Name _____ Date _____

Energy Flow and Matter Cycling Unit Review: Following Energy and Carbon Through an Ecosystem

Directions: Answer the questions on energy flow and matter cycling. The last group of questions uses a table of energy values for the trophic levels of a meadow.

1. In a mountain meadow, match each organism to its role in the ecosystem.
Write the letter of the matching answer on each line.

1. _____ Long-tailed weasels, which hunt pikas
2. _____ Alpine grasses, which capture light energy
3. _____ Fungi, which break down dead leaves and animal remains
4. _____ Pikas, which eat grasses and wildflowers

A. Secondary consumer
B. Producer
C. Decomposer
D. Tertiary consumer
E. Primary consumer

2. Carbon atoms in a meadow are used again and again, but the energy that enters the meadow as sunlight is not. Why can't energy be reused the same way?

A. Much of the energy at each level leaves as heat, which producers cannot use to make food.
B. The energy is used up completely by consumers, so there is none left over to pass on.
C. Decomposers destroy the energy stored in dead matter as they break it down into simpler parts.
D. Producers already hold all the energy the meadow needs, so they never take any back.

3. A carbon atom in a blade of grass is eaten by a pika. Which path could return that same carbon atom to the air?

A. Through heat given off by the pika's body, which carries the carbon atom into the air
B. Only through burning the pika's body in a fire, since animals cannot release carbon any other way
C. Through the pika's cells turning the carbon atom into energy that no longer exists as an atom
D. Through the pika's cellular respiration, which releases the carbon in carbon dioxide

4. Choose words from the bank to complete these sentences about the carbon cycle.

Word bank

decomposition • cellular respiration • fossil fuels • photosynthesis • minerals • transpiration

During _____, producers take in carbon dioxide and build its carbon into sugars. During _____, producers, consumers and decomposers break down sugars and release carbon dioxide. Burning _____ such as coal also releases carbon dioxide, from carbon that was stored long ago.

5. On the meadow floor, fungi and bacteria break down dead plants and the bodies of dead animals. What does this do for the cycling of matter?

A. It returns carbon dioxide and nutrients, such as nitrogen, that producers can use again.
B. It removes the matter from the ecosystem for good, so that it can never be used again.
C. It makes new food from sunlight, the same way that the grasses and wildflowers do.
D. It turns the dead matter back into fresh energy that then flows down to the producers again.

6. In waterlogged peat bogs, dead plants pile up and break down very slowly, because the soggy ground holds little oxygen. What happens to much of the carbon in those dead plants?

A. It stays stored in the peat instead of returning to the air as carbon dioxide.
B. It returns to the air faster than usual, because the water speeds up decay.
C. It turns into energy, because decomposers cannot reach the plants in the water.
D. It is destroyed, because carbon cannot exist anywhere that oxygen is scarce.

7. Coal formed from plants that lived and died millions of years ago. When coal burns, what happens to its carbon?

A. It stays in the ashes as pure carbon, so none of it reaches the air.
B. It joins with oxygen and enters the air as carbon dioxide.
C. It changes into pure energy, which is why burning gives off heat.
D. It is destroyed by the heat of the fire and no longer exists.

8. Why do food chains rarely have more than four or five trophic levels?

A. Matter is used up as it moves up the chain, so nothing is left to build the bodies of a sixth level.
B. Only a small share of the energy at each level reaches the next, so too little is left for another level.
C. Producers make only enough energy for four or five levels, and they cannot make any more of it.
D. Energy builds up at each level, so the top levels have more energy than any animal living there could use.

9. Producers in a grassland store about 30,000 kJ of energy per square meter in a year. If roughly 10 percent of the energy passes from each level to the next on average, about how much energy would reach the secondary consumers?

A. About 27,000 kJ B. About 3,000 kJ C. About 30 kJ D. About 300 kJ

Energy at Each Trophic Level of a Meadow

In a study, ecologists estimated the energy stored in new tissue by all of the organisms at each trophic level of a mountain meadow over one year. The values are totals for each level per square meter of meadow.

Energy stored in new tissue at each trophic level of a mountain meadow in one year

Trophic level	**Examples**	**Energy stored in new tissue (kJ per square meter per year)**
Producers	Grasses, sedges and wildflowers	21,000
Primary consumers	Plant eaters such as grasshoppers and pikas	1,700
Secondary consumers	Animals that eat plant eaters, such as shrews and weasels	210
Tertiary consumers	Hawks and other predators that eat secondary consumers	16

10. About what percent of the energy stored by the producers was stored by the primary consumers?

A. About 80 percent B. About 1 percent C. About 8 percent D. About 12 percent

11. Which statement about energy transfer in this meadow do the data support?

A. Exactly 10 percent of the energy passed from each level to the next level in the chain.
B. About half of each level's energy was stored by the next level up the food chain.
C. Each level stored more energy than the level below it, so energy grew up the chain.
D. The share passed from one level to the next varied, from about 8 to about 12 percent.

12. The producers stored 21,000 kJ, but the primary consumers stored only 1,700 kJ. Based on how energy moves through living things, which explanation fits this difference best?

A. The plant eaters turned most of the energy they took in into matter, which is not counted as energy.
B. Most of the energy cycled back to the producers before the plant eaters had a chance to use it.
C. Much plant material was never eaten or digested, and plant eaters lost much of what they ate as heat.
D. Energy was destroyed as it passed from the plants into the bodies of the grasshoppers and pikas.

13. Suppose a fifth level of predators fed only on the tertiary consumers. If its transfer were similar to those in the table, about how much energy would that level store per square meter in a year?

A. About 16 kJ B. About 1 to 2 kJ C. About 160 kJ D. About 8 kJ