**AST 5.3**

Chemistry 1
**Questions: Chilling Out, Warming Up**

Name: _____
Period ____ Date _____

**AST 5.3 I can read and analyze information about how animals survive temperature extremes.**

This is a graded assignment contributing to ALT 5. Review the rubric below.

| **4**<br>**Highly Proficient** | **3**<br>**Proficient** | **2**<br>**Nearly Proficient** | **1**<br>**Developing** |
|---|---|---|---|
| • Read closely to determine what the text says explicitly and to make logical inferences from it and make deeper connections.<br>• I have 9-10 correct answers. | • Read closely to determine what the text says explicitly and to make logical inferences from it.<br>• I have 7-8 correct answers. | • Read closely to determine what the text says explicitly and make some logical inferences from it.<br>• I have 5-6 correct answers. | • Read closely to determine what the text says explicitly but answers do not make logical inferences.<br>• I have fewer than 5 correct answers. |

1. List three ways camels have adapted to their environment.

2. Why are almost all large animals warm-blooded?

3. Explain the role that shape has in determining whether an animal is warm- or cold-blooded. Give examples.

4. According to the author, how has the human species adapted to environmental conditions of temperature?

5. List one disadvantage and one advantage of being warm-blooded.

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6. Since the internal temperature of cold-blooded animals approximates that of their surroundings, how do they avoid freezing to death in very cold surroundings?

7. List four examples of insulation in warm-blooded animals.

8. Explain the countercurrent heat exchange process.

9. How does sweating help a person maintain a fairly constant internal body temperature when the body gets hot?

10. List three ways animals maintain their body temperature in the heat.

**Answers to Student Questions**

1. **List three ways camels have adapted to their environment.**
   Camels have adapted to their environment in the following ways:
   *a.* Camels have large patches of thick, leathery skin on their knees that protect them from burning their legs when they kneel on the hot sand (think, OUCH! when you walk across hot sand at the beach),
   *b.* Their normal internal body temperature is higher than ours (93 to 107 $^{o}$F), so their body temperature has to be higher before they sweat, thus minimizing water loss through evaporation, and
   *c.* They have spongy bones in their noses that absorb excess moisture that would normally be lost through exhaling.
2. **Why are almost all large animals warm-blooded?**
   A large body volume makes it difficult for external heat to reach the internal body organs to warm them up. In cold temperatures, a large cold-blooded animal would be very sluggish and would be prime prey for a warm-blooded carnivore.
3. **Explain the role that shape has in determining whether an animal is warm- or cold-blooded. Give examples.**
   Like size, shape affects whether an animal is warm- or cold-blooded. A round body shape, e.g., a mouse, minimizes the effect of outside temperature on internal body temperature, while a flat body shape, e.g., a fish, or a cylindrical shape; e.g., a snake or worm, allows outside temperature to affect internal organ temperature (or vice versa) very quickly and efficiently.
4. **According to the author, how has the human species adapted to environmental conditions of temperature?**
   People living in cold climes typically have a more rounded, plump shape, thus better preserving their internal body heat; while people living in hot, dry regions tend to be thin, allowing them to dissipate body heat more quickly.
5. **List one disadvantage and one advantage of being warm-blooded.**
   Disadvantage: More heat energy (food) is required to keep internal body temperature at its normal levels than for cold-blooded animals.
   Advantage: They can stay active at lower external temperatures; e.g., in winter, than cold-blooded animals.
6. **Since the internal temperature of cold-blooded animals approximates that of their surroundings, how do they avoid freezing to death in very cold surroundings?**
   As the temperature approaches freezing, the fluid surrounding cells freezes, but fluid inside cells does not freeze. As the fluid freezes, water is drawn out of cells to help equalize the increased solute concentration in the remaining unfrozen fluid. As this occurs, glucose enters the cells. The combined loss of water and gain of glucose increases the concentration inside cells, resulting in a freezing point depression inside the cells. This prevents cells from freezing, which would be deadly to the animal.
7. **List four examples of insulation in warm-blooded animals.**
   Modes of insulation in warm-blooded animals include:
   a. Warm clothing in humans
   b. Wool or other types of hair
   c. Fluffed feathers
   d. Fat or blubber
8. **Explain the countercurrent heat exchange process.**
   The heat exchange process prevents excessive heat loss from an animal's extremities. This is accomplished thusly: "…arteries that carry warm blood away from the heart are positioned directly against the veins that carry cool blood to the heart. So, the warmer blood leaving the heart through the arteries warms the cooler blood entering the heart through the veins."
9. **How does sweating help a person maintain a fairly constant internal body temperature when the body gets hot?**
   Sweating moves warm water from inside the body to the surface of the skin. There it can evaporate into the air. But to do so, energy is required (remember that evaporation, the process of changing a liquid to a vapor by means of breaking bonds between the liquid molecules, is an endothermic process). The energy required to effect the phase change comes from the body, thus removing heat from the already too-warm body.
10. **List three ways that animals maintain their body temperature in the heat.**
    Animals maintain their core body temperature in varying ways:
    a. Dogs salivate, rather than sweating (although they do have sweat glands between their paw pads). When they pant, the saliva evaporating off their tongues helps to cool them.
    b. Cats have sweat glands on the pads of their feet and on their tongues.
    c. Cats and kangaroos (along with other animals) lick their fur. This provides water that evaporates off their fur, resulting in surface cooling.