Cognitive Levels Worksheet

Rate the cognitive level of each of the following assessment questions using the following scale (modified from Bloom, 1956).

Condensed Cognitive Levels

1. Knowledge
    - remember
2. Understanding and Application
    - grasp meaning, use, interpret
3. Critical Analysis
    - original thinking, open-ended answers, whole to parts, parts to whole, evaluation
4. Synthesis
    - Make connections

1. Two equal batches of radish seed were weighed at 1.0 g each, were watered, and were allowed to germinate. One batch was put in the LIGHT and one in the DARK. The dry biomass for each batch was measured after 10 days. You made three different predictions (shown below) regarding the biomass of the plants after 10 days. One of the predictions below is biologically feasible in terms of *photosynthesis*, *respiration*, *source/sink relations*, and *primary productivity*. The other two predictions are not conceptually sound in the context of the above concepts. Select the most feasible prediction.

a. Prediction 1: LIGHT= 1.5 g; DARK=1.35

b. Prediction 2: LIGHT= 1.5 g; DARK= 0.8 g

c. Prediction 3: LIGHT= 1.5 g; DARK=1.5 g

2. Written response: Explain in detail the following: Deep within a remote forest of Guatemala, the remains of a spider monkey were buried under an enormous mahogany tree. Although rare, jaguars have been spotted in this forest by local farmers. Use coherently written sentences and clearly labeled drawings to explain how a carbon atom in glucose contained within the muscle cells of the spider monkey might become part of a cell within the stomach lining of a jaguar. Provide a written description of the processes AND organisms the carbon atom must go through to cycle through the ecosystem. Include a clearly labeled drawing of the system. (Note: the jaguar does not dig up the monkey and eat the remains!)

3. A famous plant biologist from MSU noticed that individuals of the plant species Rocky Mountain Avens growing at 12,000 ft. had much smaller leaves than individual or the same species growing at 11,000 ft. To determine if the differences in leaf size were determined by genetic or environmental factors, she collected seeds from plants at both sites and grew them in a greenhouse in Boulder (elevation: 5,400 ft.) under controlled conditions. When the plants reached maturity, she measured leaf lengths from both groups. The results are recorded below.

	Average Leaf Length of Plants from 12,000 ft. (n = 150)	Average Leaf Length of Plants from 11,000 ft. (n = 150)
Leaf Size When Grown in Greenhouse	5 cm	11 cm

Which of the following conclusions is supported by these data?

a. The differences in leaf sizes are genetically determined.

b. The differences in leaf sizes are due to physiological responses to the environment.

c. It is impossible to determine the source of the variation because the experiment did not have a control.

4. In the space below, draw and label the organisms in a terrestrial food chain with 4 trophic levels. Incoming radiation from the sun is equal to 1,254,000 kcals/m^2/yr. Based on how energy flows through ecosystems, calculate the amount of kcals available for the top-level carnivores.

5. Think about any biome on earth, e.g., alpine tundra, tropical rain forest, grassland, desert. Which two abiotic variables are the <u>major</u> controlling factors the influence the distribution of these biomes on Earth?

a. CO_2 and precipitation

b. Light and precipitation

c. Nitrogen and temperature

d. Temperature and precipitation

6. [The following three questions are based on the following information.]

This spring, a group of MSU students went to the Baker Woodlot and saw many frogs in the ponds located throughout the woodlot. The students looked closer and noticed that many of the frogs were deformed. After consulting with the available scientific literature, they designed a laboratory experiment to test the effects and interactions of three different factors on frog development. Students collected data for the following three factors: (1) Ultraviolet radiation (UV), (2) herbicide Atrazine, and (3) parasitic trematodes. The data are summarized below.

Factors	% deformity
UV only	40
Atrazine only	0
Trematode Only	20
UV + Atrazine	40
Atrazine + Trematode	30
Control	0

Do the data support the following hypotheses?

Hypothesis: UV radiation increases the frequency of frog deformities.

a. supported by the data

b. not supported by the data

Hypothesis: Atrazine increases the susceptibility of frogs to deformities caused by UV radiation.

a. supported by the data

b. not supported by the data

Hypothesis: Atrazine increases the susceptibility of frogs to deformities caused by trematode infection.

a. supported by the data

b. not supported by the data

7. Create a concept map that illustrates your understanding of the hierarchy and relationships between these 10 concepts: photosynthesis, respiration, carbon cycle, decomposers, primary producers, consumers, carbon dioxide, oxygen, glucose, energy.