

# Unit 2 Probability

Content Area: **Math**  
Course(s): **Statistics H**  
Time Period:  
Length: **36 Days , Grade 11,12**  
Status: **Published**

## **Title Section**

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## **Department of Curriculum and Instruction**



**Belleville Public Schools**

**Curriculum Guide**

**Statistics H, Grade 11,12**

**Unit 2 Probability**

**Belleville Board of Education**

**102 Passaic Avenue**

**Belleville, NJ 07109**

**Prepared by:** Annamaria Contella

Dr. Richard Tomko, Ph.D., M.J., Superintendent of Schools

Ms. LucyAnn Demikoff, Director of Curriculum and Instruction K-12

Ms. Nicole Shanklin, Director of Elementary Education K-8, ESL Coordinator K-12

Mr. George Droste, Director of Secondary Education

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## **Unit Overview**

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In this unit students will explore the nature of probability and how to calculate probability of different events. Students will explore outcomes of diverse events and apply concepts of probability such as complementary events, sample spaces, addition, multiplication rules as well permutations and combinations to make predictions about particular events occurring

## **Enduring Understanding**

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Probability is a strong tool used in the real world to make decisions with statistical information supporting decisions.

Short term, random phenomena are unpredictable but they show long-run regularity.

The closer the probability of an event is to 1, the more likely that event will occur.

The fundamental counting principle, factorial rule, and permutation and combination rules are critical in determining.

The proportion of times the event will occur over many trials is the probability of an event.

### **Essential Questions**

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What are the differences between algebraic variables and random variables, and how do we determine which is appropriate to model a particular situation?

How can we base decisions on chance?

How can probability be used to simulate events and to predict future happenings?

Can probability be an accurate tool for making predictions?

What is the difference between theoretical and experimental probabilities?

### **Exit Skills**

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Identify type of probability.

Identify sample space and calculate probability of an event.

Rules for calculating probabilities of compound events.

Calculate probabilities using Addition Rule

Calculate probabilities using Multiplication Rule

Use Venn diagrams to calculate probabilities

Calculate Conditional Probability and interpret independent/dependent events

|             |  |
|-------------|--|
| MA.K-12.1   | Make sense of problems and persevere in solving them.  |
| MA.K-12.2   | Reason abstractly and quantitatively.  |
| MA.K-12.4   | Model with mathematics.  |
| MA.K-12.5   | Use appropriate tools strategically.   |
| MA.K-12.6   | Attend to precision.   |
| MA.K-12.7   | Look for and make use of structure.  |
| MA.S-CP.A.1 | Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events (“or,” “and,” “not”).  |
| MA.S-CP.A.2 | Understand that two events $A$ and $B$ are independent if the probability of $A$ and $B$ occurring together is the product of their probabilities, and use this characterization to determine if they are independent.   |
| MA.S-CP.A.3 | Understand the conditional probability of $A$ given $B$ as $P(A \text{ and } B)/P(B)$ , and interpret independence of $A$ and $B$ as saying that the conditional probability of $A$ given $B$ is the same as the probability of $A$ , and the conditional probability of $B$ given $A$ is the same as the probability of $B$ . |
| MA.S-CP.A.4 | Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities.   |
| MA.S-CP.A.5 | Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.   |
| MA.S-CP.B.6 | Find the conditional probability of $A$ given $B$ as the fraction of $B$ 's outcomes that also belong to $A$ , and interpret the answer in terms of the model.   |
| MA.S-CP.B.7 | Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ , and interpret the answer in terms of the model.  |
| MA.S-CP.B.8 | Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = [P(A)] \times [P(B A)] = [P(B)] \times [P(A B)]$ , and interpret the answer in terms of the model.  |
| MA.S-CP.B.9 | Use permutations and combinations to compute probabilities of compound events and solve problems.  |

## Interdisciplinary Connections

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|-------------|--|
| 9.3.12.BM.1 | Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision-making in business. |
| 9.3.12.BM.6 | Implement, monitor and evaluate business processes to ensure efficiency and quality  |

results.

- 9.3.12.FN.1 Utilize mathematical concepts, skills and problem solving to obtain necessary information for decision making in the finance industry.
- 12.9.3.ST.2 Use technology to acquire, manipulate, analyze and report data.
- 12.9.3.GV-REV.3 Design, develop, operate and review data analysis systems and procedures to minimize and eliminate revenue-related financial problems.
- 12.9.3.ST-SM.2 Apply science and mathematics concepts to the development of plans, processes and projects that address real world problems.
- 12.9.3.ST-SM.3 Analyze the impact that science and mathematics has on society.
- 12.9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

## Learning Objectives

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Interpret probability as a long run relative frequency.

Use simulation to model chance behavior.

Use basic probability rules , including the complement rule and addition rule for mutually exclusive events.

Determine sample spaces and find the probability of an event.

Find the total number of outcomes in a series of events by using the fundamental counting rule.

Apply the general addition rule to calculate probabilities.

Use two way tables or Venn diagram to model chance process and calculate probabilities involving two events.

Distinguish between permutations and combinations and apply the appropriate formulas in order to solve problems.

Discern if two events are mutually exclusive and understand how this determines which addition rule to use to determine probability.

Calculate and interpret conditional probabilities.

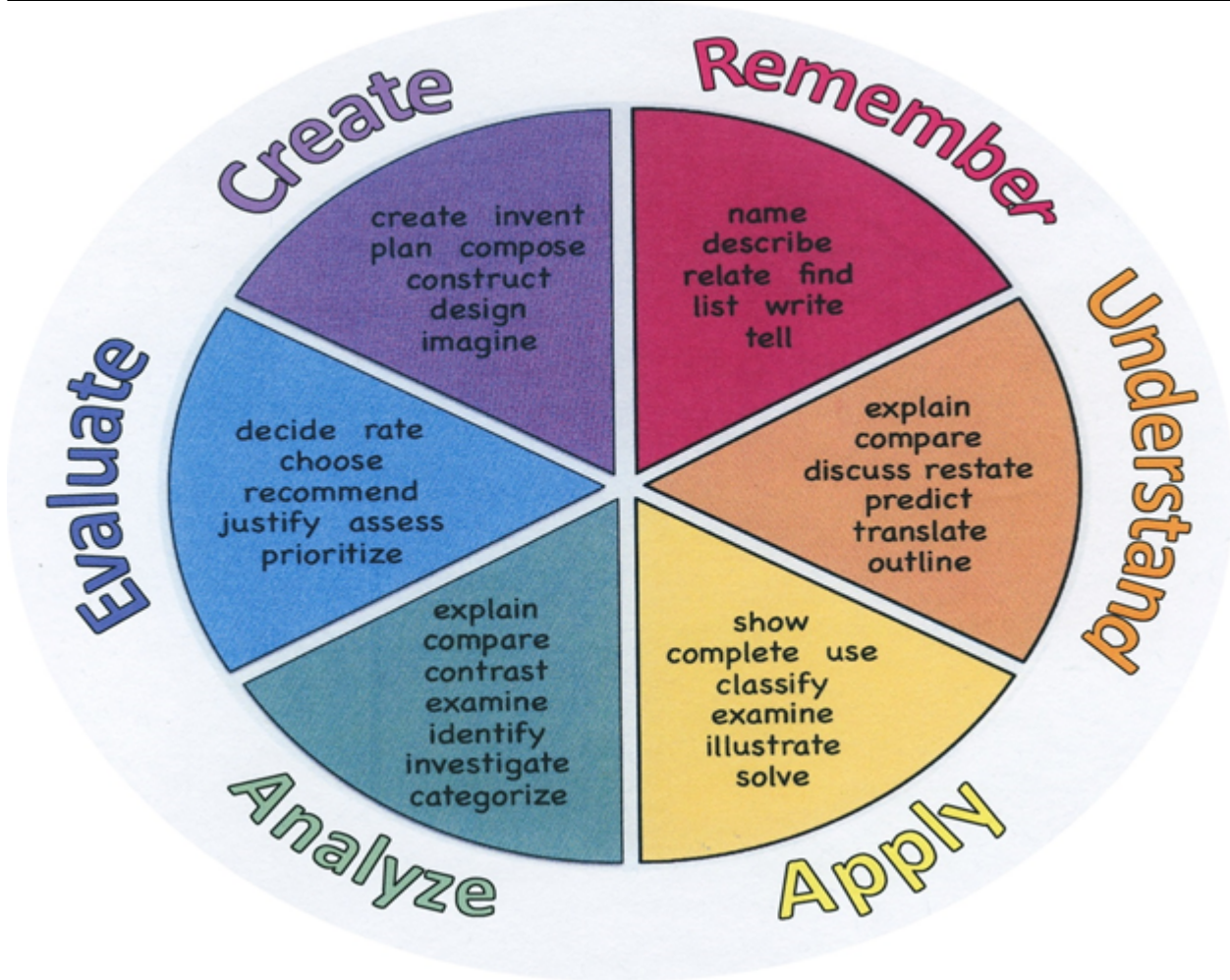
Determine if events are independent.

Use multiplication rule to calculate probability when appropriate.

**Action Verbs:** Below are examples of action verbs associated with each level of the Revised Bloom's Taxonomy.

| Remember | Understand    | Apply      | Analyze       | Evaluate  | Create      |
|----------|---------------|------------|---------------|-----------|-------------|
| Choose   | Classify      | Choose     | Categorize    | Appraise  | Combine     |
| Describe | Defend        | Dramatize  | Classify      | Judge     | Compose     |
| Define   | Demonstrate   | Explain    | Compare       | Criticize | Construct   |
| Label    | Distinguish   | Generalize | Differentiate | Defend    | Design      |
| List     | Explain       | Judge      | Distinguish   | Compare   | Develop     |
| Locate   | Express       | Organize   | Identify      | Assess    | Formulate   |
| Match    | Extend        | Paint      | Infer         | Conclude  | Hypothesize |
| Memorize | Give Examples | Prepare    | Point out     | Contrast  | Invent      |

|           |             |             |              |           |             |
|-----------|-------------|-------------|--------------|-----------|-------------|
| Name      | Illustrate  | Produce     | Select       | Critique  | Make        |
| Omit      | Indicate    | Select      | Subdivide    | Determine | Originate   |
| Recite    | Interrelate | Show        | Survey       | Grade     | Organize    |
| Select    | Interpret   | Sketch      | Arrange      | Justify   | Plan        |
| State     | Infer       | Solve       | Breakdown    | Measure   | Produce     |
| Count     | Match       | Use         | Combine      | Rank      | Role Play   |
| Draw      | Paraphrase  | Add         | Detect       | Rate      | Drive       |
| Outline   | Represent   | Calculate   | Diagram      | Support   | Devise      |
| Point     | Restate     | Change      | Discriminate | Test      | Generate    |
| Quote     | Rewrite     | Classify    | Illustrate   |           | Integrate   |
| Recall    | Select      | Complete    | Outline      |           | Prescribe   |
| Recognize | Show        | Compute     | Point out    |           | Propose     |
| Repeat    | Summarize   | Discover    | Separate     |           | Reconstruct |
| Reproduce | Tell        | Divide      |              |           | Revise      |
|           | Translate   | Examine     |              |           | Rewrite     |
|           | Associate   | Graph       |              |           | Transform   |
|           | Compute     | Interpolate |              |           |             |
|           | Convert     | Manipulate  |              |           |             |
|           | Discuss     | Modify      |              |           |             |
|           | Estimate    | Operate     |              |           |             |
|           | Extrapolate | Subtract    |              |           |             |
|           | Generalize  |             |              |           |             |
|           | Predict     |             |              |           |             |



## **Suggested Activities & Best Practices**

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Graphing Calculators:TI-84

Starnes, The Practice of Statistics, 5e, Student Resources(online textbook, study guides, worksheets)

<http://www.macmillanlearning.com/catalog/studentresources/tps5e>

Statistical Lesson Resources:

<http://www.apstatsmonkey.com/StatsMonkey/Statsmonkey.html>

Actuarial Foundation lessons:

<http://www.actuarialfoundation.org/programs/youth/hs-stats.shtml>

Statistic Tutorials

<https://stattrek.com/>

Census Bureau:

<https://www.census.gov/about/what.html>

Videos:

<http://www.learner.org/resources/series65.html?pop=yes&pid=140#>

[apstatsguy.com](http://apstatsguy.com)

American Statistical Association:

<http://www.amstat.org/>

Desmos

<https://learn.desmos.com/statistics>

## **Assessment Evidence - Checking for Understanding (CFU)**

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Starnes, The Practice of Statistics 5e, Assessments (Summative)

Edulastic Formative Assessments (Formative):

<https://app.edulastic.com/#renderResource/close/Mjk0MjE2ODUwOA%3D%3D>

Exit tickets: Google Forms, Edulastic, paper & pencil (Formative)

Common Benchmarks on OnCourse:#2 (Benchmark)

- Admit Tickets
- Anticipation Guide
- Common Benchmarks
- Compare & Contrast
- Create a Multimedia Poster
- DBQ's
- Define
- Describe
- Evaluate
- Evaluation rubrics
- Exit Tickets
- Explaining
- Fist- to-Five or Thumb-Ometer
- Illustration
- Journals
- KWL Chart
- Learning Center Activities
- Multimedia Reports
- Newspaper Headline
- Outline
- Question Stems
- Quickwrite
- Quizzes
- Red Light, Green Light



- Self- assessments
- Socratic Seminar
- Study Guide
- Surveys
- Teacher Observation Checklist
- Think, Pair, Share
- Think, Write, Pair, Share
- Top 10 List
- Unit review/Test prep
- Unit tests
- Web-Based Assessments
- Written Reports

## **Primary Resources & Materials**

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Starnes, The Practice of Statistics, 5e textbook, ebook

The Practice of Statistics digital resources

## **Ancillary Resources**

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TI-84 Graphing Calculator

ALEKS

## **Technology Infusion**

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- Youtube
- Khan academy
- Google Classroom
- GSuite
- Kutasoftware
- PodCasts
- Kahoot
- Twitter
- Ted Talks
- ALEKS

- [QR Barcode Generator](#)
- [Calculator/Graphing calculator](#)
- [Flipgrid](#)
- [Peardeck](#)
- [Edulastic](#)
- [McGraw-Hill Education](#)
- [Desmos.com](#)
- [Geogebra.org](#)



## **Alignment to 21st Century Skills & Technology**

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Mastery and infusion of **21st Century Skills & Technology** and their Alignment to the core content areas is essential to student learning. The core content areas include but are not limited to:

- English Language Arts;
- Mathematics;
- Science and Scientific Inquiry (Next Generation);
- Social Studies
- Technology;

|                   |   |
|-------------------|---|
| CRP.K-12.CRP2     | Apply appropriate academic and technical skills.  |
| CRP.K-12.CRP4     | Communicate clearly and effectively and with reason.  |
| CRP.K-12.CRP7     | Employ valid and reliable research strategies.  |
| CRP.K-12.CRP8     | Utilize critical thinking to make sense of problems and persevere in solving them.  |
| CRP.K-12.CRP11    | Use technology to enhance productivity.   |
| CAEP.9.2.12.C.2   | Modify Personalized Student Learning Plans to support declared career goals.  |
| TECH.8.1.12.A.3   | Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue. |
| TECH.8.1.12.F.CS1 | Identify and define authentic problems and significant questions for investigation.   |

## **21st Century Skills/Interdisciplinary Themes**

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- English Language Arts;
  - Mathematics;
  - Science and Scientific Inquiry (Next Generation);
  - Social Studies/Economics;
  - Technology
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- Communication and Collaboration
  - Creativity and Innovation
  - Critical thinking and Problem Solving
  - ICT (Information, Communications and Technology) Literacy
  - Information Literacy
  - Life and Career Skills
  - Media Literacy

## **21st Century Skills**

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- Civic Literacy
- Environmental Literacy
- Financial, Economic, Business and Entrepreneurial Literacy
- Global Awareness
- Health Literacy

## **Differentiation**

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Graphing calculator(Ti-84) introduction

Differentiate by giving choice of assignments

Alternative assessments

Flexible grouping

Study Guides

Khan Academy statistics lessons

### **Differentiations:**

- Small group instruction
- Small group assignments
- Extra time to complete assignments
- Pairing oral instruction with visuals
- Repeat directions
- Use manipulatives
- Center-based instruction
- Token economy
- Study guides
- Teacher reads assessments allowed
- Scheduled breaks
- Rephrase written directions
- Multisensory approaches
- Additional time
- Preview vocabulary
- Preview content & concepts
- Story guides
- Behavior management plan
- Highlight text
- Student(s) work with assigned partner
- Visual presentation
- Assistive technology
- Auditory presentations
- Large print edition

- Dictation to scribe
- Small group setting

#### **Hi-Prep Differentiations:**

- Alternative formative and summative assessments
- Choice boards
- Games and tournaments
- Group investigations
- Guided Reading
- Independent research and projects
- Interest groups
- Learning contracts
- Leveled rubrics
- Literature circles
- Multiple intelligence options
- Multiple texts
- Personal agendas
- Project-based learning
- Problem-based learning
- Stations/centers
- Think-Tac-Toes
- Tiered activities/assignments
- Tiered products
- Varying organizers for instructions

#### **Lo-Prep Differentiations**

- Choice of books or activities
- Cubing activities
- Exploration by interest
- Flexible grouping
- Goal setting with students
- Jigsaw
- Mini workshops to re-teach or extend skills
- Open-ended activities
- Think-Pair-Share
- Reading buddies
- Varied journal prompts
- Varied supplemental materials

## **Special Education Learning (IEP's & 504's)**

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Graphing calculator(TI-84)

## Khan Academy statistics lessons

Use data visualization software to reason about any data variation observed

Modify data used

Verbal analysis of data

Alternative assessments

Flexible grouping

Study Guides

Choice of assignments(choice boards, choice tables)

- printed copy of board work/notes provided
- additional time for skill mastery
- assistive technology
- behavior management plan
- Center-Based Instruction
- check work frequently for understanding
- computer or electronic device utilizes
- extended time on tests/ quizzes
- have student repeat directions to check for understanding
- highlighted text visual presentation
- modified assignment format
- modified test content
- modified test format
- modified test length
- multiple test sessions
- multi-sensory presentation
- preferential seating
- preview of content, concepts, and vocabulary
- Provide modifications as dictated in the student's IEP/504 plan
- reduced/shortened reading assignments
- Reduced/shortened written assignments
- secure attention before giving instruction/directions
- shortened assignments
- student working with an assigned partner
- teacher initiated weekly assignment sheet

- Use open book, study guides, test prototypes

## **English Language Learning (ELL)**

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Graphing calculator(TI-84)

Khan Academy English or Spanish website <https://es.khanacademy.org/math/probability>

Use data visualization software to reason about any data variation observed

Modify data used

Verbal analysis of data

Alternative assessments

Flexible grouping

Study Guides

Choice of assignments

- teaching key aspects of a topic. Eliminate nonessential information
- using videos, illustrations, pictures, and drawings to explain or clarify
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning;
- allowing students to correct errors (looking for understanding)
- allowing the use of note cards or open-book during testing
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using computer word processing spell check and grammar check features
- using true/false, matching, or fill in the blank tests in lieu of essay tests

## **At Risk**

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Graphing calculator(TI-84)

Use of manipulatives and "hands-on" activities

Differentiate assignments giving choice of data based on student interest

Khan Academy Statistics lessons

Use data visualization software to reason about any data variation observed

Modify data used

Verbal analysis of data

Alternative assessments

Flexible grouping

Study Guides

- allowing students to correct errors (looking for understanding)
- teaching key aspects of a topic. Eliminate nonessential information
- allowing products (projects, timelines, demonstrations, models, drawings, dioramas, poster boards, charts, graphs, slide shows, videos, etc.) to demonstrate student's learning
- allowing students to select from given choices
- allowing the use of note cards or open-book during testing
- collaborating (general education teacher and specialist) to modify vocabulary, omit or modify items to reflect objectives for the student, eliminate sections of the test, and determine how the grade will be determined prior to giving the test.
- decreasing the amount of work presented or required
- having peers take notes or providing a copy of the teacher's notes
- marking students' correct and acceptable work, not the mistakes
- modifying tests to reflect selected objectives
- providing study guides
- reducing or omitting lengthy outside reading assignments
- reducing the number of answer choices on a multiple choice test
- tutoring by peers
- using authentic assessments with real-life problem-solving
- using true/false, matching, or fill in the blank tests in lieu of essay tests
- using videos, illustrations, pictures, and drawings to explain or clarify

## **Talented and Gifted Learning (T&G)**

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Graphing calculator(TI-84)

Offer activities and problems that extend beyond the current assignments

AP Statistic tasks

Differentiate assignments giving more challenging one; or a task in which data is tailored to students' interests

Statistics software:

<https://www.statcato.org/>

Khan Academy Statistics lessons English/Spanish

Choice of Data:

<http://www.statcrunch.com/>

- Above grade level placement option for qualified students
- Advanced problem-solving
- Allow students to work at a faster pace
- Cluster grouping
- Complete activities aligned with above grade level text using Benchmark results
- Create a blog or social media page about their unit
- Create a plan to solve an issue presented in the class or in a text
- Debate issues with research to support arguments
- Flexible skill grouping within a class or across grade level for rigor
- Higher order, critical & creative thinking skills, and discovery
- Multi-disciplinary unit and/or project
- Teacher-selected instructional strategies that are focused to provide challenge, engagement, and growth opportunities
- Utilize exploratory connections to higher-grade concepts
- Utilize project-based learning for greater depth of knowledge

## **Sample Lesson**

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Using the template below, please develop a **Sample Lesson** for the first unit only.

Unit Name:

NJSLS:

Interdisciplinary Connection:

Statement of Objective:

Anticipatory Set/Do Now:

Learning Activity:

Student Assessment/CFU's:

Materials:

21st Century Themes and Skills:

Differentiation/Modifications:

Integration of Technology: