Question 6 [12 marks]:

On Knights and Knave Island, all natives are either knights, who always tell the truth, or knaves, who always tell lies. You meet five islanders, Alice, Bob, Carol, Steven and John, who make the following statements:

Alice: "Bob and Carol are of the same type."
Bob: "Carol is a knave."

Answer the following questions;
(a) Is Alice a knight or a knave?

Let: A represent the proposition "Alice is a knight".
B represent the proposition "Bob is a knight".
C represent the proposition "Carol is a knight".

From Alice's statement: $A \equiv (B \wedge C)$
From Bob's statement, $B \equiv \sim C$
This implies $A \equiv (B \wedge C) \equiv (\sim C \wedge C) = \text{false}$
Thus, Alice is a knave.

(b) What question can you ask Steven to identify exactly what John is?

We can ask Is it the case that the statement that John is a knight is equivalent to you, Steven, being a knight?