Crosscutting Concept: Structure and Function

***A Framework for K-12 Science Education* description of structure and function:** The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.

After presenting students with observational data as part of the scenario:

- What structures are present in _____? What function does each structure have in_____ (scenario)? How do you think each structure behaves?
- What is the relationship between the structure and its function?
- Why does the shape of _____ matter for its function? What other properties of the structure might allow it to have certain behaviors?

Ask after presenting students with a model as part of the scenario:

- What are the substructures shown in the model? For each substructure, how does it behave in the model? What properties does it have? What is its function in the model?
- Describe the organization of substructures and how the spatial relationship matters for behavior and function.
- For the model, describe the behaviors by which the structures accomplish their functions.

After presenting students with an unknown system to investigate:

- What is the structures make up the system? What are they shaped like? What behaviors do the structures have?
- What do the individual structures do? What do the structures together allow the system to do?
- What environmental properties constrain behaviors of structures in the system?

After presenting students with a description of a microscopic system:

- Together, what do the parts of the _____ (system) do? What do you think the structures look like?
- Based on the overall function of the system, how do each of the individual structures behave? What properties do they have?

After asking students to design a solution (e.g., a mechanical system):

- Describe the structures in your solution. Describe the function of your solution. What is important about the relationship between structure and function in your solution that make it a successful design?

*When asking students about **structure and function** in natural environments:*

- Identify the properties of the environment that constrain behavior of organisms. What about the structures of an organism allow them to survive within the environment? What is the behavior of the organism and the function of the structures it has?
- You locate a new animal in an environment. It has talons it uses to capture and kill prey. Given what you know about the environment, explain the behavior of this animal.

Crosscutting Concept: Stability and Change

***A Framework for K-12 Science Education* description of stability and change:** For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

- What things stay the same in [the system presented in the scenario]?
- What things change in [the system presented in the scenario]?
- What things are changing slowly in [the system presented in the scenario]?
- Is the system described in the scenario stable or unstable? Present evidence to support your claim.
- How was this system affected by [sudden event described in the scenario]?
- How might this system be affected by [sudden event not described in the scenario]?
- How was this system affected in the long term by [gradual changes described in the scenario]?
- How might this system be affected in the long term by [gradual changes not described in the scenario]?
- *Especially for systems in dynamic equilibrium:* What are the factors causing this system to be stable?
- What are the factors causing this system to be unstable?
- What is happening at the [specify scale, such as atomic] scale to make this system stable?
- What is happening at the [specify scale, such as atomic] scale to make this system unstable?
- *For designed systems:* How can you design this system to be more stable?