1. What is a scientific theory? What is one way to use a scientific theory?

A deduction (made from a set of assumptions following rules of logic)

To crystallize, encapsulate, abbreviate knowledge.
To reveal hidden implications of known facts or assumptions.
To test whether a conclusion is logically valid.

2. How do Ord’s and chisel-tooth kangaroo rats allocate resources?

Ord’s eat seeds; chisel-tooths eat leaves of salt-loving plants. The lower incisors of each are shaped to allow them to do these jobs. The chisel-tooth’s permit them to strip outer surface of the leaves, thus removing the salty layer.

3. Joe Connell excluded barnacles of the species Balanus balanoides from rocks high in the Scottish intertidal zone. Why did he do this experiment? What was its result?

Connell wanted to determine whether competition between these species exits in the field. He found that it does: Chthamalus (the barnacle that usually lives only high in the zone) was able to thrive lower down, too, if there were no Balanus.
4. Two species compete and coexist. In the space below, draw possible zero isoclines for Species-i and Species-j. On the axes, put both zero values and both carrying capacities. Shade the region of the graph within which $N_i$ increases and $N_j$ decreases.

5. What is a metapopulation? Name one question ecologists ask about metapopulations.
A set of semi-isolated populations of a single species.

What proportion of the sites where demes sometimes live are likely to be occupied at a single time?
What is the chance that the entire metapopulation will become extinct?

6. Define interspecific competition. (I prefer a mathematical definition, but you may also use an equivalent verbal one.)

$$\frac{\partial \ln N_i}{\partial N_j} \leq 0 \quad \frac{\partial \ln N_j}{\partial N_i} \leq 0$$

Increase in either species reduces the per capita rate of change of the other.
7. Briefly describe an actual experiment that helped us to understand a case of habitat difference between species. What did it conclude about the reason(s) for the difference?

Crayfish species differ in aggressiveness and tolerance for low oxygen concentrations. The aggressive species occupies the oxygen-rich habitats (rocky bottom sites); the other occupies the oxygen-poor sites.

Parasite species prefer the region of the rat gut rich in nutrients. But one excludes the tapeworms, which can live in a greater range of nutrient concentrations, to well below the rich sites.

8. Why do coyotes eat mostly rabbits (of various species)? (Hint: Many other species such as deer and ground squirrels also occur in their habitats.)

Rabbits are the best size prey for coyotes. They are as large as the coyotes can catch easily. The coyotes would be wasting their time on larger food items or smaller ones.