Practice Assessment 5

$$|\psi_A\rangle = \frac{1}{\sqrt{2}}(|+;-\rangle + |-;+\rangle) \qquad |\psi_B\rangle = \frac{1}{\sqrt{2}}(|+;-\rangle - |-;+\rangle)$$

$$P_{++} = |\langle +;+|\psi_A\rangle| = 0 \qquad P_{++} = |\langle +;+|\psi_B\rangle| = 0$$
$$P_{+-} = |\langle +;-|\psi_A\rangle| = 1/2 \qquad P_{+-} = |\langle +;-|\psi_B\rangle| = 1/2$$
$$P_{-+} = |\langle -;+|\psi_A\rangle| = 1/2 \qquad P_{-+} = |\langle -;+|\psi_B\rangle| = 1/2$$
$$P_{--} = |\langle -;-|\psi_A\rangle| = 0 \qquad P_{--} = |\langle -;-|\psi_B\rangle| = 0$$

	+	−
+	0	1/2
−	1/2	0

Uncorrelated

	+	−
+	0	1/2
−	1/2	0

Uncorrelated

$$C_A = 0 + 1/2 - 1/2 + 0 = 0 \qquad C_B = 0 + 1/2 - 1/2 + 0 = 0$$

$$\langle S_{z_1}\rangle = (P_{++} + P_{+-})\hbar/2 - (P_{-+} + P_{--})\hbar/2$$
$$= (1/2)\hbar/2 - (1/2)\hbar/2 = \hbar/4 - \hbar/4 = 0$$

$$\langle S_{z_2}\rangle = (P_{++} + P_{+-})\hbar/2 - (P_{-+} + P_{--})\hbar/2$$
$$= (1/2)\hbar/2 - (1/2)\hbar/2 = \hbar/4 - \hbar/4 = 0$$

Same expectation Value

$$\langle S_{z_1}\rangle^2 = 0 \qquad \langle S_{z_2}\rangle^2 = 0$$

$$\langle S_{z_1}^2\rangle = (P_{++} + P_{+-})\hbar^2/4 - (P_{-+} + P_{--})\hbar^2/4$$
$$= (1/2)\hbar^2/4 - (1/2)\hbar^2/4 = 0$$

$$\langle S_{z_2}^2\rangle = (P_{++} + P_{+-})\hbar^2/4 - (P_{-+} + P_{--})\hbar^2/4$$
$$= (1/2)\hbar^2/4 - (1/2)\hbar^2/4 = 0$$

$$\sigma_A = \sqrt{\langle S_{z,1}^2 \rangle - \langle S_{z,1} \rangle^2} = 0$$

$$\sigma_B = \sqrt{\langle S_{z,1}^2 \rangle - \langle S_{z,1} \rangle^2} = 0$$

Same uncertainties

Probability, Expectation values, and Uncertainty Values are all the same. There is no way to tell between the two ensembles.