Problems: Chapter Two

11- Prove that

$$(\sigma \cdot A)(\sigma \cdot B) = A \cdot B + i\sigma \cdot (A \times B)$$

$$(\sigma.A)^2 = A^2$$

12- Prove the following relations

$$1 - S_+ \alpha = 0$$

$$2 - S_+ \beta = \hbar \alpha$$

$$3 - S_- \alpha = \hbar \beta$$

$$4 - S_- \beta = 0$$

13- show that

$$1 - S_x \alpha = \frac{\hbar}{2} \beta$$

$$2 - S_y \alpha = \frac{i\hbar}{2} \beta$$

$$3 - S_z \alpha = \frac{\hbar}{2} \alpha$$

$$4 - S_x \beta = \frac{\hbar}{2} \alpha$$

$$5 - S_y \beta = \frac{-i\hbar}{2} \alpha$$

$$6 - S_z \beta = -\frac{\hbar}{2} \beta$$

14- show that

$$S_x S_y + S_y S_x = 0$$

$$S_i S_j = \frac{i\hbar}{2} S_k : i, j, k = x, y, z$$

15-Prove that

$$S_x S_y S_z S_y S_z S_x = \frac{-\hbar^6}{64}$$

$$S_x S_y S_x S_y S_z S_x = \frac{-i\hbar^5}{32} S_y$$