 Hz, 1H), 2.37 (s, 3H);

^{13}C NMR (126 MHz, $CDCl_3$) δ 165.85, 136.83, 134.73, 134.13, 132.10, 130.95, 128.93, 127.16, 124.93, 124.13, 119.39, 22.43;

MS (EI) m/z = 289.01 (M^+).

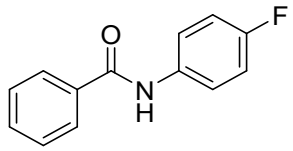


***N*-(3-Chloro-4-methylphenyl)benzamide** (**3af**)[9]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 2-chloro-1-methyl-4-nitrobenzene (172 mg, 1.0 mmol), the product **3af** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (194 mg, 0.79 mmol, 79%).
m.p. 120-121 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.32 (s, 1H), 7.97 – 7.94 (m, 3H), 7.64 – 7.58 (m, 2H), 7.55 – 7.51 (m, 2H), 7.31 (dd, *J* = 8.3, 0.8 Hz, 1H), 2.90 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.57, 138.33, 134.63, 132.87, 131.70, 131.04, 130.24, 128.41, 127.64, 120.19, 118.86, 18.96;

MS (EI) m/z = 245.06 (M^+).

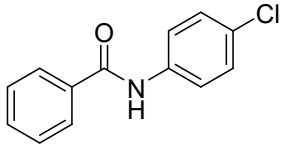


***N*-(4-Fluorophenyl)benzamide (3ag)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-fluoro-4-nitrobenzene (141 mg, 1.0 mmol), the product **3ag** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (148 mg, 0.69 mmol, 69%).
m.p. 177-178 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.30 (s, 1H), 7.97 – 7.94 (m, 2H), 7.82 – 7.78 (m, 2H), 7.61 – 7.57 (m, 1H), 7.55 – 7.51 (m, 2H), 7.22 – 7.17 (m, 2H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.47, 158.29 (d, J = 240.7 Hz), 135.53 (d, J = 7.7 Hz), 134.81, 131.58, 128.39, 127.62, 122.17 (d, J = 10.1 Hz), 115.17 (d, J = 21.4 Hz);

MS (EI) m/z = 215.07 (M^+).

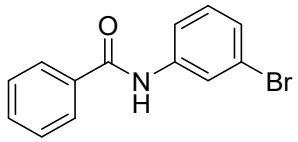


***N*-(4-Chlorophenyl)benzamide (3ah)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-chloro-4-nitrobenzene (158 mg, 1.0 mmol), the product **3ah** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (136 mg, 0.59 mmol, 59%).
m.p. 191-192 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.37 (s, 1H), 7.97 – 7.94 (m, 2H), 7.85 – 7.82 (m, 2H), 7.61 – 7.58 (m, 1H), 7.55 – 7.51 (m, 2H), 7.42 – 7.39 (m, 2H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.66, 138.16, 134.72, 131.69, 128.51, 128.41, 127.68, 127.26, 121.84;

MS (EI) m/z = 231.05 (M^+).

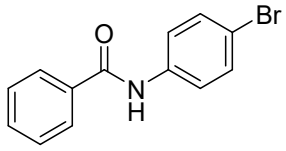


***N*-(3-Bromophenyl)benzamide (3ai)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-bromo-3-nitrobenzene (202 mg, 1.0 mmol), the product **3ai** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (170 mg, 0.62 mmol, 62%).
m.p. 132-133 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.40 (s, 1H), 8.14 (t, *J* = 1.9 Hz, 1H), 7.97 – 7.96 (m, 2H), 7.79 – 7.77 (m, 1H), 7.62 – 7.58 (m, 1H), 7.56 – 7.52 (m, 2H), 7.32 (t, *J* = 7.9 Hz, 1H), 7.30 – 7.28 (m, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.78, 140.82, 134.56, 131.78, 130.58, 128.42, 127.71, 126.20, 122.56, 121.42, 118.99;

MS (EI) m/z = 274.99 (M^+).

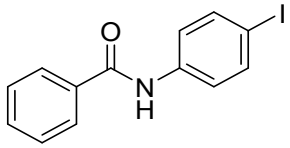


***N*-(4-Bromophenyl)benzamide (3aj)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-bromo-4-nitrobenzene (202 mg, 1.0 mmol), the product **3aj** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (181 mg, 0.66 mmol, 66%).
m.p. 201-203 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.37 (s, 1H), 7.96 – 7.94 (m, 2H), 7.79 – 7.76 (m, 2H), 7.62 – 7.58 (m, 1H), 7.55 – 7.52 (m, 4H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.65, 138.58, 134.70, 131.70, 131.42, 128.40, 127.67, 122.20, 115.31;

MS (EI) m/z = 274.99 (M^+).

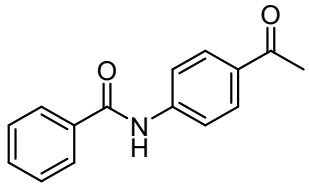


***N*-(4-Iodophenyl)benzamide (3ak)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-iodo-4-nitrobenzene (249 mg, 1.0 mmol), the product **3ak** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (210 mg, 0.65 mmol, 65%).
m.p. 218-220 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.34 (s, 1H), 7.95 (d, *J* = 7.0 Hz, 2H), 7.69 (d, *J* = 8.9 Hz, 2H), 7.64 (d, *J* = 8.9 Hz, 2H), 7.60 (t, *J* = 7.3 Hz, 1H), 7.54 – 7.52 (m, 2H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.64, 139.05, 137.26, 134.72. 131.69, 128.40, 127.67, 122.45, 87.30;

MS (EI) m/z = 322.98 (M^+).

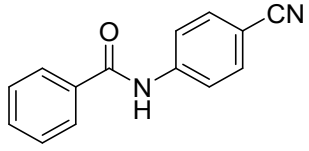


***N*-(4-Acetylphenyl)benzamide (3al)**[5]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-(4-nitrophenyl)ethan-1-one (165 mg, 1.0 mmol), the product **3al** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (125 mg, 0.52 mmol, 52%).
m.p. 197-198 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.56 (s, 1H), 7.99 – 7.94 (m, 6H), 7.63 – 7.60 (m, 1H), 7.57 – 7.53 (m, 2H), 2.55 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 196.58, 165.99, 143.62, 134.58, 132.01, 131.88, 129.29, 128.44, 127.81, 119.43, 26.46;

MS (EI) m/z = 239.09 (M^+).

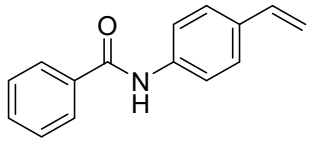


***N*-(4-Cyanophenyl)benzamide (3am)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 4-nitrobenzonitrile (148 mg, 1.0 mmol), the product **3am** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (162 mg, 0.73 mmol, 73%).
m.p. 168-170 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.64 (s, 1H), 8.01 – 7.99 (m, 2H), 7.97 – 7.95 (m, 2H), 7.83 – 7.81 (m, 2H), 7.64 – 7.61 (m, 1H), 7.57 – 7.54 (m,2H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 166.19, 143.51, 134.39, 133.12, 132.04, 128.49, 127.84, 120.17, 119.08, 105.34;

MS (EI) m/z = 222.08 (M^+).

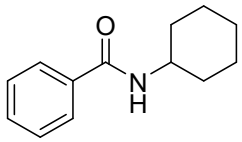


***N*-(4-Vinylphenyl)benzamide (3an)**[5]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-nitro-4-vinylbenzene (149 mg, 1.0 mmol), the product **3an** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (87 mg, 0.39 mmol, 39%).
m.p. 149-151 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 10.29 (s, 1H), 7.94 – 7.96 (m, 2H), 7.78 (d, *J* = 8.7 Hz, 2H), 7.59 (t, *J* = 7.3 Hz, 1H), 7.52 – 7.55 (m, 2H), 7.46 (d, *J* = 8.8 Hz, 2H), 6.70 (dd, *J* = 17.7, 11.0 Hz, 1H), 5.77 (dd, *J* = 17.7, 2.2 Hz, 1H), 5.20 (dd, *J* = 11.0, 1.0 Hz, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.50, 138.92, 136.19, 134.90, 132.53, 131.57, 128.38, 127.64, 126.44, 120.23, 112.94;

MS (EI) m/z = 223.10 (M^+).

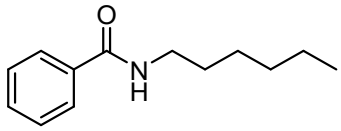


***N*-Cyclohexylbenzamide (3ao)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and nitrocyclohexane (129 mg, 1.0 mmol), the product **3ao** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a white solid (120 mg, 0.59 mmol, 59%).
m.p. 148-149 °C;
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 8.17 (d, *J* = 8.0 Hz, 1H), 7.84 – 7.82 (m, 2H), 7.50 (t, *J* = 7.3 Hz, 1H), 7.45 - 7.42 (m, 2H), 3.79 – 3.72 (m, 1H), 1.83 – 1.80 (m, 2H), 1.74 – 1.72 (m, 2H), 1.60 (d, *J* = 12.3 Hz, 1H), 1.35 – 1.23 (m, 4H), 1.16 – 1.11 (m, 1H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.31, 134.90, 130.87, 128.09, 127.24, 48.30, 32.41, 25.26, 24.95;

MS (EI) m/z = 203.13 (M^+).

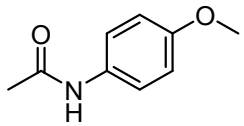


***N*-Hexylbenzamide (3ap)**[2]

According to the general procedure using phenyl(1H-pyrazol-1-yl)methanone (172 mg, 1.0 mmol) and 1-nitrohexane (131 mg, 1.0 mmol), the product **3ap** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (9:1) and obtained as a yellow oil (141 mg, 0.69 mmol, 69%).
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 8.43 (t, J = 5.7 Hz, 1H), 7.88 – 7.82 (m, 2H), 7.49 (t, J = 7.3 Hz, 1H), 7.44 (t, 7.3 Hz, 2H), 3.29 – 3.22 (m, 2H), 1.51 (quin, J = 7.7 Hz, 2H), 1.34 – 1.23 (m, 6H), 0.89 – 0.82 (m, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 166.04. 134.75, 130.88, 128.14, 127.10, 39.20, 31.04, 29.11, 26.19, 22.07, 13.87;

MS (EI) m/z = 205.15(M^+).

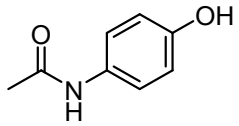


***N*-(4-methoxyphenyl)acetamide (3xt)**[10]

According to the general procedure using 1-(1H-pyrazol-1-yl)ethan-1-one (110 mg, 1.0 mmol) and 1-methoxy-4-nitrobenzene (153 mg, 1.0 mmol), the product **3xt** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (3:1) and obtained as a brown solid (135 mg, 0.82 mmol, 82%).
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.76 (s, 1H), 7.49 – 7.46 (m, 2H), 6.87 – 6.84 (m, 2H), 3.70 (s, 3H), 2.00 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 167.72, 155.01, 132.54, 120.53, 113.77, 55.11, 23.79;

MS (EI) m/z = 165.08(M^+).

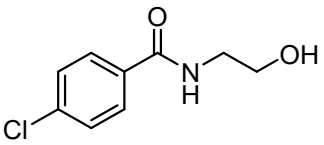


***N*-(4-hydroxyphenyl)acetamide (3xu)**[10]

4-Nitrophenol (139 mg, 1.0 mmol) and $B_2(OH)_4$ (269 mg, 3.0 mmol, 3.0 equiv) were dissolved in DMF (5 mL, 0.2M) and stirred at 100 °C for 6 h. 1-(1H-pyrazol-1-yl)ethan-1-one (110 mg, 1.0 mmol) was added to the reaction mixture and stirred at 70 °C for 18 h. The product **3xu** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (1:1) and obtained as a brown solid (109 mg, 0.72 mmol, 72%).
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 9.63 (s, 1H), 9.12 (s, 1H), 7.35 – 7.32 (m, 2H), 6.69 – 6.65 (m, 2H), 1.97 (s, 3H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 167.50, 153.11, 131.04, 120.81, 114.99, 23.74;

MS (EI) m/z = 151.06(M^+).



4-chloro-*N*-(2-hydroxyethyl)cyclohexa-2,4-diene-1-carboxamide (3mv)[11]

2-Nitroethan-1-ol (91 mg, 1.0 mmol) and $B_2(OH)_4$ (269 mg, 3.0 mmol, 3.0 equiv) were dissolved in DMF (5 mL, 0.2M) and stirred at 100 °C for 6 h. (4-chlorophenyl)(1H-pyrazol-1-yl)methanone (207 mg, 1.0 mmol) was added to the reaction mixture and stirred at 70 °C for 18 h. The product **3mv** was purified by chromatography on silica gel eluting with *n*-hexane/EtOAc (1:4) and obtained as a white solid (124 mg, 0.62 mmol, 62%).
^{1}H NMR (500 MHz, $(CD_3)_2SO$) δ 8.55 (t, J = 5.8 Hz, 1H), 7.93 – 7.90 (m, 2H), 7.58 – 7.55 (m, 2H), 4.77 (t, 5.6 Hz, 1H), 3.56 (q, J = 6.0 Hz, 2H), 3.37 (q, J = 6.0 Hz, 2H);

^{13}C NMR (126 MHz, $(CD_3)_2SO$) δ 165.28, 135.90, 133.31, 129.15, 128.30, 59.69, 42.26;

MS (EI) m/z = 201.06 (M^+).

5. **References**

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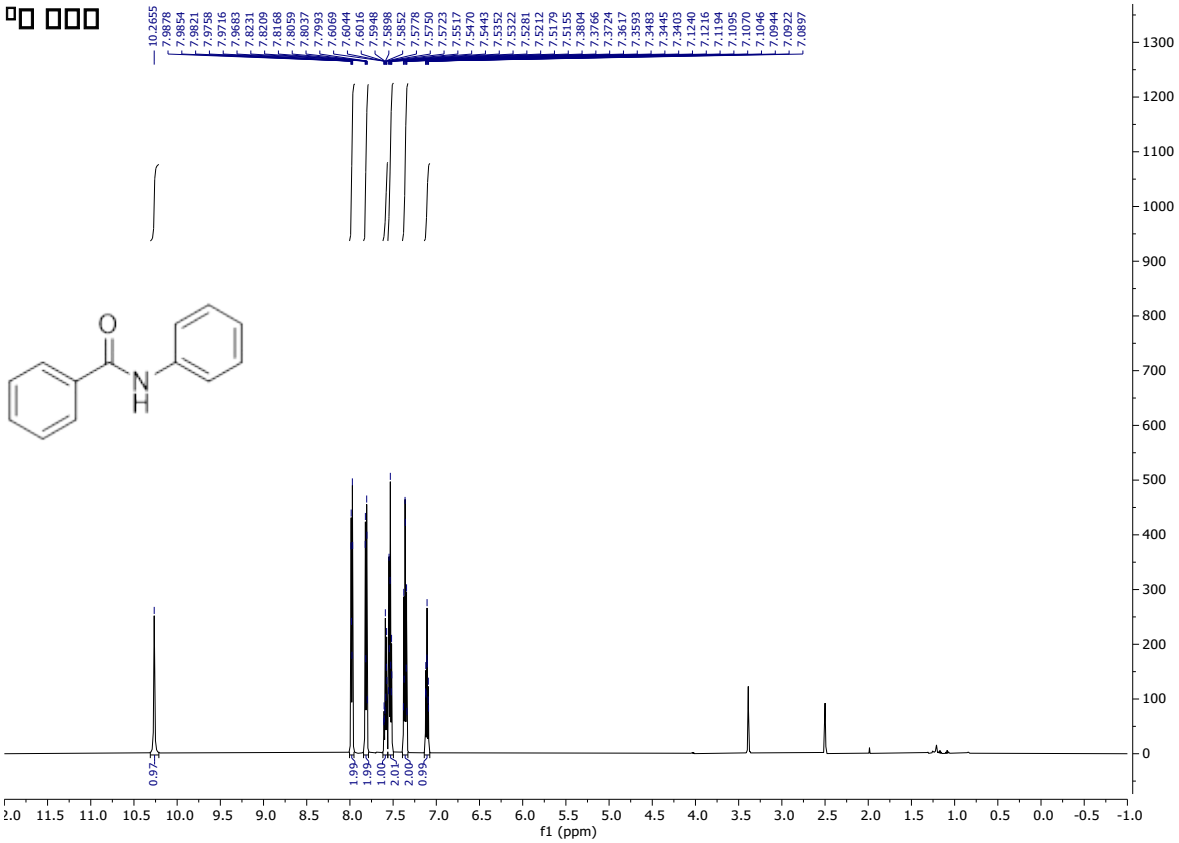
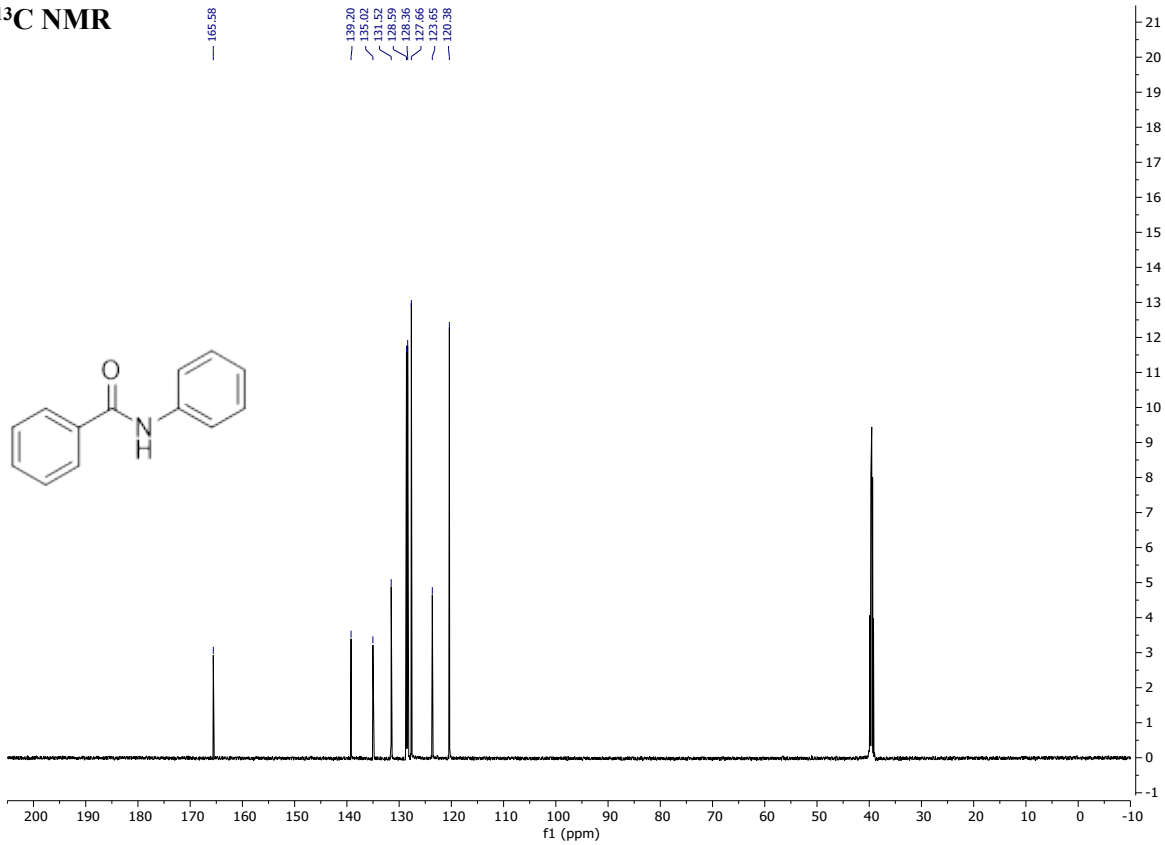
6. ^{1}H and ^{13}C NMR spectra of products

N-Phenylbenzamide (3aa)

□□ □□□

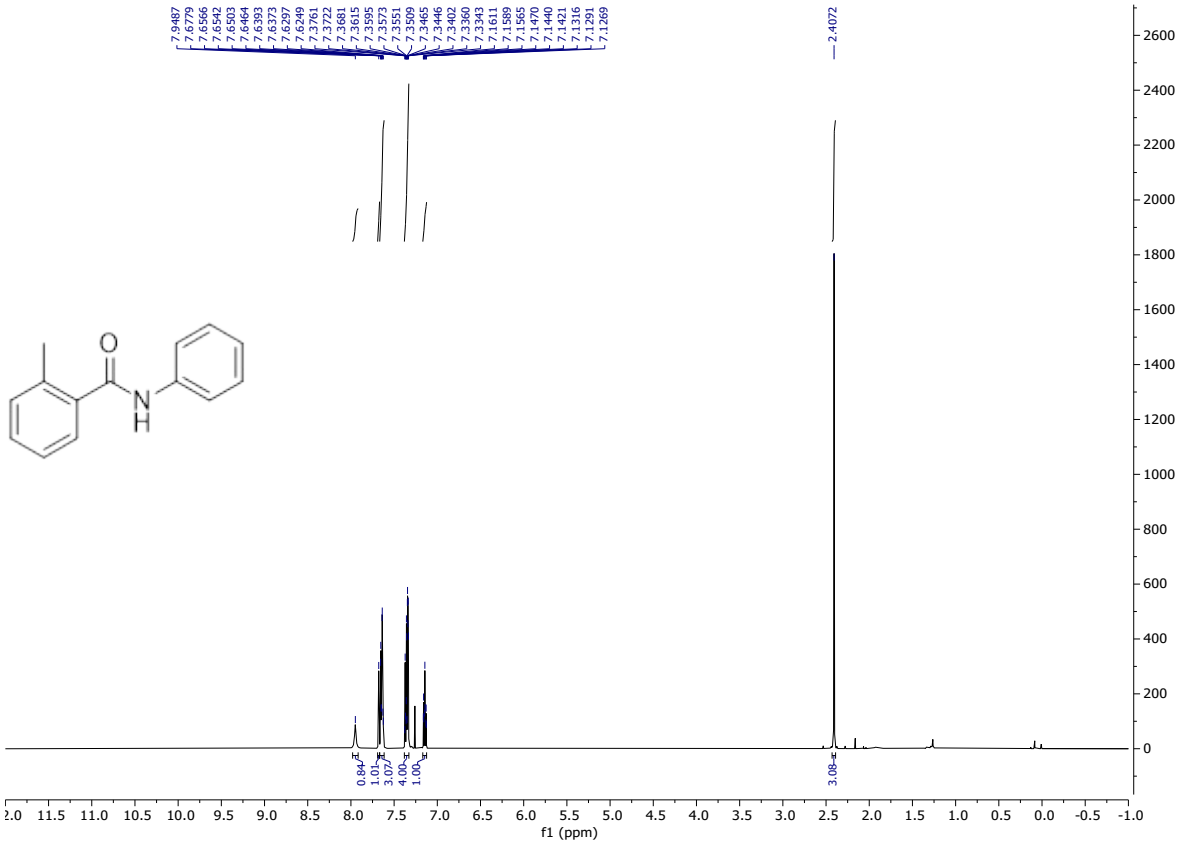


^{13}C NMR

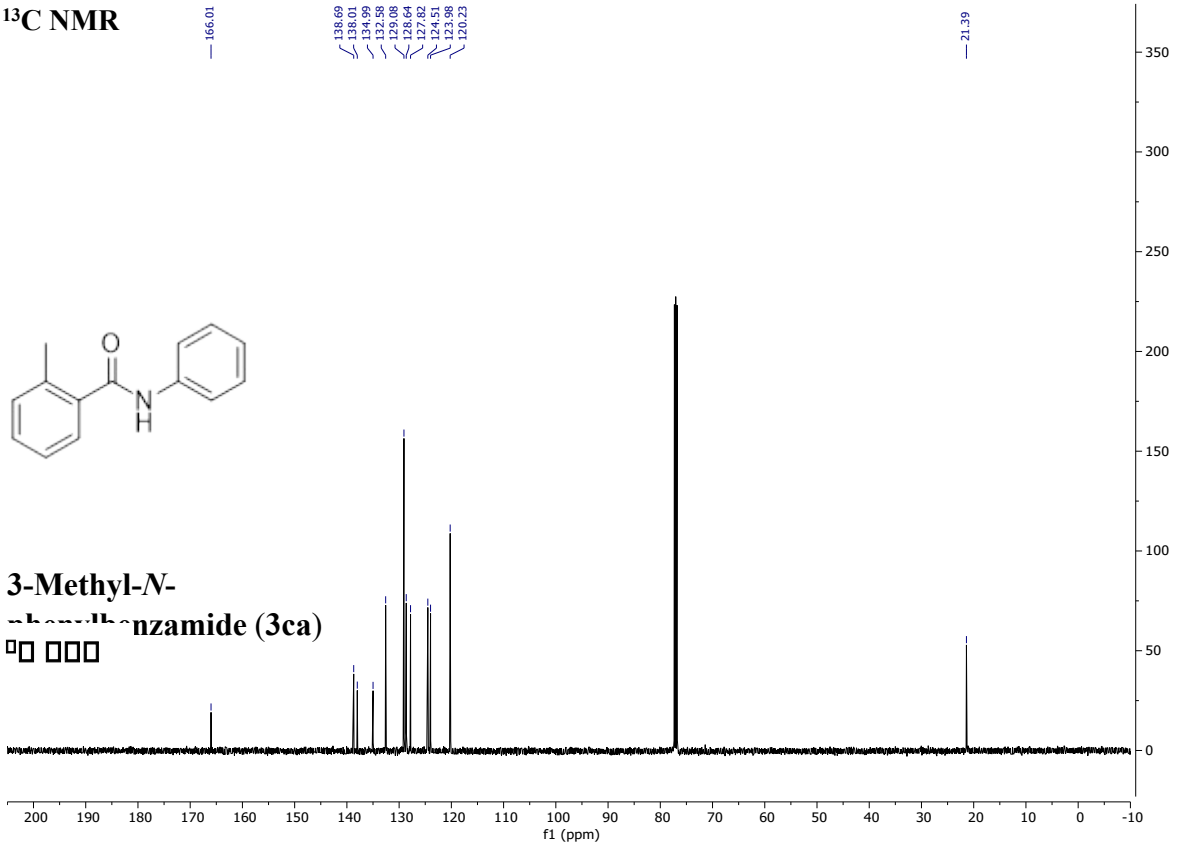


2-Methyl-*N*-phenylbenzamide (3ba)

□□ □□□

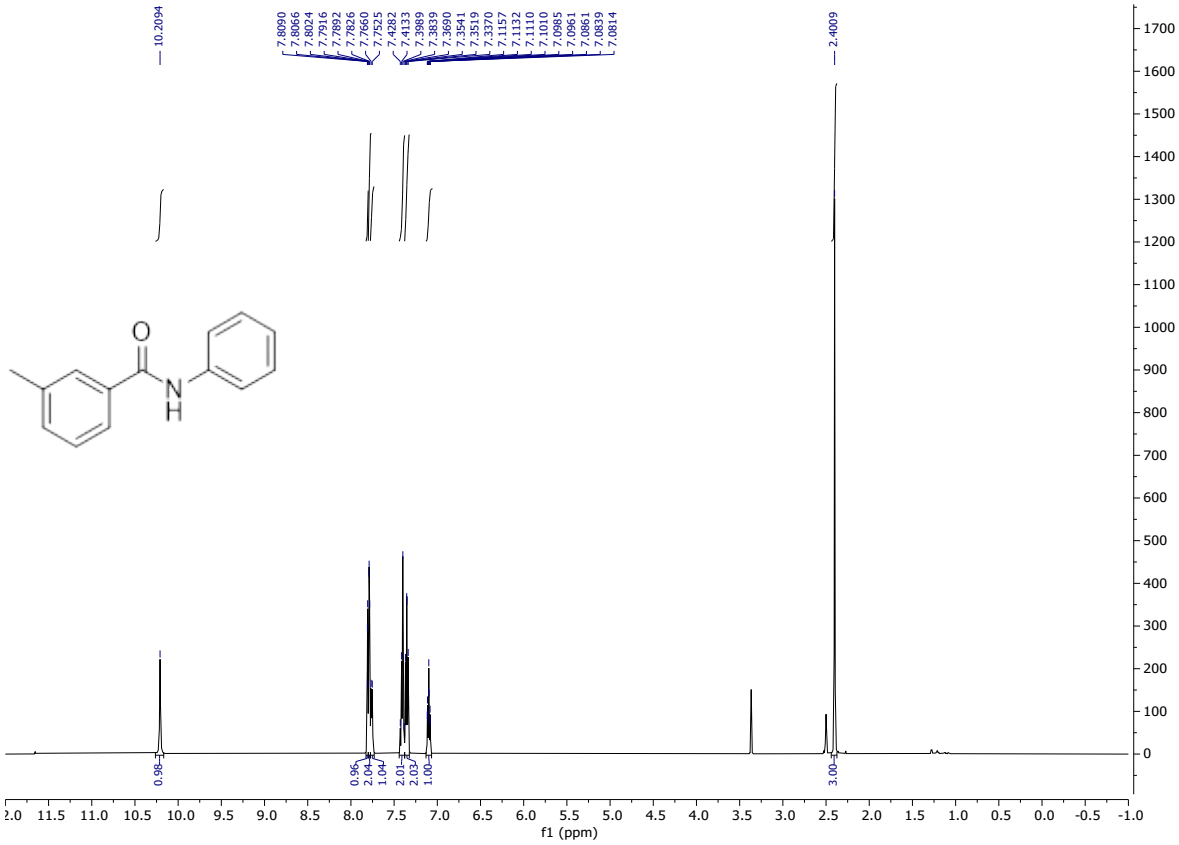


^{13}C NMR



3-Methyl-*N*-phenylbenzamide (3ca)

□□ □□□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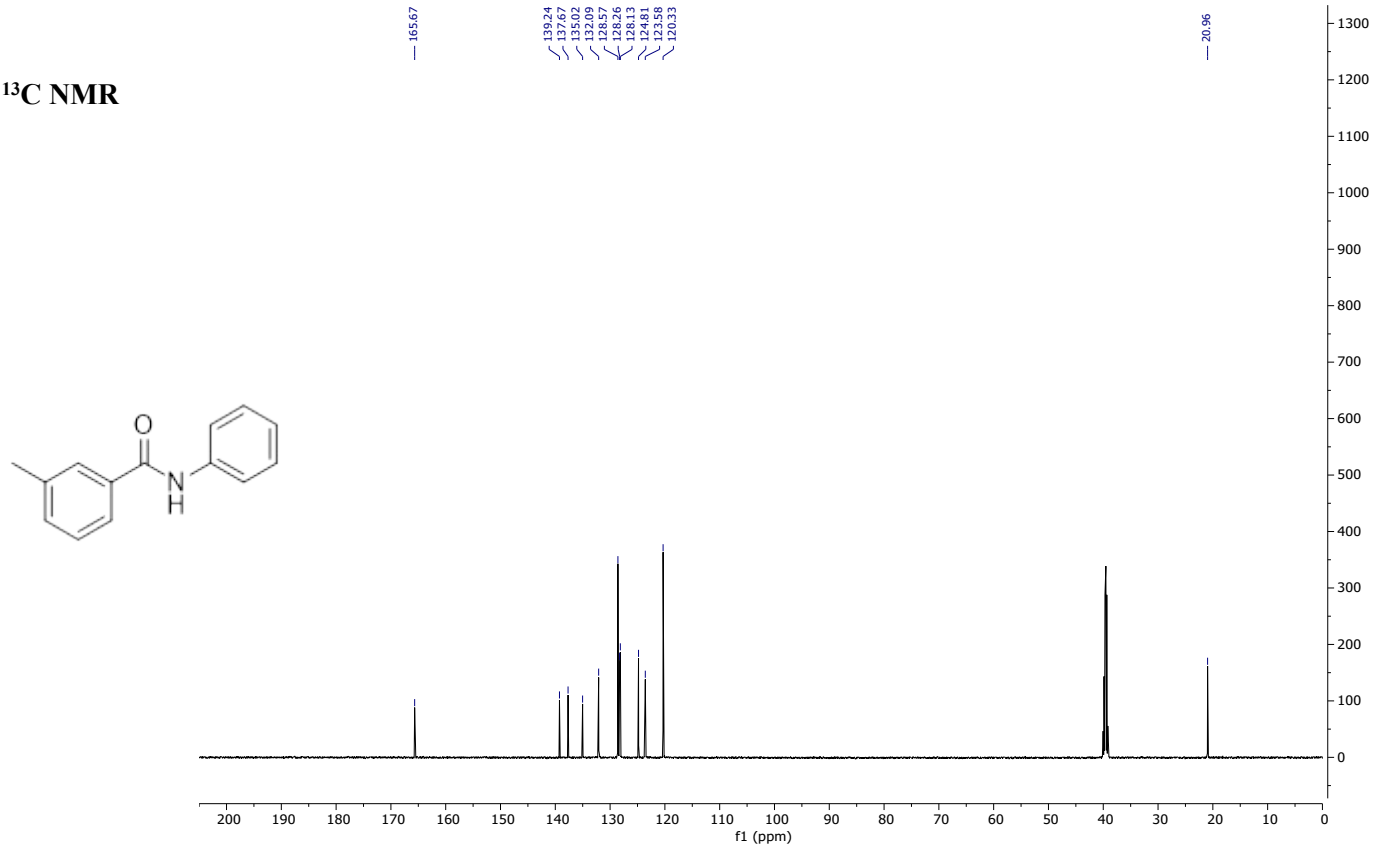
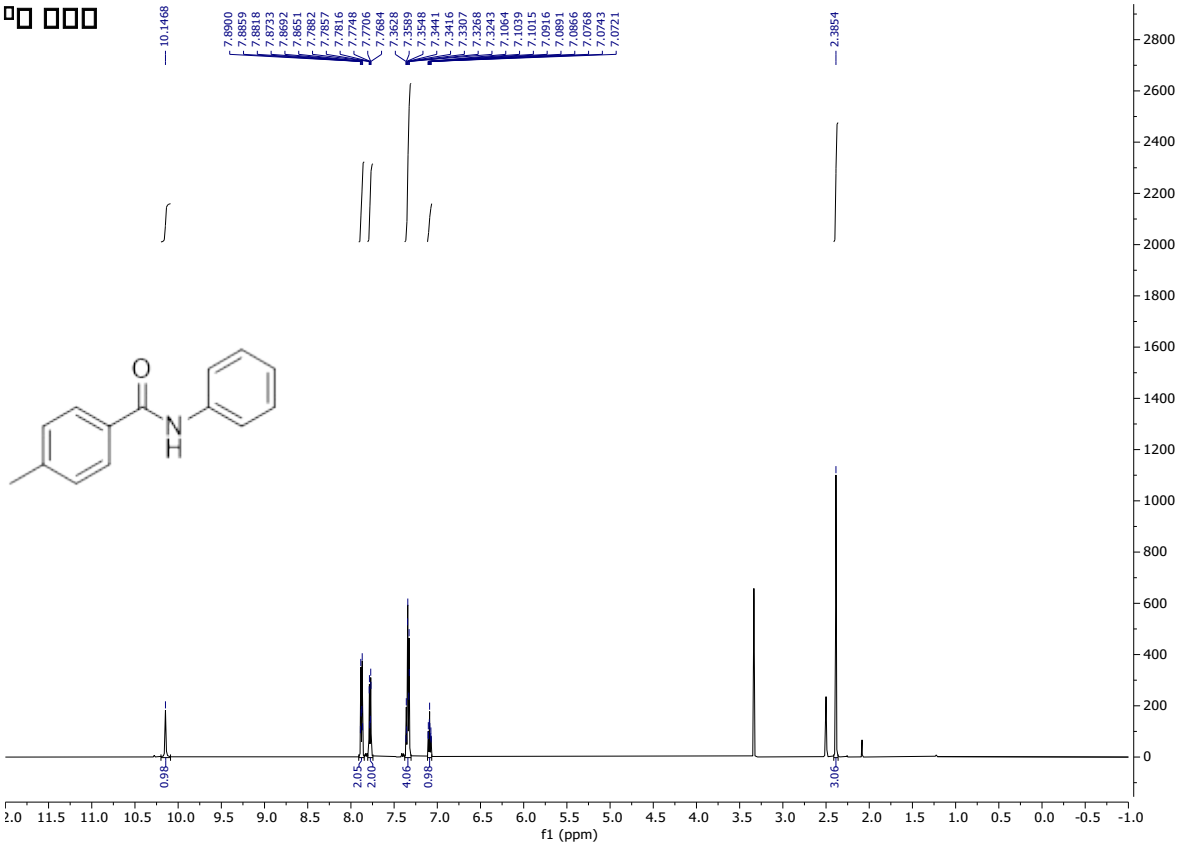
7.8090
7.8066
7.8024
7.7916
7.7892
7.7826
7.7660
7.7525
7.4282
7.4133
7.3989
7.3839
7.3690
7.3541
7.3519
7.3370
7.1157
7.1132
7.1110
7.1010
7.0985
7.0961
7.0861
7.0839
7.0814
2.4009
0.98
0.96
2.04
1.04
2.01
2.03
1.00
3.00
f1 (ppm)

^{13}C NMR

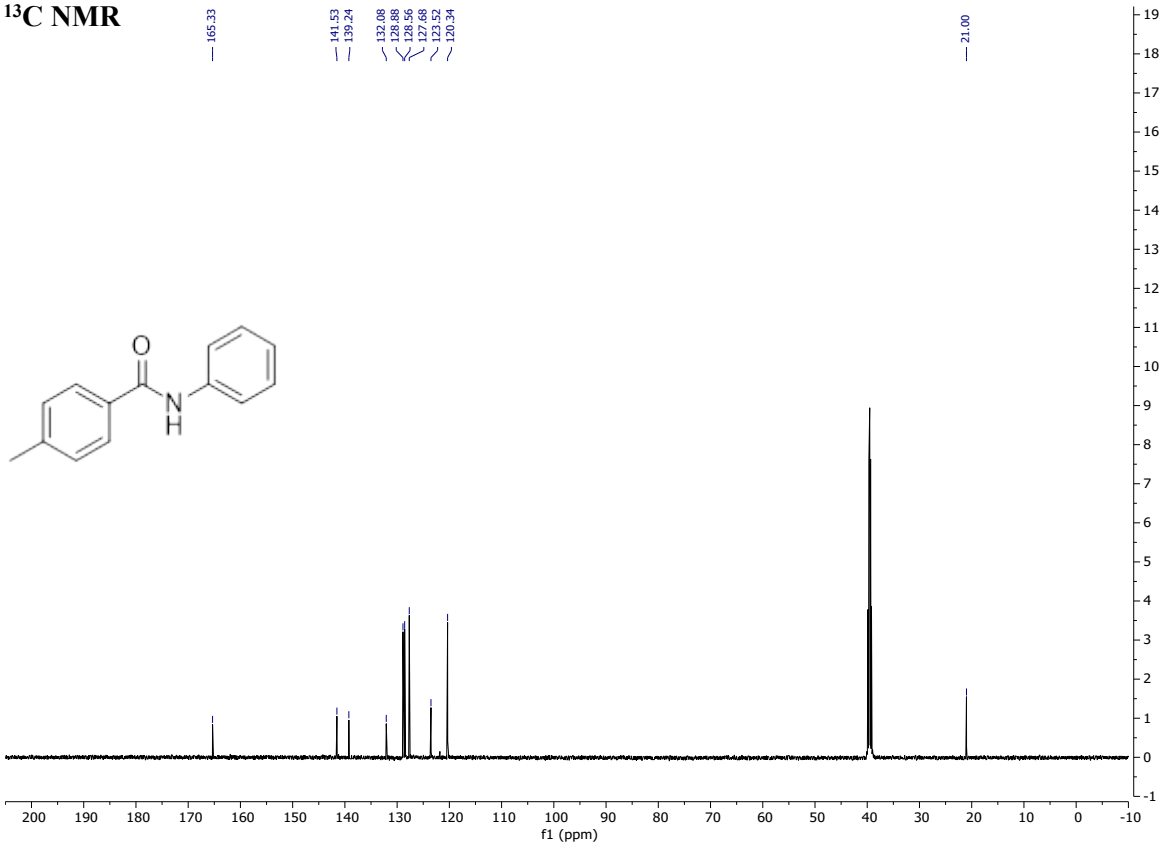

165.67
139.24
137.67
135.02
132.09
128.57
128.26
128.13
124.81
123.58
120.33
20.96
f1 (ppm)

4-Methyl-*N*-phenylbenzamide (3da)

□□ □□□

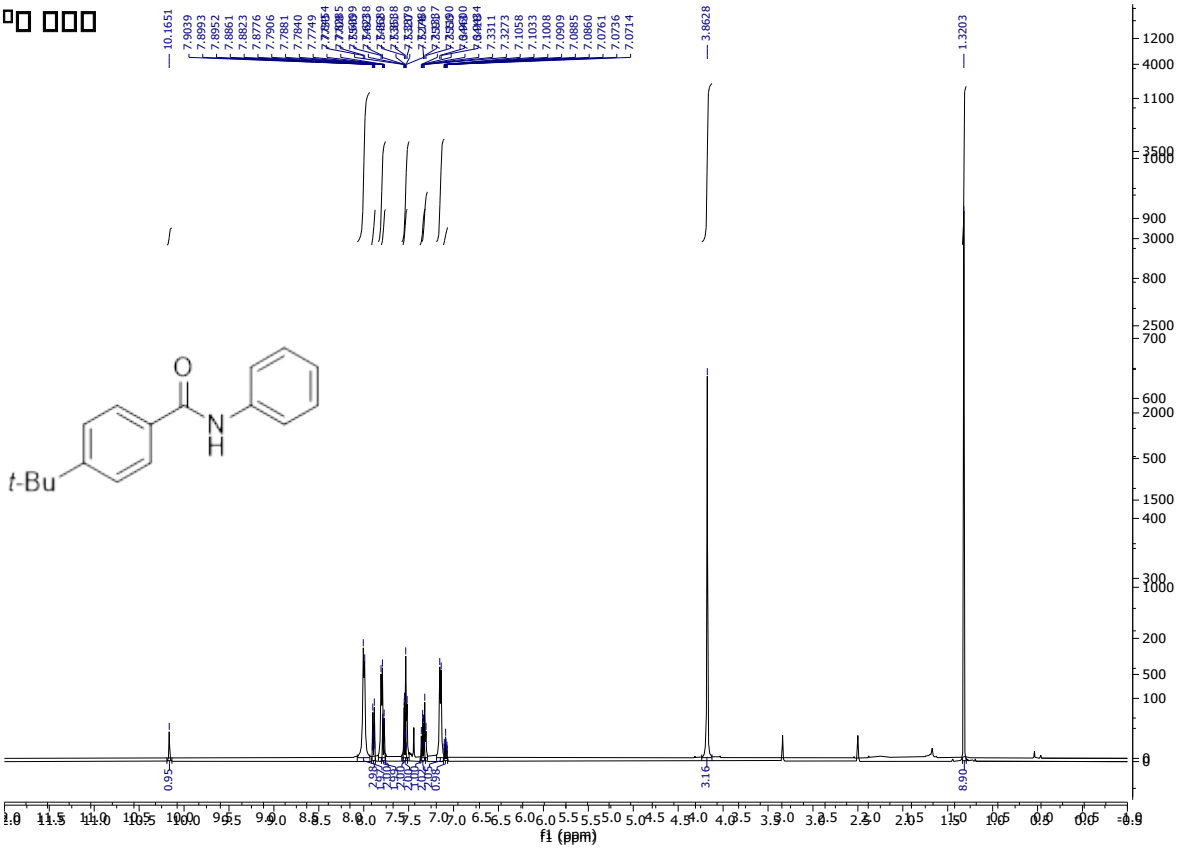


^{13}C NMR

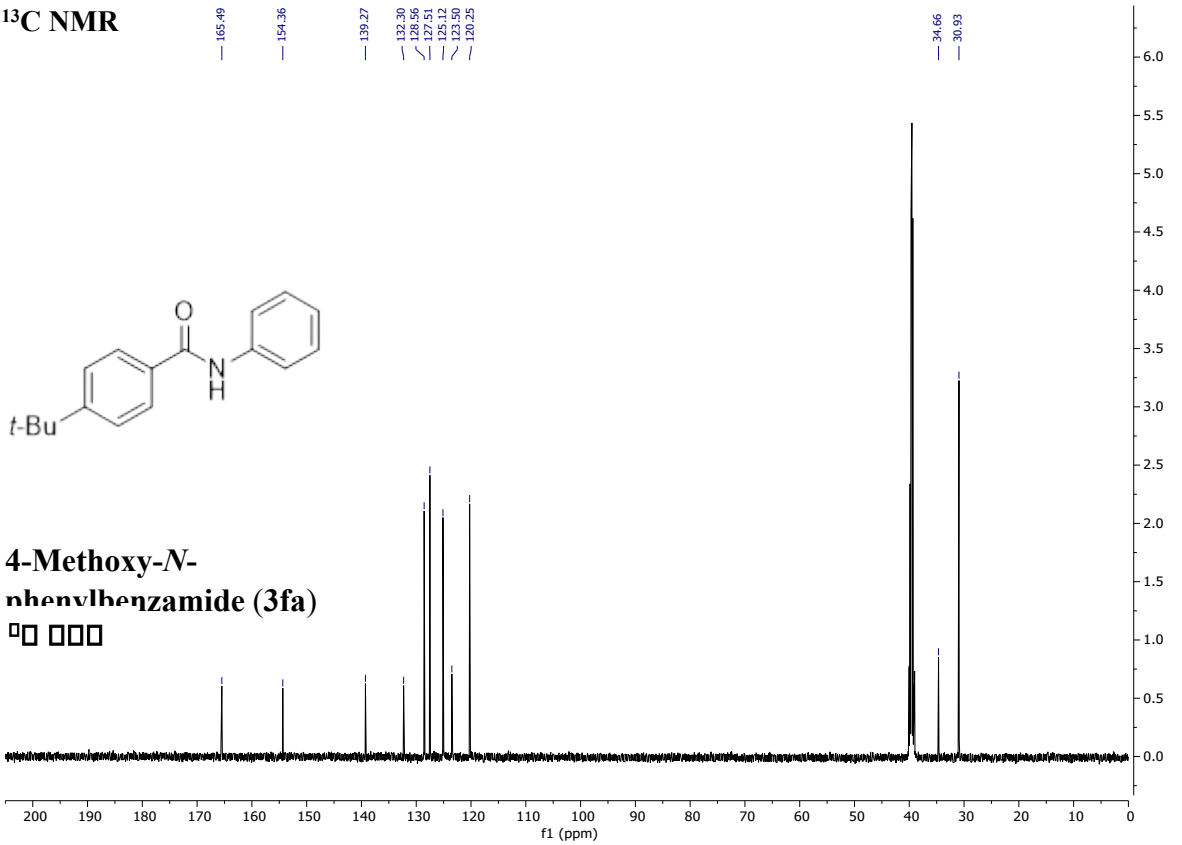


4-(Tert-butyl)-*N*-phenylbenzamide (3ea)

□□ □□□

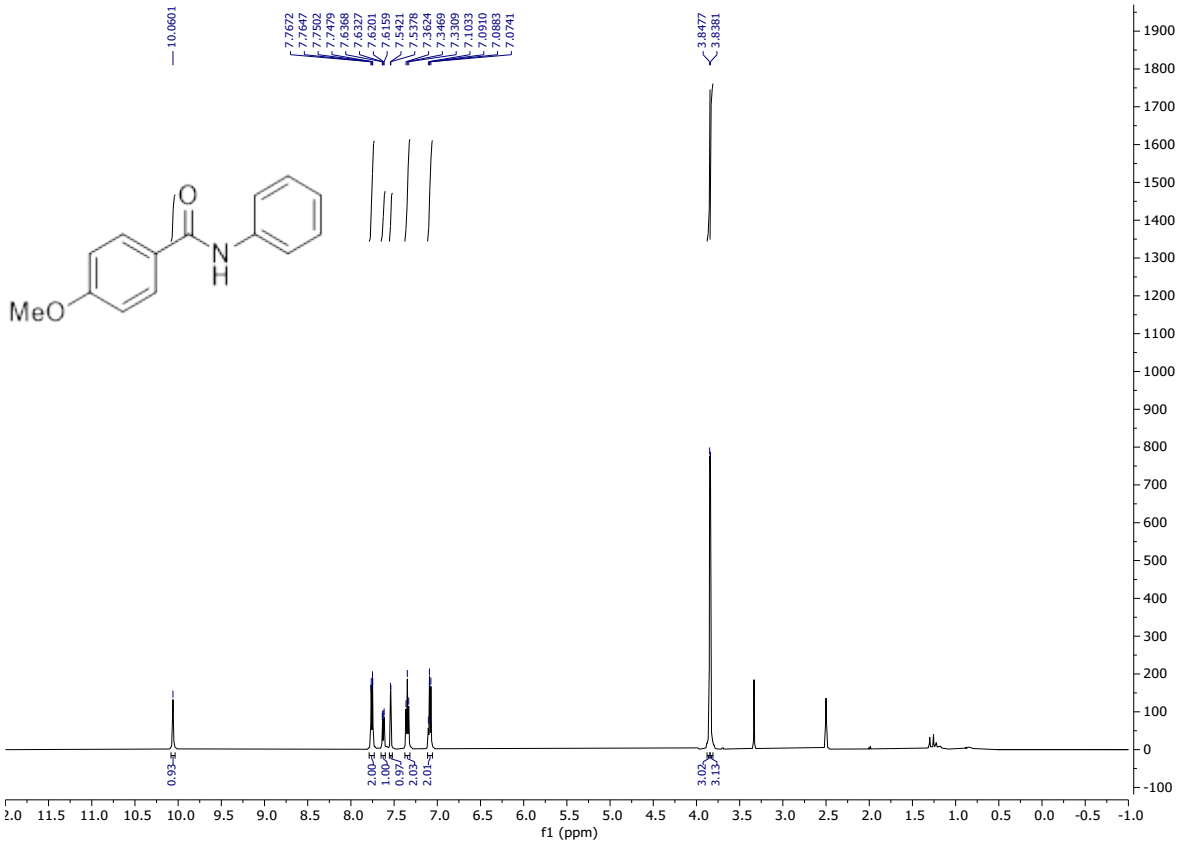


^{13}C NMR

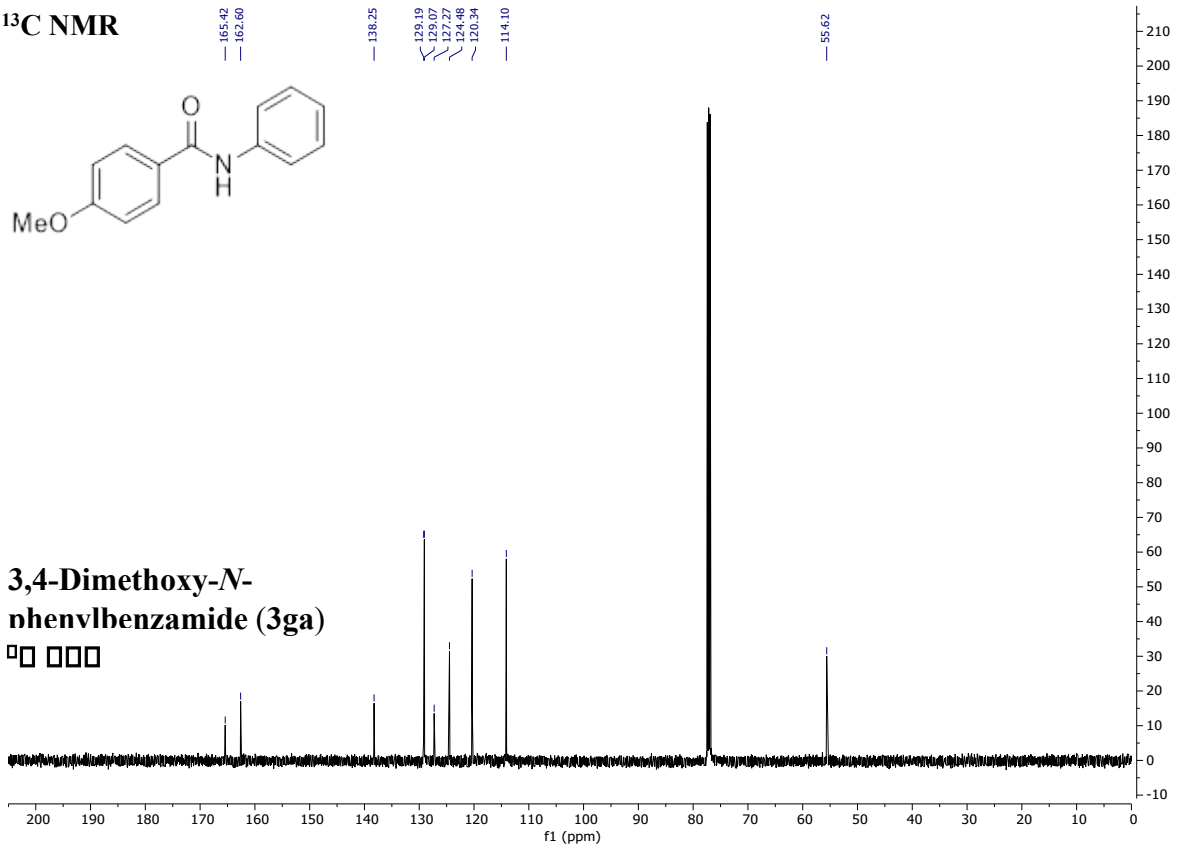


4-Methoxy-*N*-phenylbenzamide (3fa)

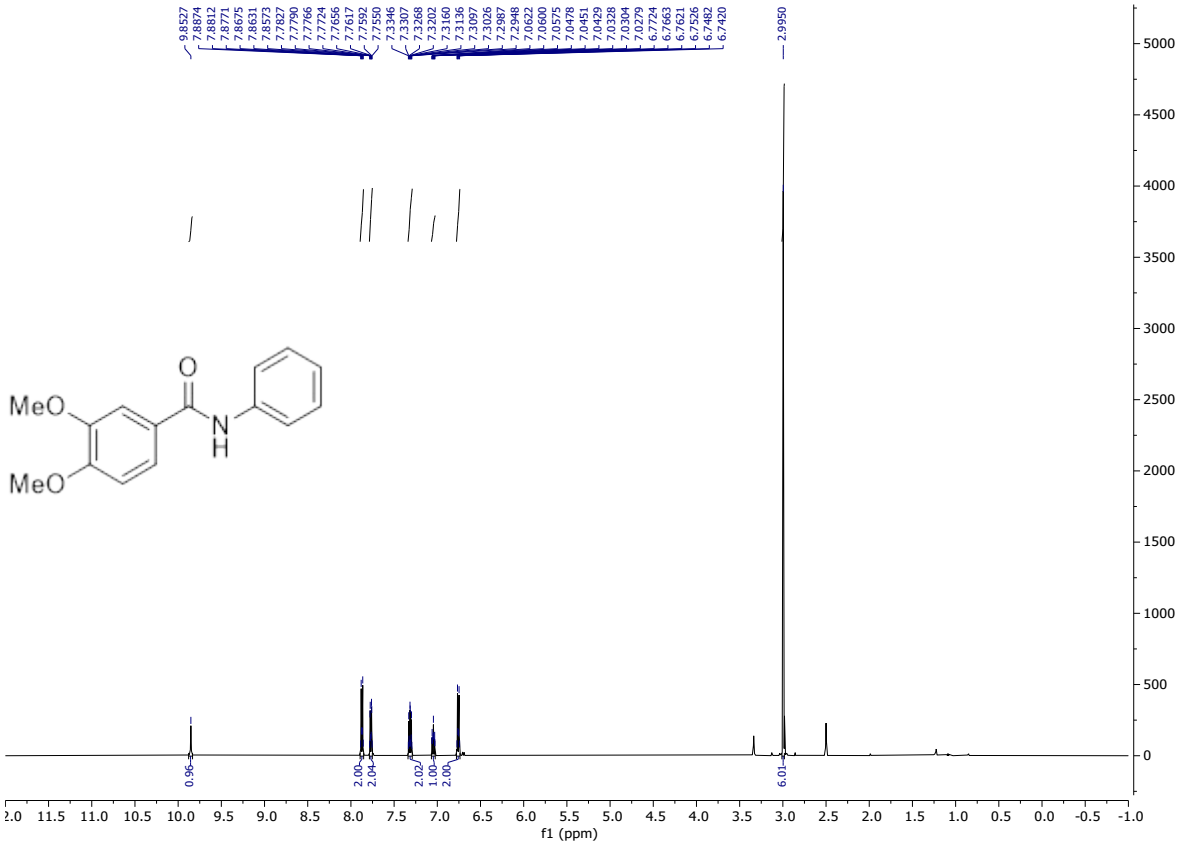
□□ □□□



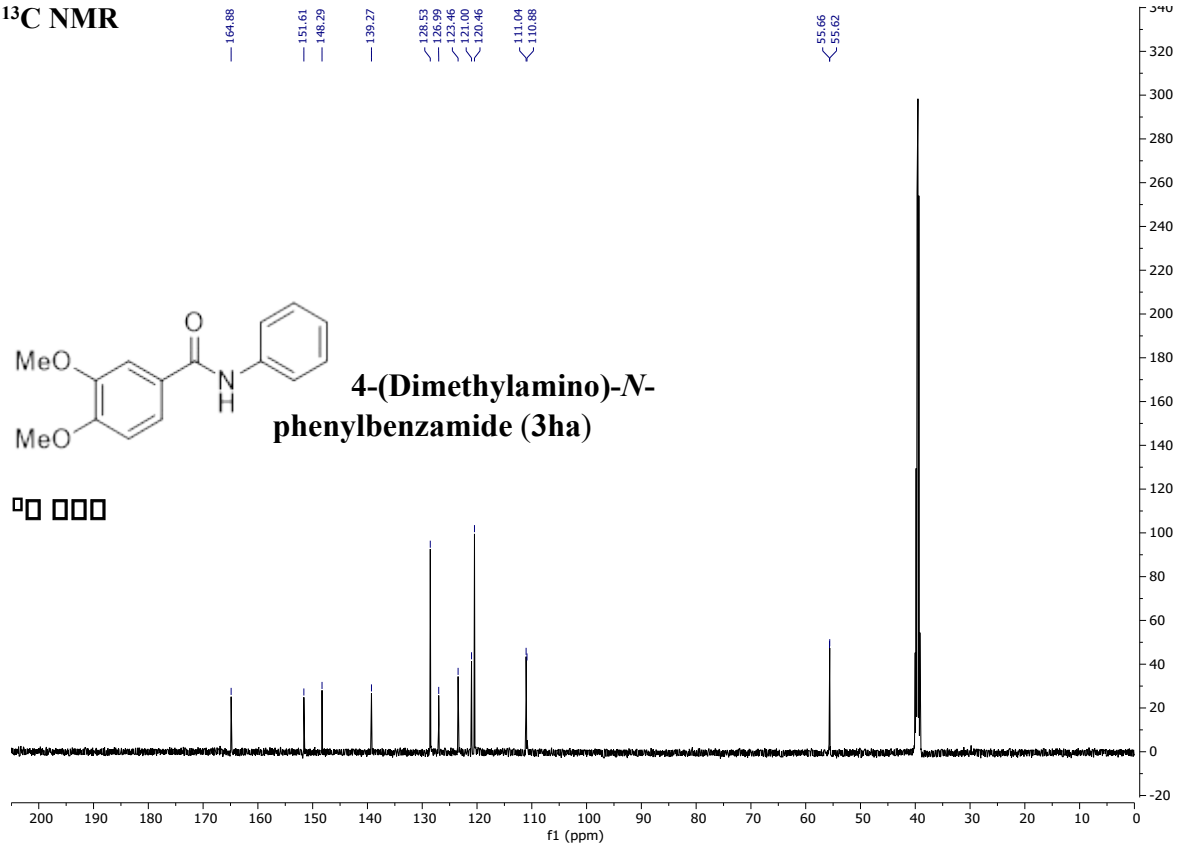
^{13}C NMR



3,4-Dimethoxy-*N*-phenylbenzamide (3ga)

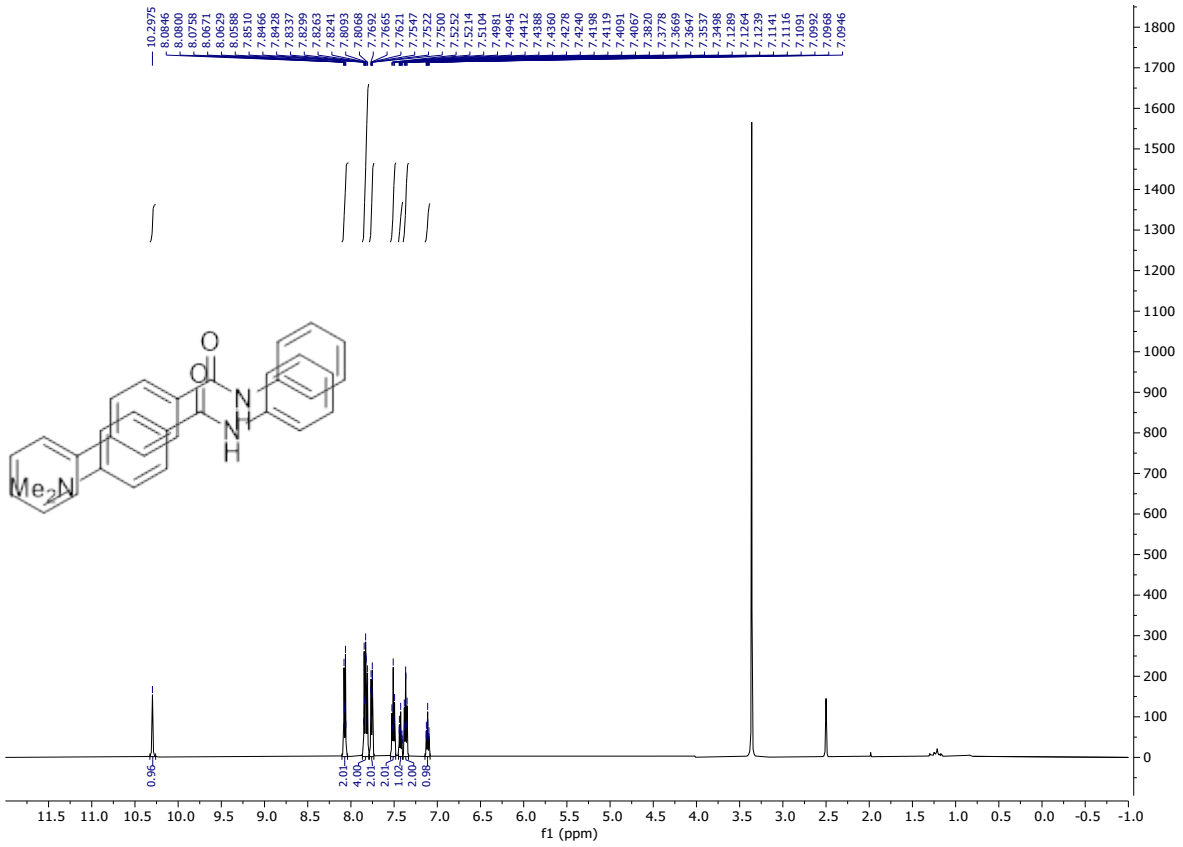


^{13}C NMR

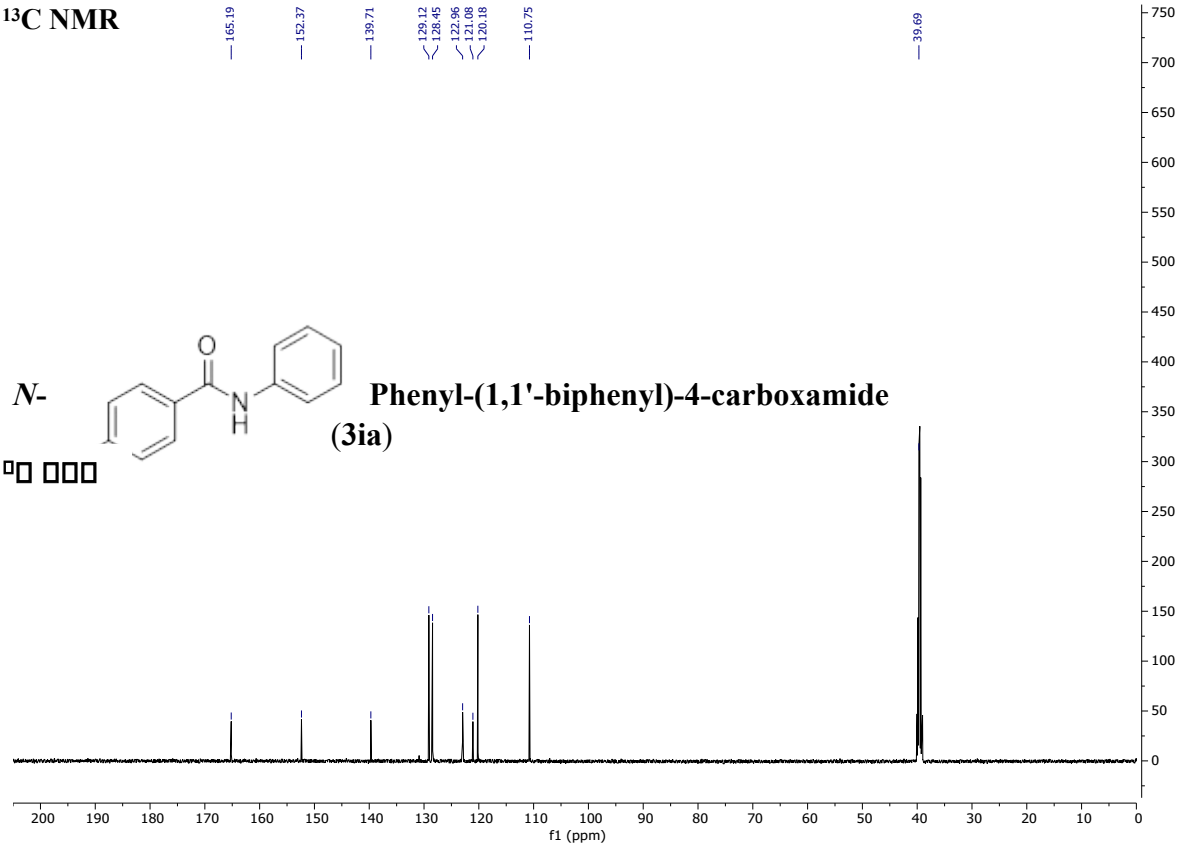


4-(Dimethylamino)-*N*-phenylbenzamide (3ha)

□□ □□□

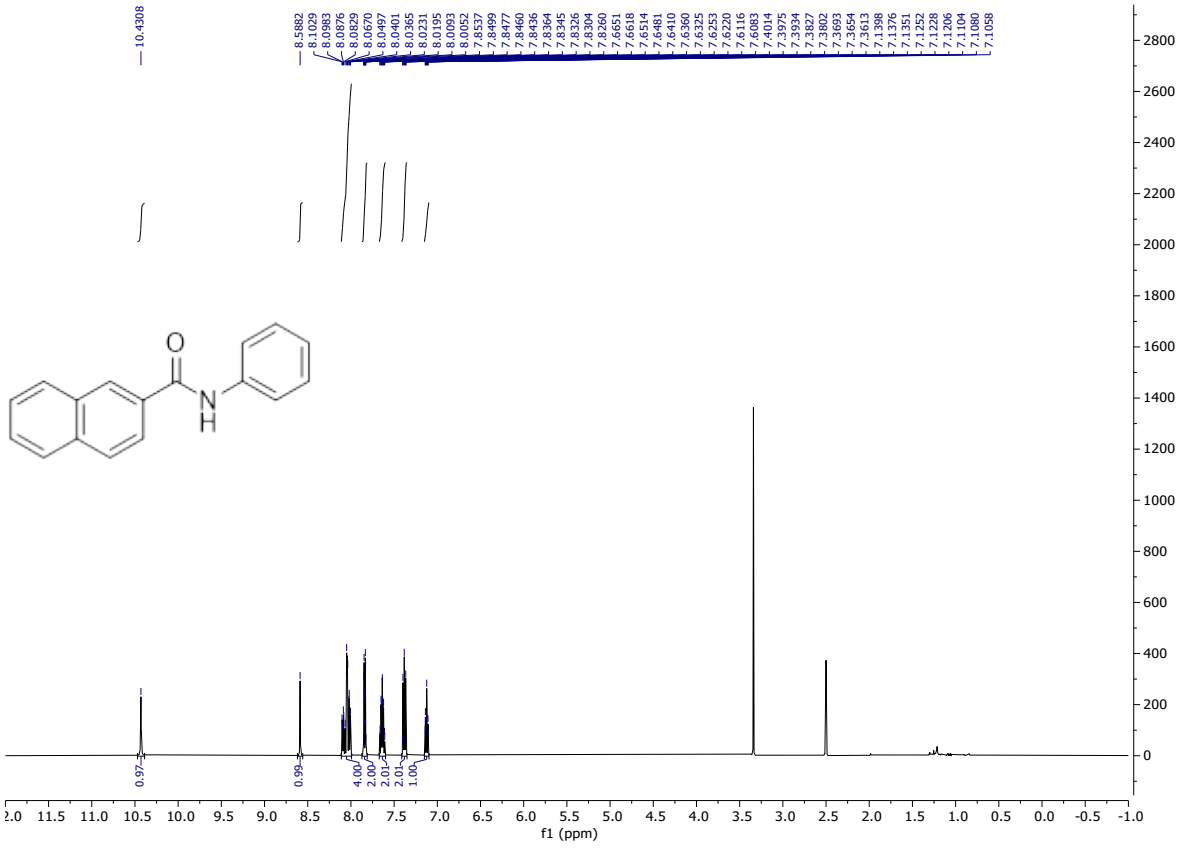


^{13}C NMR

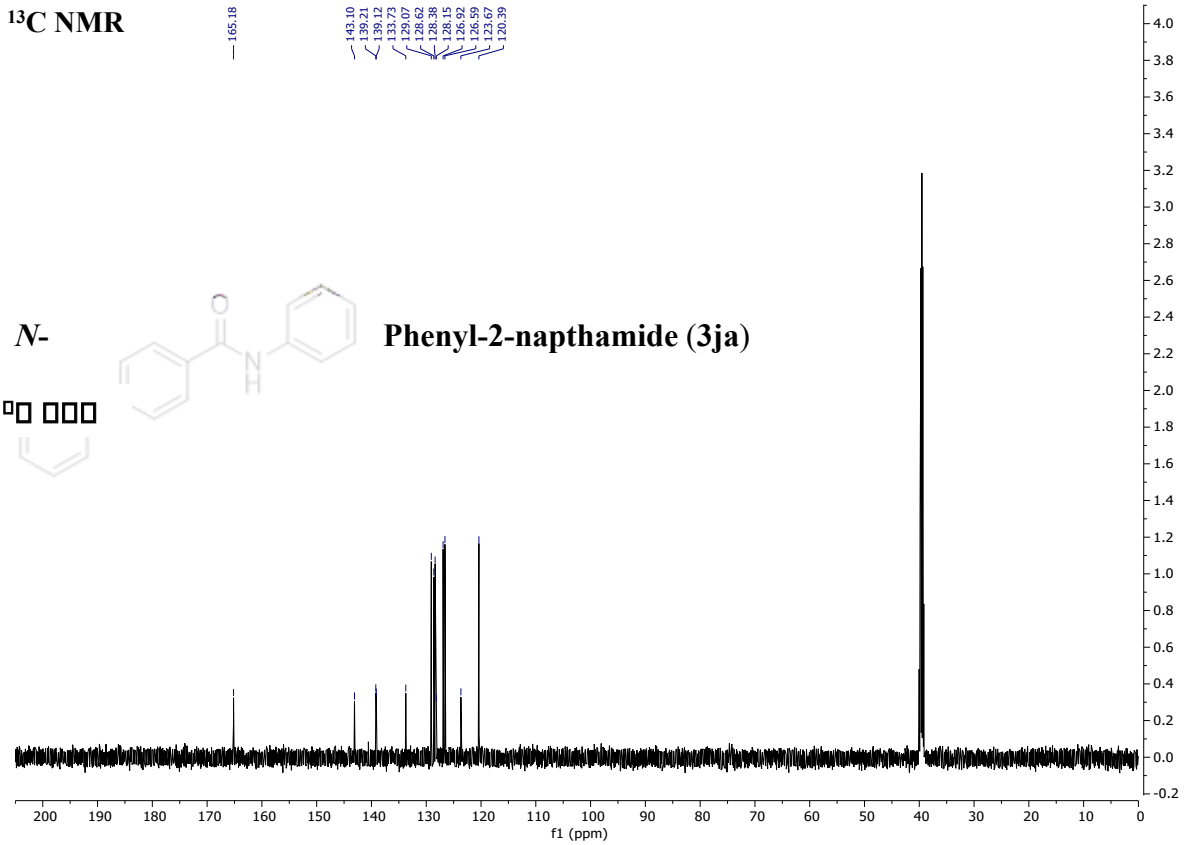


***N*-Phenyl-(1,1'-biphenyl)-4-carboxamide (3ia)**

□□ □□□

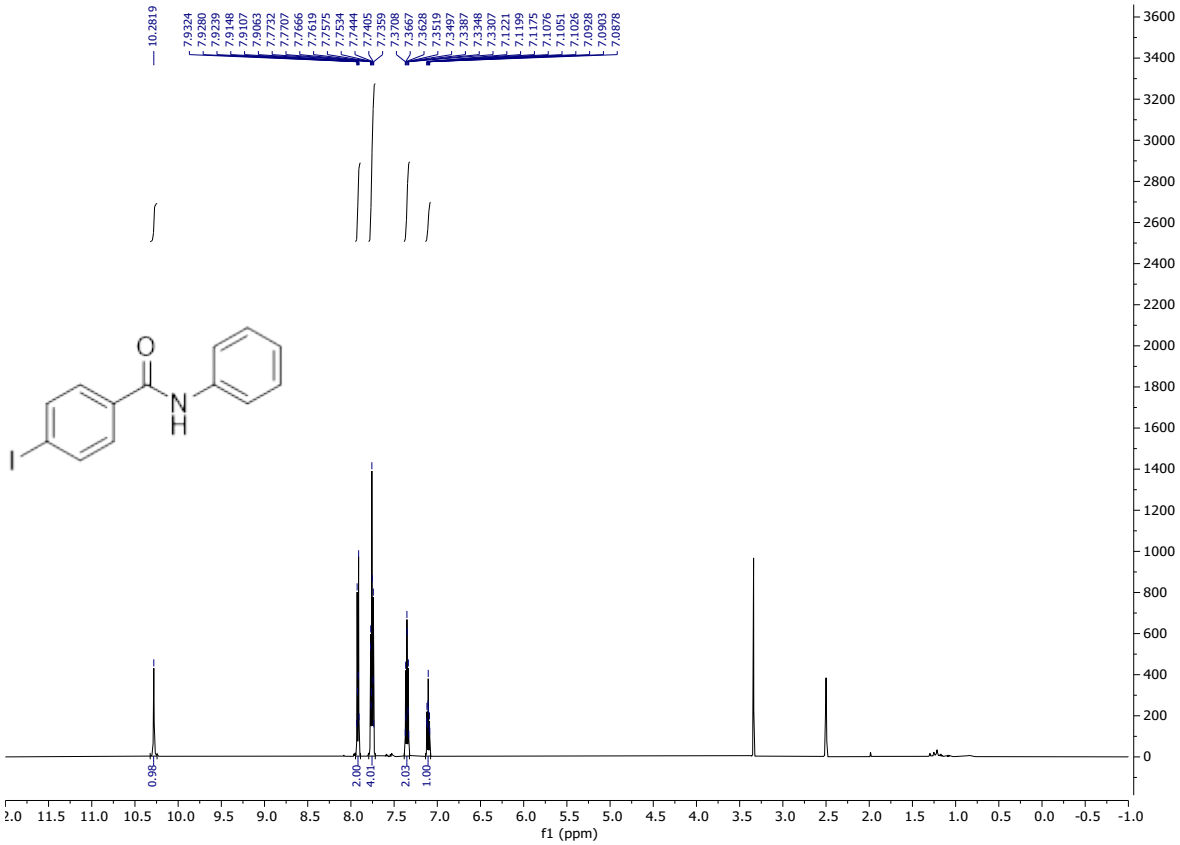


^{13}C NMR

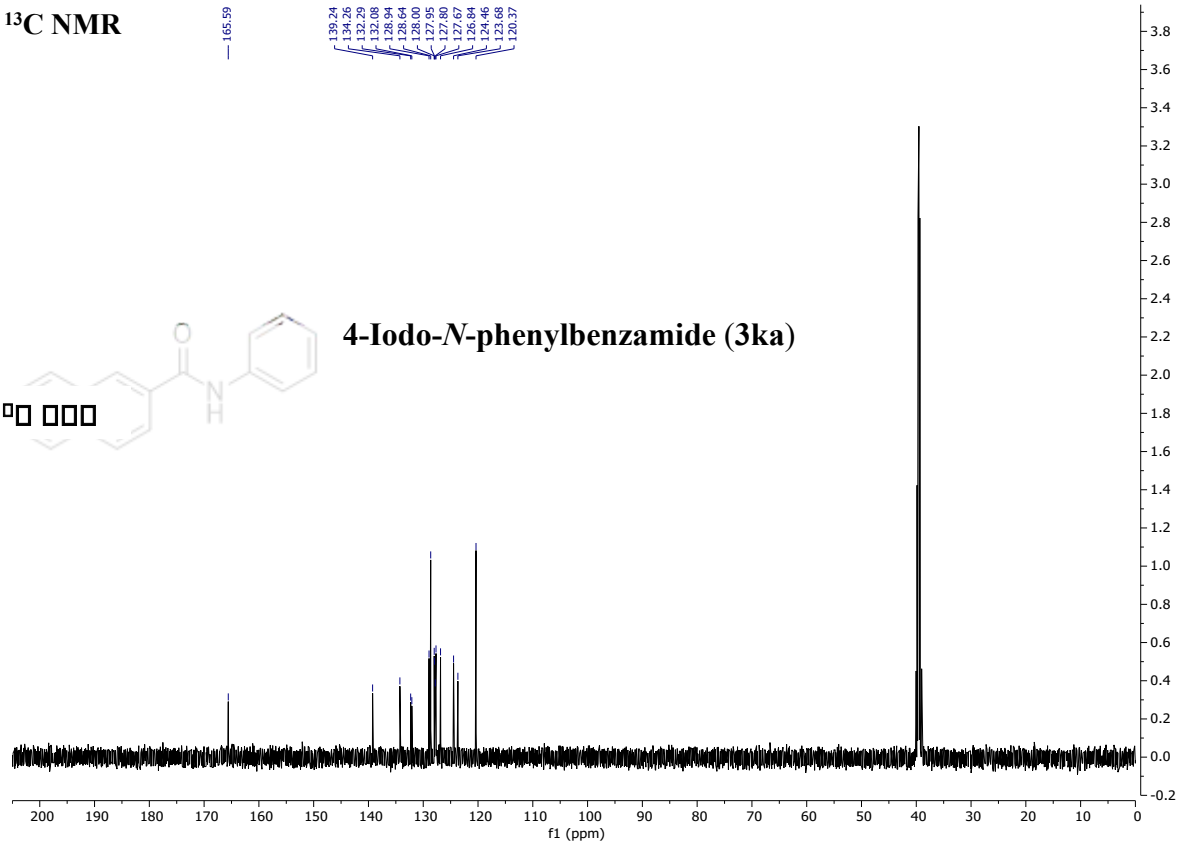


***N*-** **Phenyl-2-napthamide (3ja)**

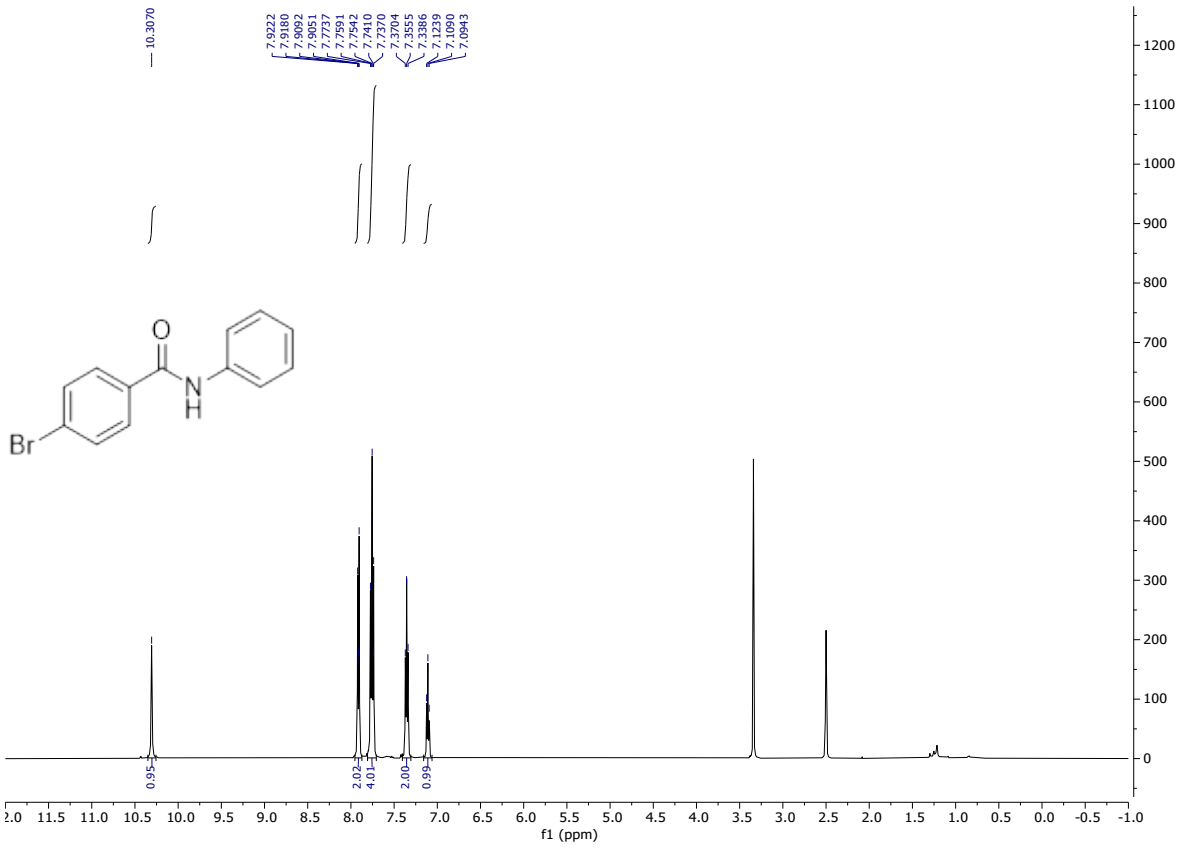
□□ □□□



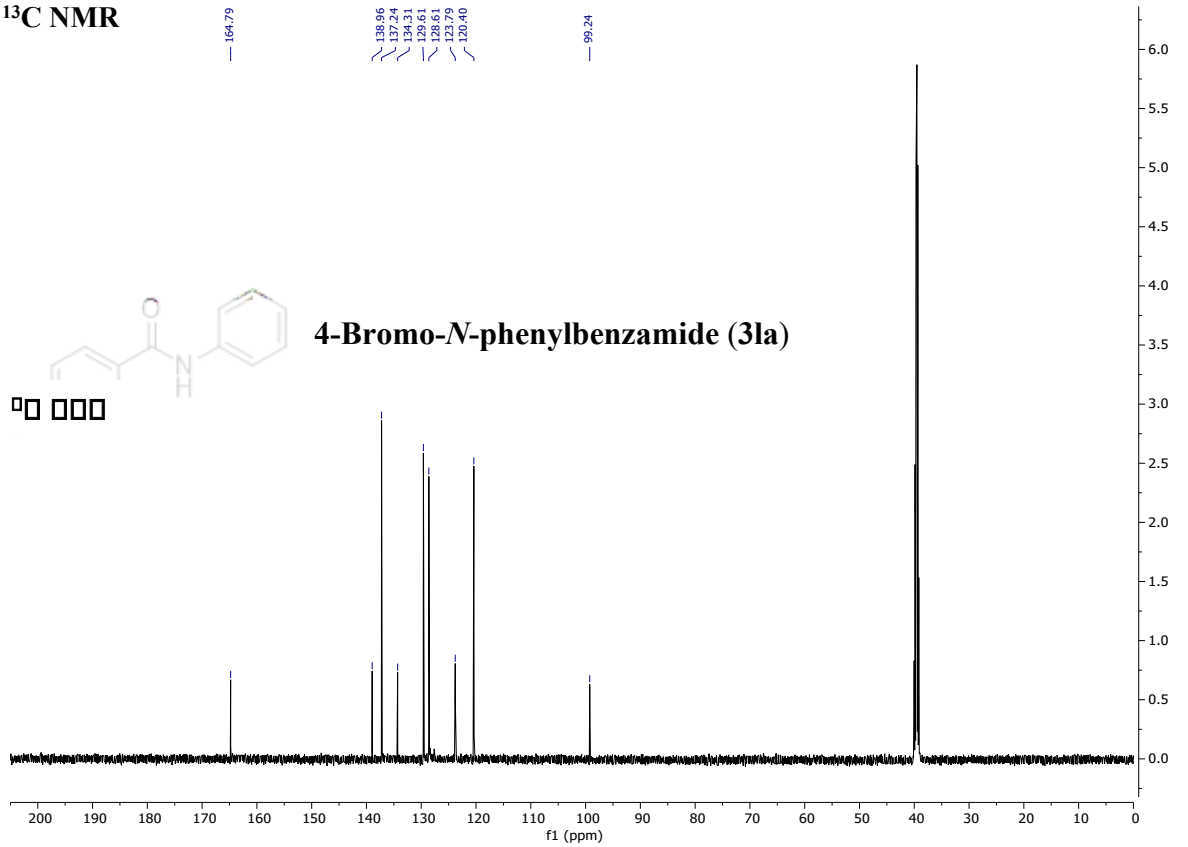
^{13}C NMR



4-Iodo-*N*-phenylbenzamide (3ka)

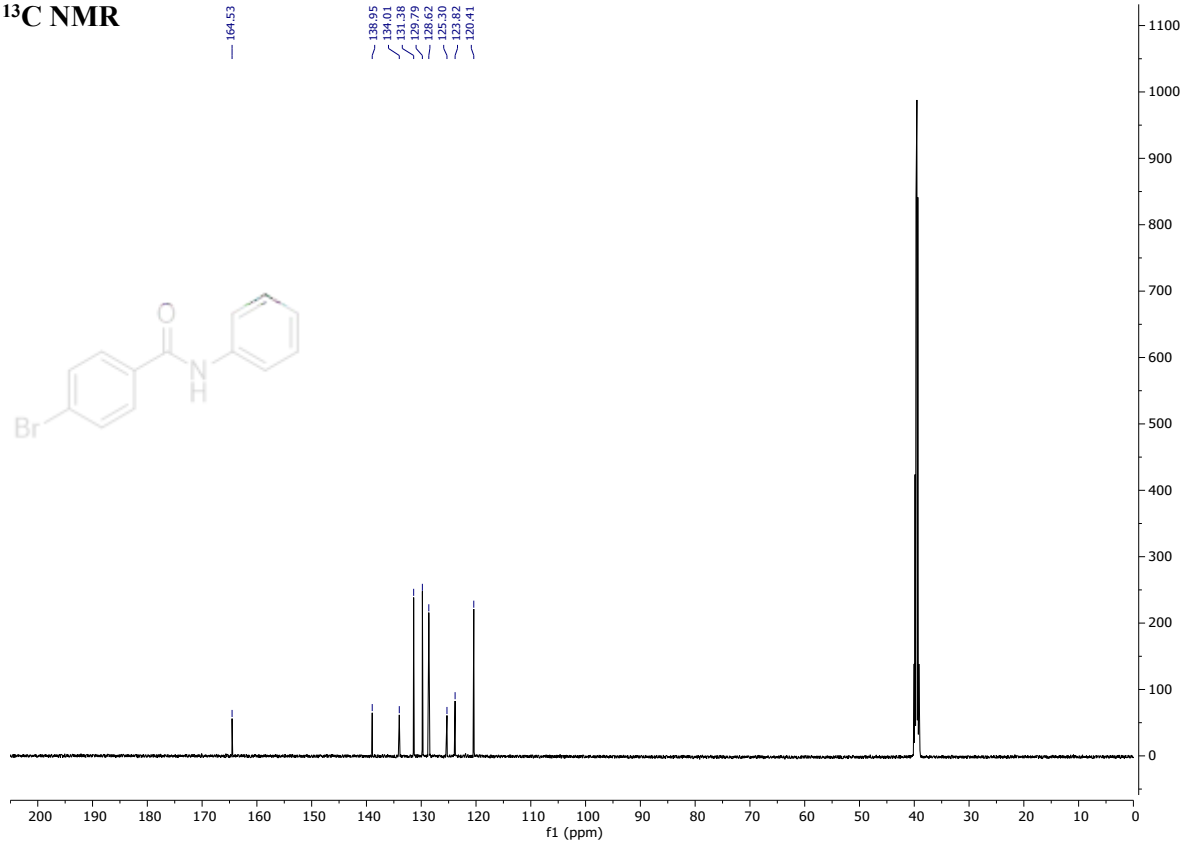


^{13}C NMR



4-Bromo-*N*-phenylbenzamide (3la)

^{13}C NMR


164.53
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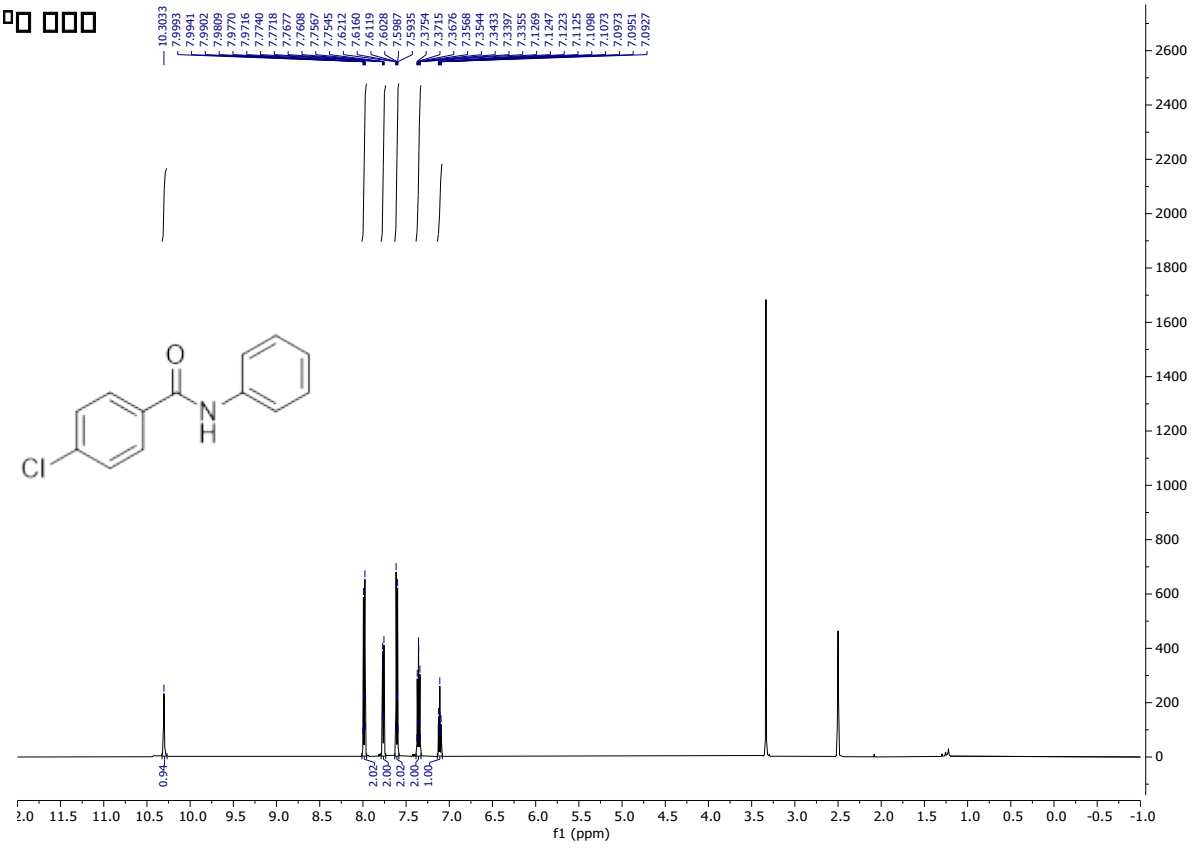
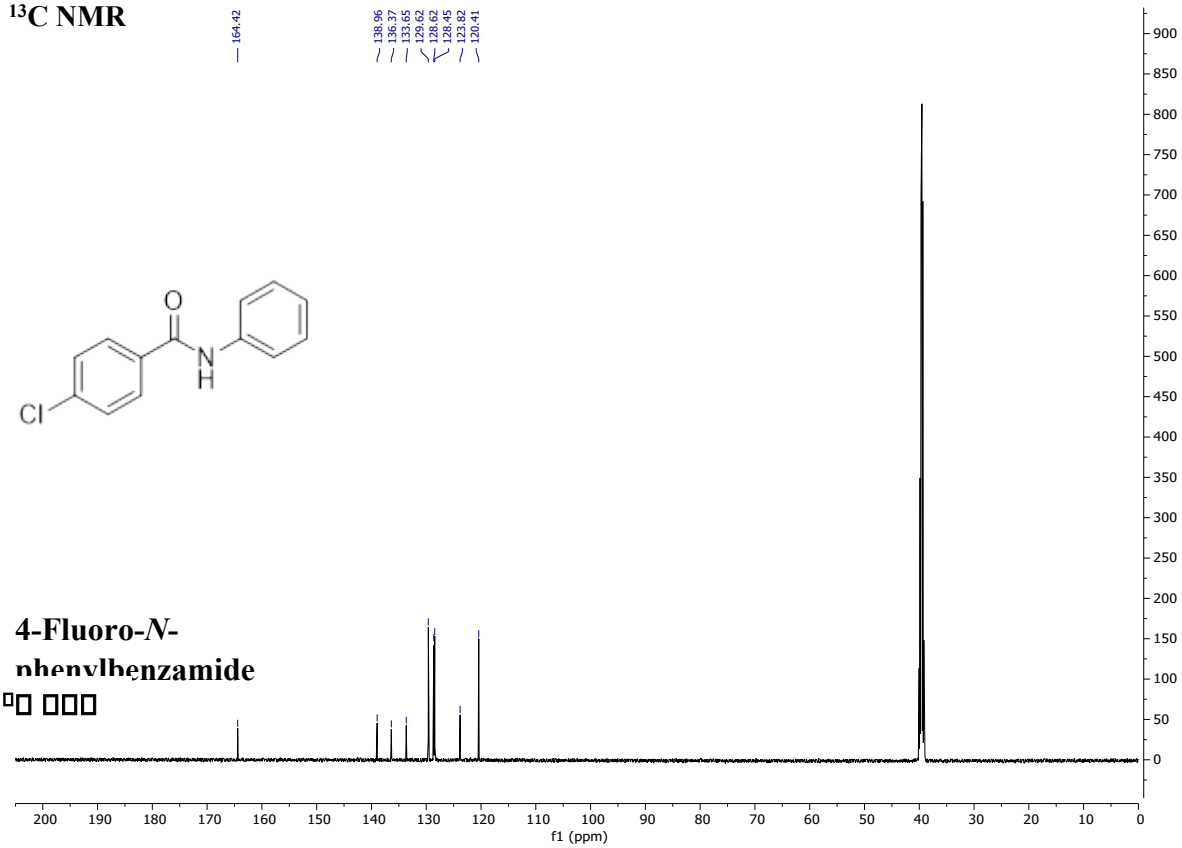
131.38
129.79
128.62
125.30
123.82
120.41
O
N
H
Br
f1 (ppm)

4-Chloro-*N*-phenylbenzamide (3ma)

□□ □□□

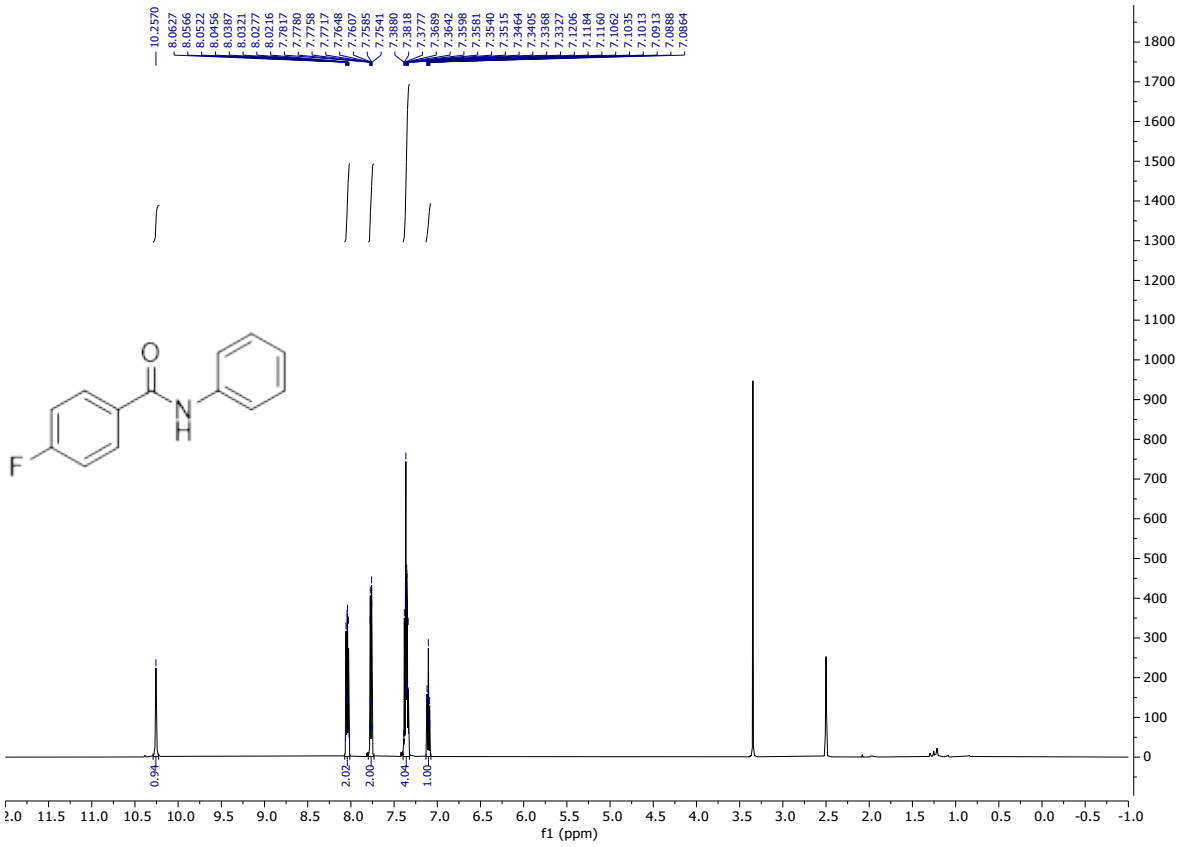


^{13}C NMR



4-Fluoro-*N*-phenylbenzamide

□□ □□□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8.0456
8.0387
8.0321
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8.0216
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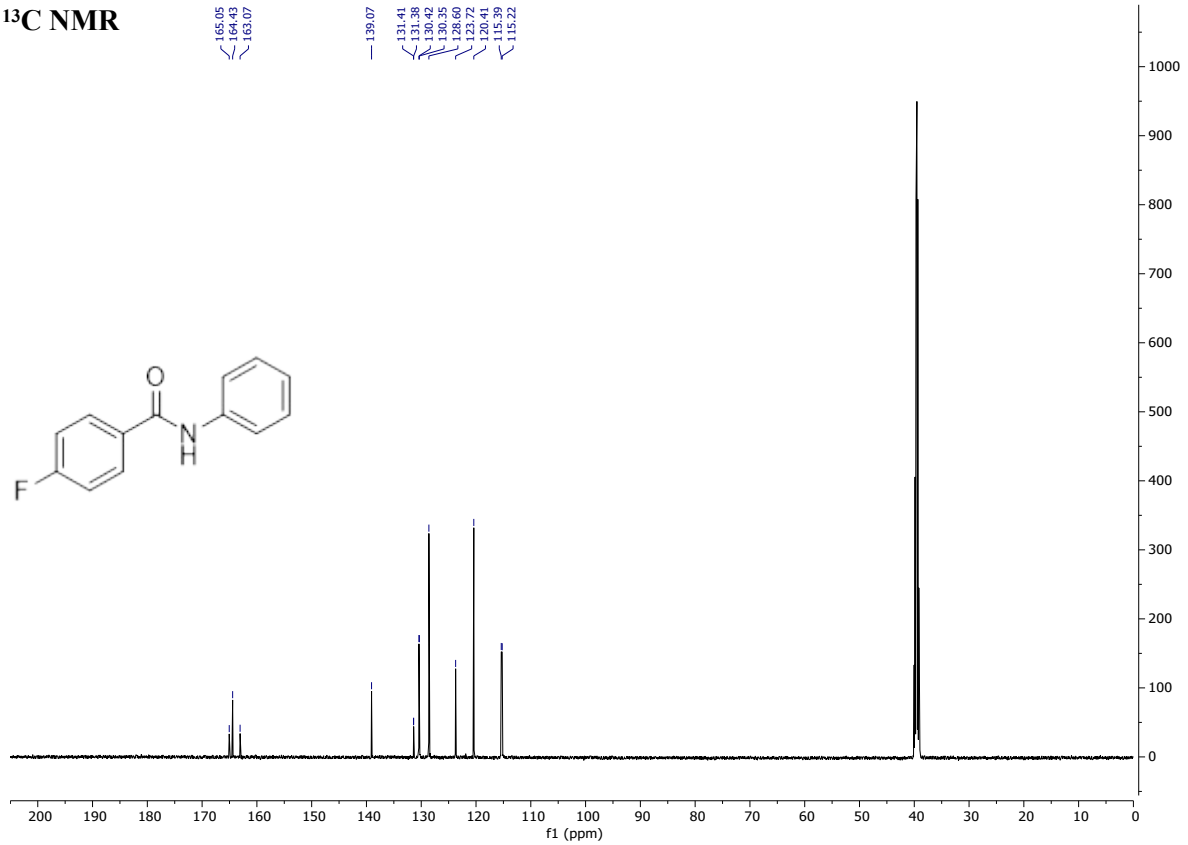
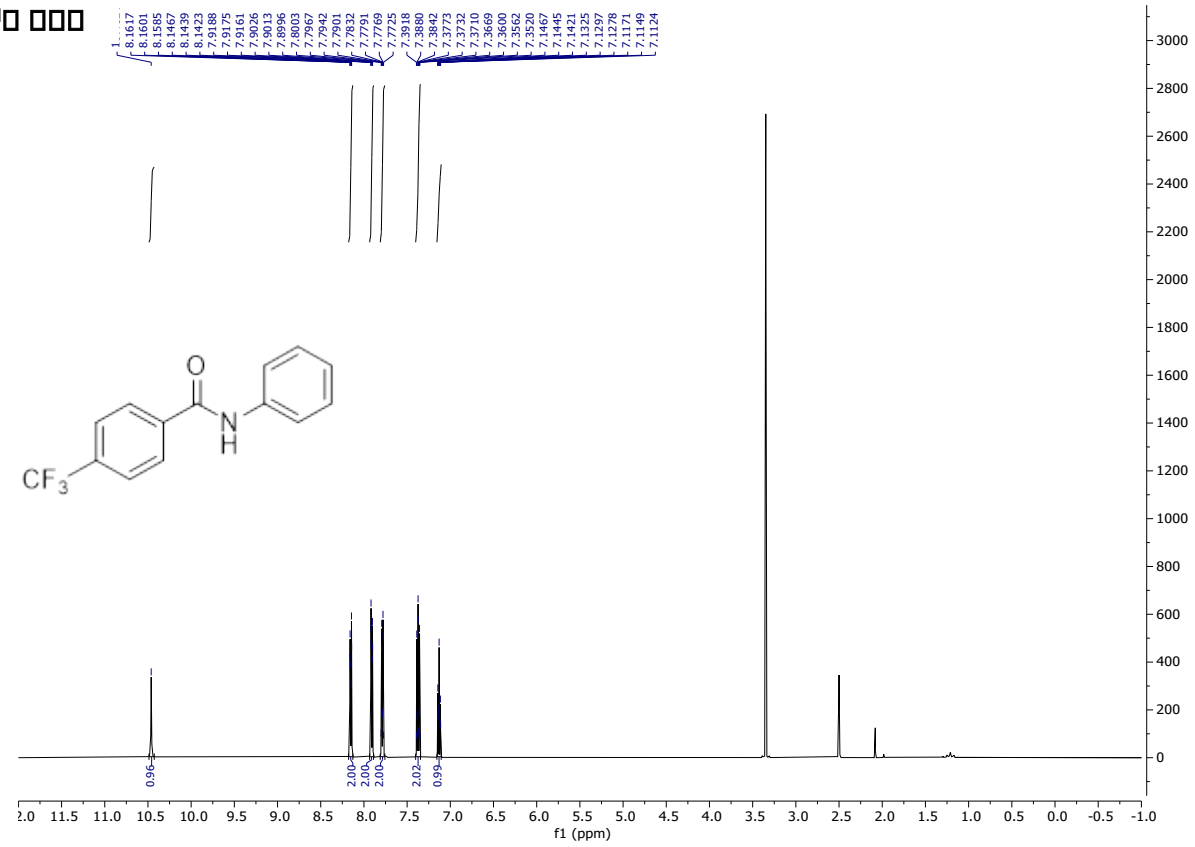
7.3581
7.3540
7.3515
7.3464
7.3405
7.3368
7.3327
7.1206
7.1184
7.1160
7.1062
7.1035
7.1013
7.0913
7.0888
7.0864
0.94
2.02
2.00
4.04
1.00
f1 (ppm)

^{13}C NMR

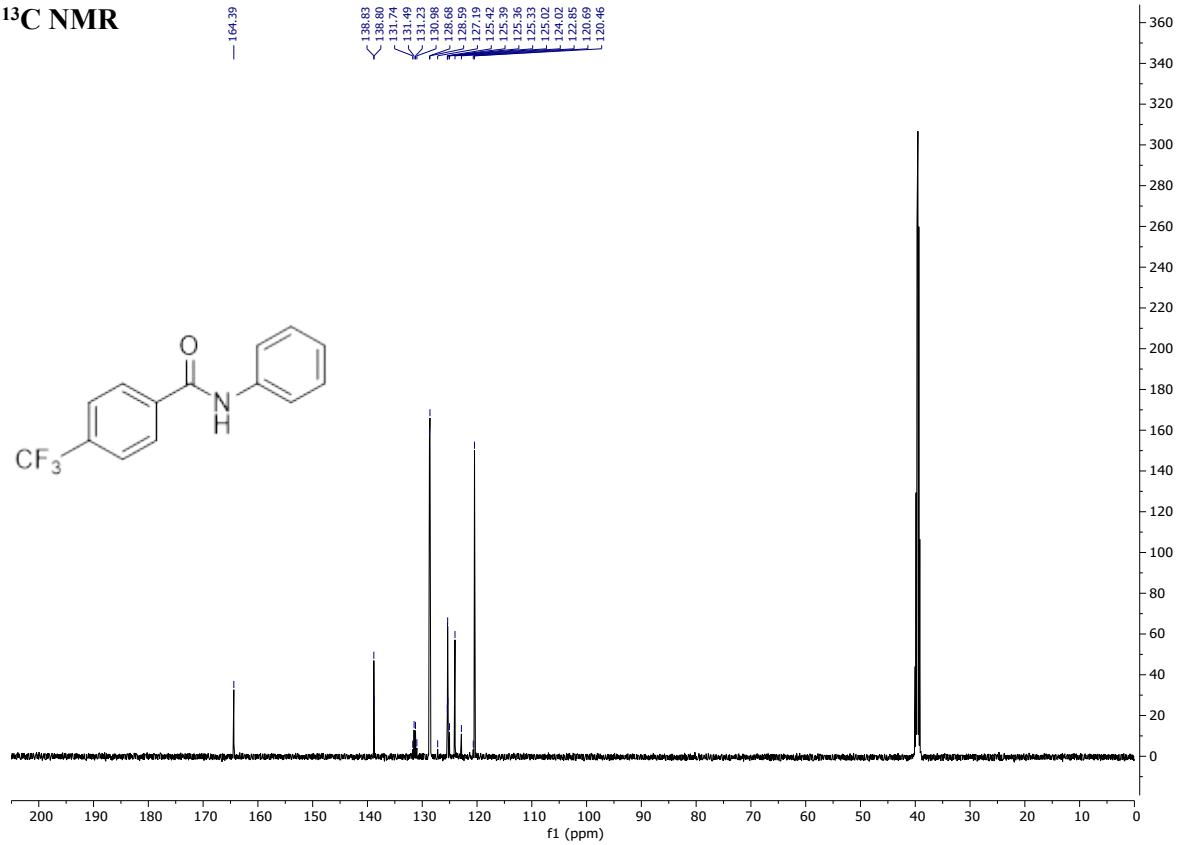

165.05
164.43
163.07
139.07
131.41
131.38
130.42
130.35
128.60
123.72
120.41
115.39
115.22
f1 (ppm)

N-Phenyl-4-(trifluoromethyl)benzamide (3oa)

□□ □□□

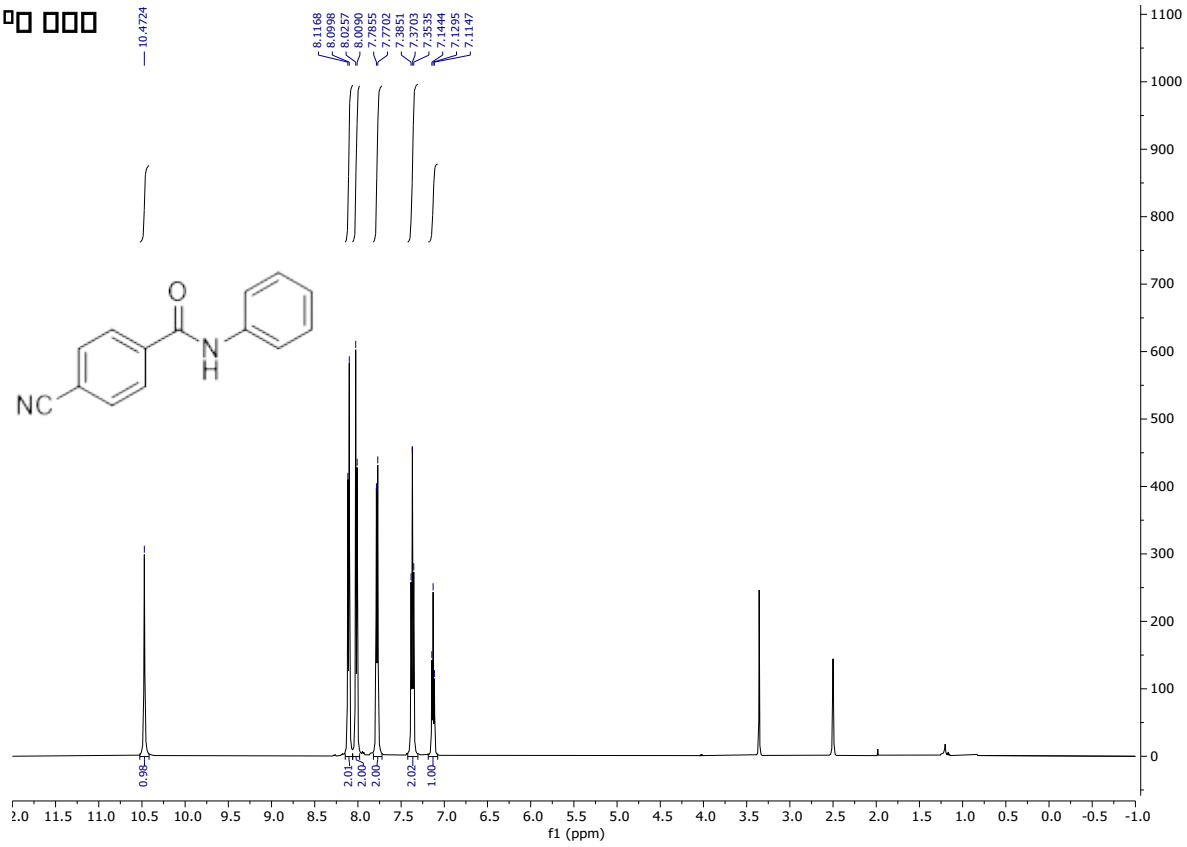


^{13}C NMR

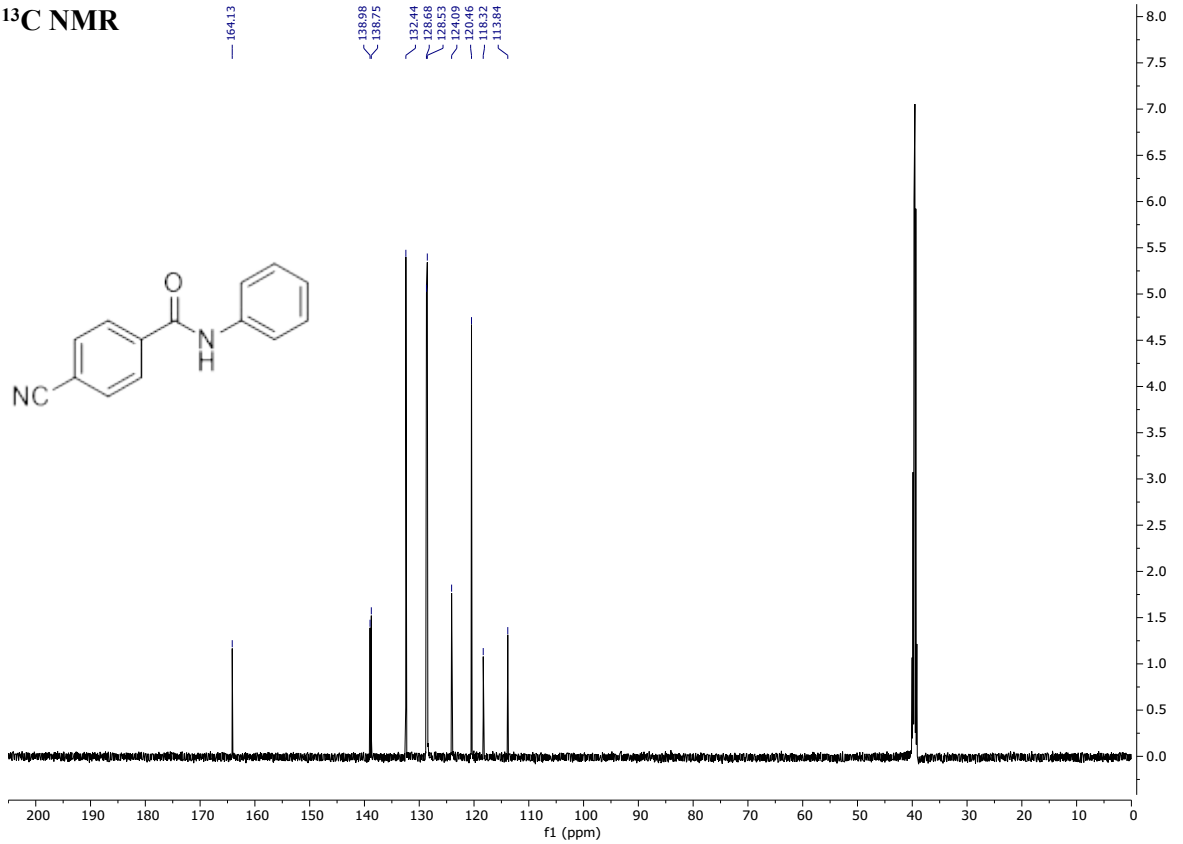


4-Cyano-*N*-phenylbenzamide (3pa)

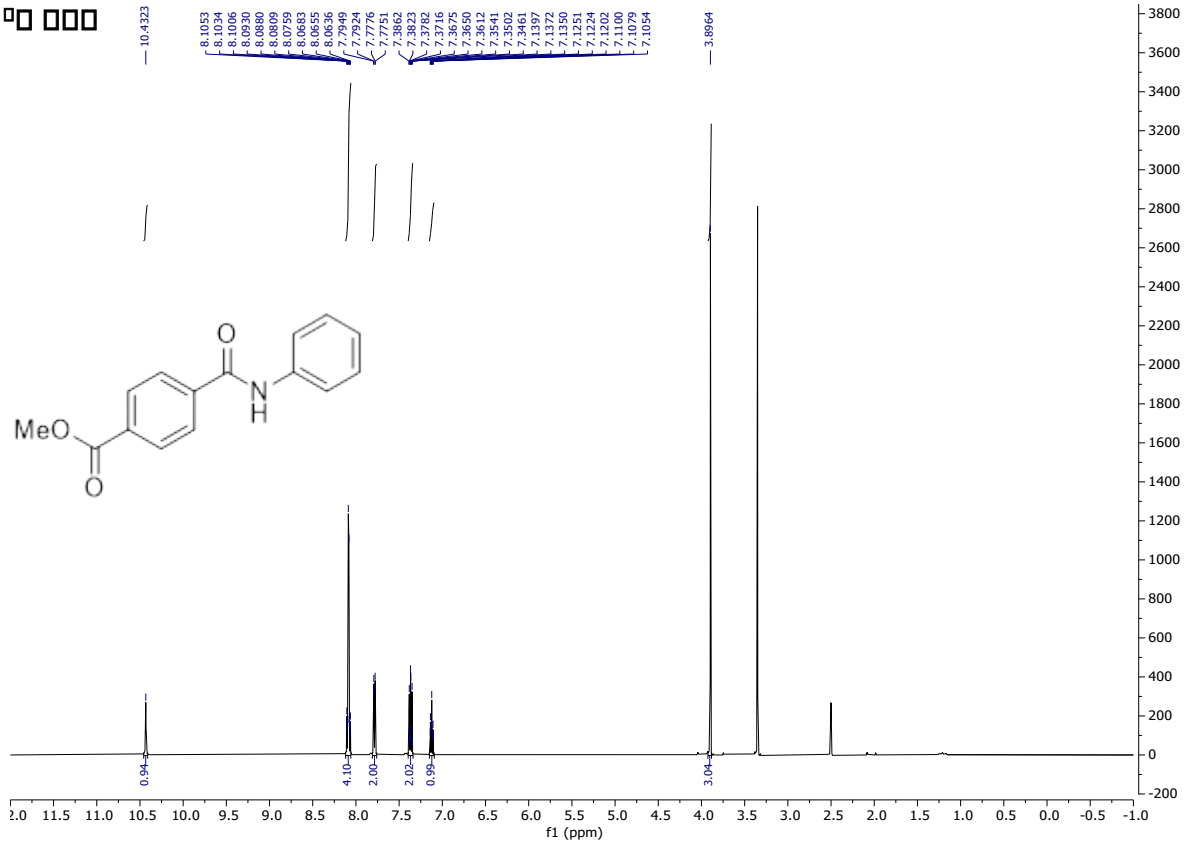
□□ □□□



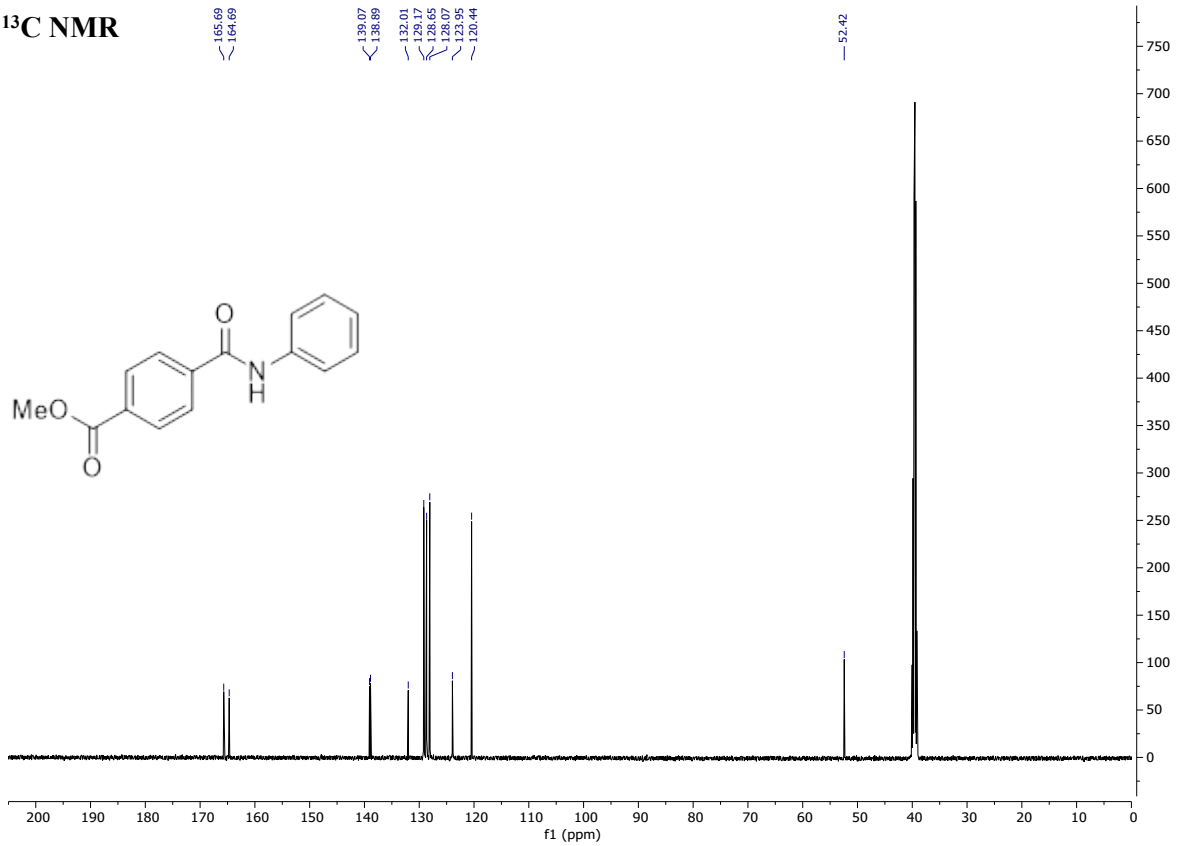
^{13}C NMR



Methyl-4-(phenylcarbamoyl)benzoate (3qa)

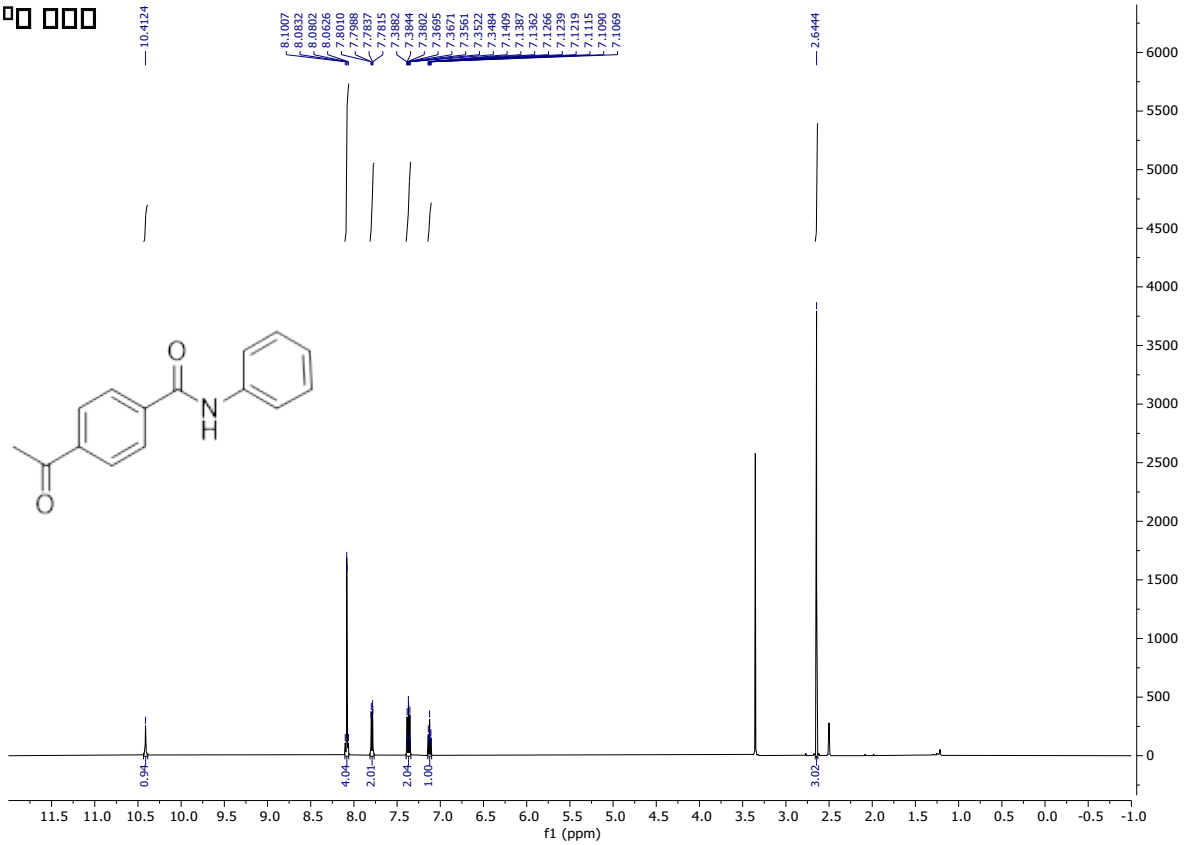


^{13}C NMR

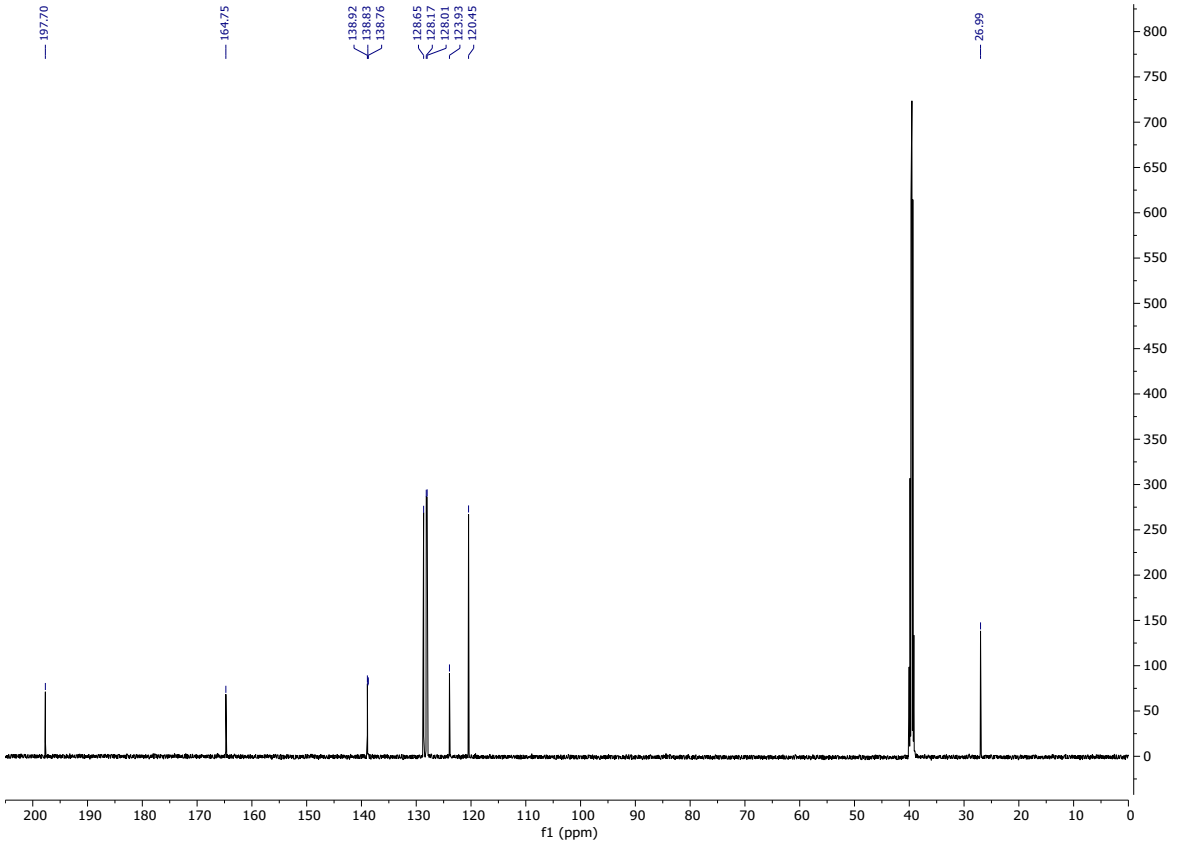


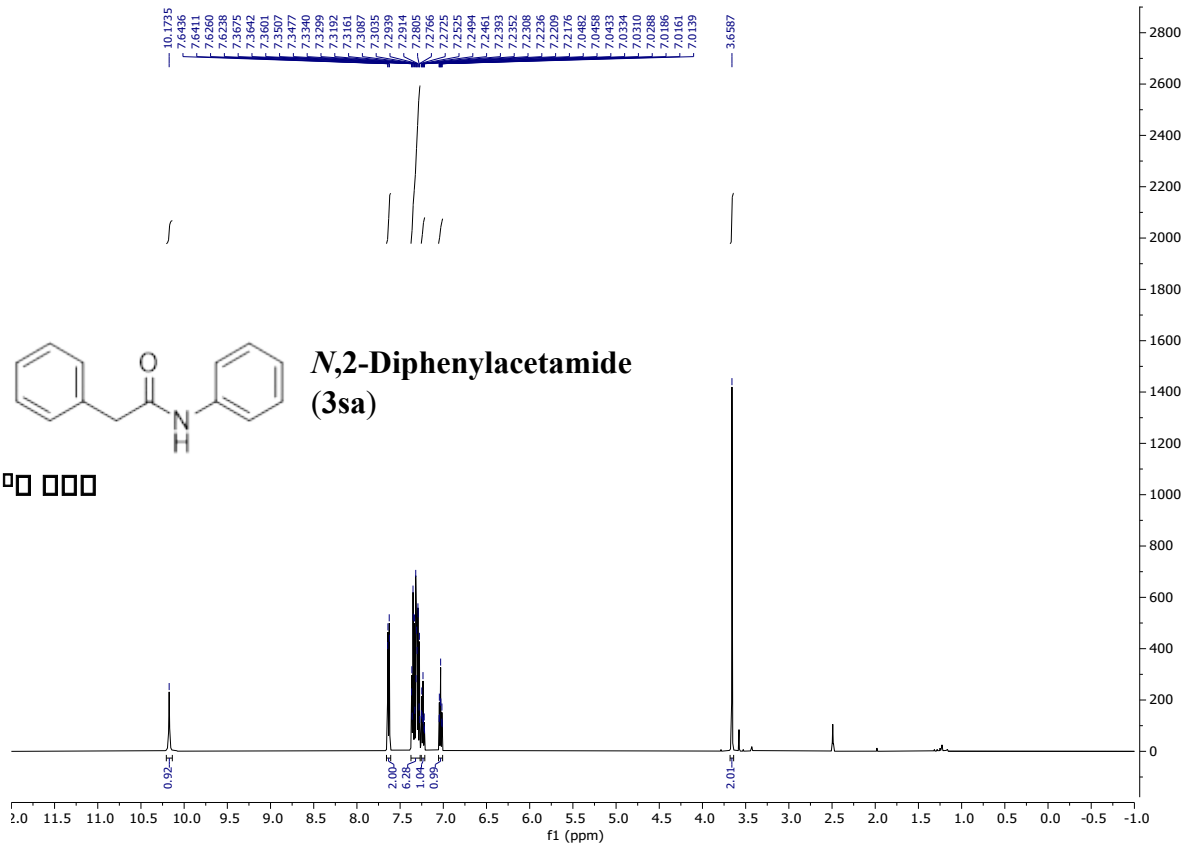
4-Acetyl-*N*-phenylbenzamide (3ra)

□□ □□□



^{13}C NMR

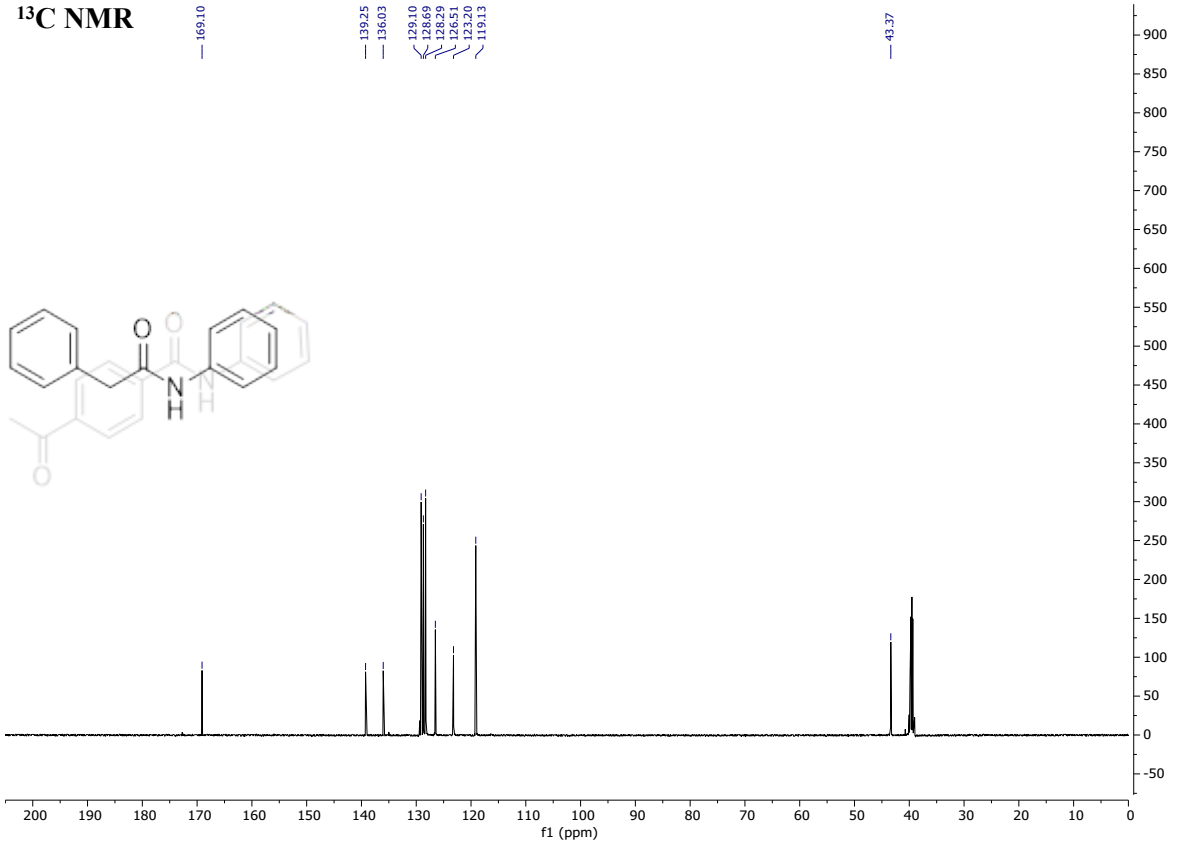




N,2-Diphenylacetamide (3sa)

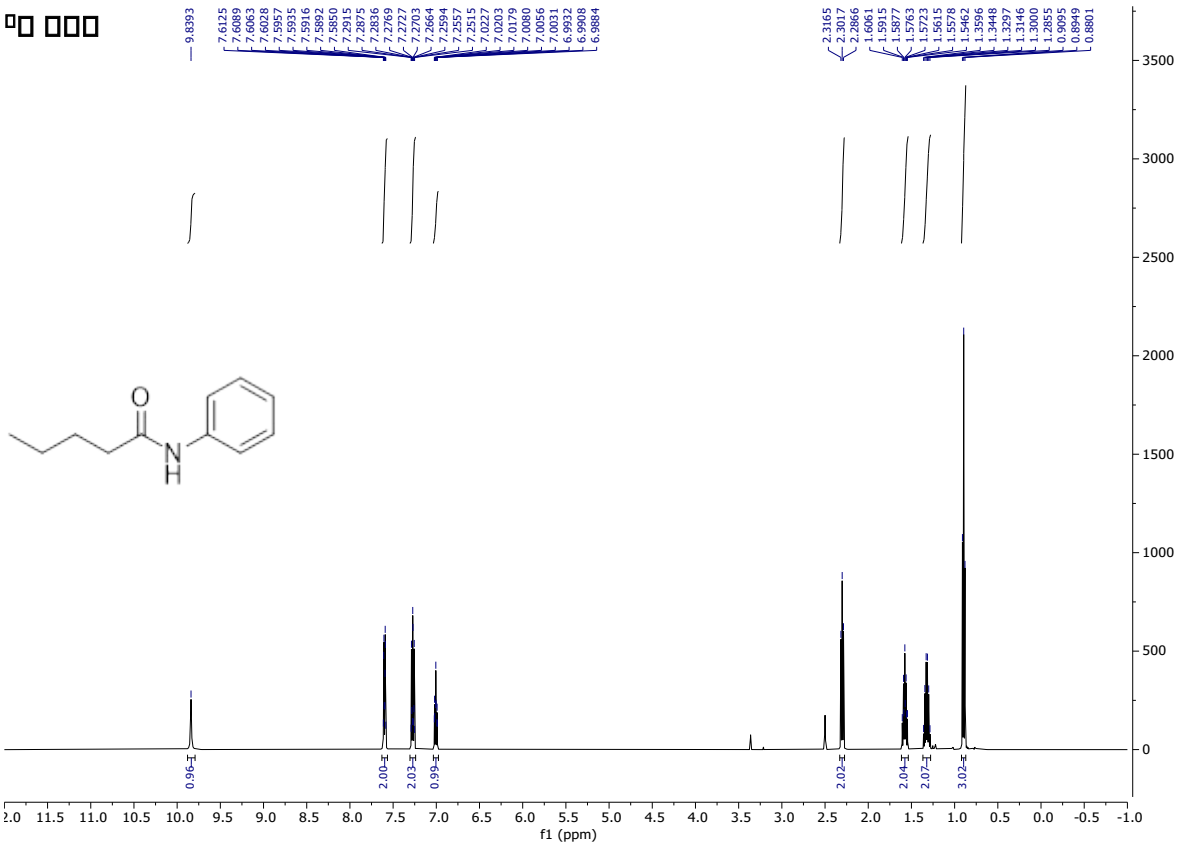
□□ □□□

^{13}C NMR

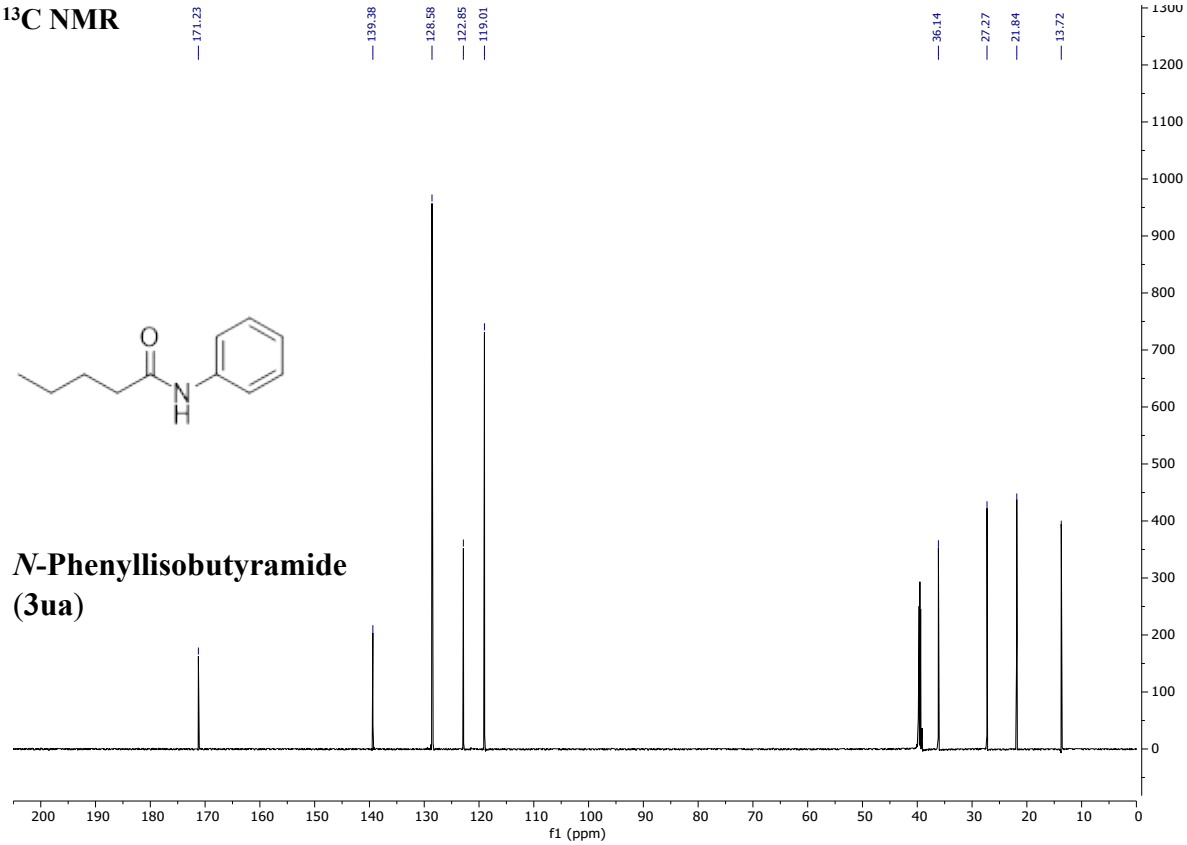


N-Phenylpentanamide (3ta)

□□ □□□

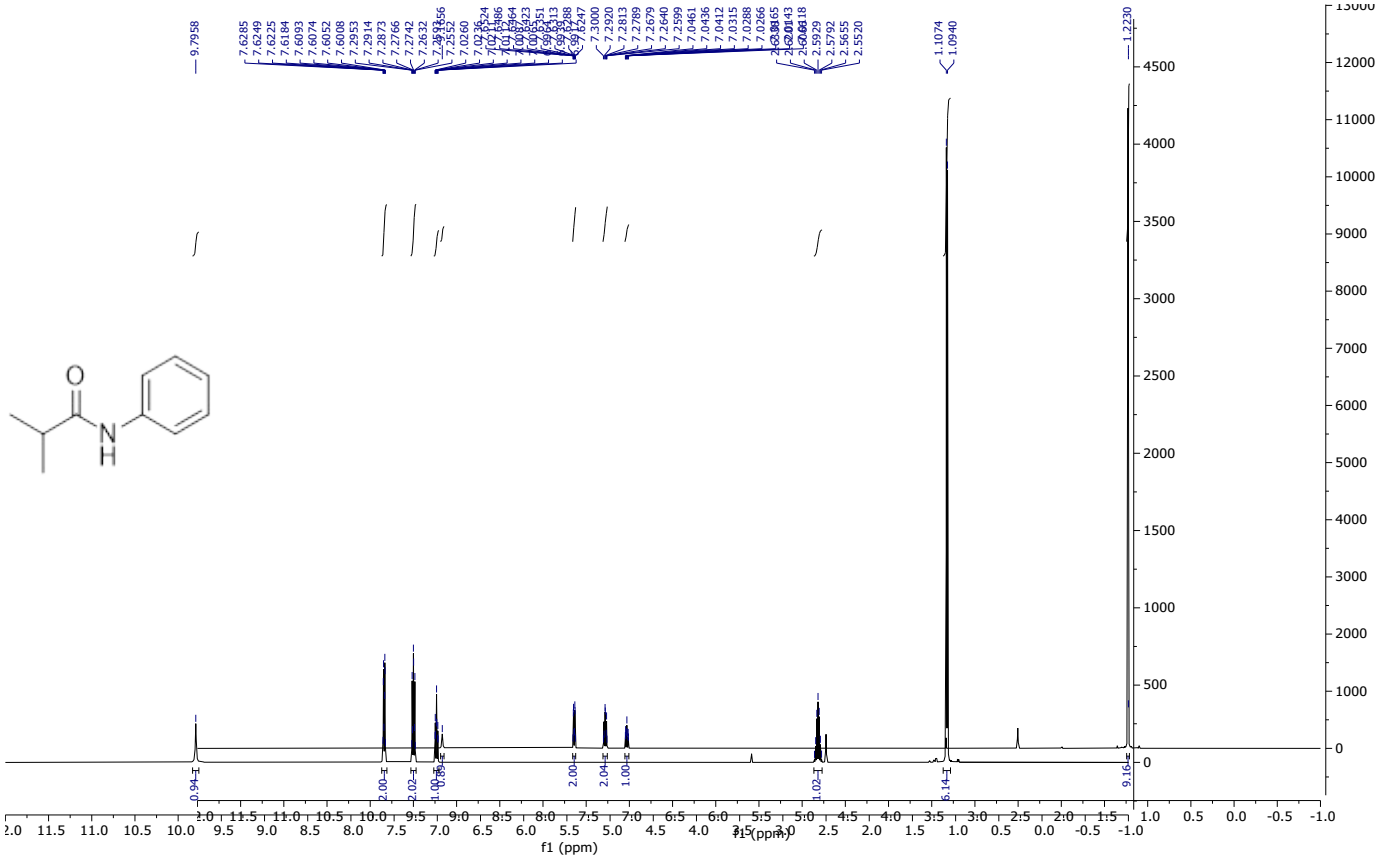


^{13}C NMR

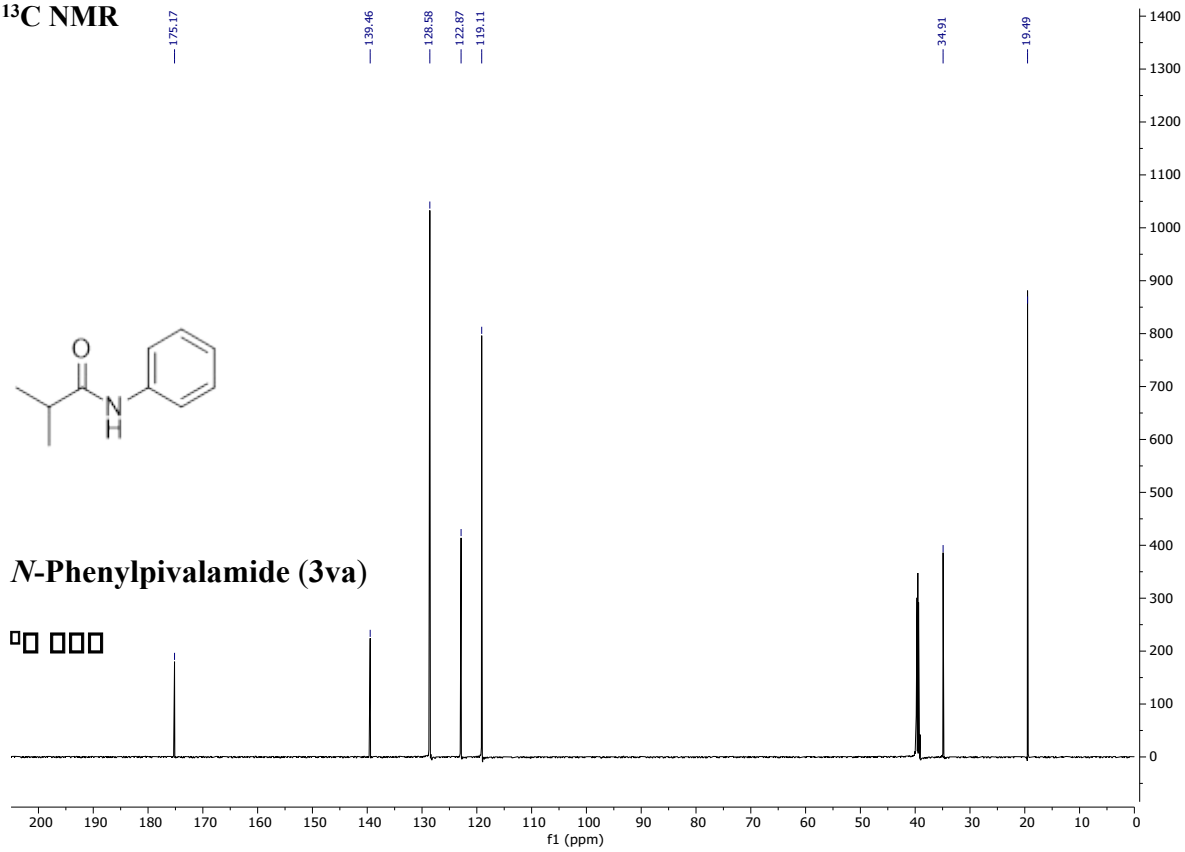


N-Phenyllisobutyramide (3ua)

□□ □□□

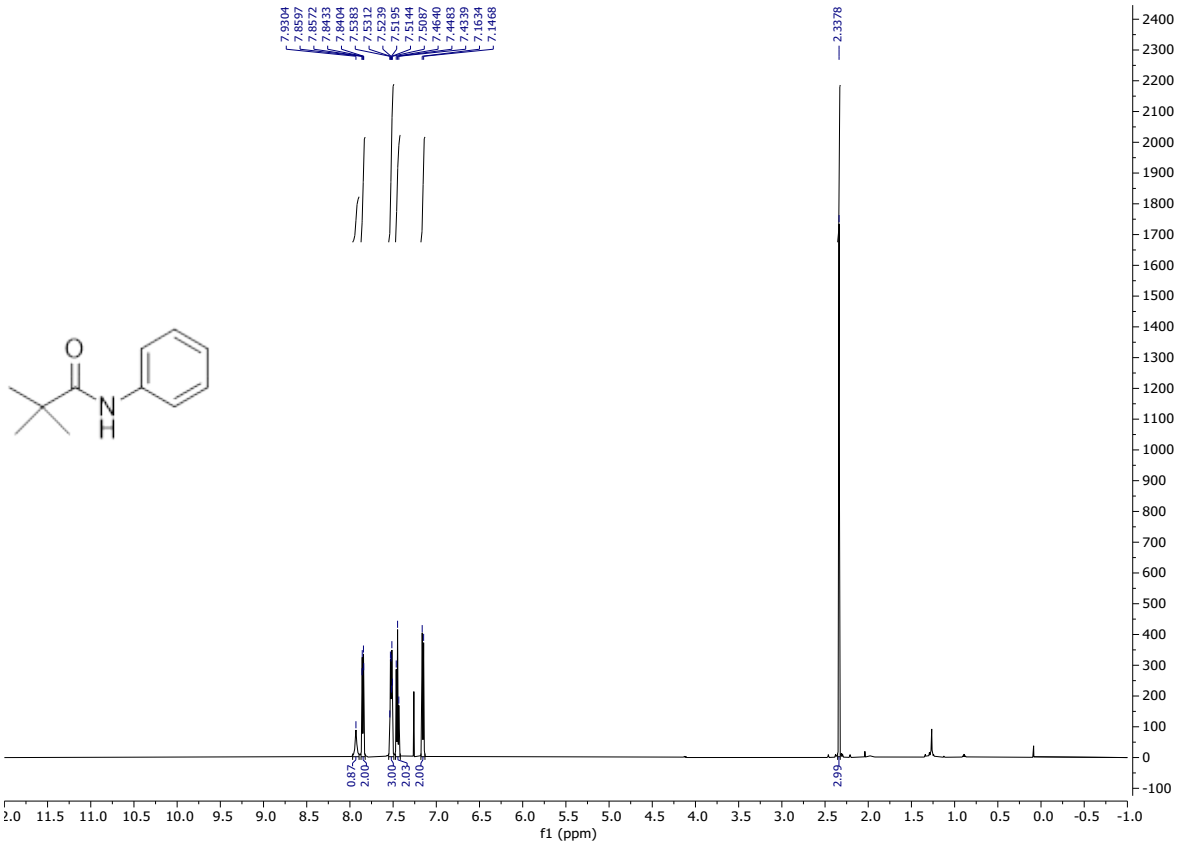


^{13}C NMR

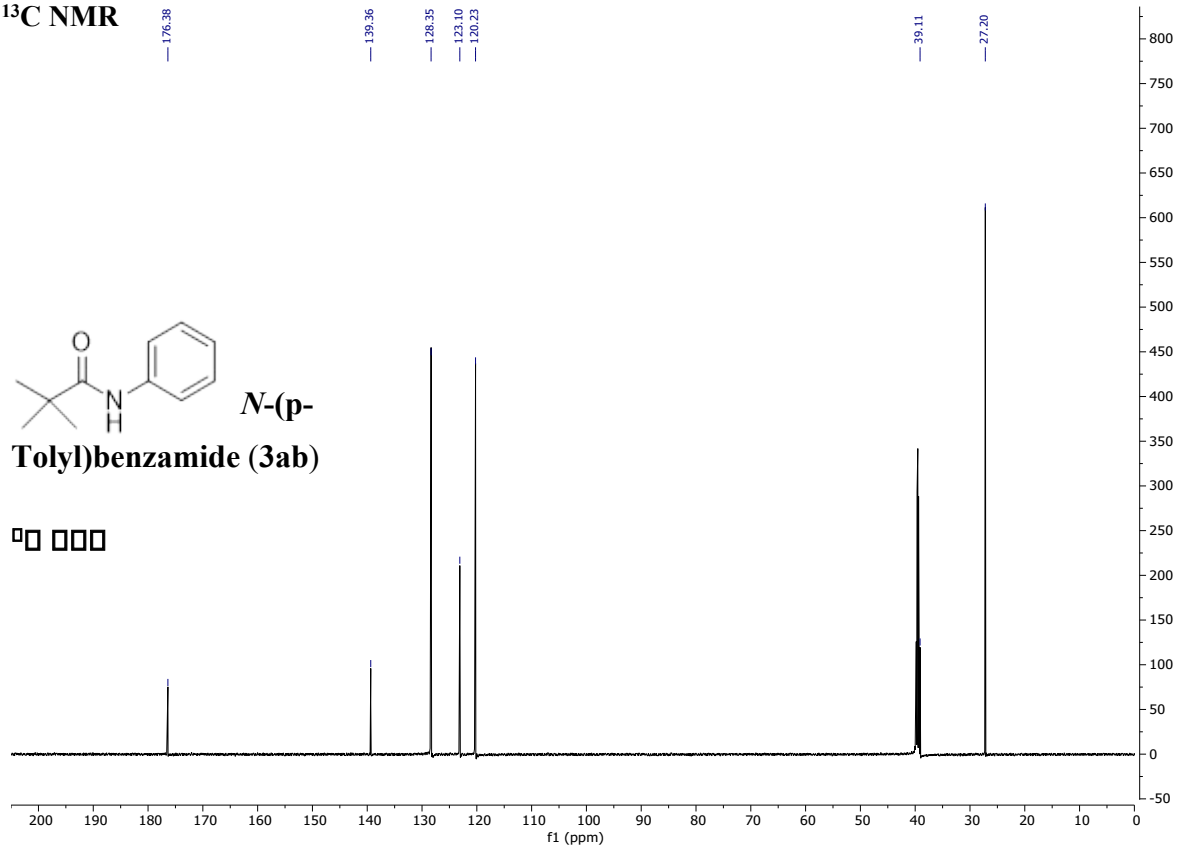


***N*-Phenylpivalamide (3va)**

□□ □□□

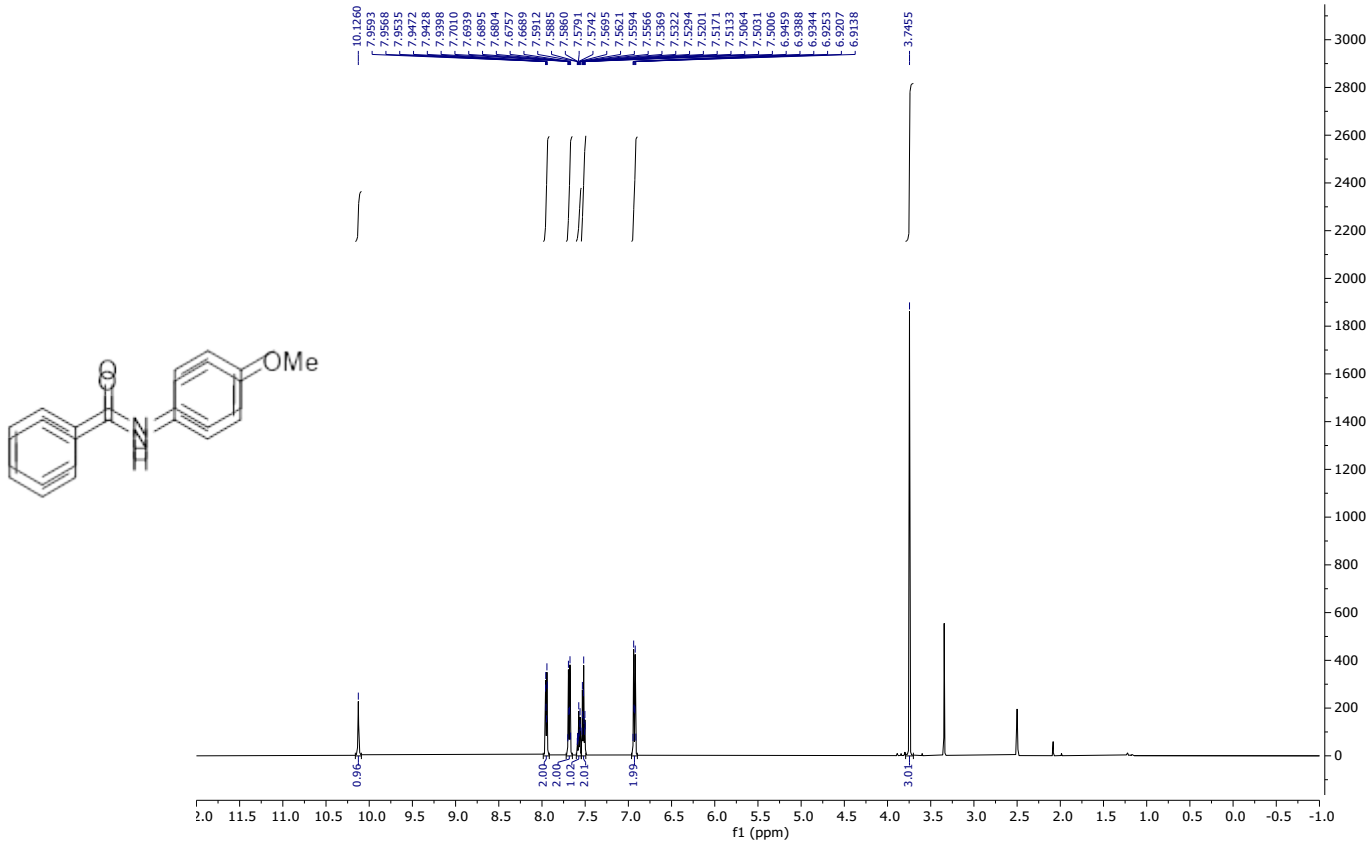


^{13}C NMR

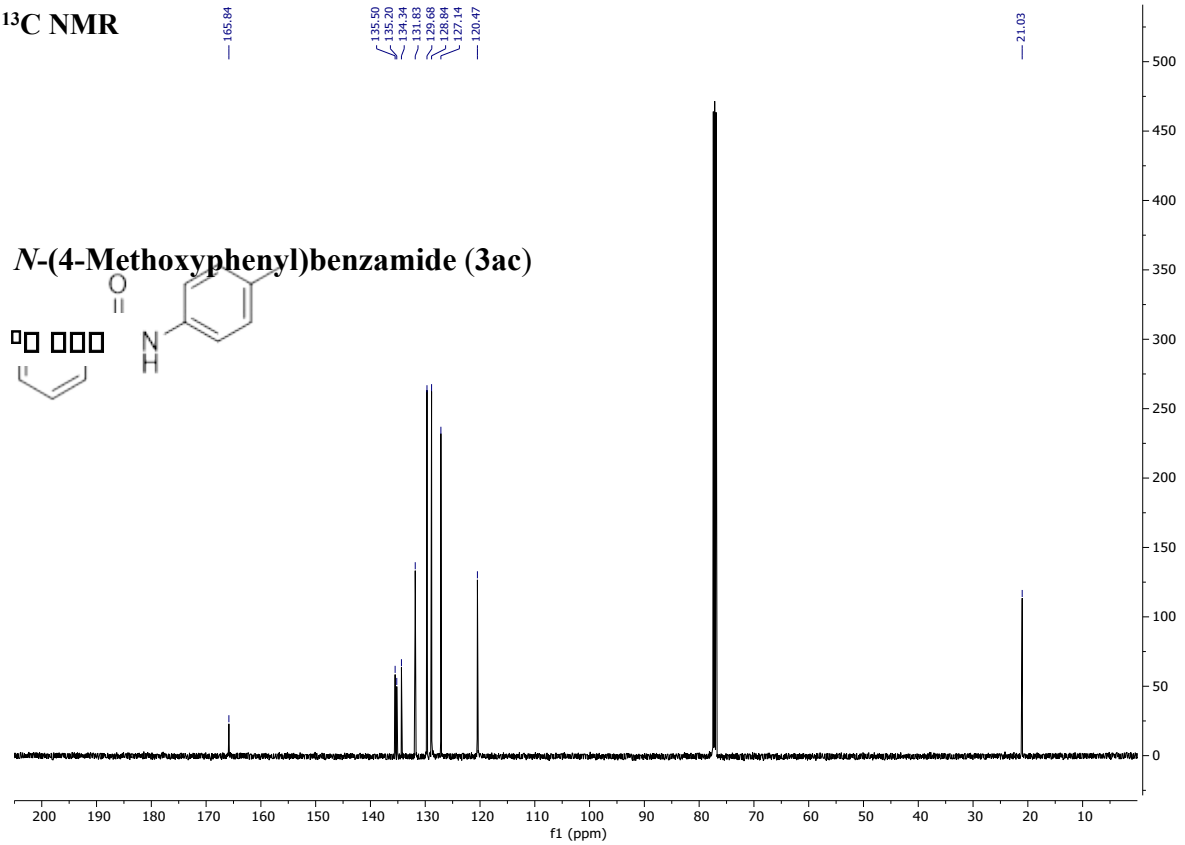


***N*-(p-Tolyl)benzamide (3ab)**

□□ □□□

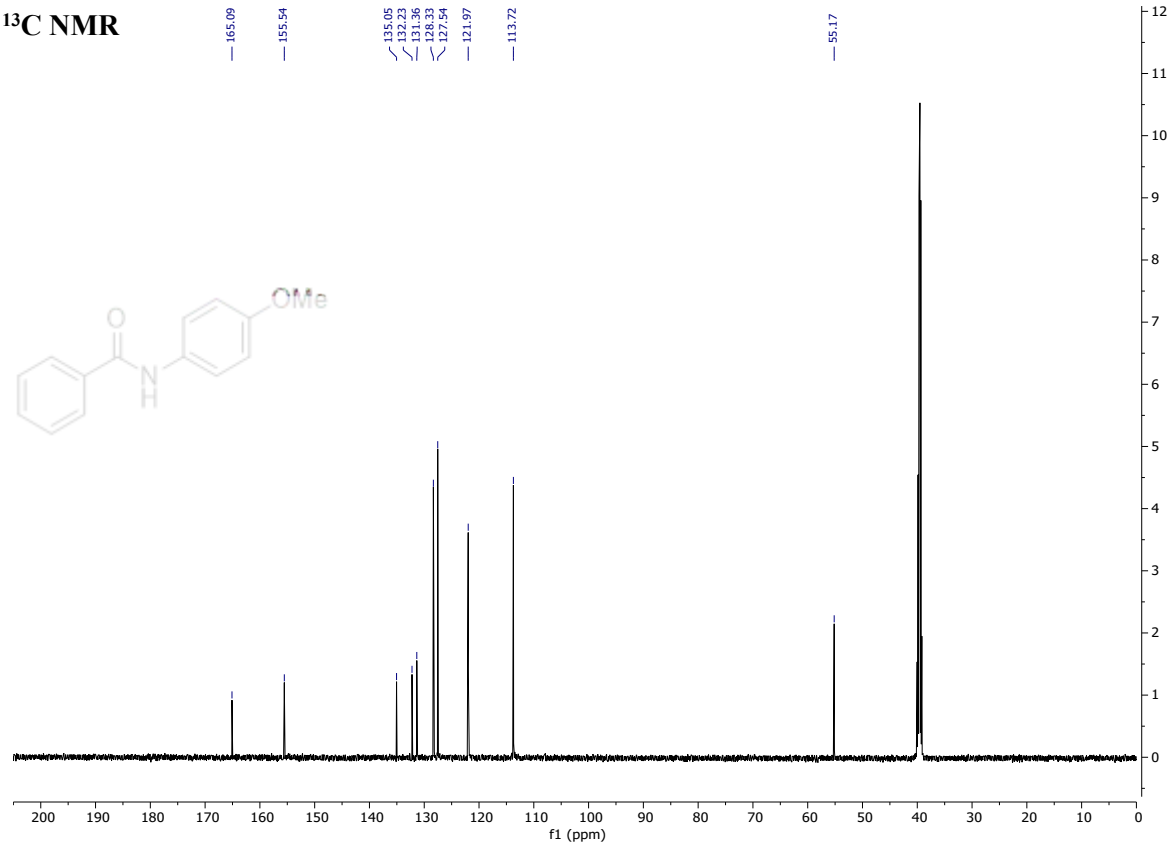


^{13}C NMR



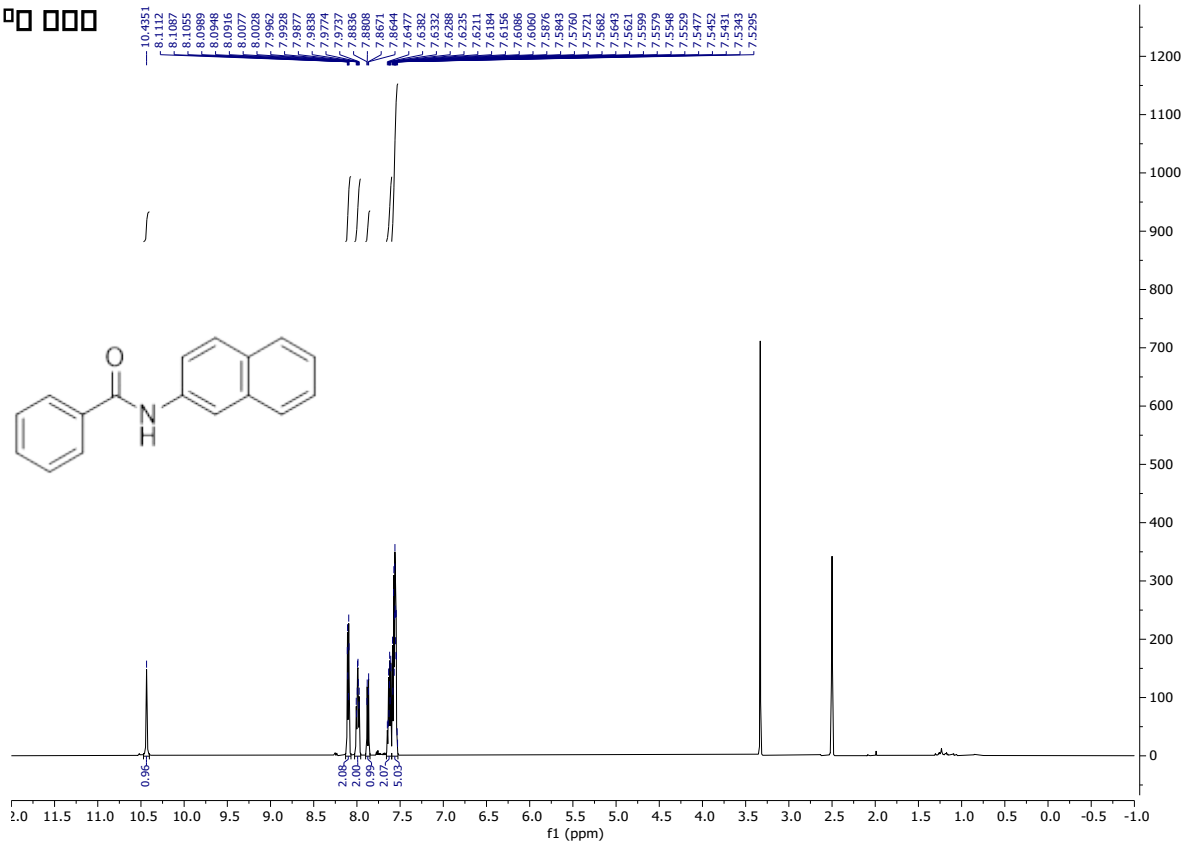
***N*-(4-Methoxyphenyl)benzamide (3ac)**

^{13}C NMR

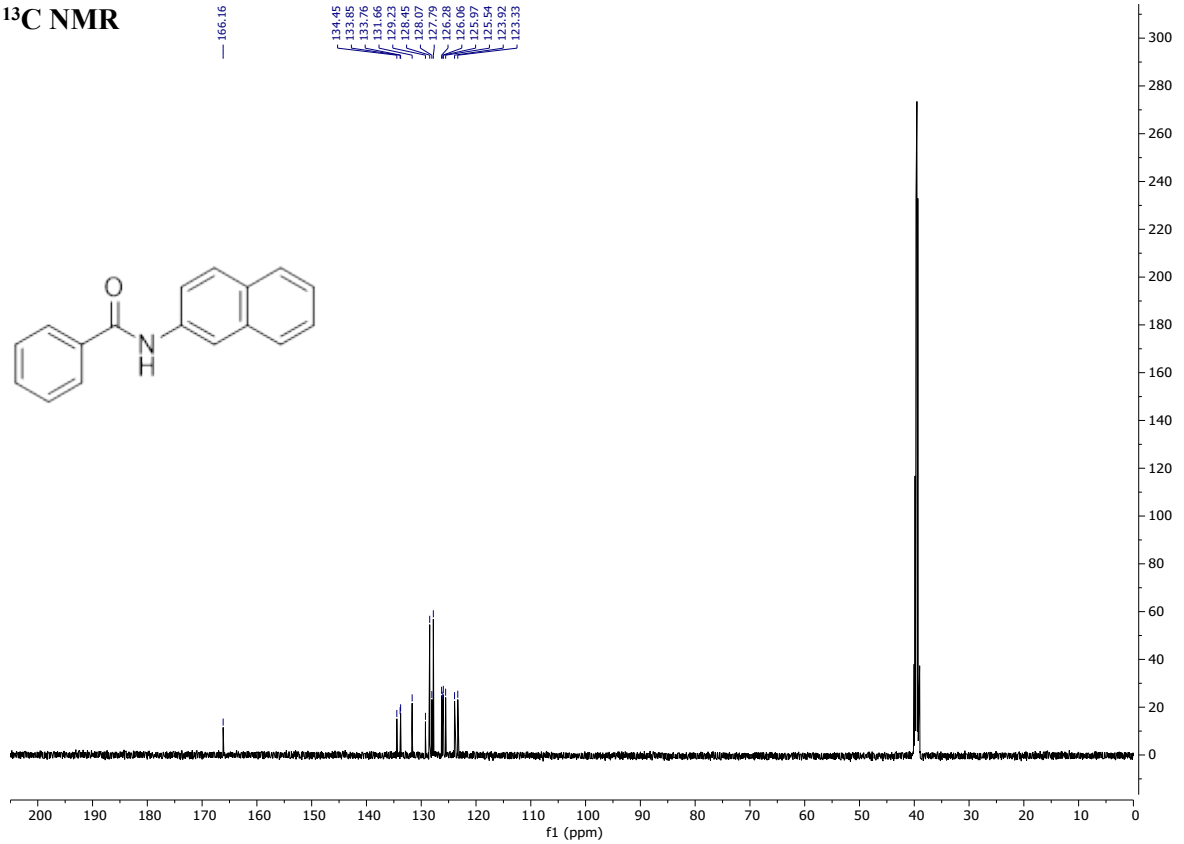

165.09
155.54
135.05
132.23
131.36
128.33
127.54
121.97
113.72
55.17
OMe
O
N
H
f1 (ppm)

N-(Naphthalen-2-yl)benzamide (3ad)

□□ □□□

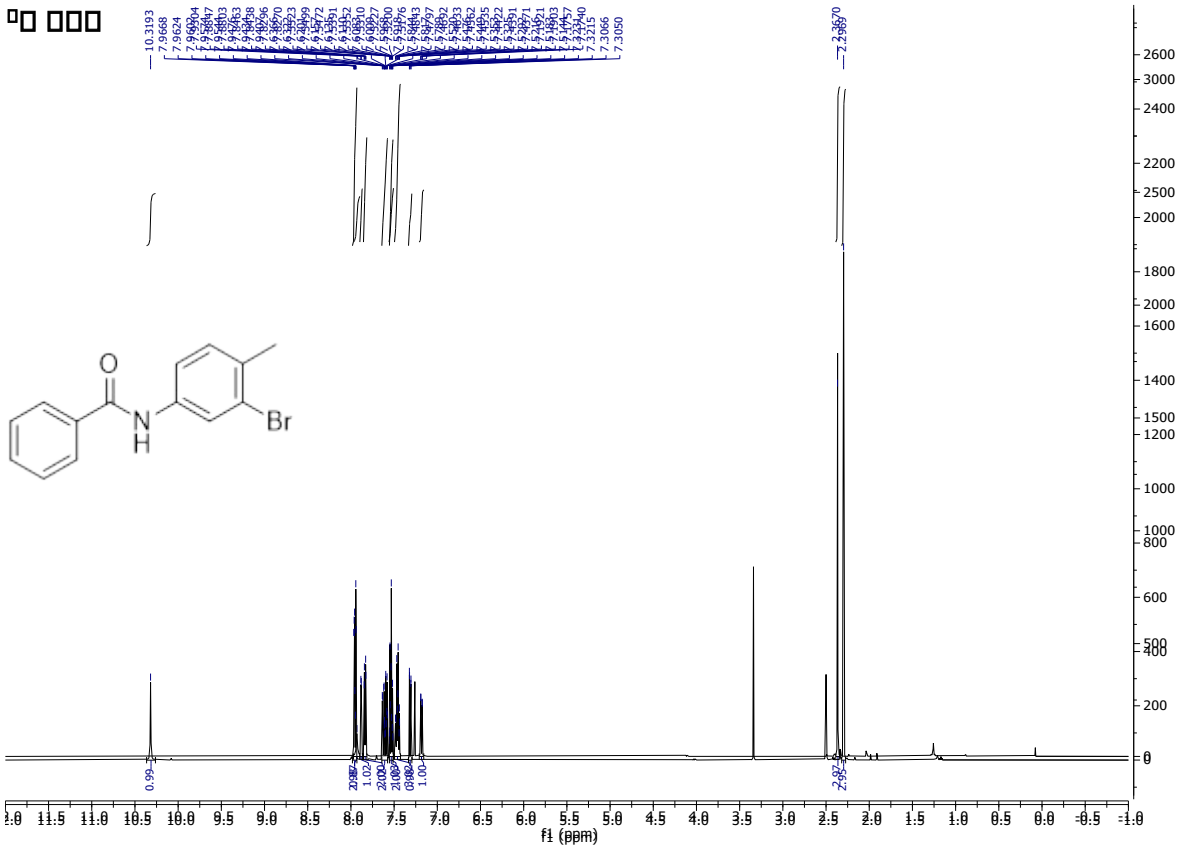


^{13}C NMR

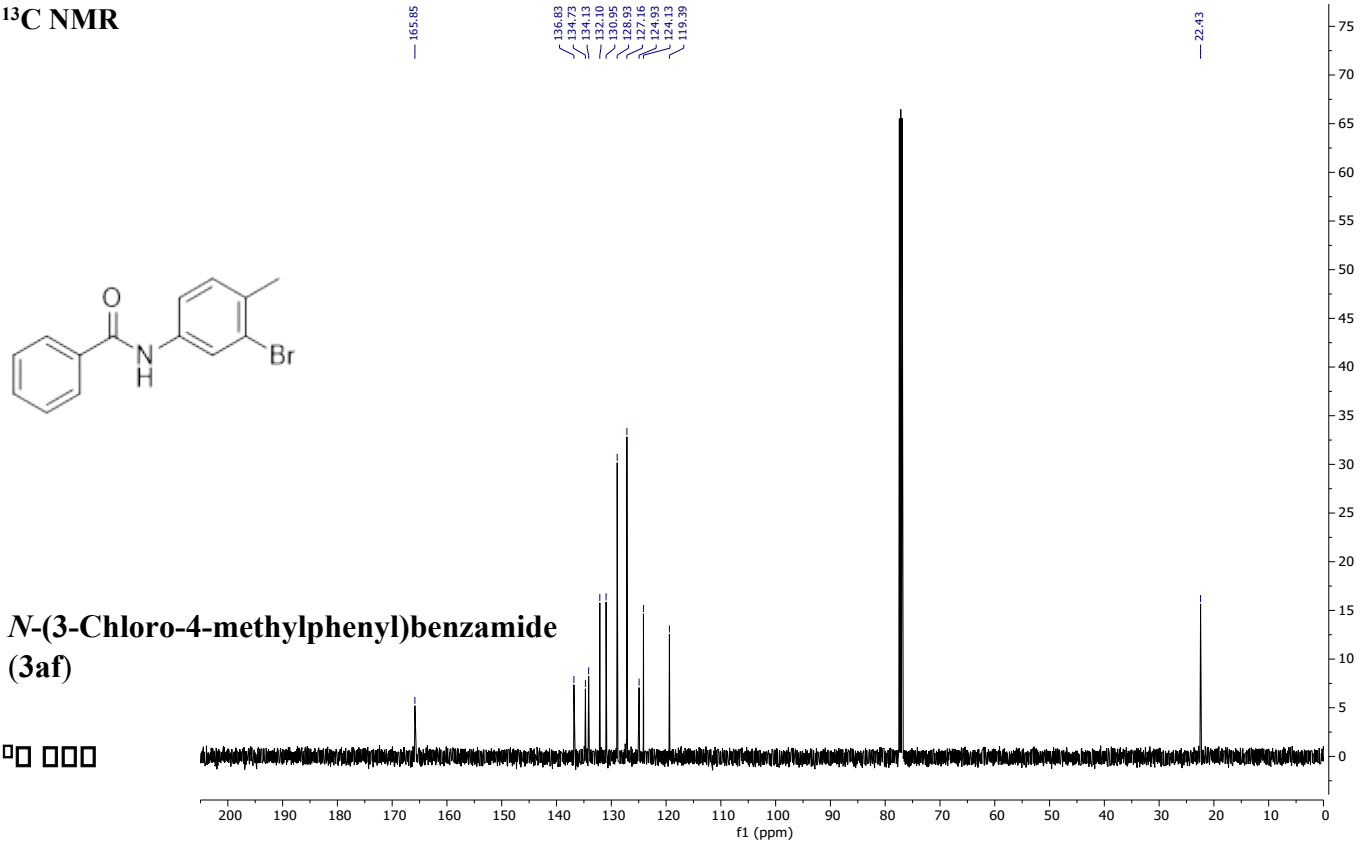


N-(3-Bromo-4-methylphenyl)benzamide (3ae)

□□ □□□

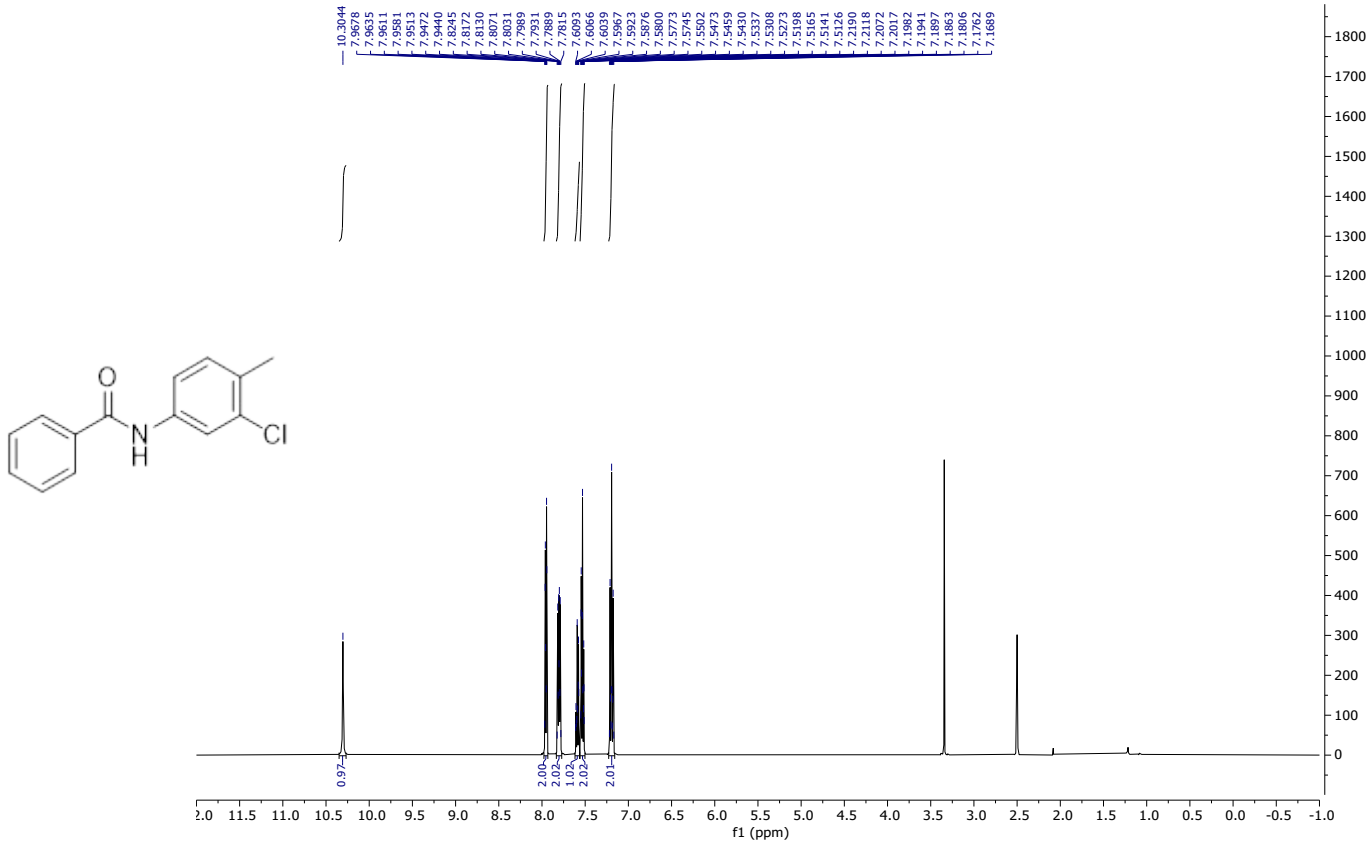


^{13}C NMR

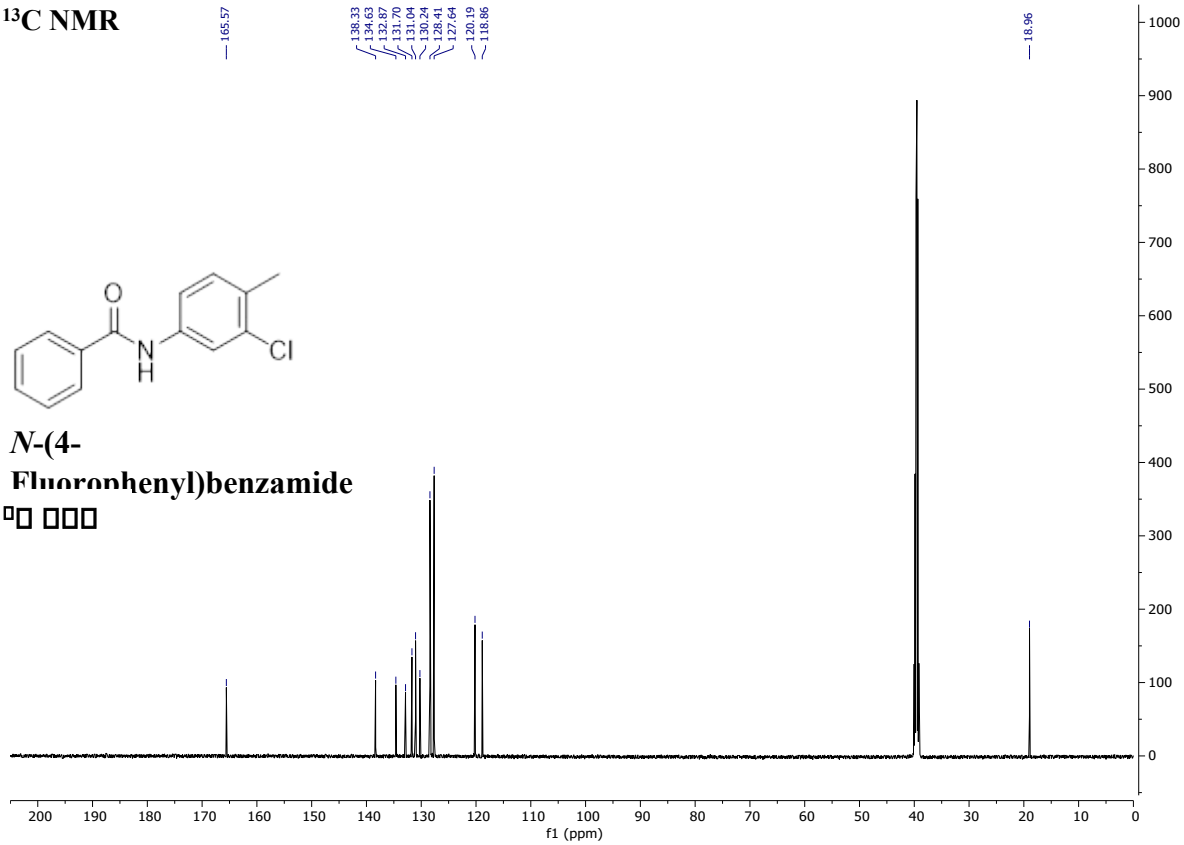


N-(3-Chloro-4-methylphenyl)benzamide (3af)

□□ □□□

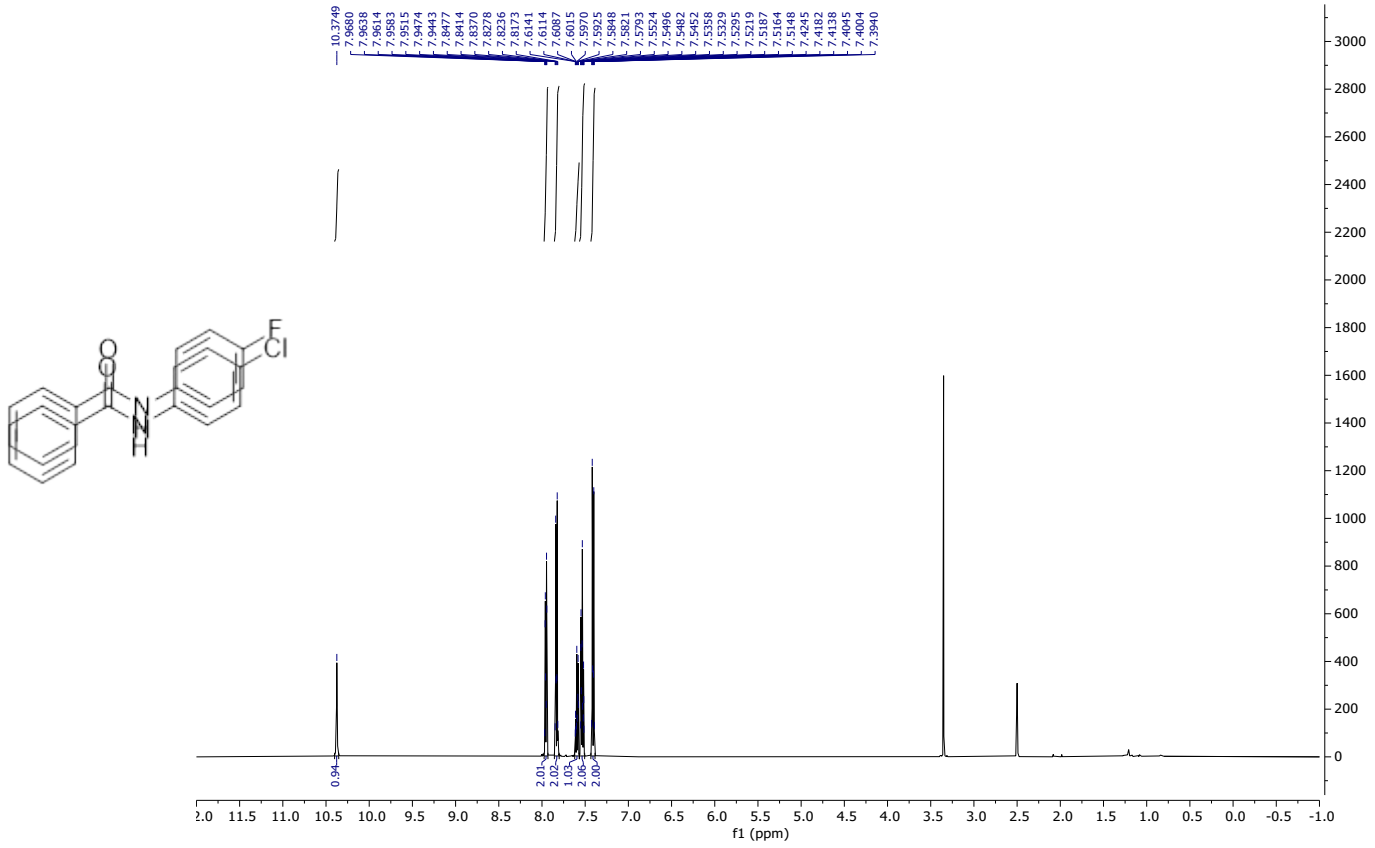


^{13}C NMR

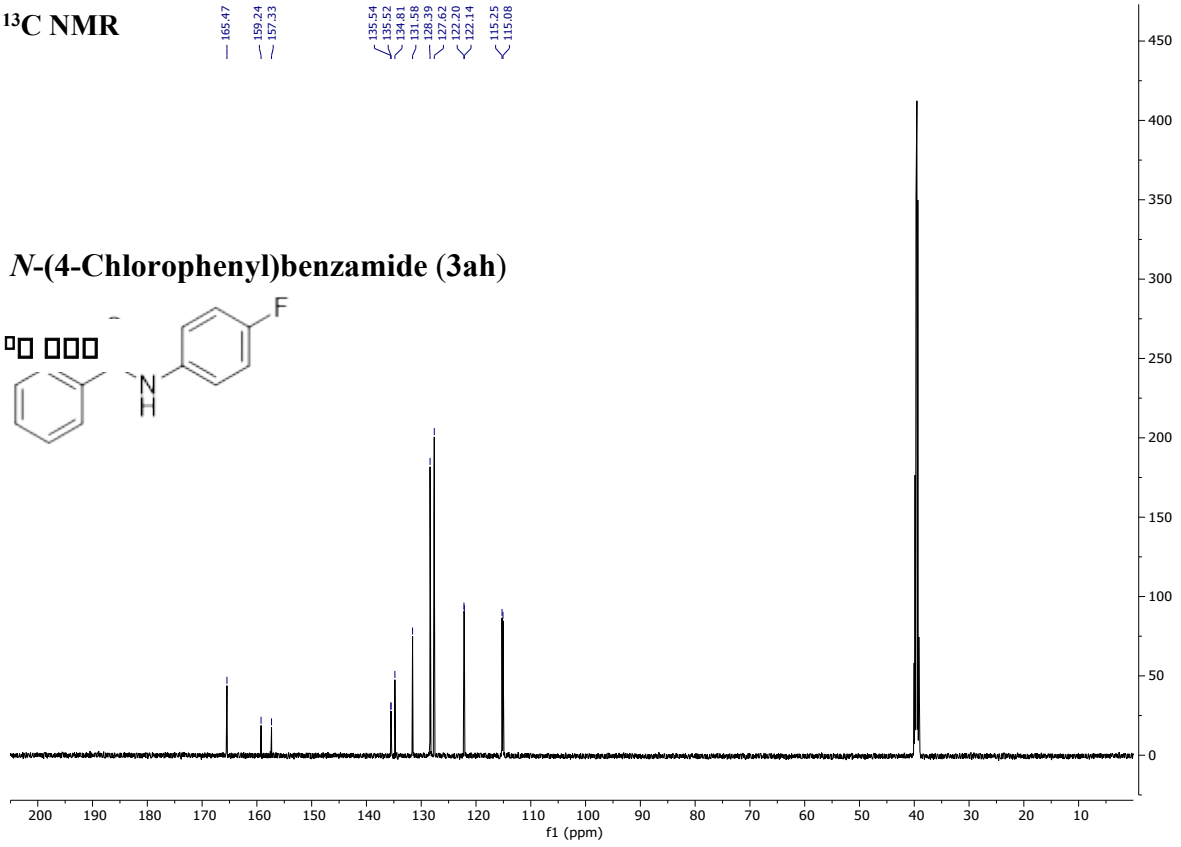


***N*-(4-Fluorophenyl)benzamide**

□□ □□□

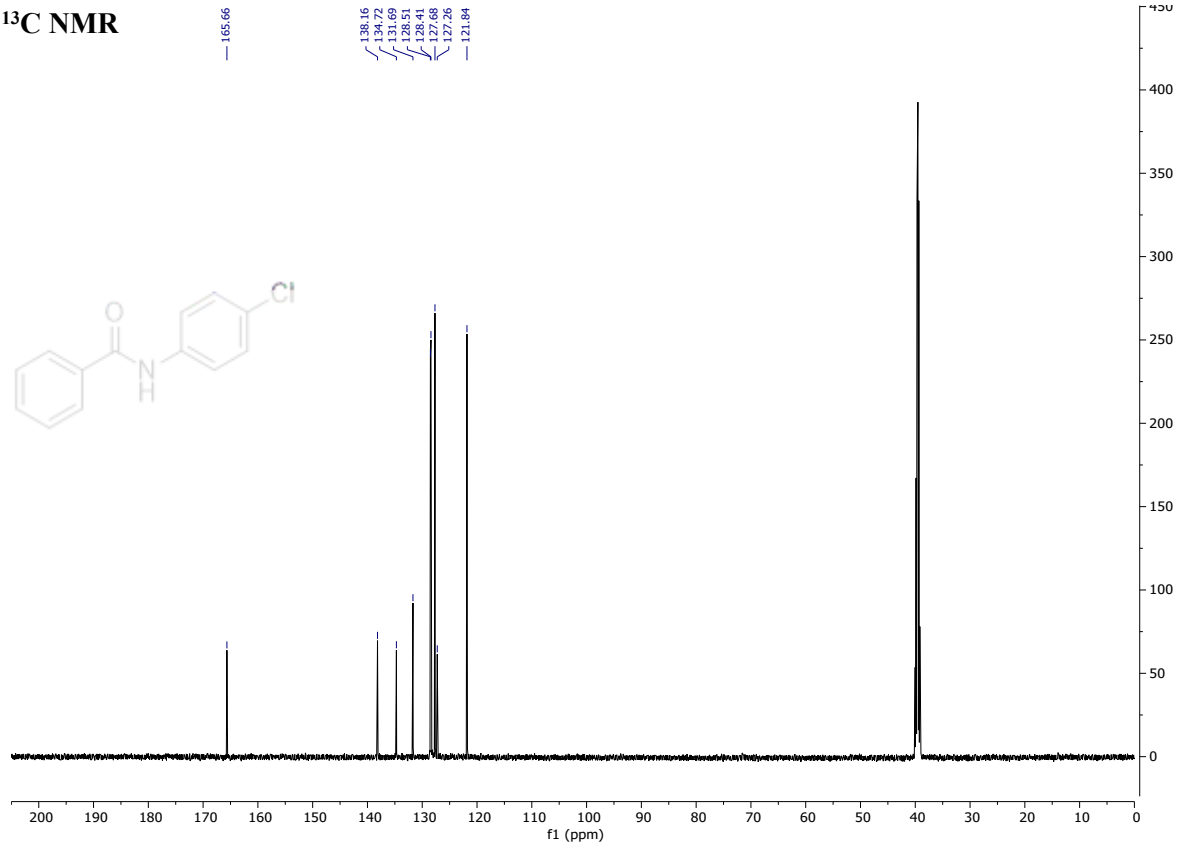


^{13}C NMR

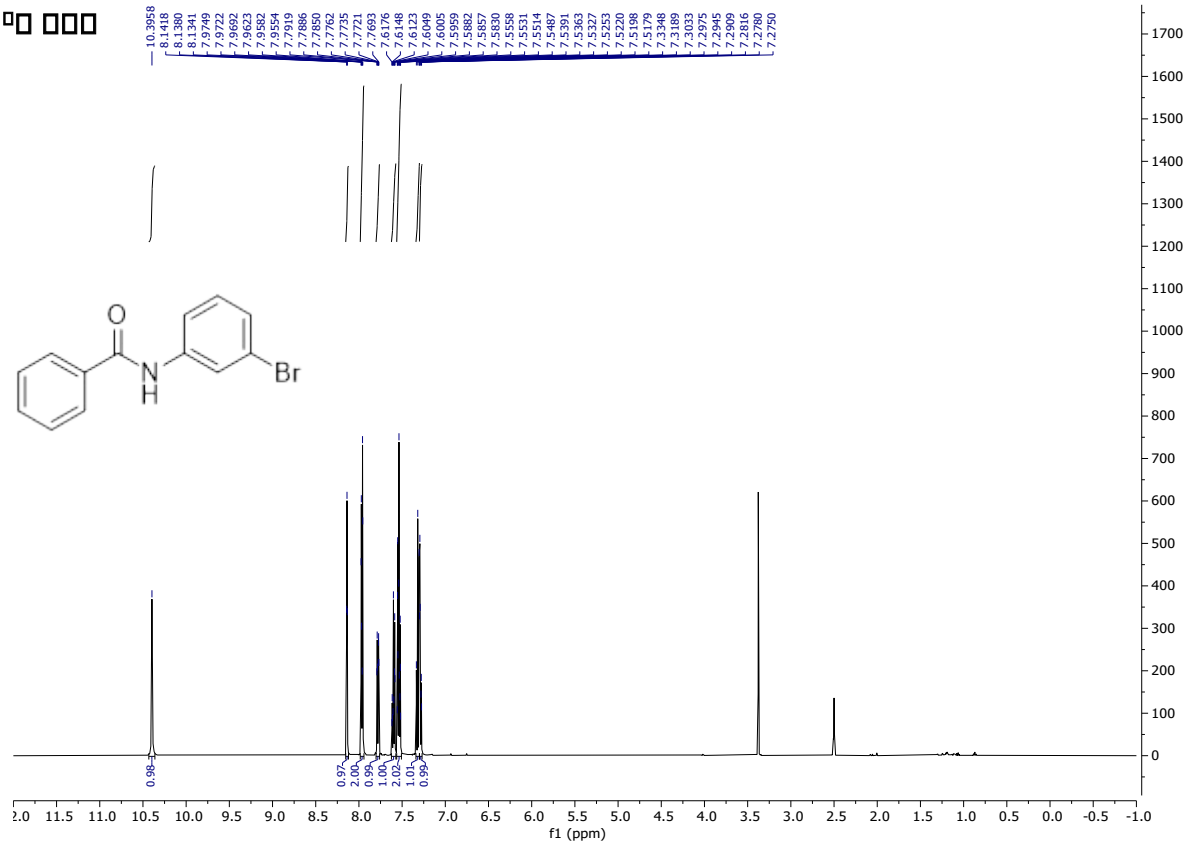


***N*-(4-Chlorophenyl)benzamide (3ah)**

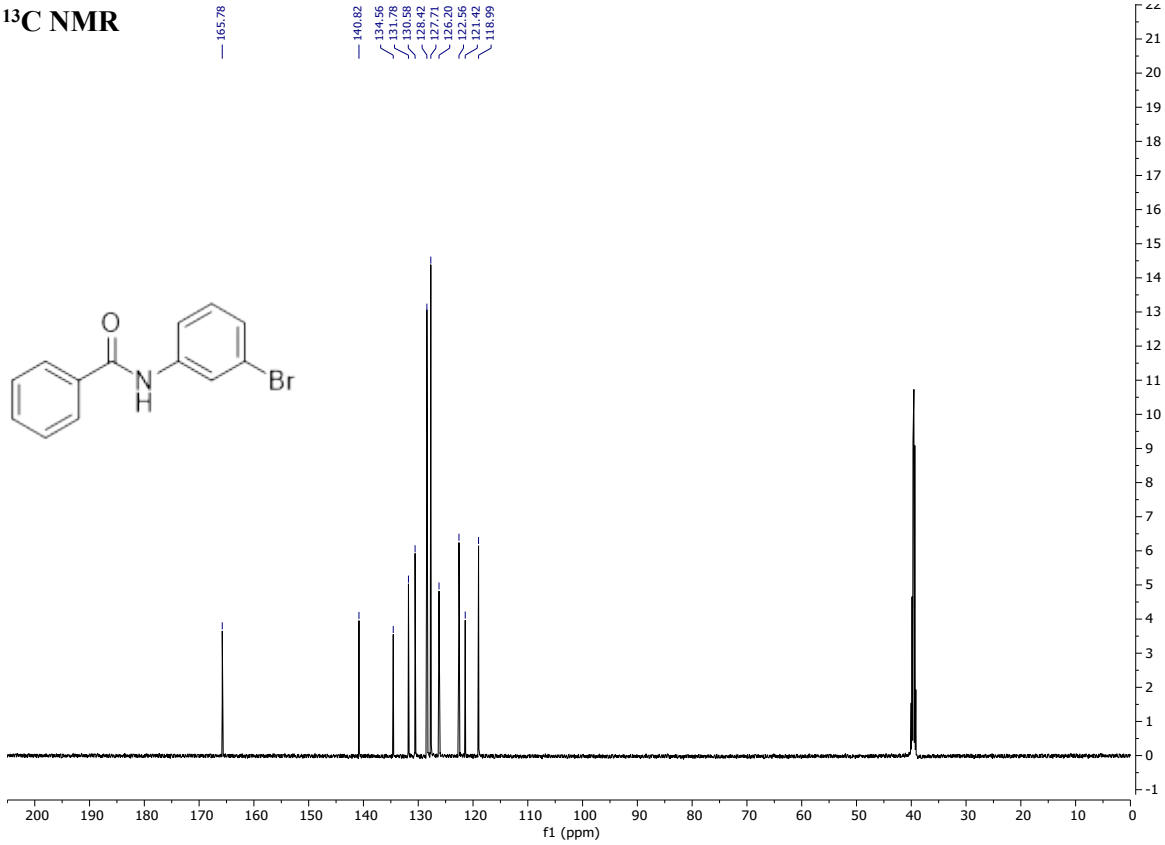
^{13}C NMR


165.66
138.16
134.72
131.69
128.51
128.41
127.68
127.26
121.84
O
N
H
Cl
200
190
180
170
160
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10
0
f1 (ppm)
450
400
350
300
250
200
150
100
50
0

N-(3-Bromophenyl)benzamide (3ai)

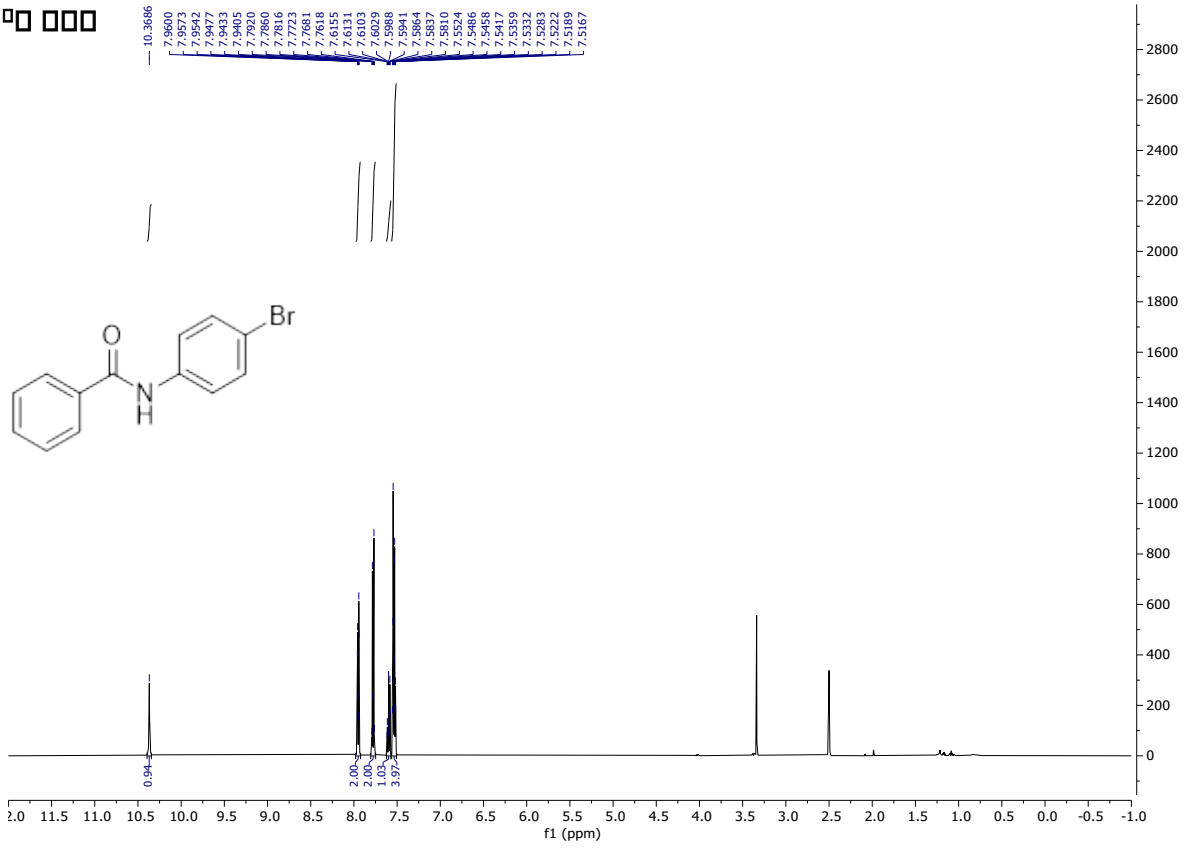


^{13}C NMR

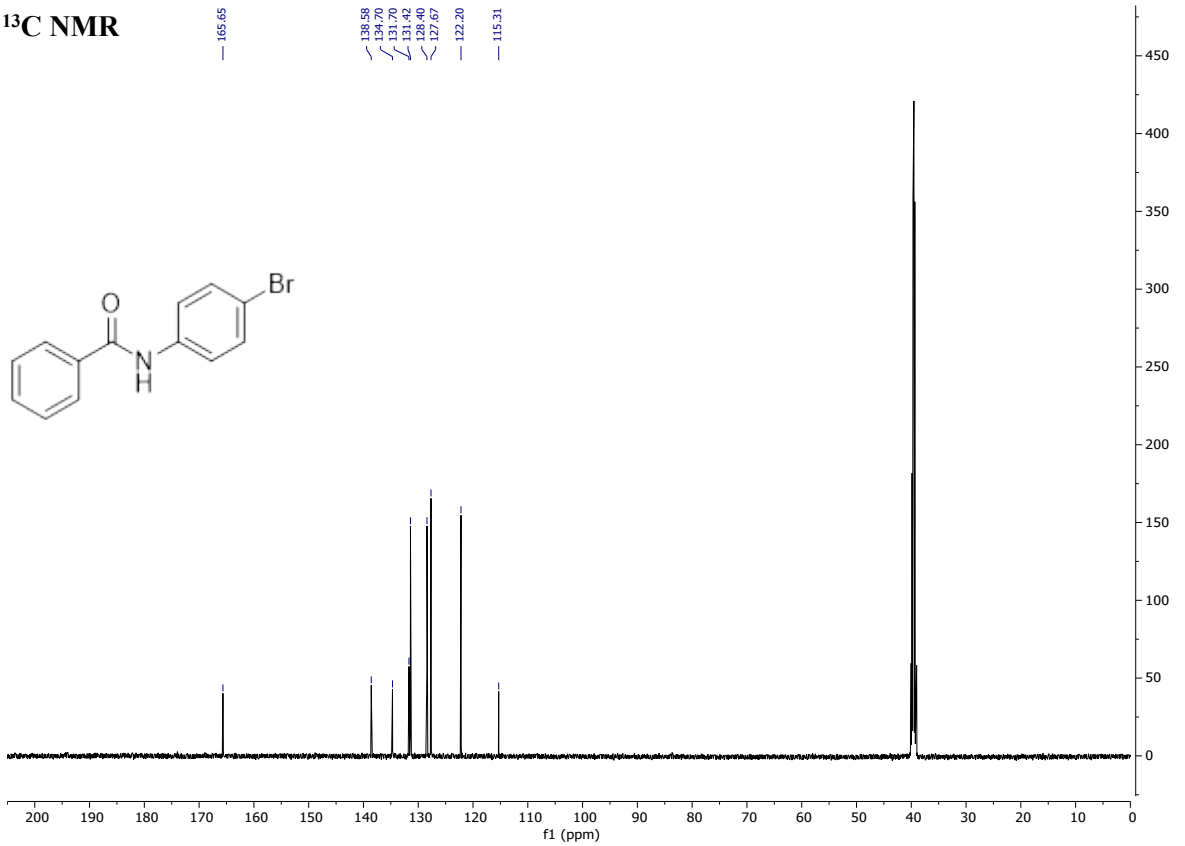


N-(4-Bromophenyl)benzamide (3aj)

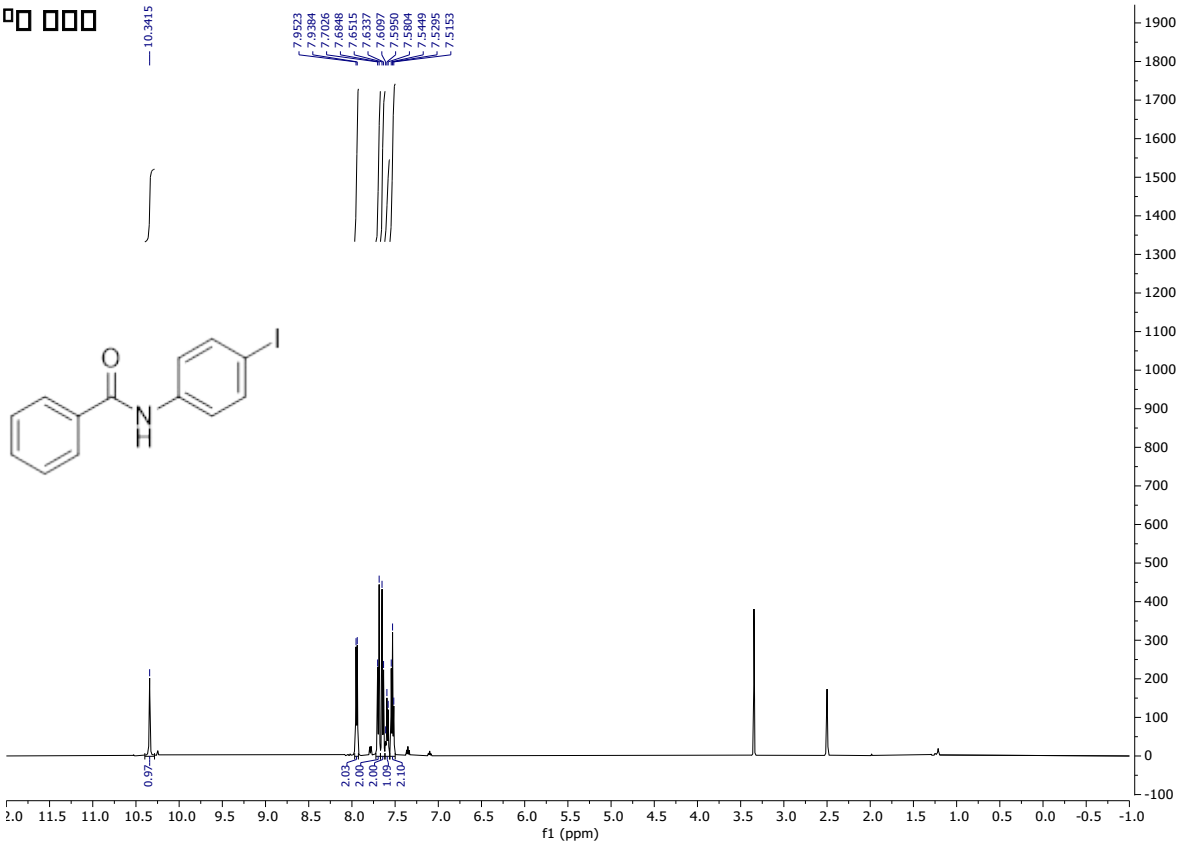
□□ □□□



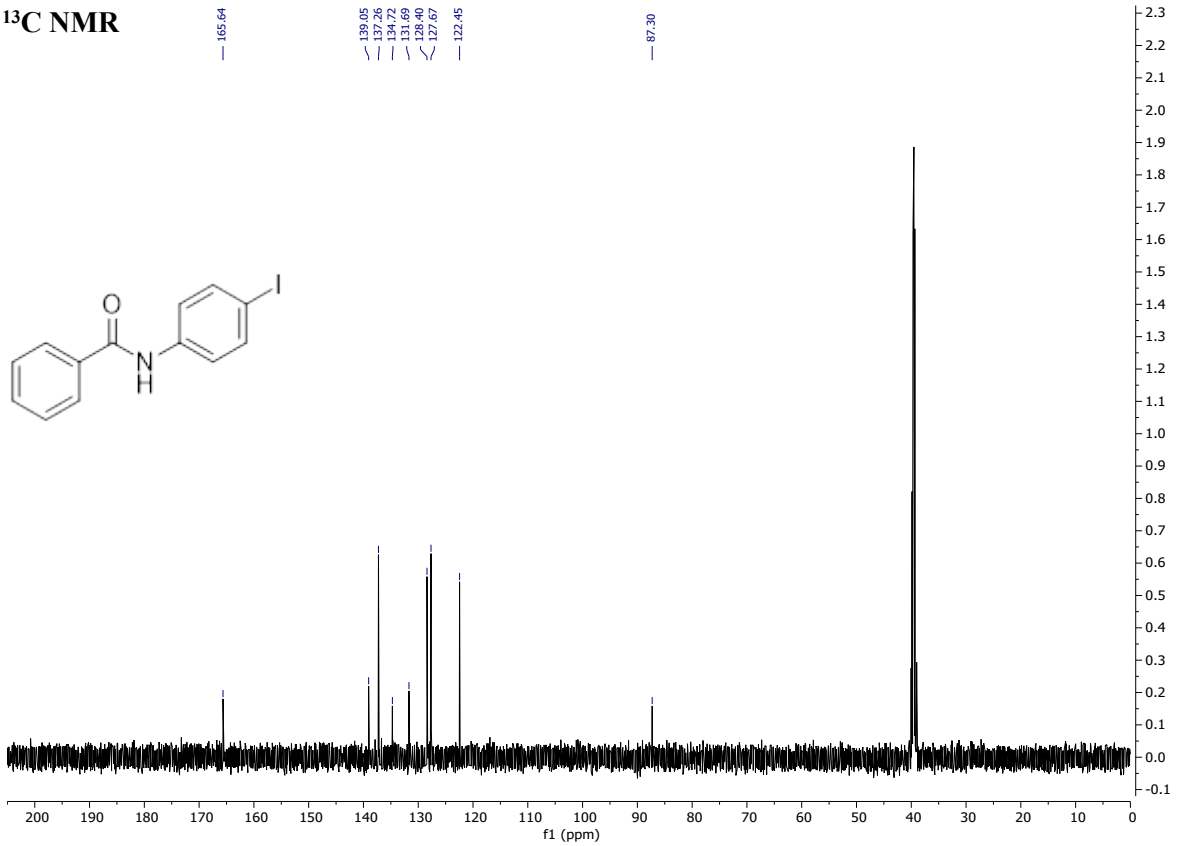
^{13}C NMR



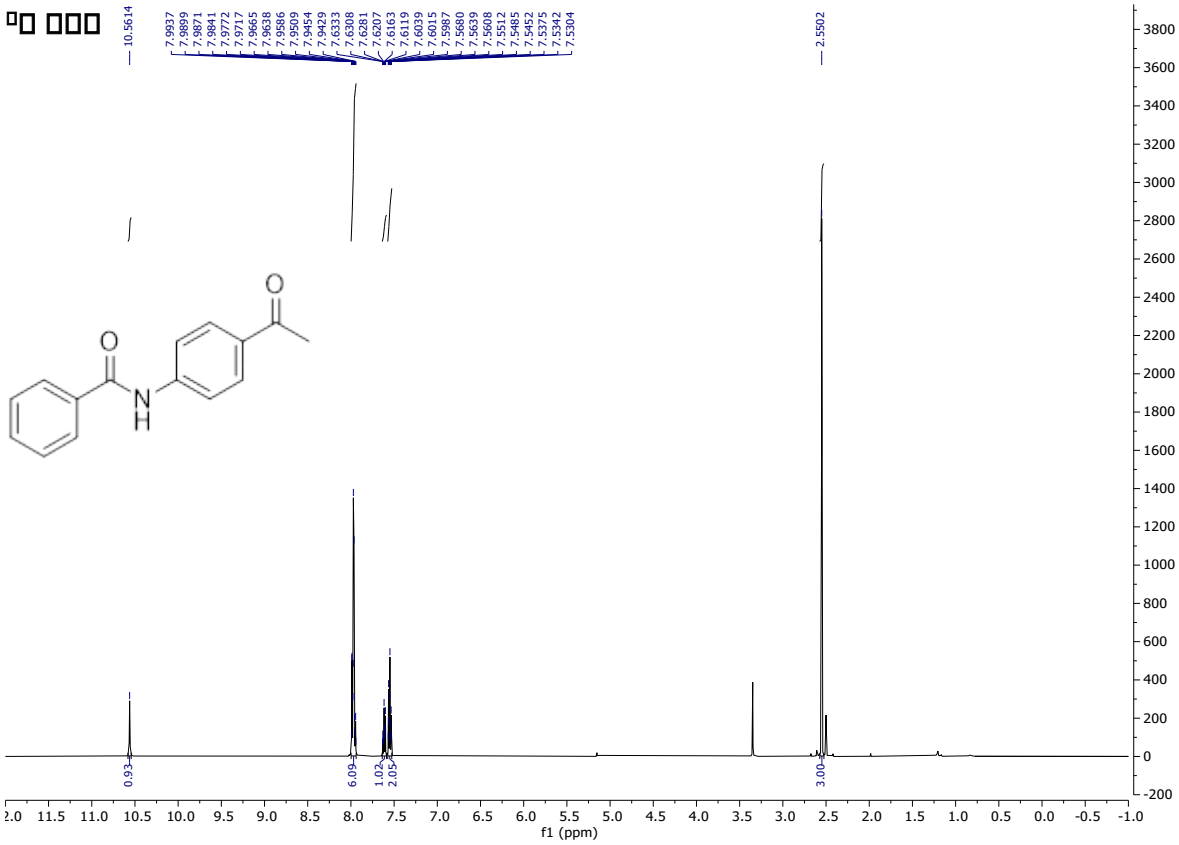
N-(4-Iodophenyl)benzamide (3ak)



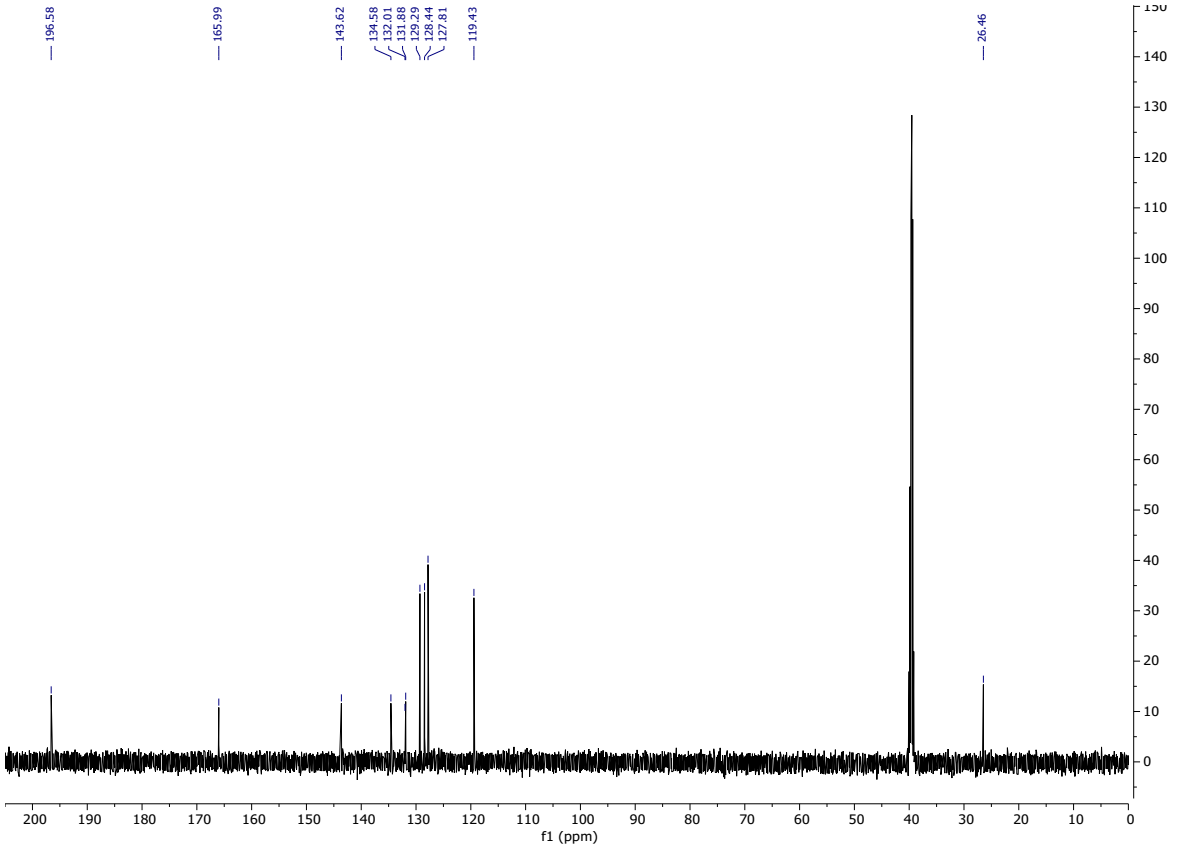
^{13}C NMR

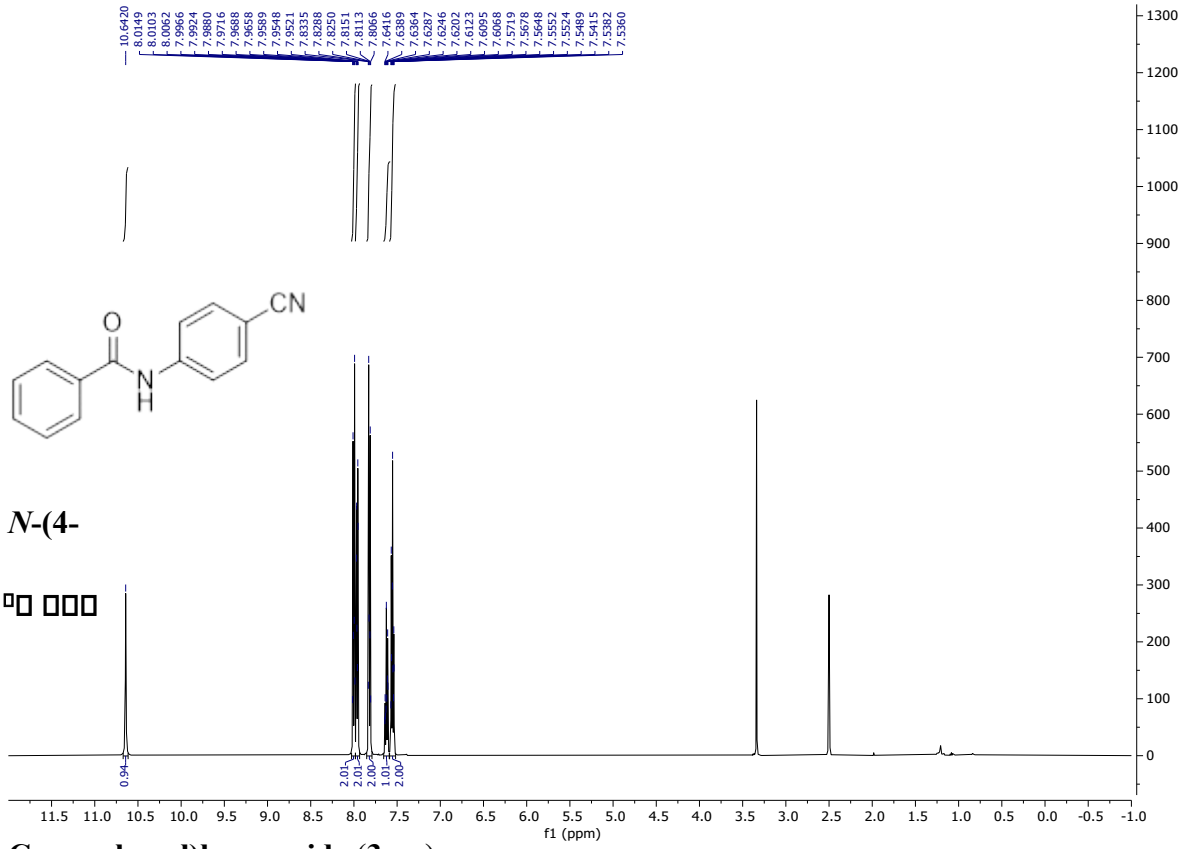


N-(4-Acetylphenyl)benzamide (3al)



^{13}C NMR

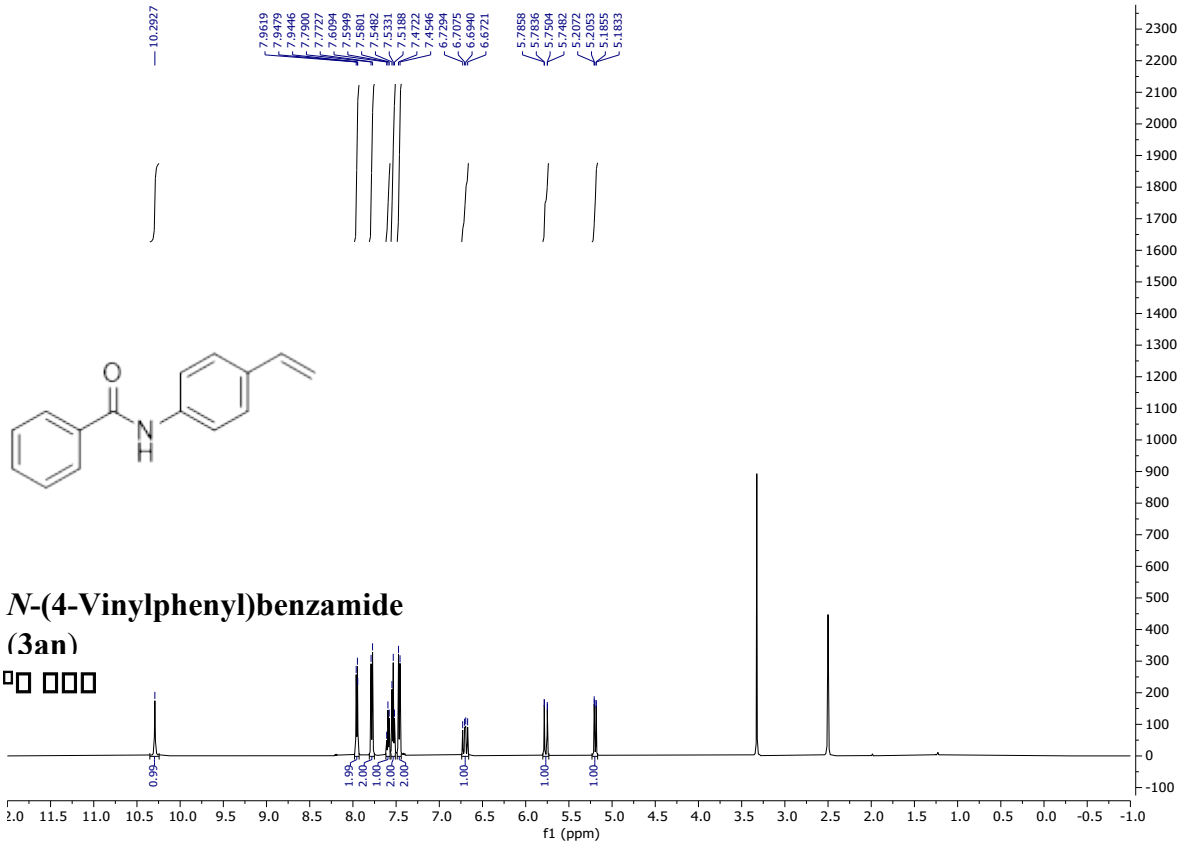




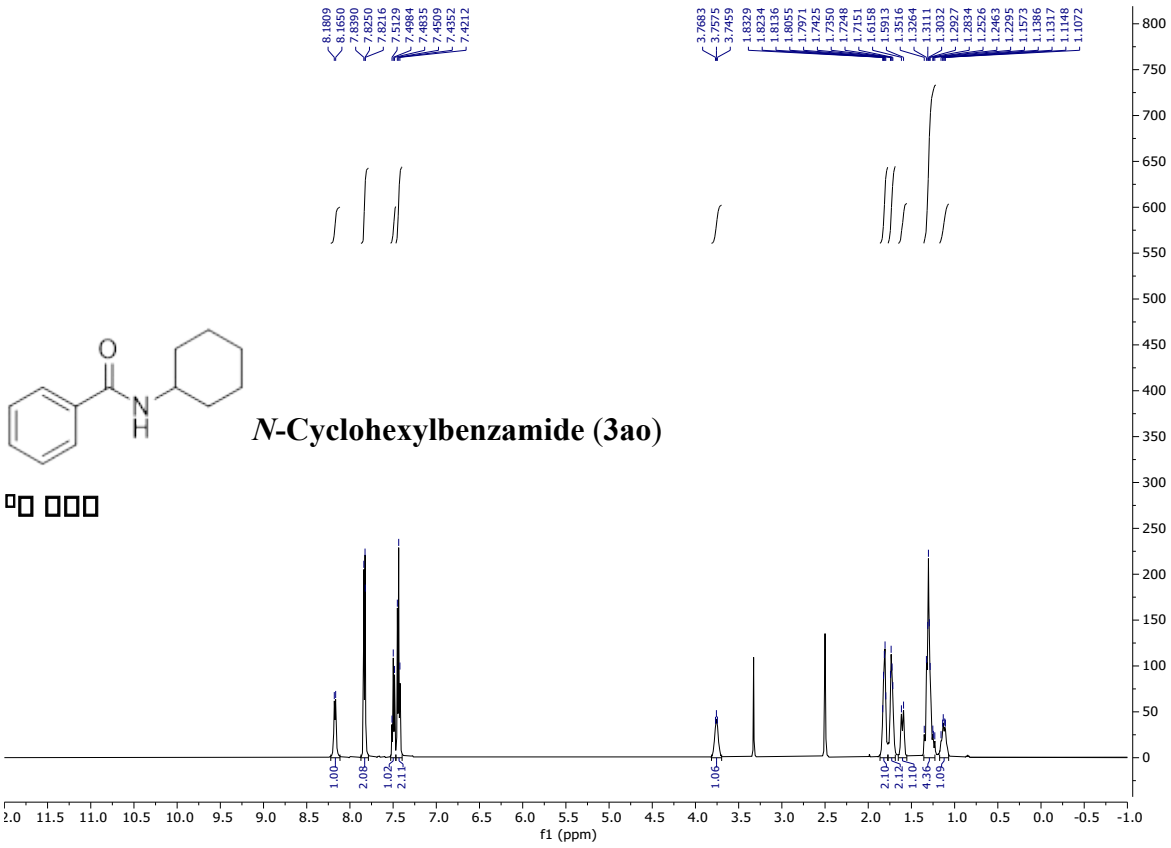
***N*-(4-**

□ □□□

Cyanophenyl)benzamide (3am)



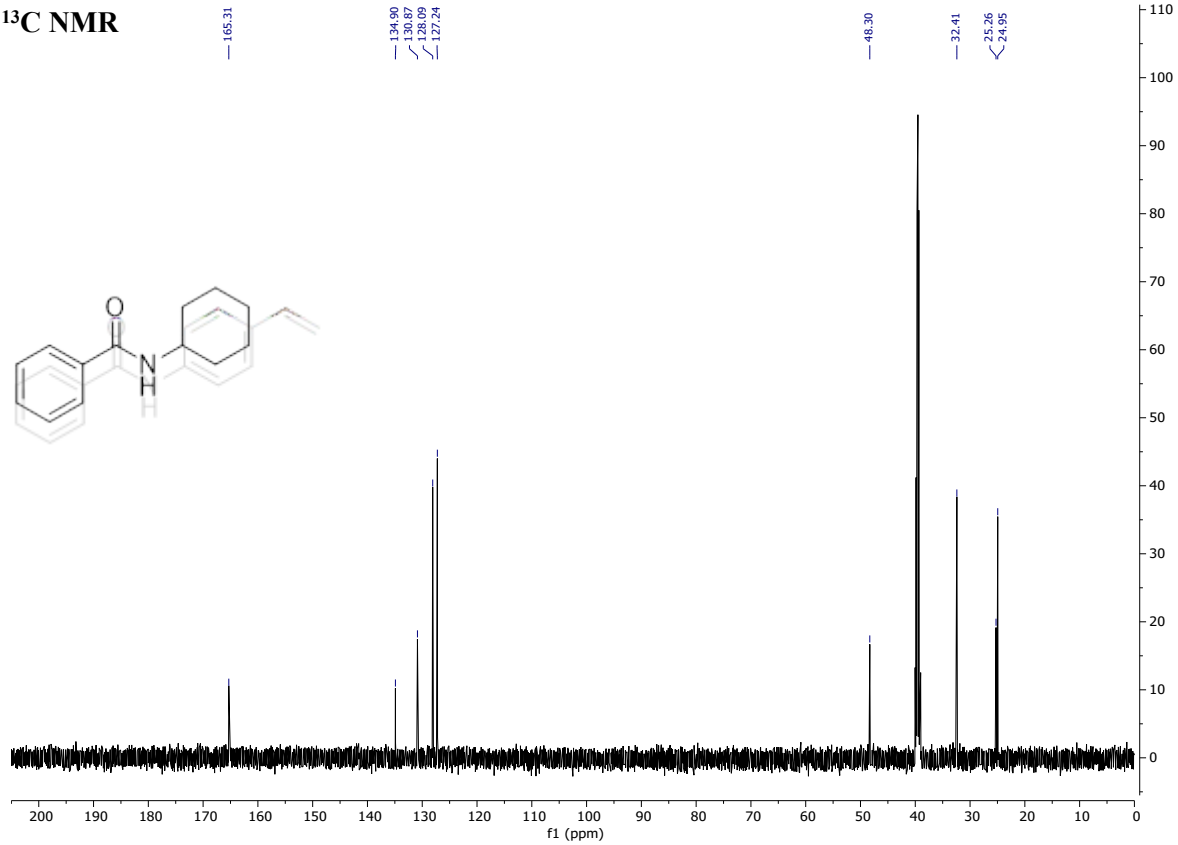
***N*-(4-Vinylphenyl)benzamide (3an)**



***N*-Cyclohexylbenzamide (3ao)**

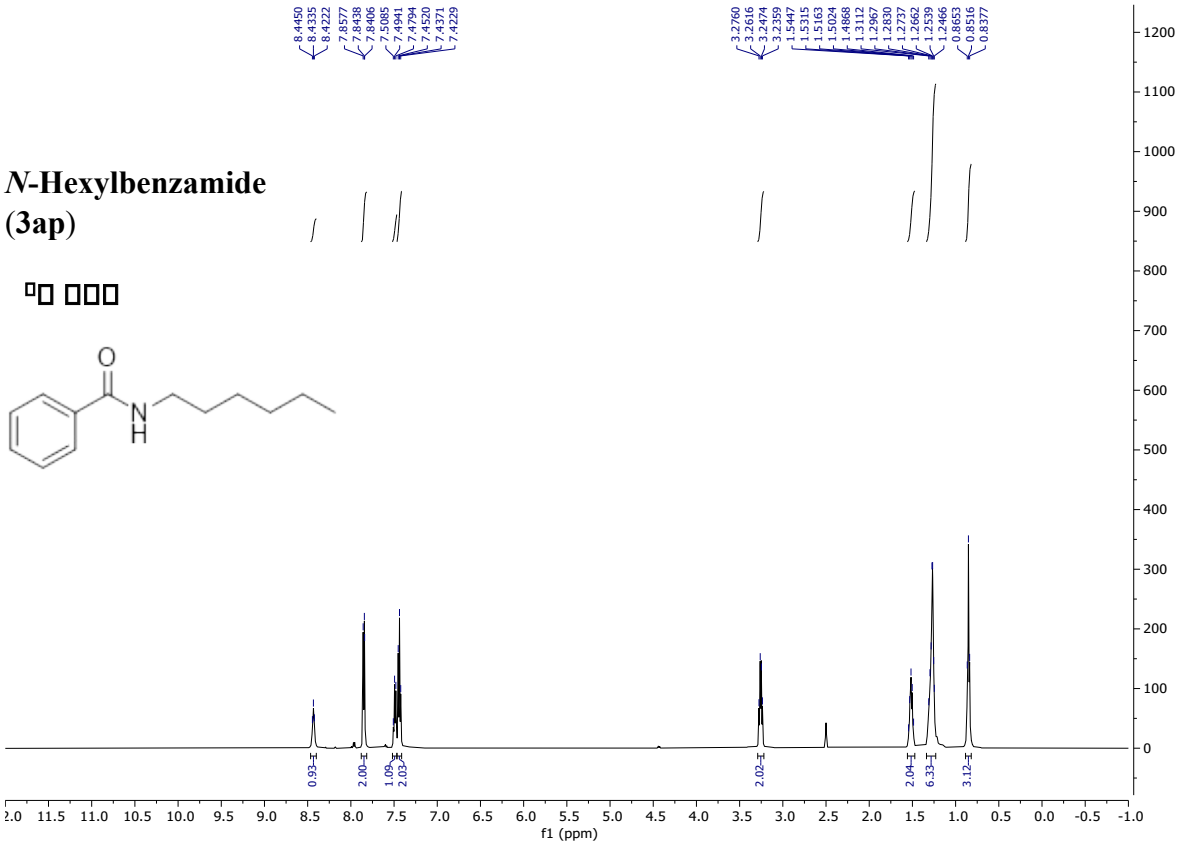
□□ □□□

^{13}C NMR

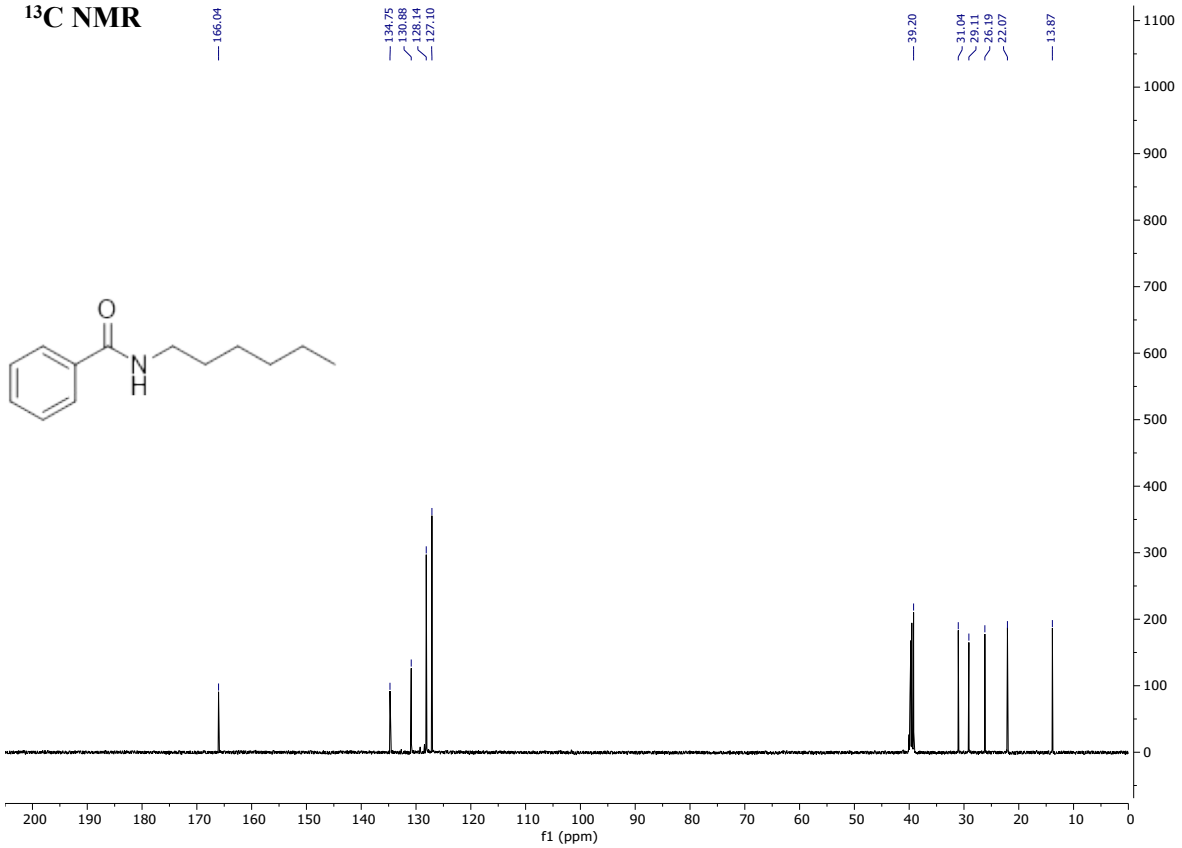


***N*-Hexylbenzamide**
(3ap)

□□ □□□

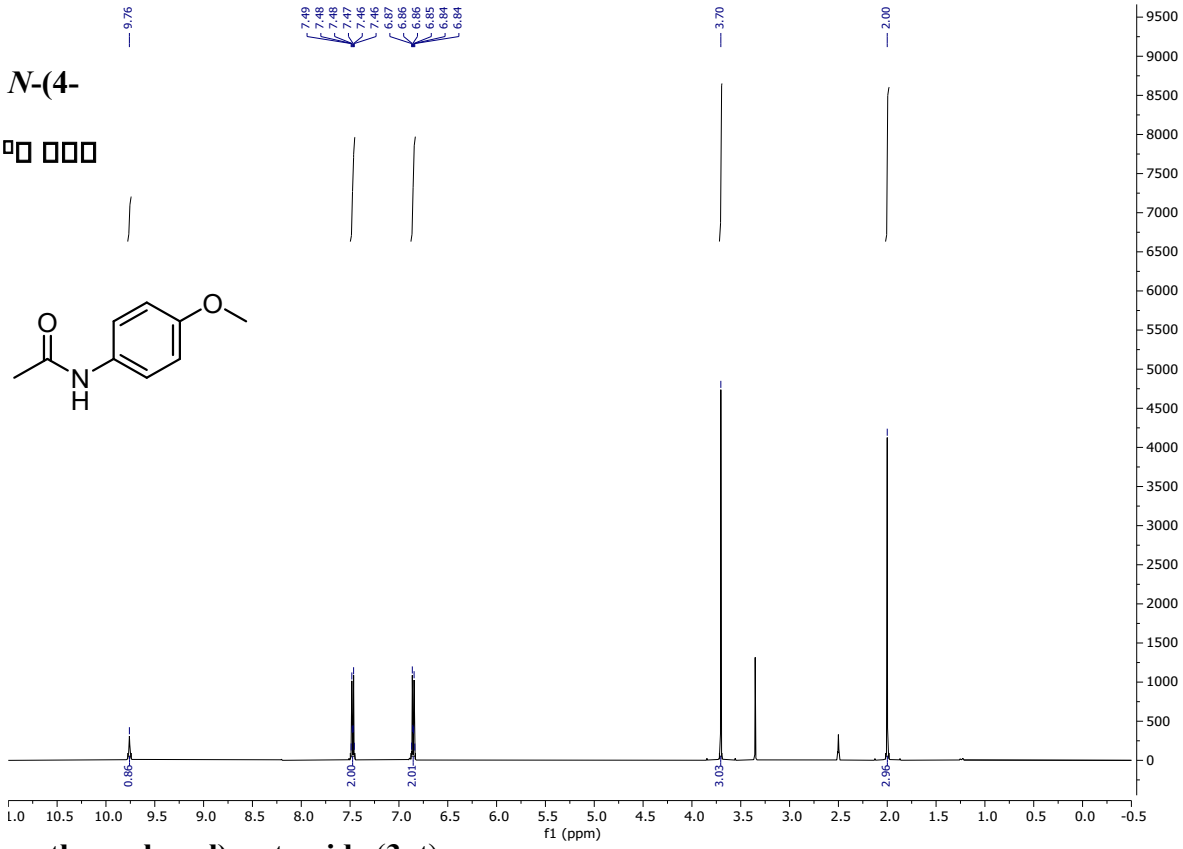


^{13}C NMR



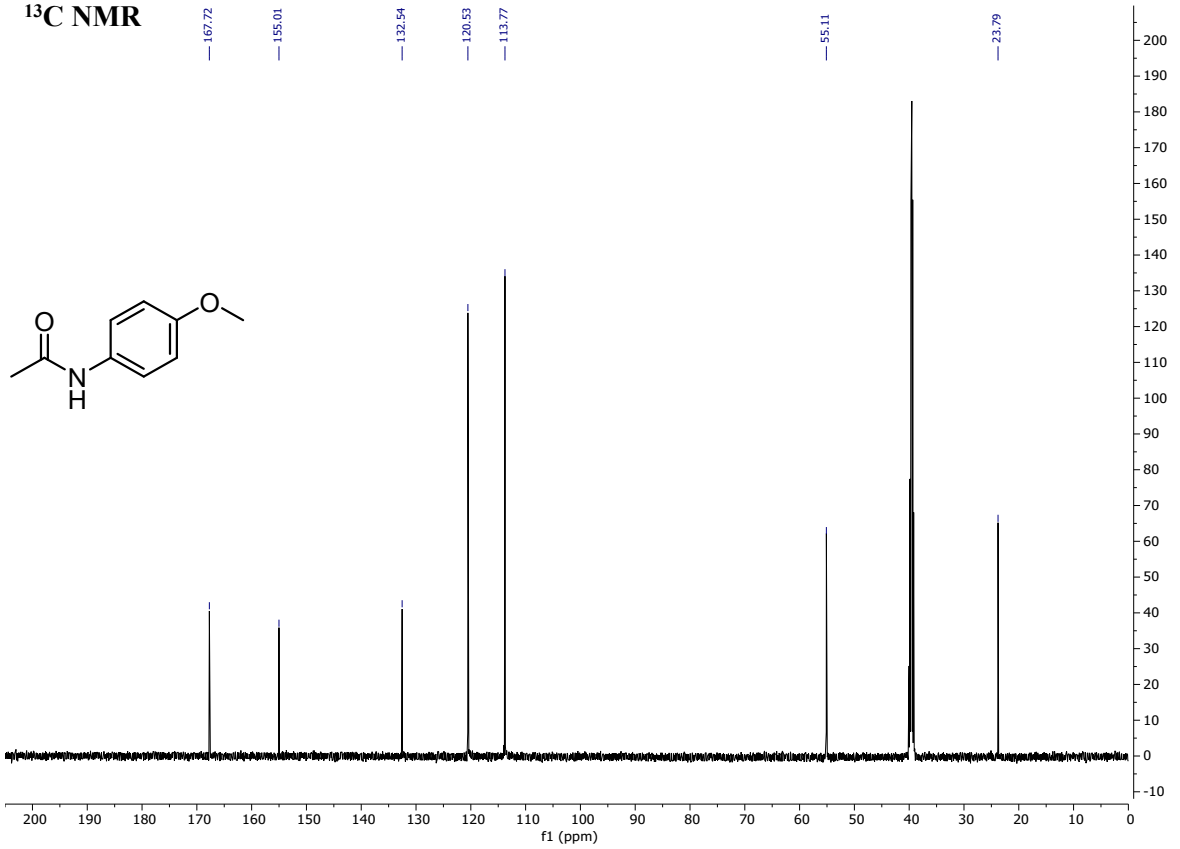
***N*-(4-**

□□ □□□

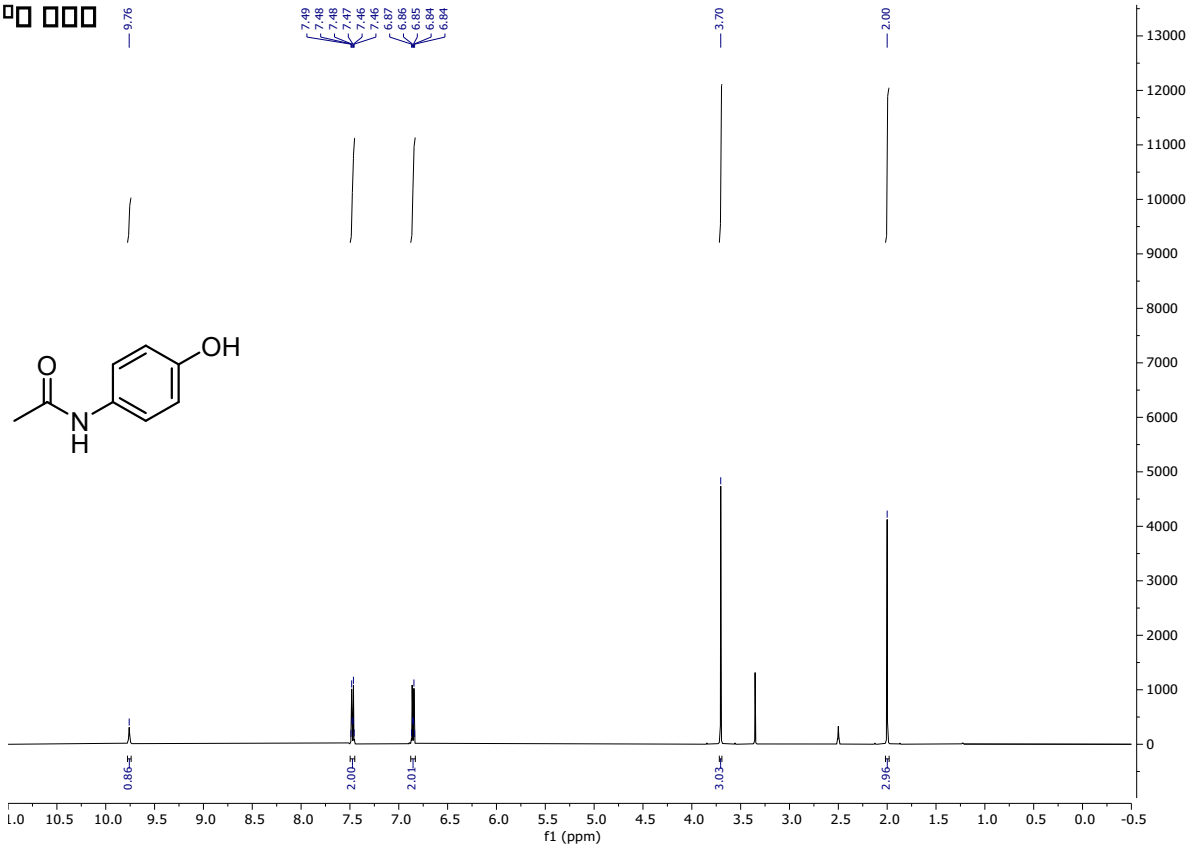


methoxyphenyl)acetamide (3xt)

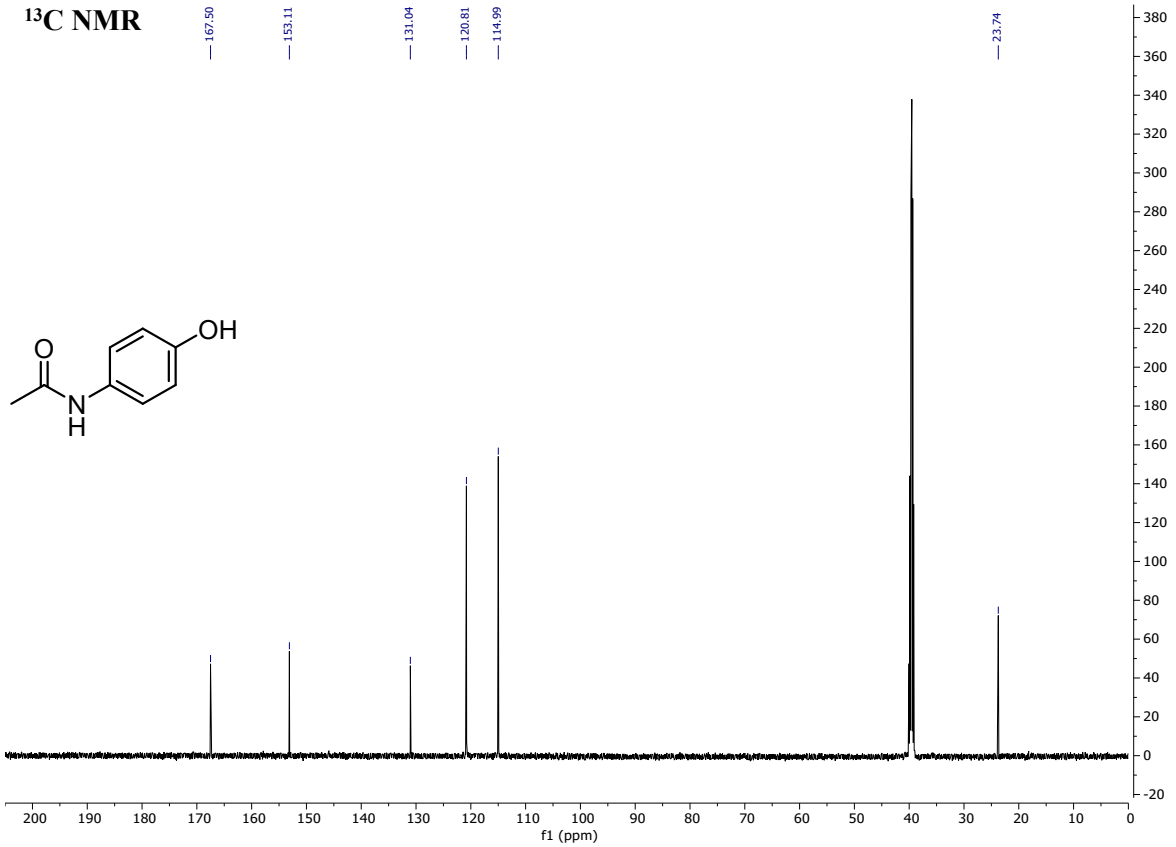
^{13}C NMR



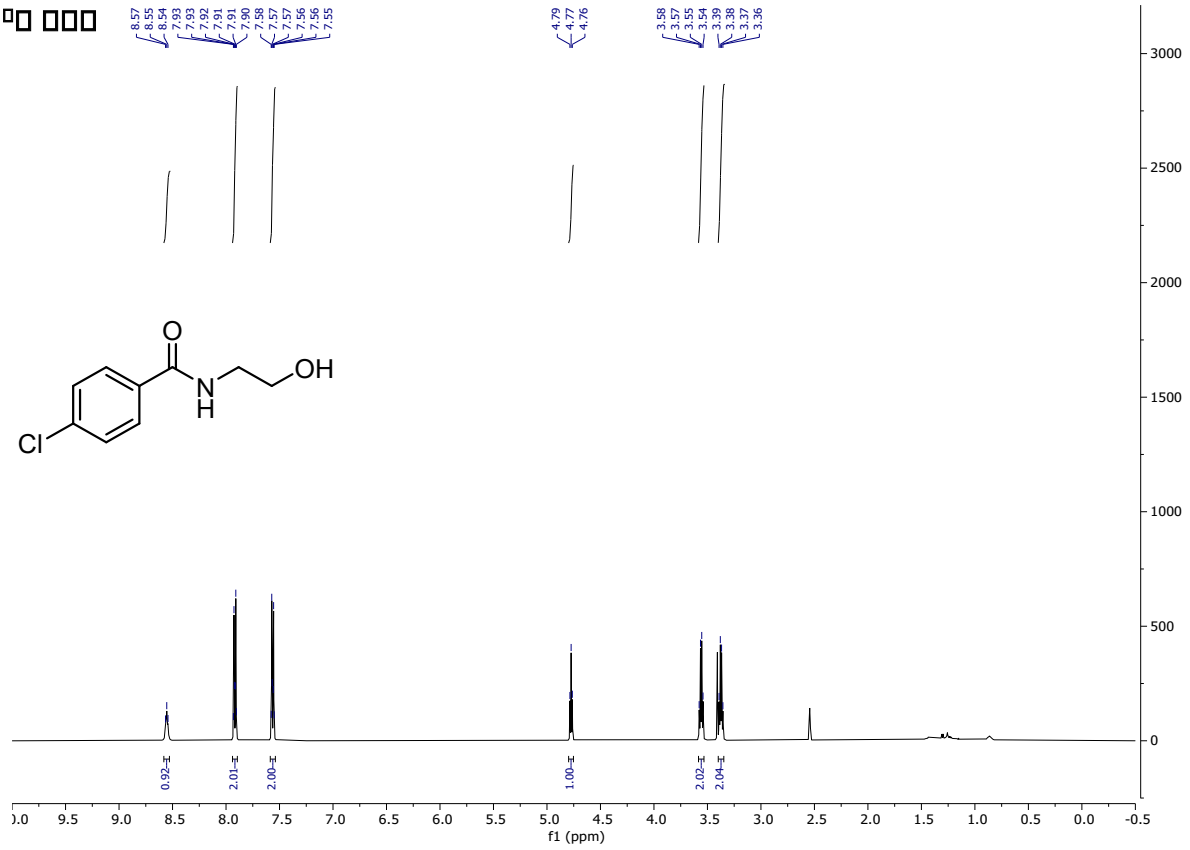
N-(4-hydroxyphenyl)acetamide (3xu)



^{13}C NMR



***4*-chloro-*N*-(2-hydroxyethyl)cyclohexa-2,4-diene-1-carboxamide (3mv)**



^{13}C NMR