Assessment: Matching.

Match the following term to the correct definition, and then provide an example of tooth change.

An example is provided.

Evolutionary Concept	*Definition*	*Example.*
Morphology	Genetic changes in a species in response to evolutionary and environmental pressures.	*Browsers and grazers exhibit different tooth morphology depending on diet.*
Adaptation	The process by which a single species evolves into separate species.	_____ _____
Evolution	The independent evolution of similar structures or features in species of different lineages.	_____ _____
Convergent Evolution	The change in genetic traits of biological populations over successive generations.	_____ _____
Divergent Evolution	The form and structure of certain features of an organism.	_____ _____

Assessment. Answer 2 out of 3.

Why might **silica phytoliths** be better preserved in the fossil record than blades of grass or leaves?

When did **grasslands** first become an important ecosystem in North America- in the past 20,000 years or 20 million years? What global climate changes influenced the development of these new landscapes?

Pronghorns are an example of a hoofed mammal native to the North American Great Plains. Pronghorns have **highly hypsodont** teeth but only 12% of their diet consists of grasses. Why might this be the case?

Assessment Activity: Timeline

Instructions: place events correctly sequenced on the timeline.

First appearance of C4 grasses in the fossil record (10-20 % of grassland composition).

Grasslands are dominated by C4 grasses, representing over 50% of grass species.

Grasslands represent over 50% of habitat composition in the Great Plains of North America.

First appearance of high-crowned teeth in ancestral horses in the Great Plains of North America.

High-crowned teeth become the dominant tooth type in large land mammals in North America (reprensenting >50% of tooth types measured in the fossil tooth study).

Critical Thinking: Answer one out of the three.

Respond to the following sample arguments for or against the GRASS OR GRIT hypothesis.

Changes in tooth morphology favoring hypsodonty occur NOT ONLY in horses, but other species (such as rodents) that are not only eating grass. Is it accurate to say that changes in tooth morphology cannot be confined solely to grass?

How does the timing and spread of C4 grasses differ from that of the spread of open areas? How might this affect the evolution of mammals adapting to grassland environments?

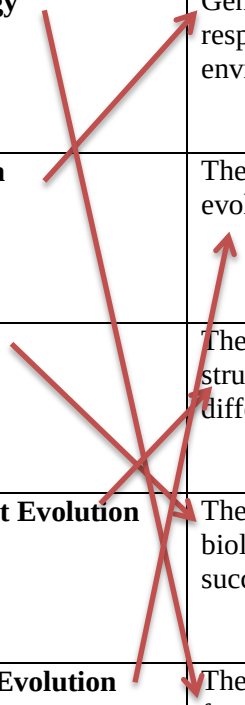
What might affect the spread of grassland environments, and favor certain types of grasses over others? (C4 and C3 grasses)

Assessment: Matching.

Match the following term to the correct definition, and then provide an example of tooth change.

An example is provided.

Evolutionary Concept	*Definition*	*Example.*
Morphology	Genetic changes in a species in response to evolutionary and environmental pressures.	Browsers and grazers exhibit different tooth morphology depending on diet.
Adaptation	The process by which a single species evolves into separate species.	Land mammals adapting to new open grassland habitats evolved specific morphological traits such as specialized teeth to deal with new diets.
Evolution	The independent evolution of similar structures or features in species of different lineages.	Many different species of land mammals evolved to match new open grassland habitats.
Convergent Evolution	The change in genetic traits of biological populations over successive generations.	Teeth with high-crowned molars (hypsodont dentition) evolved independently in rodents, rabbits and horses (all are different types of mammals).
Divergent Evolution	The form and structure of certain features of an organism.	Land mammals living in open grassland habitats evolved distinct morphological features to support a lifestyle of grazing grass different from other species evolved to live in forests.



Assessment. Answer 2 out of 3.

Why might **silica phytoliths** be better preserved in the fossil record than blades of grass or leaves?

Phytolith comes from the Greek “plant-stone”; silica phytoliths are rigid, microscopic structures in plant cells and tissues that are used for structural support. Because of their hard nature, they often persist after the decay of the plant. When plant tissues decompose, silica phytoliths remain in the soil and can be well preserved in the fossil record. For more information: http://depts.washington.edu/strmbrgl/StrombergLab_website/Phytoliths.html .

When did **grasslands** first become an important ecosystem in North America- in the past 20,000 years or 20 million years? What global climate changes influenced the development of these new landscapes?

Globally, large scale climactic cooling fragmented tropical forests and reduced tropical species, opening the landscape for dominance by grasslands 20 million years ago. Plants which used the C4 photosynthesis pathway are better adapted to drier climate and became more dominant in grasslands starting 8-5 million years ago. Today over 50% of grasses use C4 photosynthesis.

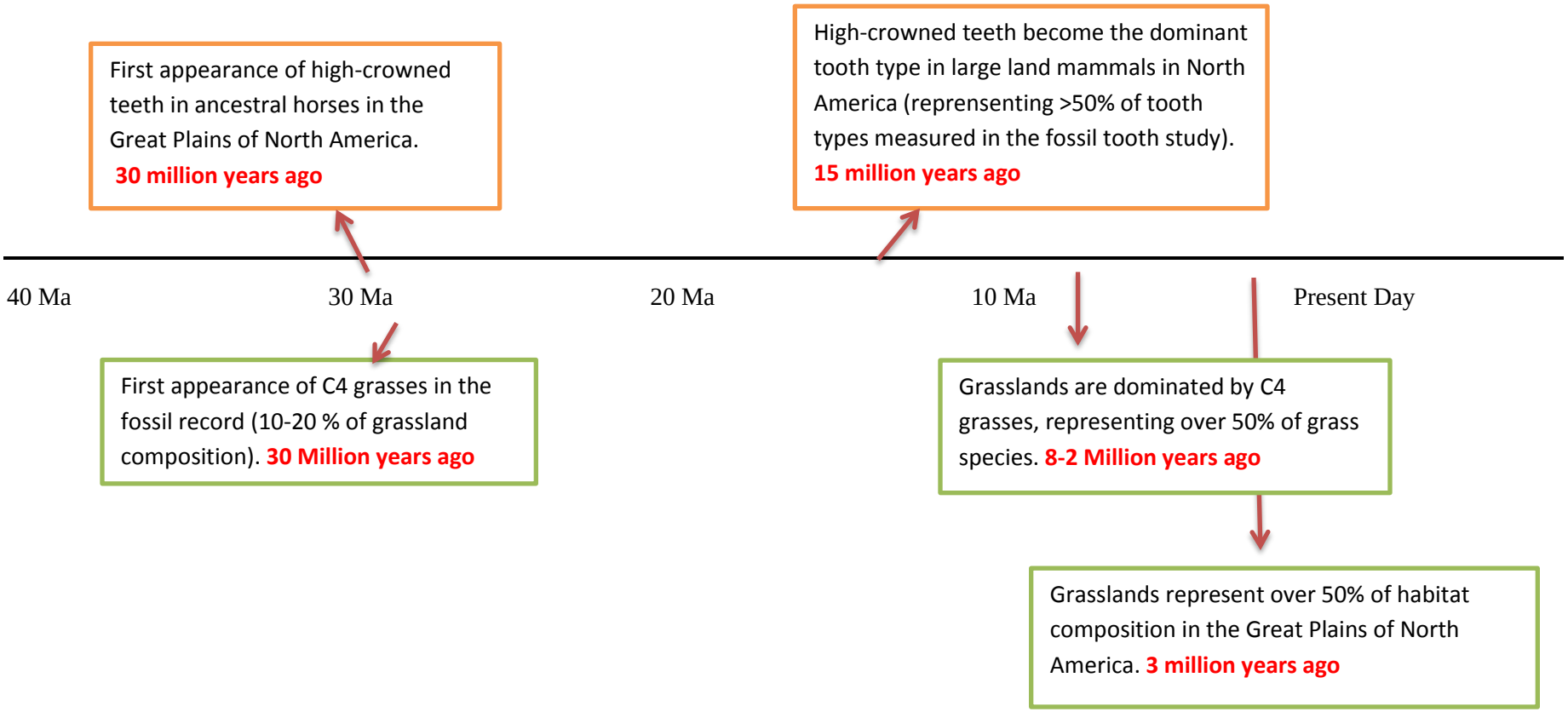
Pronghorns are an example of a hoofed mammal native to the North American Great Plains. Pronghorns have **highly hypsodont** teeth but only 12% of their diet consists of grasses. Why might this be the case?

Pronghorns consume large amounts of grit and soil by feeding in open prairies on low-lying shrubs and grasses that grow close to the ground.

(Extra Note: Pronghorns (the American antelope) are an example of a ‘relict’ species of megafauna native to the North American Great Plains. The North American pronghorn is one of the fastest species in the world, but today they lack their predatory counterpart, the extinct North American cheetah. The pronghorn is an example of a species which exhibits ‘relict’ evolutionary pressure.)

Assessment Activity: Timeline

Instructions: place events correctly sequenced on the timeline.



Critical Thinking: Answer one out of the three.

Respond to the following sample arguments for or against the GRASS OR GRIT hypothesis.

Changes in tooth morphology favoring hypsodonty occur NOT ONLY in horses, but other species (such as rodents) that are not only eating grass. Is it accurate to say that changes in tooth morphology cannot be confined solely to grass?

Changes in tooth types in other mammals who are not restricted just to eating grass suggest that high-crowned teeth developed for different reasons, perhaps due to the ingestion of more grit in small shrubs and grasses that were being consumed in open areas.

How does the timing and spread of C4 grasses differ from that of the spread of open areas? How might this affect the evolution of mammals adapting to grassland environments?

The spread of open areas (seen in the reduced land area for forests and reduction in warm tropical species such as palms) occurs much earlier than the dominance of grasslands by C4 grasses.

What might affect the spread of grassland environments, and favor certain types of grasses over others? (C4 and C3 grasses)

Changing climates and changes in the levels of carbon dioxide in the air may have caused plants to evolve specific adaptations such as the C4 photosynthetic pathway.