Gas exchange in an oak tree

An experiment was done to measure the amount of carbon dioxide diffusing into an oak tree on a partially cloudy day in May. The experiment was done over 18 hours and the results are shown in the graph below.

1. The units for the amount of carbon dioxide that diffuses into the leaves is given as cm³/m²/min – that is cm³ of carbon dioxide per m² of leaf area per minute. How much carbon dioxide was diffusing into the plant at:
   a. 14:00 hrs   b. 09:00 hrs?

2. a. The line is below 0 cm³/m²/min for the first part of the day. Explain what this tells you.
   b. What process causes this to happen?
   c. What time do you think dawn was? Explain your answer.

3. a. The time at which there is no overall diffusion of carbon dioxide into or out of the tree is called the compensation point. At what time did the compensation point occur?

4. For each part of this question, explain your answer. How would the time of the compensation point change if:
   a. the skies were clear   b. it was partially cloudy but colder
   c. it was the middle of winter? (Be careful!)

5. a. What was the maximum rate of diffusion of carbon dioxide into the leaf?
   b. The whole tree had leaves with a total surface area of 50 m². How much carbon dioxide would have diffused into the tree in 12 hours if the diffusion stayed at its maximum rate? Show your working. Give your answer in cm³.
   c. There are 1000 cm³ in 1 litre. Write down the answer to part b in litres.
   d. One litre of carbon dioxide has a mass of 1.8 g. Write down your answer to part c in kilograms of carbon dioxide.

6. Sketch a graph to show what you would expect to find if the amount of diffusion of oxygen into the leaves had been measured instead.