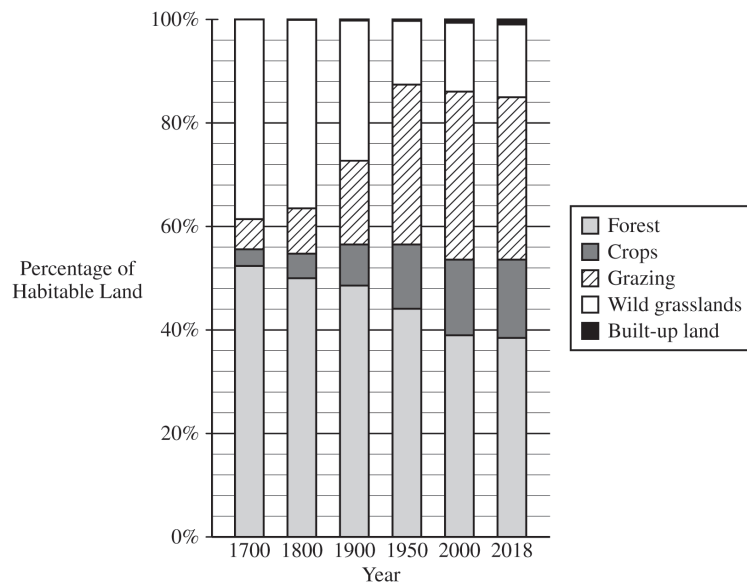


2. The following graph shows how global uses of habitable land have changed since 1700.

Land Use Changes on Earth, 1700–2018



- (a) Based on the data in the graph, **identify** the year with the highest percentage of forest.
- (b) Based on the data in the graph, **describe** the relationship between the land use changes in the wild grasslands and grazing from 1700 to 1950.
- (c) **Identify** an environmental problem associated with overgrazing by livestock.
- (d) A student hypothesized that the change in the percentage of forest from 1700 to 2018 has decreased atmospheric carbon dioxide concentrations. **Explain** whether the hypothesis is supported or refuted based on the data in the graph.

Urban environments have accounted for an increasing percentage of land use within the last few decades.

- (e) **Describe** a water-related environmental problem associated with urbanization.
- (f) **Describe** a potential response to mitigate the environmental problem identified in part (e).

Farmers who own large sections of cropland notice that bobcats, a medium-sized predatory forest cat, were present many years ago but are now virtually absent in the area. Instead, smaller mammal species now inhabit the area. Over time, the farmers have cleared nearly all of the forest on their property and converted it to farmland.

- (g) **Explain** why there are fewer bobcats present on the farmland now compared to several decades ago.

The small mammal species are considered pests by the farmers. The farmers partner with a conservation group to increase the number of bobcats in the area. As a solution, the conservation group will introduce bobcats onto the few isolated patches of the original forested habitat left in the area. They can introduce only a small number of bobcats in each patch.

- (h) **Describe** a disadvantage of introducing only a small population of bobcats.
- (i) **Propose** a solution to improve the chances that the bobcat reintroductions will be successful in reestablishing wild populations.
- (j) **Justify** the solution proposed in part (i) by describing an additional advantage, other than reestablishing the bobcat population near the farms.

Begin your response to this question at the top of a new page in the separate Free Response booklet and fill in the appropriate circle at the top of each page to indicate the question number.

4. Biogeochemical cycles describe the movement of certain elements (typically bound with other elements in compounds) through Earth's atmosphere, hydrosphere, biosphere, and lithosphere. These elements and their compounds are necessary components of all life, and because they cycle, they can be used repeatedly by new generations of organisms. Each biogeochemical cycle has different pathways with various reservoirs (sources and sinks) where elements may reside for days or millions of years.
- (a) The atmosphere is one important carbon reservoir.
 - (i) **Describe** a biological process by which carbon is removed from the atmosphere and converted to organic molecules.
 - (ii) **Describe** a biological process by which carbon is converted from organic molecules to a gas and returned to the atmosphere.
 - (b) Oceans and terrestrial systems are also important carbon reservoirs.
 - (i) **Explain** how atmospheric carbon is incorporated into two oceanic sinks.
 - (ii) **Identify** one terrestrial sink, other than fossil fuels, that stores carbon for thousands to millions of years.
 - (c) The burning of fossil fuels has been shown to increase the concentration of carbon in the atmosphere. **Discuss** TWO other human activities that increase the concentration of carbon in the atmosphere.
 - (d) **Identify** an environmental problem that results from elevated atmospheric carbon concentrations. **Discuss** one consequence of the problem you identified.
 - (e) Phosphorus is another element important to all organisms.
 - (i) **Describe** one major way in which the phosphorus cycle differs from the carbon cycle.
 - (ii) **Identify** one reason that phosphorus is necessary for organisms.

STOP

END OF EXAM