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## APPENDIX A

Experimental conditions

APPENDIX A.1 Study of the effect of increasing chromate concentration on the barium chromate precipitation (Section 4.2)

| Type no. | [QUAT] (M) | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]$ (M) | $\frac{[CrO_4^{2-}]}{[QUAT]}$ | $\frac{[Ba^{2+}]}{[CrO_4^{2-}]}$ |
|---|---|---|---|---|---|
| a-1-1 | 0.1 | 0.08 | 0.08 | 0.8 | 1 |
| a-1-2 | 0.1 | 0.04 | 0.08 | 0.4 | 2 |
| a-1-3 | 0.1 | 0.016 | 0.08 | 0.16 | 5 |
| a-1-4 | 0.1 | 0.01 | 0.08 | 0.1 | 8 |
| a-1-5 | 0.1 | 0.008 | 0.08 | 0.08 | 10 |
| a-2-1 | 0.2 | 0.08 | 0.08 | 0.4 | 1 |
| a-2-2 | 0.2 | 0.04 | 0.08 | 0.2 | 2 |
| a-2-3 | 0.2 | 0.016 | 0.08 | 0.08 | 5 |
| a-2-4 | 0.2 | 0.01 | 0.08 | 0.05 | 8 |
| a-2-5 | 0.2 | 0.008 | 0.08 | 0.04 | 10 |
| a-3-1 | 0.3 | 0.08 | 0.08 | 0.2667 | 1 |
| a-3-2 | 0.3 | 0.04 | 0.08 | 0.1333 | 2 |
| a-3-3 | 0.3 | 0.016 | 0.08 | 0.0533 | 5 |
| a-3-4 | 0.3 | 0.01 | 0.08 | 0.0333 | 8 |
| a-3-5 | 0.3 | 0.008 | 0.08 | 0.0267 | 10 |
| a-4-1 | 0.4 | 0.08 | 0.08 | 0.2 | 1 |
| a-4-2 | 0.4 | 0.04 | 0.08 | 0.1 | 2 |
| a-4-3 | 0.4 | 0.016 | 0.08 | 0.04 | 5 |

| Type no. | [QUAT] (M) | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]$ (M) | $\frac{[CrO_4^{2-}]}{[QUAT]}$ | $\frac{[Ba^{2+}]}{[CrO_4^{2-}]}$ |
|---|---|---|---|---|---|
| a-4-4 | 0.4 | 0.01 | 0.08 | 0.025 | 8 |
| a-4-5 | 0.4 | 0.008 | 0.08 | 0.02 | 10 |
| a-5-1 | 0 | 0.08 | 0.088 | 0 | 1 |
| a-5-2 | 0 | 0.04 | 0.08 | 0 | 2 |
| a-5-3 | 0 | 0.016 | 0.08 | 0 | 5 |
| a-5-4 | 0 | 0.01 | 0.08 | 0 | 8 |
| a-5-5 | 0 | 0.008 | 0.08 | 0 | 10 |

Note: The barium concentration was held constant at 0.08 M while the QUAT concentrations were constant at 0.1, 0.2, 0.3, and 0.4 M. The experimental data were shown in appendix B.2.

APPENDIX A.2 Study of the effect of increasing barium concentration on the barium chromate precipitation (Section4.2)

| Type no. | [QUAT] (M) | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]$ (M) | $\frac{[CrO_4^{2-}]}{[QUAT]}$ | $\frac{[Ba^{2+}]}{[CrO_4^{2-}]}$ |
|---|---|---|---|---|---|
| b-1-1 | 0.1 | 0.002 | 0.002 | 0.02 | 1 |
| b-1-2 | 0.1 | 0.002 | 0.004 | 0.02 | 2 |
| b-1-3 | 0.1 | 0.002 | 0.01 | 0.02 | 5 |
| b-1-4 | 0.1 | 0.002 | 0.016 | 0.02 | 8 |
| b-1-5 | 0.1 | 0.002 | 0.02 | 0.02 | 10 |
| b-2-1 | 0.1 | 0.02 | 0.02 | 0.2 | 1 |
| b-2-2 | 0.1 | 0.02 | 0.04 | 0.2 | 2 |
| b-2-3 | 0.1 | 0.02 | 0.1 | 0.2 | 5 |
| b-2-4 | 0.1 | 0.02 | 0.16 | 0.2 | 8 |
| b-2-5 | 0.1 | 0.02 | 0.20 | 0.2 | 10 |
| b-3-1 | 0.1 | 0.06 | 0.06 | 0.6 | 1 |
| b-3-2 | 0.1 | 0.06 | 0.12 | 0.6 | 2 |
| b-3-3 | 0.1 | 0.06 | 0.3 | 0.6 | 5 |
| b-3-4 | 0.1 | 0.06 | 0.48 | 0.6 | 8 |
| b-3-5 | 0.1 | 0.06 | 0.6 | 0.6 | 10 |
| b-4-1 | 0 | 0.002 | 0.002 | 0 | 1 |
| b-4-2 | 0 | 0.002 | 0.004 | 0 | 2 |
| b-4-3 | 0 | 0.002 | 0.01 | 0 | 5 |
| b-4-4 | 0 | 0.002 | 0.016 | 0 | 8 |
| b-4-5 | 0 | 0.002 | 0.02 | 0 | 10 |
| b-5-1 | 0 | 0.02 | 0.02 | 0 | 1 |
| b-5-2 | 0 | 0.02 | 0.04 | 0 | 2 |

| Type no. | [QUAT] (M) | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]$ (M) | $\frac{[CrO_4^{2-}]}{[QUAT]}$ | $\frac{[Ba^{2+}]}{[CrO_4^{2-}]}$ |
|---|---|---|---|---|---|
| b-5-3 | 0 | 0.02 | 0.1 | 0 | 5 |
| b-5-4 | 0 | 0.02 | 0.16 | 0 | 8 |
| b-5-5 | 0 | 0.02 | 0.2 | 0 | 10 |
| b-6-1 | 0 | 0.06 | 0.06 | 0 | 1 |
| b-6-2 | 0 | 0.06 | 0.12 | 0 | 2 |
| b-6-3 | 0 | 0.06 | 0.3 | 0 | 5 |
| b-6-4 | 0 | 0.06 | 0.48 | 0 | 8 |
| b-6-5 | 0 | 0.06 | 0.6 | 0 | 10 |

Note: The QUAT concentration was held constant at 0.1 M while the chromate concentrations were constant at 0.002, 0.02, and 0.06 M. The experimental data were shown in appendix B.3.

APPENDIX A.3 Study of the effect of increasing QUAT concentration on the barium chromate precipitation (Section4.2)

| Type no. | [QUAT] (M) | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]$ (M) | $\frac{[CrO_4^{2-}]}{[QUAT]}$ | $\frac{[Ba^{2+}]}{[CrO_4^{2-}]}$ |
|---|---|---|---|---|---|
| c-1-1 | 0.1 | 0.02 | 0.02 | 0.2 | 1 |
| c-1-2 | 0.2 | 0.02 | 0.02 | 0.1 | 1 |
| c-1-3 | 0.3 | 0.02 | 0.02 | 0.0667 | 1 |
| c-1-4 | 0.4 | 0.02 | 0.02 | 0.05 | 1 |
| c-2-1 | 0.1 | 0.02 | 0.04 | 0.2 | 2 |
| c-2-2 | 0.2 | 0.02 | 0.04 | 0.1 | 2 |
| c-2-3 | 0.3 | 0.02 | 0.04 | 0.0667 | 2 |
| c-2-4 | 0.4 | 0.02 | 0.04 | 0.05 | 2 |
| c-3-1 | 0.1 | 0.02 | 0.1 | 0.2 | 5 |
| c-3-2 | 0.2 | 0.02 | 0.1 | 0.1 | 5 |
| c-3-3 | 0.3 | 0.02 | 0.1 | 0.0667 | 5 |
| c-3-4 | 0.4 | 0.02 | 0.1 | 0.05 | 5 |
| c-4-1 | 0.1 | 0.02 | 0.16 | 0.2 | 8 |
| c-4-2 | 0.2 | 0.02 | 0.16 | 0.1 | 8 |
| c-4-3 | 0.3 | 0.02 | 0.16 | 0.0667 | 8 |
| c-4-4 | 0.4 | 0.02 | 0.16 | 0.05 | 8 |
| c-5-1 | 0.1 | 0.02 | 0.2 | 0 | 10 |
| c-5-2 | 0.2 | 0.02 | 0.2 | 0 | 10 |
| c-5-3 | 0.3 | 0.02 | 0.2 | 0 | 10 |
| c-5-4 | 0.4 | 0.02 | 0.2 | 0 | 10 |
| c-6-1 | 0 | 0.02 | 0.02 | 0 | 1 |
| c-6-2 | 0 | 0.02 | 0.04 | 0 | 2 |

| Type no. | [QUAT] (M) | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]$ (M) | $\frac{[CrO_4^{2-}]}{[QUAT]}$ | $\frac{[Ba^{2+}]}{[CrO_4^{2-}]}$ |
|---|---|---|---|---|---|
| c-6-3 | 0 | 0.02 | 0.1 | 0 | 5 |
| c-6-4 | 0 | 0.02 | 0.16 | 0 | 8 |
| c-6-5 | 0 | 0.02 | 0.2 | 0 | 10 |

Note: The chromate concentration was held constant at 0.02 M while the barium concentrations were constant at 0.02, 0.04, 0.1, 0.16, and 0.2 M. The experimental data were shown in appendix B.4.

## APPENDIX B

Experimental data

APPENDIX B.1 The experimental data of the equilibrium time study

| Time(hrs) | $CrO_4^{2-}$ Precipitates(%) | |
|---|---|---|
| | At [QUAT] = 0.4M<br>$[CrO_4^{2-}]$ = 0.8M<br>$[Ba^{2+}]$ = 0.4 M | At [QUAT] = 0.1M<br>$[CrO_4^{2-}]$ = 0.002M<br>$[Ba^{2+}]$ = 0.002M |
| 0 | 48.4 | 89 |
| 0.5 | 57.72 | 92.05 |
| 1 | 45.84 | 91.3 |
| 2 | 51.78 | 91.21 |
| 4 | 46.67 | 93.78 |
| 6 | 52.21 | 88.02 |
| 10 | 53.41 | 89.99 |
| 12 | 52.25 | 86.44 |
| 15 | 52.18 | 85.62 |
| 24 | 46.58 | 86.95 |
| 48 | 46.47 | 85.97 |
| 96 | 45.67 | 86.74 |
| 144 | 45.05 | 85.63 |
| 168 | 46.97 | |

Note: The plots of the percentage of chromate in the barium chromate precipitate were shown in Figure 4-1.

APPENDIX B.2 Analytical data of the experiment obtained from appendix A.1

| Type no. | Initial condition | | | | $[Ba^{2+}]$ | | | | $[CrO_4^{2-}]$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [QUAT] (M) | $[CrO_4^{2-}]$ / [QUAT] | $[CrO_4^{2-}]$ (M) | $[Ba^{2+}]/[CrO_4^{2-}]$ | Initial (ppm) | Supernatant (ppm) | Precipitate (ppm) | % Precipitate | Initial (ppm) | Supernatant (ppm) | Precipitate (ppm) | % Precipitate |
| a-1-1 | 0.1 | 0.800 | 0.080 | 1 | 10987.2 | 0.6803 | 10986.5197 | 99.99 | 9279.488 | 416.0690 | 8863.4190 | 95.52 |
| a-1-2 | 0.1 | 0.400 | 0.040 | 2 | 10987.2 | 5797.0588 | 5190.1412 | 47.24 | 4639.744 | 0.4657 | 4639.2783 | 99.99 |
| a-1-3 | 0.1 | 0.160 | 0.016 | 5 | 10987.2 | 9197.0588 | 1790.1412 | 16.29 | 1855.8976 | 0.2329 | 1855.6647 | 99.99 |
| a-1-4 | 0.1 | 0.100 | 0.010 | 8 | 10987.2 | 9844.1177 | 1143.0823 | 10.40 | 1159.936 | 0.0000 | 1159.9360 | 100.00 |
| a-1-5 | 0.1 | 0.080 | 0.008 | 10 | 10987.2 | 11012.5000 | -25.3000 | -0.23 | 927.9488 | 0.0000 | 927.9488 | 100.00 |
| a-2-1 | 0.2 | 0.400 | 0.080 | 1 | 10987.2 | 2.4615 | 10984.7385 | 99.98 | 9279.488 | 373.7743 | 8905.7137 | 95.97 |
| a-2-2 | 0.2 | 0.200 | 0.040 | 2 | 10987.2 | 5993.7107 | 4993.4893 | 45.45 | 4639.744 | 1.0081 | 4638.7359 | 99.98 |
| a-2-3 | 0.2 | 0.080 | 0.016 | 5 | 10987.2 | 9773.5849 | 1213.6151 | 11.05 | 1855.8976 | 0.4911 | 1855.4065 | 99.97 |
| a-2-4 | 0.2 | 0.050 | 0.010 | 8 | 10987.2 | 11303.1250 | -315.9250 | -2.88 | 1159.936 | 0.0000 | 1159.9360 | 100.00 |
| a-2-5 | 0.2 | 0.040 | 0.008 | 10 | 10987.2 | 11135.2201 | -148.0201 | -1.35 | 927.9488 | 0.0000 | 927.9488 | 100.00 |
| a-3-1 | 0.3 | 0.267 | 0.080 | 1 | 10987.2 | 1.8447 | 10985.3553 | 99.98 | 9279.488 | 467.7073 | 8811.7807 | 94.96 |
| a-3-2 | 0.3 | 0.133 | 0.040 | 2 | 10987.2 | 5202.3121 | 5784.8879 | 52.65 | 4639.744 | 0.5488 | 4639.1952 | 99.99 |
| a-3-3 | 0.3 | 0.053 | 0.016 | 5 | 10987.2 | 8537.5723 | 2449.6277 | 22.30 | 1855.8976 | 0.2744 | 1855.6232 | 99.99 |
| a-3-4 | 0.3 | 0.033 | 0.010 | 8 | 10987.2 | 10251.4451 | 735.7549 | 6.70 | 1159.936 | 0.2744 | 1159.6616 | 99.98 |
| a-3-5 | 0.3 | 0.027 | 0.008 | 10 | 10987.2 | 10557.8035 | 429.3965 | 3.91 | 927.9488 | 0.2744 | 927.6744 | 99.97 |
| a-4-1 | 0.4 | 0.200 | 0.080 | 1 | 10987.2 | 3.4568 | 10983.7432 | 99.97 | 9279.488 | 597.2231 | 8682.2649 | 93.56 |
| a-4-2 | 0.4 | 0.100 | 0.040 | 2 | 10987.2 | 5470.5882 | 5516.6118 | 50.21 | 4639.744 | 0.6401 | 4639.1039 | 99.99 |
| a-4-3 | 0.4 | 0.040 | 0.016 | 5 | 10987.2 | 9147.0588 | 1840.1412 | 16.75 | 1855.8976 | 0.6401 | 1855.2575 | 99.97 |
| a-4-4 | 0.4 | 0.025 | 0.010 | 8 | 10987.2 | 9158.8235 | 1828.3765 | 16.64 | 1159.936 | 0.6401 | 1159.2959 | 99.94 |
| a-4-5 | 0.4 | 0.020 | 0.008 | 10 | 10987.2 | 9605.8824 | 1381.3176 | 12.57 | 927.9488 | 1.2802 | 926.6686 | 99.86 |
| a-5-1 | 0 | 0.000 | 0.080 | 1 | 10987.2 | 1.2270 | 10985.9730 | 99.99 | 9279.488 | 139.2798 | 9140.2082 | 98.50 |
| a-5-2 | 0 | 0.000 | 0.040 | 2 | 10987.2 | 5788.3436 | 5198.8564 | 47.32 | 4639.744 | 0.1902 | 4639.5538 | 100.00 |
| a-5-3 | 0 | 0.000 | 0.016 | 5 | 10987.2 | 9898.7730 | 1088.4270 | 9.91 | 1855.8976 | 0.1432 | 1855.7544 | 99.99 |
| a-5-4 | 0 | 0.000 | 0.010 | 8 | 10987.2 | 10576.6871 | 410.5129 | 3.74 | 1159.936 | 0.1902 | 1159.7458 | 99.98 |
| a-5-5 | 0 | 0.000 | 0.008 | 10 | 10987.2 | 10773.0061 | 214.1939 | 1.95 | 927.9488 | 0.1667 | 927.7821 | 99.98 |

APPENDIX B.3 Analytical data of the experiment obtained from appendix A.2

| Type no. | Initial condition | | | | $[Ba^{2+}]$ | | | | $[CrO_4^{2-}]$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $CrO_4^{2-}$] / [QUAT | [ $CrO_4^{2-}$] | $[Ba^{2+}]/[CrO_4^{2-}$ | $[Ba^{2+}]$ | Initial (ppm) | Supernatant (ppm) | Precipitate (ppm) | Precipitate (%) | Initial (ppm) | Supernatant (ppm) | Precipitate (ppm) | Precipitate (%) |
| b-1-1 | 0.02 | 0.002 | 1 | 0.002 | 274.6800 | 2.0000 | 272.6800 | 99.27 | 231.9872 | 73.9995 | 157.9877 | 68.10 |
| b-1-2 | 0.02 | 0.002 | 2 | 0.004 | 549.3600 | 171.3333 | 378.0267 | 68.81 | 231.9872 | 3.2494 | 228.7378 | 98.60 |
| b-1-3 | 0.02 | 0.002 | 5 | 0.010 | 1373.4000 | 1096.3855 | 277.0145 | 20.17 | 231.9872 | 0.9218 | 231.0654 | 99.60 |
| b-1-4 | 0.02 | 0.002 | 8 | 0.016 | 2197.4400 | 1971.0843 | 226.3557 | 10.30 | 231.9872 | 1.4058 | 230.5814 | 99.39 |
| b-1-5 | 0.02 | 0.002 | 10 | 0.020 | 2746.8000 | 2580.7229 | 166.0771 | 6.05 | 231.9872 | 0.6914 | 231.2958 | 99.70 |
| b-2-1 | 0.20 | 0.020 | 1 | 0.020 | 2746.8000 | 8.2667 | 2738.5333 | 99.70 | 2319.8720 | 42.3809 | 2277.4911 | 98.17 |
| b-2-2 | 0.20 | 0.020 | 2 | 0.040 | 5493.6000 | 2962.6506 | 2530.9494 | 46.07 | 2319.8720 | 1.4519 | 2318.4201 | 99.94 |
| b-2-3 | 0.20 | 0.020 | 5 | 0.100 | 13734.0000 | 11689.6552 | 2044.3448 | 14.89 | 2319.8720 | 0.2535 | 2319.6185 | 99.99 |
| b-2-4 | 0.20 | 0.020 | 8 | 0.160 | 21974.4000 | 21086.2069 | 888.1931 | 4.04 | 2319.8720 | 0.4840 | 2319.3880 | 99.98 |
| b-2-5 | 0.20 | 0.020 | 10 | 0.200 | 27468.0000 | 24500.0000 | 2968.0000 | 10.81 | 2319.8720 | 0.2535 | 2319.6185 | 99.99 |
| b-3-1 | 0.60 | 0.060 | 1 | 0.060 | 8240.4000 | 13.3333 | 8227.0667 | 99.84 | 6959.6160 | 68.5147 | 6891.1013 | 99.02 |
| b-3-2 | 0.60 | 0.060 | 2 | 0.120 | 16480.8000 | 8574.7126 | 7906.0874 | 47.97 | 6959.6160 | 0.9679 | 6958.6481 | 99.99 |
| b-3-3 | 0.60 | 0.060 | 5 | 0.300 | 41202.0000 | 36408.0460 | 4793.9540 | 11.64 | 6959.6160 | 0.2535 | 6959.3625 | 100.00 |
| b-3-4 | 0.60 | 0.060 | 8 | 0.480 | 65923.2000 | 64674.5562 | 1248.6438 | 1.89 | 6959.6160 | 0.4840 | 6959.1320 | 99.99 |
| b-3-5 | 0.60 | 0.060 | 10 | 0.600 | 82404.0000 | 80414.2012 | 1989.7988 | 2.41 | 6959.6160 | 0.2535 | 6959.3625 | 100.00 |

APPENDIX B.4 Analytical data of the experiment obtained from appendix A.3

| Type no. | Initial condition | | | | $[Ba^{2+}]$ | | | | $[CrO_4^{2-}]$ | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | [QUAT] | $CrO_4^{2-}$] / [QUAT] | $Ba^{2+}$]/[$CrO_4^{2-}$] | [$Ba^{2+}$] | Initial (ppm) | Supernatant (ppm) | Precipitate (ppm) | Precipitate (%) | Initial (ppm) | Supernatant (ppm) | Precipitate (ppm) | Precipitate (%) |
| c-1-1 | 0.1 | 0.20 | 1 | 0.02 | 2746.8 | 1.9231 | 2744.8769 | 99.93 | 2319.8720 | 151.8855 | 2167.9865 | 93.45 |
| c-1-2 | 0.2 | 0.10 | 1 | 0.02 | 2746.8 | 1.5267 | 2745.2733 | 99.94 | 2319.8720 | 232.7032 | 2087.1688 | 89.97 |
| c-1-3 | 0.3 | 0.07 | 1 | 0.02 | 2746.8 | 0.9091 | 2745.8909 | 99.97 | 2319.8720 | 322.1072 | 1997.7648 | 86.12 |
| c-1-4 | 0.4 | 0.05 | 1 | 0.02 | 2746.8 | 1.2195 | 2745.5805 | 99.96 | 2319.8720 | 417.4501 | 1902.4219 | 82.01 |
| c-2-1 | 0.1 | 0.20 | 2 | 0.04 | 5493.6 | 2711.9761 | 2781.6239 | 50.63 | 2319.8720 | 1.3358 | 2318.5362 | 99.94 |
| c-2-2 | 0.2 | 0.10 | 2 | 0.04 | 5493.6 | 2527.9762 | 2965.6238 | 53.98 | 2319.8720 | 1.4596 | 2318.4124 | 99.94 |
| c-2-3 | 0.3 | 0.07 | 2 | 0.04 | 5493.6 | 2346.4706 | 3147.1294 | 57.29 | 2319.8720 | 1.8458 | 2318.0262 | 99.92 |
| c-2-4 | 0.4 | 0.05 | 2 | 0.04 | 5493.6 | 2308.8235 | 3184.7765 | 57.97 | 2319.8720 | 0.6079 | 2319.2641 | 99.97 |
| c-3-1 | 0.1 | 0.20 | 5 | 0.10 | 13734.0 | 11131.2500 | 2602.7500 | 18.95 | 2319.8720 | 1.1132 | 2318.7588 | 99.95 |
| c-3-2 | 0.2 | 0.10 | 5 | 0.10 | 13734.0 | 11309.3750 | 2424.6250 | 17.65 | 2319.8720 | 0.7298 | 2319.1422 | 99.97 |
| c-3-3 | 0.3 | 0.07 | 5 | 0.10 | 13734.0 | 11434.3750 | 2299.6250 | 16.74 | 2319.8720 | 0.7911 | 2319.0809 | 99.97 |
| c-3-4 | 0.4 | 0.05 | 5 | 0.10 | 13734.0 | 11700.0000 | 2034.0000 | 14.81 | 2319.8720 | 0.6079 | 2319.2641 | 99.97 |
| c-4-1 | 0.1 | 0.20 | 8 | 0.16 | 21974.4 | 20977.0115 | 997.3885 | 4.54 | 2319.8720 | 0.4453 | 2319.4267 | 99.98 |
| c-4-2 | 0.2 | 0.10 | 8 | 0.16 | 21974.4 | 19482.7586 | 2491.6414 | 11.34 | 2319.8720 | 0.2433 | 2319.6287 | 99.99 |
| c-4-3 | 0.3 | 0.07 | 8 | 0.16 | 21974.4 | 21390.8046 | 583.5954 | 2.66 | 2319.8720 | 0.2637 | 2319.6083 | 99.99 |
| c-4-4 | 0.4 | 0.05 | 8 | 0.16 | 21974.4 | 20620.6897 | 1353.7103 | 6.16 | 2319.8720 | 0.0000 | 2319.8720 | 100.00 |
| c-5-1 | 0.1 | 0.20 | 10 | 0.20 | 27468.0 | 25208.3333 | 2259.6667 | 8.23 | 2319.8720 | 1.7811 | 2318.0909 | 99.92 |
| c-5-2 | 0.2 | 0.10 | 10 | 0.20 | 27468.0 | 25440.4762 | 2027.5238 | 7.38 | 2319.8720 | 0.2433 | 2319.6287 | 99.99 |
| c-5-3 | 0.3 | 0.07 | 10 | 0.20 | 27468.0 | 27821.4286 | -353.4286 | -1.29 | 2319.8720 | 0.5537 | 2319.3183 | 99.98 |
| c-5-4 | 0.4 | 0.05 | 10 | 0.20 | 27468.0 | 27345.2381 | 122.7619 | 0.45 | 2319.8720 | 0.3039 | 2319.5681 | 99.99 |
| c-6-1 | 0 | | 1 | 0.20 | 27468.0 | 25.1515 | 27442.8485 | 99.91 | 2319.8720 | 5.6164 | 2314.2556 | 99.76 |
| c-6-2 | 0 | | 2 | 0.04 | 5493.6 | 2872.7273 | 2620.8727 | 47.71 | 2319.8720 | 1.6906 | 2318.1814 | 99.93 |
| c-6-3 | 0 | | 5 | 0.10 | 13734.0 | 12296.9697 | 1437.0303 | 10.46 | 2319.8720 | 0.2384 | 2319.6336 | 99.99 |
| c-6-4 | 0 | | 8 | 0.16 | 21974.4 | 22703.0303 | -728.6303 | -3.32 | 2319.8720 | 0.3959 | 2319.4761 | 99.98 |
| c-6-5 | 0 | | 10 | 0.20 | 27468.0 | 28878.7879 | -1410.7879 | -5.14 | 2319.8720 | 0.3718 | 2319.5002 | 99.98 |

# CURRICULUM VITAE

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