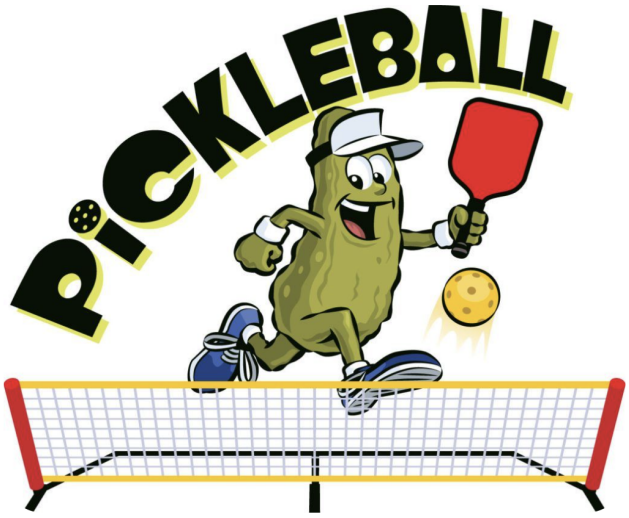

The Integration of STEM in Pickleball

Grade 7

Welcome to this Grade 7 Pickleball Unit Plan presented by a research team at George Mason University! Our goal with this plan is to present lesson activities for physical education instruction while integrating STEM content. Using Virginia Standards of Learning, we sought to combine relevant science topics for fifth graders with games to develop pickleball skills. This plan is flexible, so feel free to use this unit plan in its entirety, or use lesson activities and games as you see fit.

We have found that integrating STEM topics is extremely beneficial for students. Students can get extra time exploring their classroom content. This integration can also pique interest in activities for those who may not usually be as engaged during PE. Some of our lesson plans already include science concepts, but we encourage you to reach out to science teachers at your school to not only get some new ideas, but to make your curriculum custom to your students!

Good luck in your unit and lesson planning! We hope the activities presented are useful to you.

To learn more about the George Mason University 100% online Master's program in physical education:
https://education.gmu.edu/health-and-physical-education/med-physical-education
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Block Plan

The Integration of STEM in Pickleball Grade 7 Block Plan			
Day	**Objectives**	**PE Skills & STEM Content**	**Assessments**
1	Students will be able to understand the parts of the scientific method with 80% accuracy on the worksheet by filling out the scientific method worksheet and how to apply it to a situation by practicing their pickleball skills on a wall throughout the activity.	Scientific Method Wall Ball	Worksheet
2	Students will be able to understand that their heart rate or pulse rises as they work harder with 70% accuracy on their heart rate throughout the activity by writing it down on a piece of paper. Students will be able to demonstrate a competitive relationship as well as understand the game of pickleball by completing the check out slip with 80% accuracy at the end of the activity. Students will show understanding of the terminology, rules, and strategies by completing the "How well do you know Pickleball" assessment with an accuracy of 70% at the end of activity.	Balance It and Organism Competition Tag Activity	Check Out Slip Day 2
3	Students will be able to understand the different types of relationships in nature by 80%, more specifically a mutualistic relationship, by practicing dink shots and rallying on half of the court by peer assessment.	Begin with Symbiotic Singles and then Dinking and Aiming Recycling Activity. **PE skill resource:** 5 Keys to Successful Dinking **STEM Concept Resource:** **Recycling Video**	Check Out Slip Day 3 For PE assessment check out Dinking

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4	Students will be able to define two concepts* related to natural selection with 80% accuracy at the end of the unit. *(natural selection, adaptation, evolution, and fitness) Students will be able to identify the skill cues for the forehand and backhand volleys by performing these skills with 70% accuracy during teacher's observation.	Pancake Paddle and Volleying Natural Selection Activity **PE skill resource:** The Volley Top 3 Tips For Strong Pickleball Volleys **STEM Concept Resource:** Natural Selection Video	Assess students individually on how they are improving pickleball skills **For PE assessment check out** Volleying
5	Students will be able to list two advantages and two disadvantages of being predator and prey with 80% accuracy during peer assessment. Students will be able to demonstrate serving skills with at least 80% of accuracy throughout the unit.	Serving and Returning Predator versus Prey Activity **PE Skill Resource:** 5 Tips for PERFECT Pickleball Serve Technique **STEM Concept Resource:** Predator versus Prey Video	Discussion as described **For PE assessment check out** Serving
6	Students will learn about catastrophic disturbances and how they are more likely to be caused by climate change now while also challenging their pickleball skills.	Climate Change and Catastrophic Disturbances Activity **PE Skill Resource:** How to do a pickleball groundstroke for beginners **STEM Concept Resource:** Causes and Effects of Climate Change	Day 6 Kahoot to be played before and after pickleball game to check progress

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7	Students will be able to show their knowledge of unicellular vs. multicellular organisms by completing the worksheet with 80% accuracy by the end of the activity. Students will be able to demonstrate groundstrokes with at least 80% of accuracy throughout the activity.	Goundstrokes and Multicellular and Unicellular Activity **PE Skill Resource:** **STEM Concept Resource:** Unicellular and Multicellular	Check out Slip Day 7 **For PE assessment check out** Goundstrokes
8	Students will be able to explain their understanding of Earth's rotations and season creation by completing an assessment with 80% accuracy at the end of the unit plan. Students will be able to demonstrate serving skills with at least 80% of accuracy throughout the unit.	Serving and Solar System activity **PE Skill Resource:** 5 Tips for PERFECT Pickleball Serve Technique **STEM Concept Resource:** Why Do We Have Different Seasons? Seasons	Check out Slip Day 8 **For PE assessment check out** Serving
9	Students will be able to express their understanding of genetic variation by completing the worksheet with 80% accuracy at the end of the unit. Students will be able to demonstrate critical pickleball skills including dinking with at least 80% of accuracy during teacher's observation.	Dinking and Genetic Variation Activity **PE Skill Resource:** 5 Keys to Successful Dinking **STEM Concept Resource:** Genetic Variation	Check out Slip Day 9 **For PE assessment check out** Dinking
10	Students will be able to show their understanding of Earth's atmosphere by completing the assessment with 80% accuracy at the end of the unit. Students will be able to demonstrate serving skills with at least 80% of accuracy throughout the unit.	Serving and Atmosphere Measures Activity **PE Skill Resource:** 5 Tips for PERFECT Pickleball Serve Technique **STEM Concept Resource:** The Earth's Atmosphere: Up and beyond the sky	Check Out Slip Day 10 **For PE assessment check out** Serving

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Virginia Standards of Learning

Physical Education SOL's

- 7.1.a The student will be able to demonstrate and apply mature movement forms and skill combinations competently in a variety of cooperative and tactical activities that include dynamic and unpredictable situations.
- 7.1.c The student will be able to demonstrate the movement learning progression (practice, self or peer assessment, correct, practice at a higher level, and reassess) for a specific skill or activity.
- 7.2.b The student will be able to analyze skill patterns and movement performance of self and others, detecting and correcting mechanical errors and describing balance in the planes of movement for selected movements.
- 7.3.b The student will be able to use a variety of resources, including available technology, to evaluate, monitor, and record activities for fitness improvement.
- 7.4.a The student will be able to explain the importance of cooperating with classmates, and demonstrate supportive behaviors that promote the inclusion and safety of others.
- 7.4.b The student will be able to identify specific safety concerns associated with at least one activity that includes rules, equipment, and etiquette.

STEM SOL's

- LS.3 The student will investigate and understand that there are levels of structural
- organization in living things. Key ideas include unicellular and multicellular organisms have comparative structures;
- LS.7.a The student will investigate and understand that interactions exist among members of a population. Key concepts include a) competition, cooperation, social hierarchy, territorial imperative.
- LS.8.b The student will investigate and understand interactions among populations in a biological community. Key concepts include the relationship between predators and prey.
- LS.11.e The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include environmental issues.
- LS.13.a The student will investigate and understand that populations of organisms change over time. Key concepts include the relationships of mutation, adaptation, natural selection, and extinction.
- LS.11.a) mutation, adaptation, natural selection, and extinction change populations;c The student will investigate and understand that populations of organisms can change over time. Key ideas included environmental factors and genetic variation, influence survivability and diversity of organisms
- The student will investigate and understand that there are levels of structural
- organization in living things. Key ideas include

- b) unicellular and multicellular organisms have comparative structures;

- LS. 6.7.b.e The student will investigate and understand that air has properties and that Earth's atmosphere has structure and is dynamic. Key ideas include the atmosphere has physical characteristics; atmospheric measures are used to predict weather conditions;
- LS. 6.3.d The student will investigate and understand that there is a relationship between the sun, Earth, and the moon. Key ideas included the rotation of Earth in relationship to the sun causes day and night;Earth's tilt as it revolves around the sun causes the seasons

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Objectives

Physical Education Objectives

Psychomotor Skills

- Students will be able to demonstrate critical pickleball skills including dinking with at least 80% of accuracy during teacher's observation.
- Students will be able to demonstrate volleying skills with at least 80% of accuracy during peer assessment.
- Students will be able to demonstrate groundstrokes with at least 80% of accuracy throughout the activity.
- Students will be able to demonstrate lobbying skills with at least 80% of accuracy by the end of the unit plan.
- Students will be able to demonstrate serving skills with at least 80% of accuracy throughout the unit.
- Students will be able to perform basic paddle skills with an accuracy of at least 80% by the end of the unit.
- Students will be able to perform the forehand and backhand lob assessment with 80% accuracy during the activity.
- Students will be able to demonstrate rallying skills with at least 80% of accuracy during peer assessment.
- Students will be able to use various shots learned throughout the pickleball unit in a regulation pickleball game with a 80% during peer observation.

Cognitive Skills

- Students will show understanding of the terminology, rules, and strategies by completing the "How well do you know Pickleball" assessment with an accuracy of 70% at the end of activity.
- Students will be able to identify the skill cues for the forehand and backhand volleys by performing these skills with 70% accuracy during peer observation.

STEM Objectives

- Students will be able to understand the parts of the scientific method with 80% accuracy by filling out the scientific method worksheet and how to apply it to a situation by practicing their pickleball skills on a wall throughout the activity.
- Students will be able to understand that their heart rate or pulse rises as they work harder with 70% accuracy throughout the activity by writing it down on a piece of paper
- Students will be able to understand the different types of relationships in nature by 80%, more specifically a mutualistic relationship, by practicing dink shots and rallying on half of the court by peer assessment.
- Students will be able to count to the highest number by peer assessment with 90% accuracy.
- Students will be able to give three examples of the environmental harm of not recycling with 80% accuracy at the end of the unit.
- Students will be able to list two advantages and two disadvantages of being predator and prey with 80% accuracy during peer assessment.
- Students will be able to define two concepts* related to natural selection with 80% accuracy at the end of the unit. *(natural selection, adaptation, evolution, and fitness)
- Students will be able to show their understanding of catastrophic disturbances by completing the kahoot with 70% accuracy at the end of the activity.

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- Students will be able to demonstrate a competitive relationship as well as understand the game of pickleball by completing the check out slip with 80% accuracy at the end of the activity.
- Students will be able to show their understanding of Earth's atmosphere by completing the assessment with 80% accuracy at the end of the unit.
- Students will be able to show their knowledge of unicellular vs. multicellular organisms by completing the worksheet with 80% accuracy by the end of the activity.
- Students will be able to express their understanding of genetic variation by completing the matching worksheet with 80% accuracy at the end of the unit.
- Students will be able to explain their understanding on Earth's rotations and season creation by completing an assessment with 80% accuracy at the end of the unit plan.

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Organization

Time
Unit plan is approximately eight, thirty to forty-five minute, lessons.

Space Needed
A pickleball court is approximately 44 feet long and 20 feet wide. A smaller or larger court can be used if it is the only option!

Equipment and Supplies

- Three different colored hula hoops per two students, and as many pickleballs as one can get (in various and corresponding colors to hula hoops).
- Pickleball paddles, enough for every student.

Basic Grouping of Students
For most activities, students will be in teams of two, unless working on individual skill building activities.

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Content

Introduction to Pickleball

Pickleball has elements of three different games including tennis, badminton, and ping-pong. Pickleball was created in 1965 by Joel Pritchard, Bill Bell, and Barney McCallum.

In 1970 to 1980 pickle ball became well known both in the U.S and abroad. The first official tournament was hosted in 1976. By the 1990s the game was played in all of the 50 states. In 2008, the USAPA published the first official Pickleball Tournament Rulebook. Pickleball was named as the fastest-growing sport in the U.S., according to the Sports & Fitness Industry Association in 2015. In 2015 the US Open Pickleball Championship was founded.

Basic Rules

- Pickleball is played either as doubles (two players per team) or singles; doubles is most common
- The same size playing area and rules are used for both singles and double
- The height of the net should be kept around 34 inches in the center of the court

The Serve

- The server's arm must be moving in an upward arc when the ball is struck.
- Paddle contact with the ball must not be made above the waist level.
- The head of the paddle must not be above the highest part of the wrist at contact.
- At the time the ball is struck, the server's feet may not touch the court or outside the imaginary extension of the sideline or centerline and at least one foot must be behind the baseline on the playing surface or the ground behind the baseline.
- The serve is made diagonally crosscourt and must land within the confines of the opposite diagonal court.
- Only one serve attempt is allowed per server.

Serving Sequence

- Both players on the serving doubles team have the opportunity to serve and score points until they commit a fault *(except for the first service sequence of each new game).
- The first serve of each side-out is made from the right/even court.
- If a point is scored, the server switches sides and the server initiates the next serve from the left/odd court.
- As subsequent points are scored, the server continues switching back and forth until a fault is committed and the first server loses the serve.
- When the first server loses the serve the partner then serves from their correct side of the court (except for the first service sequence of the game*).
- The second server continues serving until his team commits a fault and loses the serve to the opposing team.
- Once the service goes to the opposition (at side out), the first serve is from the right/even court and both players on that team have the opportunity to serve and score points until their team commits two faults.
- In singles the server serves from the right/even court when his or her score is even and from the left/odd when the score is odd.
- *At the beginning of each new game only one partner on the serving team has the opportunity to serve before faulting, after which the service passes to the receiving team.

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Scoring

- Points are scored only by the serving team.
- Games are normally played to 11 points, win by 2.
- Tournament games may be to 15 or 21, win by 2.
- When the serving team's score is even (0, 2, 4, 6, 8, 10) the player who was the first server in the game for that team will be in the right/even court when serving or receiving; when odd (1, 3, 5, 7, 9) that player will be in the left/odd court when serving or receiving.

Two-Bounce Rule

- When the ball is served, the receiving team must let it bounce before returning, and then the serving team must let it bounce before returning, thus two bounces.
- After the ball has bounced once in each team's court, both teams may either volley the ball (hit the ball before it bounces) or play it off a bounce (ground stroke).
- The two-bounce rule eliminates the serve and volley advantage and extends rallies.

Non-Volley Zone

- The non-volley zone is the court area within 7 feet on both sides of the net.
- Volleying is prohibited within the non-volley zone. This rule prevents players from executing smashes from a position within the zone.
- It is a fault if, when volleying a ball, the player steps on the non-volley zone, including the line and/or when the player's momentum causes them or anything they are wearing or carrying to touch the non-volley zone including the associated lines.
- It is a fault if, after volleying, a player is carried by momentum into or touches the non-volley zone, even if the volleyed ball is declared dead before this happens.
- A player may legally be in the non-volley zone any time other than when volleying a ball.
- The non-volley zone is commonly referred to as "the kitchen."

Line Calls

- A ball contacting any part of any line, except the non-volley zone line on a serve, is considered "in."
- A serve contacting the non-volley zone line is short and a fault.

Faults

- A fault is any action that stops play because of a rule violation.
- A fault by the receiving team results in a point for the serving team.
- A fault by the serving team results in the server's loss of serve or side out.

Determining Serving Team

- Any fair method can be used to determine which player or team has the first choice of side, service, or receive. (Example: Write a 1 or 2 on the back of the score sheet.)

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Skills

1) Serving
    a) To place the ball in play with the paddle
    b) Hit with an underhand stroke and contact with ball is made below the waist
    c) Serve diagonally to the opposite side of the opposite service court
    d) "Drop serve" can be used where the server can drop the ball, let it bounce, and then hit the ball to serve.
    e) Learn more and watch videos about serving here
2) Dinks
    a) A light hit from your non-volley zone. to the opposing sides, non-volley zone
    b) The ball will arc downward when crossing the net
    c) Learn more and watch videos about dinks here
3) Drop Shot
    a) A soft shot hit from a deep bounce intended to land in the persons non-volley zone, close to the net
    b) Learn more and watch videos about drop shots here
4) Groundstroke
    a) Forehand groundstroke: Avoid reaching, pivot shoulders, and step forward with foot towards the direction the ball is going to go in. The paddle is slightly angled and follows through.
    b) Backhand groundstroke: Avoid reaching, move feet, move hips sideways, and move paddle across body and follow through.
    c) Learn more and watch videos about groundstrokes here
5) Volleys
    a) The ball is hit in the air, returning it back to the other player
    b) Can be forehand or backhand
    c) Learn more and watch videos about volleys here
6) Lobs
    a) A shot that leads the ball to go high and deep into the opposing players court
    b) A defensive technique
    c) Learn more and watch videos about lobs here
7) Overhead Smash
    a) An overhand shot in which the ball will go directly downward
    b) A defensive technique
    c) The paddle is extended over head and the elbow is straight
    d) Learn more and watch videos about overhead smashes here

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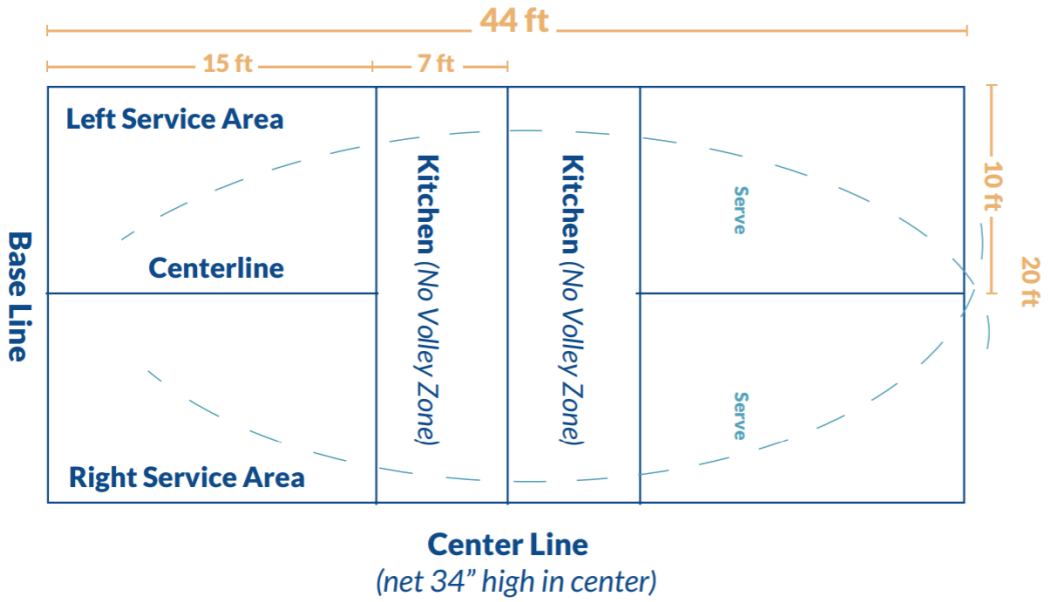
Pickleball Court & Markings



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Lead Up Games

1) **Scientific Method Wall Ball**
   a) Using a paddle, ball, and a wall, have the students practice serving and volleying against a wall.
   b) This lead up game will talk more about the scientific method. The scientific method is a way of researching a certain topic. It has about six components.
      i) The problem or question= what the student wants to answer
      ii) The hypothesis= what they think is going to happen
      iii) The procedure= what are they going to do to answer the problem or question
      iv) The data= what actually happened during the procedure
      v) The observations= what they perceived happened during procedure
      vi) The conclusion= what they will do next time and if hypothesis was correct/incorrect
   c) If the ball goes out of control, have the studentevaluate their error, and hypothesize to make a prediction on how the fixed solution will better the outcome.
   d) If no error occurs, still have the student explain if their hypothesis was correct/incorrect.
   e) Have the student keep count of how many times they can hit it against the wall at a time and have them fill out the worksheet on scientific method.
   f) OBJECTIVE: Students will be able to understand the parts of the scientific method with 80% accuracy by filling out the scientific method worksheet and how to apply it to a situation by practicing their pickleball skills on a wall throughout the activity
   g) Check out our youtube video for more details

2) **Balance It**
   a) To begin, educate students on the game of pickleball as described above.
   b) Using a paddle and a pickleball students will try to balance their ball on their paddle.
   c) The students will be wearing a heart rate monitor, and will be able to see how fast their heart rate will rise as this activity progresses.
   d) In order to make it harder, ask them to use a non-dominant hand, jump on one foot, etc.
   e) MODIFICATION: if heart rate monitor is not available, have students check pulse on wrist and write down their numbers every minute on a blank sheet of paper to watch the increase/decrease.
   f) OBJECTIVE: Students will be able to understand that their heart rate or pulse rises as they work harder with 70% accuracy throughout the activity by writing it down on a piece of paper.
   g) Check out our youtube video for more details

3) **Symbiotic Singles**
   a) This game is to be played with two people.
   b) Both will work together to practice hitting dink shots on half of the court.
   c) Students will stand on opposite sides of the net in the "serve" area of the court. Instead of serving diagonally across the court, they will be hitting it to the person directly in front of them.

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d) The purpose of the activity is to practice dink shots as well as practicing rallying.
e) Before the activity begins discuss all kinds of relationships using the terms provided down below→
    i) mutualism= relationship between organisms of different species, in which both organisms benefit from the association
    ii) commensalism= relationship between organisms where one organism benefits from the association while not harming the other
    iii) predation= behavior of one animal feeding on another
    iv) competition= contest between organisms for resources, recognition, or group or social status
f) This will demonstrate a mutualism symbiotic relationship where both students are benefitting from this warm up activity.
g) This activity will not cover the other relationships, but it is good to educate students on them.
h) Another team will be working right next to them on the other side of the court performing the same relationship.
i) OBJECTIVE: Students will be able to understand the different types of relationships in nature by 80%, more specifically a mutualistic relationship, by practicing dink shots and rallying on half of the court by peer assessment.
j) Check out our youtube video for more details

4) Pancake Paddle

a) In order to develop the forehand and backhand technique, pancake paddle will be played.
b) In teams of two, each pair needs one pickleball and two paddles.
c) A jump rope will be placed on the ground, creating a small court, and students will bounce the ball over the rope and practice hitting it back and forth.
d) With every hit of the ball, the students will alternate using forehand and backhand.
e) Students will count how many times they can hit it back and forth, and try to get the highest score in the class.
f) OBJECTIVE: Students will be able to count to the highest number by peer assessment with 90% accuracy.
g) Check out our youtube video for more details

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Activities to Develop Skills

1) Dinking and Aiming Recycling Activity

a) First educate students on the harm of not recycling for the environment→ collapse of ecosystems, climate change, pollution, and overflowing of landfills.
   i) Not recycling contributes to the collapse of ecosystems since it contributes to air pollution when it just ends up in a landfill instead of a place where the material can be broken down.
   ii) Instead of using the same material over and over again, if an item that could be recycled is thrown away, more raw materials, such as trees will be cut down, thus contributing to climate change.
   iii) The overflow of landfills is self explanatory andwill overall end up polluting air and water, thus making humans and animals sick.

b) On each side of a pickleball court place three bins or garbage cans (total six bins), one representing paper disposal, one for glass disposal, and one for plastic disposal.

c) Students will be given a mix of different colored pickleballs and the teacher will designate a color to each category (paper, glass, plastic, and trash).

d) There will be two teams, four players in total. During the game, only one player from each team will practice aiming, while their partner hands them the balls and ensures the ball successfully bounces in the correct bin.

e) The players will try to successfully and quickly grab the balls from their partner and aim them into the corresponding bins, which will demonstrate the sorting of items into recycling.

f) If a player comes across a "trash" pickleball, they will have to aim at those anywhere outside of the bins.

g) Whichever side has the most and correct amount of pickleballs in the bins, wins. Three rounds will be played. Winners move up a court and losers move down a court.

h) MODIFICATION: The size of the bins can vary, if thegame is too easy, put down smaller bins, if it is too hard, make them bigger.

i) OBJECTIVE: Students will be able to give three examples of the environmental harm of not recycling with 80% accuracy at the end of the unit.

j) Have students fill out "Check Out Slip Day 3"

2) Serving and Returning Predator versus Prey Activity

a) In either teams of one or two depending on the situation, one team will be assigned to be the top predator while the other is the prey.
   i) Top predator=species at the top of the food chain, with no predators of its own. Also called an alpha predator or apex predator.
   ii) Prey= animal that is hunted and eaten by other animals.

b) The two teams will be playing a basic game of pickleball, while taking on the role of either predator or prey.

c) If they are the predator, they will serve balls to the prey and rally with the prey. They also can add multiple balls in the court at a time, if they can handle it.

d) If they are the prey, they will play the game on a scooter board. At a disadvantage, this will demonstrate the predator and prey concept. They will try their hardest to volley the balls back to the predator.

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e) Every minute, the students will rotate to have a chance to experience both roles.
f) MODIFICATION: If scooter boards are not available, have students bend down and play while squatting.
g) OBJECTIVE: Students will be able to list two advantages and two disadvantages of being predator and prey with 80% accuracy during peer assessment.

3) Volleying Natural Selection Activity
Explain what natural selection is and define natural selection, adaptation, evolution, and fitness.

a) The pickleball game will be played as normal and all rules will be followed. The trick here is to tell all the students to use their non-dominant hands.
b) Some students will persevere and be able to adapt to the changes, while some will not. This will demonstrate and teach natural selection in an environment.
   i) Natural Selection= the process through which species adapt to their environments. It is the engine that drives evolution.
   ii) Adaptation= adaptation is the biological mechanism by which organisms adjust to new environments or to changes in their current environment
   iii) Evolution= change in heritable traits of a population over time.
c) Since natural selection is all about adapting to new environments, using their non-dominant hand will be something new for the students to try, as well as seeing if they can adapt to that change. It will take some getting used to, but after a while most students will get better and better.
d) MODIFICATION: If non-dominant hands do not work out, think of a new challenge such as using a smaller paddle, different object they are striking such as a tennis ball etc.
e) OBJECTIVE: Students will be able to define two concepts* related to natural selection with 80% accuracy at the end of the unit. *(natural selection, adaptation, evolution, and fitness)

4) Climate Change and Catastrophic Disturbances Activity

a) Demonstrates that even small disturbances cause catastrophic disturbances in an environment which contributes to climate change.
b) Small disturbances, such as local flooding, seasonal fires, and disease outbreaks, over time, trigger bigger catastrophic disturbances, for example, state-wide fires, volcanic eruptions, hurricanes, tsunamis, etc.
c) These small disturbances occur due to climate change because of rising sea water temperatures, air pollution, etc.
d) To begin, have students play the "kahoot" for a pre-assessment and to learn more.
e) This activity should be played as a normal pickleball game.
f) At random times, the teacher will tell students that one part of the court is a no-play zone due to a fire, volcanic eruption, hurricanes, etc.
g) Students will have to avoid those parts of the court, and the other team can use them to their advantage in order to win.
h) This will demonstrate the severity of climate change caused catastrophic disturbances, and how such a small change in the court can be the end to a pickleball game.

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i) MODIFICATION: If students are not following the rules, cones can be placed to dictate which parts of court are no-play zones.
j) OBJECTIVE: Students will be able to show their understanding of catastrophic disturbances by completing the kahoot with 70% accuracy at the end of the activity.
k) Have students play the "kahoot" again for a post-assessment.

5) Organism Competition Tag Activity

a) Life Science covers organism competition in nature and how animals compete in the wild for food, habitat, etc.
b) All students will be given a paddle.
c) In this game, the students will be divided into two teams, the taggers and those who are going to avoid being tagged.
d) The students will be competing for "food", which will be pickleballs in this case.
e) There will be approximately twenty pickleballs on the ground of the gymnasium or wherever available.
f) Students who are avoiding being tagged, will run to the pickleballs, pick them up, place them on their paddle, and run them back to their "shelter" which are hula hoops, or the side of the gymnasium, all while keeping the ball balanced.
g) The taggers will be balancing a pickleball and trying to tag the opposing team as they are collecting food.
h) The objective of the game is to keep the pickleball balanced on the paddle as they are running around. All students regardless of position are going to be balancing the pickleball.
i) If a player gets tagged, the "food" will be dropped and they have to return to their "habitat".
j) If the "food" falls off the paddle, the student willreturn to their "habitat" and try again.
k) This demonstrates a competition since the teams are competing to win.
l) Every few minutes, the students will change roles.
m) MODIFICATION: Instead of tag or running around, students can use scooter boards or another method of differentiating the two groups.
n) OBJECTIVE: Students will be able to demonstrate a competitive relationship as well as understand the game of pickleball by completing the check out slip with 80% accuracy at the end of the activity.
o) Have students fill out "Check Out Slip Day 2"

6) Serving and Atmosphere Measures Activity

The purpose of this activity is that the students understand that the atmosphere has physical characteristics. The students will understand that physical characteristics such as wind patterns can impact weather conditions. This will be done by using an oscillating fan (as wind), and showing how the movement of the ball (moisture)differs each time the direction of the electric fan changes.
Materials include: paddles, balls, and oscillating fan (each group of 4 students needs one oscillating fan), Baskets(each group of 4 students needs one basket)

a) This game will be played like a normal pickleball game but with some modifications. Students will work in groups of 4. Each group will have one oscillating fan, 4 balls, and four paddles. The oscillating fan and the basket should be placed on opposite sides of the court. The student #1 will grab the ball (moisture) and then try to do a

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serve into the basket while the oscillating fan is on (facing towards the student #1). Student #2 will grab the ball (moisture) and then try to do a serve into the basket, but this time the oscillating fan will be turned to the left a little bit (in order to create a different wind direction). Student #3 will grab the ball (moisture) and then try to do a serve into the basket, but this time the oscillating fan is turned to the right a little bit (in order to create a different wind direction). Student #4 will grab the ball (moisture) and then try to do a serve into the basket, but this time the oscillating fan is faced up a little bit (in order to create a different wind direction). After each student of group serves the ball into the basket, have students compare how wind direction (oscillating fan) impacts the movement of moisture and thus affecting the weather conditions. The teacher can have a short class discussion about this concept and show this video (The Earth's Atmosphere: Up and beyond the sky for more information. Students can also fill out the worksheet to show their understanding of this concept.

b) MODIFICATION: if the school doesn't have the oscillating fan, then the students can play the game outside.

c) OBJECTIVE:
   - Students will be able to show their understanding of Earth's atmosphere by completing the worksheet with 80% accuracy at the end of the unit.
   - Students will be able to demonstrate serving skills with at least 80% of accuracy throughout the unit.

7) **Groundstrokes and Multicellular and Unicellular Activity**

The purpose of this activity is that students understand the difference between the multicellular and unicellular activity. In this activity the students will be able to learn the difference about these organisms but also practice their groundstrokes skills. This game will be played in a normal pickleball game.

Equipment needed: 1 ball, 5-6 balls with different colors (red, blue, orange, purple, green, yellow), and paddles

a. In this activity, the number of balls represents the number of cells. Because unicellular organisms are made of only one cell, only one ball is used to show unicellular material. For representing multicellular organisms 5-6 balls were used. The different colors of the ball represents the complexity of the organism, meaning if one color is used the organism is simple, while many different balls represent a complex organism such as a multicellular organism.

b. This activity involves two groups of students. Group A and Group B will consist of two students in each group. Group A will play the unicellular part of the activity and group B will play the multicellular activity. Group A will grab one ball and perform shots (groundstroke) to the other student. After group A has performed multiple consecutive shots, the teacher can stop the student and explain to students that unicellular organisms consist of only one cell and they are not complex. Next, Group B will grab the bag consisting of balls with multiple colors. Each time, a student in Group B will grab a red ball and perform a shot, then grab another ball with a different color and perform a shot. Group B students will need to perform a shot (groundstrokes) with all of the different balls. Once group B has finished, the teacher can give a short explanation on multicellular organisms. The teacher can further clarify that multicellular organisms are complex hence why multiple colors have been chosen

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to represent them, while unicellular organisms are simple so only one color is used to show them.

c. MODIFICATION: If the school doesn't have different ball colors, the teacher can only talk about the number of cells and omit talking about complexity of the unicellular and multicellular organisms.

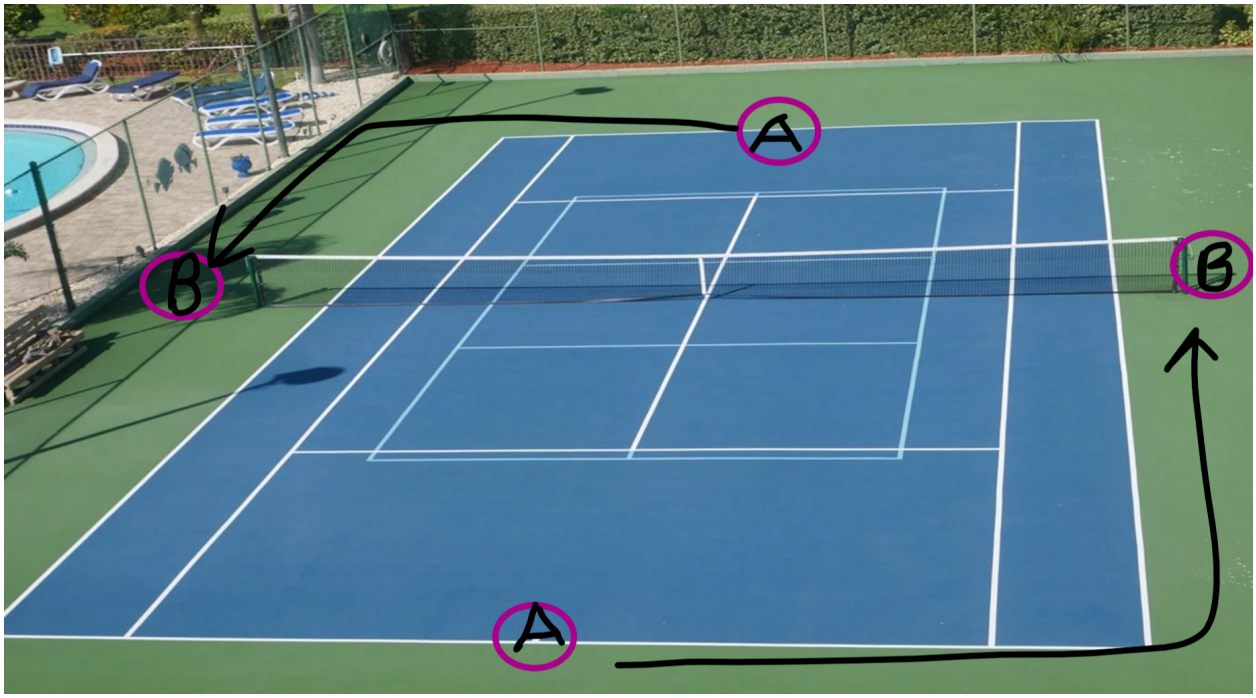
d. OBJECTIVE:
   - Students will be able to show their knowledge of unicellular vs. multicellular organisms by completing the worksheet with 80% accuracy by the end of the activity.
   - Students will be able to demonstrate groundstrokes with at least 80% of accuracy throughout the activity.

8) **Serving and Solar system**

The purpose of this activity is that the students understand how the rotation of Earth allows day and night. The students understand that the seasons are created due to different combinations.
More information for teacher: Seasons are caused by a combination of the tilt of the Earth on its axis, the curvature of Earth's surface and the angle at which sunlight strikes the surface of Earth during its annual revolution around the sun (SOL Pass Virginia)

Equipment needed: Paddles and balls

Pickleball Court Diagram:



a. This game is played on a pickleball court and it follows normal pickleball rules. The game is played in groups of two students. In this game, the student #1 and student #2 will represent Earth and the net will represent the Sun. The two students in the group will stand on opposite sides of the court, location A (as shown in the picture). Then, the teacher will carry the discussion that the student #1 represents Spring and student #2 represents Autumn. Student #1 will pick the ball and hit to the student #2 (serve). Then, the students #1 and #2 will move to the location B (as shown in the picture). The teacher will explain that the student #1 represents Winter and students #2 represents Summer. Once the students have

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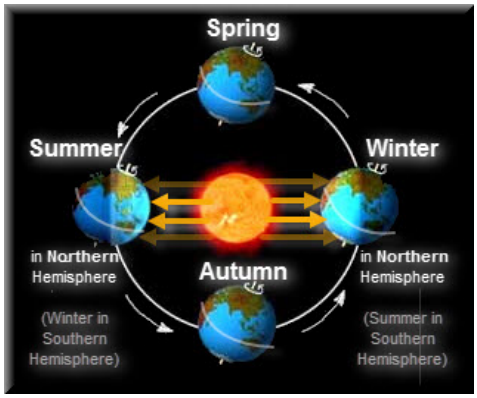
understood what their positions mean, they will be directed to their previous position (location A). Then, the students will be asked to continue to play normal pickleball. The teacher can have a discussion about this concept toward the end of the class and show this video (Why Do We Have Different Seasons?).

b. OBJECTIVE:

- Students will be able to explain their understanding on Earth's rotations and season creation by completing an assessment with 80% accuracy at the end of the unit plan.
- Students will be able to demonstrate serving skills with at least 80% of accuracy throughout the unit.

c. RESOURCES:

- https://www.solpass.org/science6-8-new/s6/standards6/6-2-standards-space-2018.html?section=study-1
- Why Do We Have Different Seasons?
- Seasons
- Teachers can use this image to further clarify the concept of Seasons.
-



9) **Dinking and Genetic Variation**

The purpose of this activity is that students understand what genetic variation means and how it affects the overall genome. The students will also get familiar with concepts like mutation, adaptation, natural selection, and extinction and how it relates to the human genome. The students will also work on their thinking skills. This game will be played on a normal pickleball court.

Materials include: multiple bags, multiple baskets, multiple ball colors, and paddles

a. Students will work in pairs. Each group will share a bag of ~20 balls and each student will have their own basket that they will be dinking into. The baskets should be placed on the opposite side of the net. Students will grab a ball (chromosomes) from the bag without looking and then try to toss it into their basket to form their own individual genetic makeup. After each group has finished tossing all the balls in their bag, have students compare the color of the balls with their partner. After completion of this activity the students can fill out the worksheet about the genetic variation.

b. OBJECTIVE:

- Students will be able to demonstrate critical pickleball skills including dinking with at least 80% of accuracy during teacher's observation.
- Students will be able to express their understanding of genetic variation by completing the worksheet with 80% accuracy at the end of the unit.

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Assessment Tools

Day 1 Worksheet for students for Scientific Method Wall Ball
https://www.nationalgeographic.org/media/scientific-method-chart/

Day 5 Students will be asked to list two advantages and two disadvantages of being predator and prey

Day 6 Kahoot on Catastrophic Disturbances to help students learn and test their knowledge
https://www.nationalgeographic.org/interactive/catastrophic-weather-events/

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Assessments:

Check Out Slip Day 2

Name:

How well do you know Pickleball?	True or False, if False write the "true" answer
1. The height of the net should be 10 inches high.	
2. If the ball hits the line, it is considered "out".	
3. Games are played until 11 points and tournaments are played until 15 or 21 points.	
4. Games and tournaments win by 3 points.	

Answer Key to Check Out Slip Day 2

1. False, 34 inches high
2. False, it would be considered "in"
3. True
4. False, win by 2 points

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Check Out Slip Day 3

Name:

Directions: Match the correct relationship to the definition

Mutualism

relationship between organisms of different species, in which both organisms benefit from the association

Commensalism

behavior of one animal feeding on another

Predation

contest between organisms for resources, recognition, or group or social status

Competition

relationship between organisms where one organism benefits from the association while not harming the other

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Answer Key to Check Out Slip Day 3
Mutualism= relationship between organisms of different species, in which both organisms benefit from the association
Commensalism= relationship between organisms where one organism benefits from the association while not harming the other
Predation= behavior of one animal feeding on another
Competition= contest between organisms for resources, recognition, or group or social status

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Check Out Slip Day 7

Fill in the blanks with words from the word bank.

Complex	Multicellular organisms	unicellular organism	yeast
amoeba	simple	bacteria	

1. _____ are made of only one cell.
2. _____are made of many cells.
3. Multicellular organisms are known to be _____.
4. Unicellular organisms are known to be _____.

Answer Key to Check Out Slip Day 7

1. Unicellular organisms
2. Multicellular organisms
3. Complex
4. simple

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Check Out Slip Day 8

Fill in the blanks with words from the word bank.

weather	angle	seasons	moisture	air pressure
Earth's surface	Earth	rotates		

1. The interactions and orientations of the sun, Earth, and moon lead to patterns that are evidenced in _____.
2. As Earth_____, different sides of Earth face toward or away from the sun, thus causing day and night, respectively.
3. Seasons are caused by a combination of the tilt of _____ on its axis, the curvature of _____and, thus, the _____ at which sunlight strikes the surface of Earth during its annual revolution around the sun.

Answer Key to Check Out Slip Day 8:

1. Seasons
2. rotates
3. Earth, Earth's surface, angle

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Check Out Slip Day 9

Fill in the blanks with words from the word bank.

Chromosomes	Gene Variation	Genes	RNA
Genome	Nucleotides	DNA	

1. _____ is made of chromosomes.
2. _____is all the hereditary information of an organism.
3. _____refers to differences among the genomes of members of the same species.

Answer Key to Check Out Slip Day 9

1. DNA
2. Genome- it is all the hereditary information of an organism.
3. Genetic Variation- refers to differences among the genomes of members of the same species.

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Check Out Slip Day 10

Fill in the blanks

1. _____ is a mixture of gaseous elements and compounds. These include nitrogen, oxygen, water, argon and carbon dioxide.
2. Air exerts _____.
3. _____are important indicators of atmospheric conditions.
4. The atmosphere is made up of layers (_____, stratosphere, _____, and thermosphere) that have distinct characteristics.
5. _____ are important for understanding and predicting the weather.
6. Maintaining good _____is a crucial goal for modern society, and it is everyone's responsibility to work toward it.

Answer Key to Check Out Slip Day 10:

1. Air
2. Pressure
3. Clouds
4. Troposphere, Mesosphere
5. Weather Maps
6. Air quality

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Skill Assessment

Skill Assessment	
Name:	Date:

SKILLS		Never	Sometimes	Usually	Always
Groundstrokes	Knows all the main rules including correcting the score and server				
	Demonstrates control/consistency on backhand groundstrokes				
	Demonstrates control/consistency on forehand groundstrokes				
	Able to play with partners effectively, uses court strategies like partner communication				
	Has good mobility				
	Uses slower paced shots vs faster paced shots to their advantage				
	Has good hand-eye coordination				
Serving	Knows all the main rules including correcting the score and server				
	Has good mobility				
	Has good hand-eye coordination				
	Places serves deep in the court				
	Uses deeper and higher returns of serve to approach the net quicker				
	Avoids hitting out balls				
	Consistently returns lower balls over the net				
	Demonstrates a wide variety of shots with some consistency				
	Adjusts to differing ball speeds consistently				
	Uses slower paced shots vs faster paced shots to their advantage				

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Volleying	Has good mobility				
	Has good hand-eye coordination				
	Sustains a short volley session at the net with some placement and control				
	Quickly approaches the non-volley line				
	Uses slower paced shots vs faster paced shots to their advantage				
	Able to play with partners effectively, uses court strategies like partner communication				
	Demonstrates a wide variety of shots with some consistency				
Dinking	Has good mobility				
	Has good hand-eye coordination				
	Initiates and maintains a sustained dink exchange at the net				
	Uses slower paced shots vs faster paced shots to their advantage				
	Able to play with partners effectively, uses court strategies like partner communication				
	Demonstrates a wide variety of shots with some consistency				
Rallying	Developing patience during rallies				
	Has good hand-eye coordination				
	Has good mobility				

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P.E. Glossary of Terms

*All terms have been defined through the USA Pickleball Organization *

Backhand Groundstroke- Used when a ball is approaching the side opposite the paddle arm. However, many players consider the backhand groundstroke as their "go to" shot and use it for up to 75-percent of their groundstrokes.

Dink- A soft shot hit on a bounce from the NVZ intended to arc over the net and land within the opposing NVZ either straight across or diagonally crosscourt.

Drop shot- The drop is a soft shot hit off a bounce from deep in the court, intended to land in the opponents' NVZ, preferably close to the net

Forehand Groundstroke- Typically, the most powerful and most accurate shot; therefore, the most utilized from at or near the baseline

Lob- A lofted shot that sends the ball high overhead and deep

Overhead Smash- A hard, overhand shot directed downward into the opponent's court, usually as a return of an opponent's lob, high return, or high bounce

Serving- The purpose of the serve (at the developing levels) is simply to place the ball in play and is not intended as an offensive weapon

Volleys- A ball hit in the air before it bounces onto the court during a rally

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STEM Glossary of Terms

All terms have been defined through the National Geographic Resource Library Encyclopedia and some other resources

Adaptation- adaptation is the biological mechanism by which organisms adjust to new environments or to changes in their current environment.

Catastrophic Disturbances- include hurricanes, tornadoes, blizzards, and droughts, among others. As these massively destructive and costly events become more frequent, scientific evidence points to climate change as a leading cause. While they can often be predicted, the loss of life and property take an emotional and economic toll on the community impacted.

Climate Change- a long-term shift in global or regional climate patterns. Often climate change refers specifically to the rise in global temperatures from the mid-20th century to present.

Commensalism- relationship between organisms where one organism benefits from the association while not harming the other.

Competition- contest between organisms for resources, recognition, or group or social status.

Ecosystem- a geographic area where plants, animals, and other organisms, as well as weather and landscapes, work together to form a bubble of life.

Evolution- change in heritable traits of a population over time.

Extinction- Extinction is the dying out of a species.

Genome- A genome is all the hereditary information of an organism.

Genetic Variation- refers to differences among the genomes of members of the same species.

Mutations- mutations are changes in the structure of the molecules that make up genes

Mutualism- relationship between organisms of different species, in which both organisms benefit from the association.

Natural Selection- the process through which species adapt to their environments. It is the engine that drives evolution.

Orbit- it is a regular, repeating path that one object takes around another object or center of gravity.

Orbital Motion- Orbital motion occurs whenever an object is moving forward and at the same time is pulled by gravity toward another object.

Pollution- introduction of harmful materials into the environment.

Predation- behavior of one animal feeding on another.

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Prey-animal that is hunted and eaten by other animals.

Recycling- to clean or process in order to make it suitable for reuse.

Symbiosis- a term describing any relationship or interaction between two dissimilar organisms. The specific kind of symbiosis depends on whether either or both organisms benefit from the relationship.

Top Predator- species at the top of the food chain, with no predators of its own. Also called an alpha predator or apex predator.

Waste- material that has been used and thrown away.

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*If you have a printed copy of the unit plan, scanthis code to access the electronic version and the links embedded in it.

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