Purpose Statement

Physical Science

The Physical Science End-of-Course (EOC) exam is intended to measure student proficiency of the New Mexico Science Standards. This course-level exam is provided to all students who have completed Physical Science or related courses. This exam can be given for the following STARS course codes:

1703 - Physical Science

Intended as a final exam for the course, this is a summative exam covering a range of content, skills, and applications. Scores are reported to the teacher, school, district, and state levels for the purposes of student grades, curriculum review, student graduation requirements, and NMTeach summative reports.

Materials Required for Testing:
NMPED Physical Science Reference Sheet/Periodic Table and a Scientific or Graphing Calculator

“The EOCs are exams written by New Mexico Teachers for New Mexico Students.”
During the 2016-17 school year, teachers were brought together in person or online as part of the blueprint and exam revision process. The NMPED extends our gratitude to all those who contributed to this improvement process. Although we were unable to implement every suggestion due to conflicting viewpoints at times, this blueprint reflects the best collaborative effort among dedicated peers.

The NMPED would like to especially recognize the following person(s) who led the revision for this blueprint:

- Debbie Dean, Ph.D., Hobbs Municipal Schools, NBCT, Blueprint Lead
### Explanation of Blueprint Layout & Test Specifications Table

<table>
<thead>
<tr>
<th>Standard</th>
<th>Standards with Test Item Specifications:</th>
</tr>
</thead>
<tbody>
<tr>
<td>The standards identified in this portion of the blueprint are aligned to the New Mexico Grades 9-12 Science Standards:</td>
<td>• This portion of the blueprint identifies the specific skills and knowledge students will have to demonstrate during the exam.</td>
</tr>
<tr>
<td></td>
<td>• Although the standard may be broader, the item specifications may place constraint on portions of the standards in order to provide more transparency as to what specifically will be measured relative to the standard.</td>
</tr>
<tr>
<td></td>
<td>• Item specifications provide guidelines for the item writer so they know what topics to specifically focus on when authoring items.</td>
</tr>
<tr>
<td></td>
<td>• Topics and terms in <strong>bold</strong> will be emphasized on the exam.</td>
</tr>
<tr>
<td>New Mexico Teachers identified the standards to be measured on the EOC exam using the following criteria: 1) a great deal of instructional time is spent on the standard as identified in the curriculum and/or; 2) the standard is important to subsequent learning.</td>
<td></td>
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<td></td>
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<tr>
<td>It is important to note that the standards in the blueprint are only a <strong>subset</strong> of standards to be measured with the understanding that teachers cover more standards during the course of instruction than what has been selected to be measured.</td>
<td></td>
</tr>
</tbody>
</table>

**Item Types:**

*The item types for this EOC exam are limited to:*

- MC = multiple choice with or without stimulus (e.g., picture, graph, chart)

**Sample Question(s):**

Sample questions have been provided to assist teachers to correlate the questions with the performance standards and the test item specification, when applicable.

- An * denotes the correct answer
- DOK = Depth of Knowledge
- Some sample questions may be items released items from prior EOC exams
### Blueprint Table - Physical Science

<table>
<thead>
<tr>
<th>Standard/Learning Outcome</th>
<th>Standard with Test Item Specifications:</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.I.I.1</td>
<td>1. Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions.</td>
</tr>
<tr>
<td><strong>Strand I:</strong> Scientific Thinking and Practice</td>
<td><strong>Specifications:</strong></td>
</tr>
</tbody>
</table>
| **Standard I:** Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically |  ● Identify appropriate use of laboratory equipment  
  ● Identify proper lab safety techniques & procedures |
| **Benchmark I:** Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results. | |
| **Item Types:** |  
MC = multiple choice with or without stimulus |
| **Sample Question:** |  
Which of the above would be used to make the most accurate measurements?  

1 | 2 | 3 | 4 |
<table>
<thead>
<tr>
<th>Standard with Test Item Specifications:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Design and conduct scientific investigations that include:</td>
</tr>
<tr>
<td>• testable hypotheses</td>
</tr>
<tr>
<td>• controls and variables</td>
</tr>
<tr>
<td>• methods to collect, analyze, and interpret data</td>
</tr>
<tr>
<td>• results that address hypotheses being investigated</td>
</tr>
<tr>
<td>• predictions based on results</td>
</tr>
<tr>
<td>• re-evaluation of hypotheses and additional experimentation as necessary</td>
</tr>
<tr>
<td>• error analysis</td>
</tr>
</tbody>
</table>

**Specifications:**

- Distinguish between hypotheses, theories, and laws
- Distinguish between independent and dependent variables
- Distinguish between control groups and experimental groups (and their importance)

**Item Types:**

- MC = multiple choice with or without stimulus

**Sample Question:**

In an experiment that determines how adding heat to gas changes the volume of the gas, which would be a correct statement?
A) The volume of gas is the independent variable and the temperature is the dependent variable.
B) The volume of gas is the dependent variable and heat is the independent variable.*
C) The temperature is dependent on the amount of gas.
D) The amount of heat is independent of the volume of gas.

Standard: I.I.I.2
DOK Level: 2

I.I.I.4

Strand I: Scientific Thinking and Practice

Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically

Benchmark I: Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.

Standard with Test Item Specifications:

4. Convey results of investigations using scientific concepts, methodologies, and expressions, including:
   • scientific language and symbols
   • diagrams, charts, and other data displays
   • mathematical expressions and processes (e.g., mean, median, slope, proportionality
   • clear, logical, and concise communication
   • reasoned arguments.

Specifications:

   • Interpret data using graphs, diagrams, charts, and data displays
   • Compute averages, ratios, and percentages from data

Item Types:

MC = multiple choice with or without stimulus

Sample Question:
Using the graph above, choose the statement that accurately describes the data.

A) As time passes, the temperature decreases.
B) As heat is added, the temperature decreases.
C) As time passes, the heat decreases.
D) As heat is added, the temperature increases.*

Standard: I.I.I.4
DOK Level: 2

I.I.II.2

Strand I: Scientific Thinking and Practice

Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically

Standard with Test Item Specifications:

2. Use scientific reasoning and valid logic to recognize:
   • faulty logic
   • cause and effect
   • the difference between observation and unsubstantiated inferences and conclusions
   • potential bias

Specifications:

• Analyze how the manipulated (independent) variable affects the responding
**Benchmark II:** Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.

**Item Types:**

- **MC = multiple choice with or without stimulus**

**Sample Question:**

If a scientist chooses data from a particular trial to report instead of representing all of the trials, what is this known as?

A) analyzing data  
B) a blind experiment  
C) removing outliers  
D) exhibiting bias*

*Standard: I.I.II.2  
DOK Level: 1*

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**I.I.III.4**

**Strand I:** Scientific Thinking and Practice

**Standard I:** Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting, and validating to think critically.

**Standard with Test Item Specifications:**

4. Identify and apply measurement techniques and consider possible effects of measurement errors.

**Specifications:**

- Use specific measurement techniques, such as:
  - Measuring length using SI units (m, cm, mm, km, etc.)
  - Distinguish and use appropriate SI prefixes
  - Measure volume using a graduated cylinder correctly
  - Use a digital scale to measure mass
**Benchmark III:** Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.

### Item Types:

*MC = multiple choice with or without stimulus*

### Sample Question:

Use the illustration to determine the most accurate reading of volume.

![Volume Illustration](image)

- A) 16.5 ml
- B) 15.5 ml*
- C) 17 ml
- D) 10.5 ml

*Standard: I.I.III.4
DOK Level: 1*

### I.I.III.5

<table>
<thead>
<tr>
<th>Strand I: Scientific Thinking and Practice</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Standard I:</strong> Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting,</td>
</tr>
</tbody>
</table>

### Standard with Test Item Specifications:

5. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis).

### Specifications:

- SI unit conversions
- Convert between scientific notation and standard form (and vise-versa)
- Understand why scientific notation is useful in dealing with really large or
predicting, and validating to think critically.

**Benchmark III**: Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.

**Sample Question:**

The distance from Earth to Alpha Centauri is $4.132 \times 10^{16}$ km. Which of the following expresses this distance correctly?

A) 413,200,000,000,000,000,000,000
B) 413,200,000,000
C) 41,320,000,000,000,000 *
D) 4,132,000,000,000,000

*Standard: I.I.II.5
DOK Level: 1*

**II.I.I.1**

**Strand II**: The Content of Science

**Standard I (Physical Science)**: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark I**: Understand the properties, underlying structure, and reactions of

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**Standard with Test Item Specifications:**

**Properties of Matter**

1. Classify matter in a variety of ways (e.g., element, compound, mixture; solid, liquid, gas; acidic, basic, neutral).

**Specifications:**

- Identify differences between elements and compounds
- Identify differences between homogeneous and heterogeneous mixtures
- Identify the factors which are used to distinguish between solids, liquids, and gases (volume and shape)

**Item Types:**

*MC = multiple choice with or without stimulus*
Sample Question:

Matter can be classified as either a substance or a mixture. Which of the following is classified correctly?

- A) calcium - compound
- B) vanilla ice cream - homogenous mixture*
- C) gold - heterogeneous mixture
- D) vanilla ice cream – element

Standard: II.I.1.1
DOK Level: 1

II.I.1.2
Strand II: The Content of Science

Standard I (Physical Science):
Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

Benchmark I: Understand the properties, underlying structure, and reactions of matter.

Standard with Test Item Specifications:

Properties of Matter
2. Identify, measure, and use a variety of physical and chemical properties (e.g., electrical conductivity, density, viscosity, chemical reactivity, pH, melting point).

Specifications:
- Acid-base questions will be conceptual only
- Identify acids and bases by the use of a pH scale (need a visual of the pH scale)
- Calculate density using the density formula

Item Types:
MC = multiple choice with or without stimulus

Sample Question:
Calculate the density of a rock with a mass of 13 grams and a volume of 5 cm³.
Standard: II.I.I.2
DOK Level: 1

II.I.I.4

Strand II: The Content of Science

Standard I (Physical Science):
Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

Benchmark I: Understand the properties, underlying structure, and reactions of matter.

Standard with Test Item Specifications:

Properties of Matter
4. Describe trends in properties (e.g., ionization energy or reactivity as a function of location on the periodic table, boiling point of organic liquids as a function of molecular weight).

Specifications:
- Need the use of a periodic table
- Interpreting the periodic table (e.g., how it’s organized based on atomic number, valence electrons, metals, non-metals, metalloids. From left to right across a period, and down a group/family, what is the ionization energy trend?)

Item Types:
MC = multiple choice with or without stimulus

Sample Question:
Use the periodic table to predict which one of the following elements has the highest ionization energy.

A) Ba
B) N
C) He*
D) H
| Standard: II.I.I.4  
DOK Level: 2 |

| II.I.I.6  
Strand II: The Content of  
Science  

Standard I (Physical Science):  
Understand the structure and  
properties of matter, the  
characteristics of energy, and  
the interactions between  
matter and energy.  

Benchmark I: Understand the  
properties, underlying  
structure, and reactions of  
matter.  

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### Standard with Test Item Specifications:

**Structure of Matter**

6. Understand atomic structure, including:

- most space occupied by electrons
- nucleus made of protons and neutrons
- isotopes of an element
- masses of proton and neutron 2000 times greater than mass of electron
- atom held together by proton-electron electrical forces

### Specifications:

- Understand location, size, and charge of subatomic particles
- Know what an isotope is
- Understand that the atomic mass is calculated off the weighted average of all isotopes for that element

### Item Types:

*MC = multiple choice with or without stimulus*

### Sample Question:

Elements that have the same number of protons, but different number of neutrons are known as which of the following?

A) compounds  
B) prototypes  
C) isotonic  
D) isotopes*
<table>
<thead>
<tr>
<th>Standard: II.I.I.8</th>
<th>Standard with Test Item Specifications:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strand II:</strong> The Content of Science</td>
<td><strong>Structure of Matter</strong></td>
</tr>
<tr>
<td><strong>Standard I (Physical Science):</strong> Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.</td>
<td>8. Make predictions about elements using the periodic table (e.g., <strong>number of valence electrons</strong>, metallic character, <strong>reactivity</strong>, conductivity, <strong>type of bond between elements</strong>).</td>
</tr>
<tr>
<td><strong>Benchmark I:</strong> Understand the properties, underlying structure, and reactions of matter.</td>
<td><strong>Specifications:</strong></td>
</tr>
<tr>
<td></td>
<td>• Need the use of a periodic table (based on the location on the periodic table, student should be able to determine the number of valence electrons)</td>
</tr>
<tr>
<td></td>
<td>• Know ionic bonds are between metal and non-metal</td>
</tr>
<tr>
<td></td>
<td>• Know covalent bonds are between two non-metals</td>
</tr>
<tr>
<td><strong>Item Types:</strong></td>
<td><strong>Sample Question:</strong></td>
</tr>
<tr>
<td><em>MC = multiple choice with or without stimulus</em></td>
<td>Use the periodic table to determine which of the following combinations form covalent bonds:</td>
</tr>
<tr>
<td></td>
<td>A) Bi and Ne</td>
</tr>
<tr>
<td></td>
<td>B) Al and Si</td>
</tr>
<tr>
<td></td>
<td>C) Na and Cl</td>
</tr>
<tr>
<td></td>
<td>D) N and F*</td>
</tr>
</tbody>
</table>

*Standard: II.I.I.8  
DOK Level: 2*
### Benchmark I: Understand the properties, underlying structure, and reactions of matter.

#### Standard I (Physical Science):
Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

#### Structure of Matter
Know that states of matter (i.e., solid, liquid, gas) depend on the arrangement of atoms and molecules and on their freedom of motion.

#### Specifications:
- Identify the change in kinetic (endothermic or exothermic) energy during phase changes (sublimation, deposition, vaporization, condensation, melting, and freezing)

#### Item Types:
- **MC = multiple choice with or without stimulus**

#### Sample Question:
Which sample of water would have the lowest amount of internal energy?

- A) ice
- B) water with ice
- C) water without ice
- D) steam

*Standard: II.I.I.10
DOK Level: 2*

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#### Standard I (Physical Science):
Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

#### Chemical Reactions
13. Understand **types of chemical reactions** (e.g., synthesis, decomposition, combustion, redox, neutralization) and identify them as exothermic or endothermic.

#### Specifications:
properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark I:** Understand the properties, underlying structure, and reactions of matter

- Given a specific chemical reaction, interpret the type of reaction that took place
- Determine products or reactants in a chemical reaction

**Item Types:**
*MC = multiple choice with or without stimulus*

**Sample Question:**

Which of the following formulas demonstrates a synthesis reaction?

A) \( A + BC \rightarrow AC + B \)
B) \( AB + CD \rightarrow AD + CB \)
C) \( AB \rightarrow A + B \)
D) \( A + B \rightarrow AB^* \)

*Standard: II.I.I.13*
*DOK Level: 1*

**II.I.I.14**

**Strand II: The Content of Science**

**Standard I (Physical Science):** Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Standard with Test Item Specifications:**

**Chemical Reactions**

14. Know how to express chemical reactions with balanced equations that show:
   - conservation of mass
   - products of common reactions

**Specifications:**

- Know how to balance a simple chemical reaction to fulfill the law of conservation of mass

**Item Types:**
**Benchmark I**: Understand the properties, underlying structure, and reactions of matter.

**Sample Question**:
Which formula correctly shows the reaction of hydrogen gas and oxygen gas to form water?

- A) \(2H + O \rightarrow H_2O\)
- B) \(H + O \rightarrow H_2O\)
- C) \(H_2 + O_2 \rightarrow H_2O\)
- D) \(2H_2 + O_2 \rightarrow 2H_2O^*\)

*Standard: II.I.I.14  
*DOK Level: 1*

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**II.I.II.1**

**Strand II**: The Content of Science

**Standard I (Physical Science)**: Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark II**: Understand the transformation and transmission of energy and how energy and matter interact.

**Standard with Test Item Specifications**:

**Energy Transformation and Transfer**
1. Identify different forms of energy, including kinetic, gravitational (potential), chemical, thermal, nuclear, and electromagnetic.

**Specifications**:
- Distinguish between potential and kinetic energy

**Item Types**:

*MC = multiple choice with or without stimulus*

**Sample Question**:
Which of the following most accurately describes the form of energy found in food that you eat and gasoline in cars?

- A) mechanical energy
**II.I.II.4**

**Strand II: The Content of Science**

**Standard I (Physical Science):** Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark II: Understand the transformation and transmission of energy and how energy and matter interact.**

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**Standard with Test Item Specifications:**

*Energy Transformation and Transfer*

4. Understand how heat can be transferred by conduction, convection, and radiation, and how heat conduction differs in conductors and insulators.

**Specifications:**

- Given different real life examples of heat transfer, be able to distinguish between conduction, convection, and radiation

**Item Types:**

*MC* = multiple choice with or without stimulus

**Sample Question:**

Heat transferred through an eating utensil from a bowl of hot soup is an example of what type of heat transfer?

A) insulation  
B) radiation  
C) convection  
D) conduction*

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**Standard: II.I.II.4**  
**DOK Level: 1**

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**B) kinetic energy**  
**C) chemical potential energy**  
**D) thermal energy**

**Standard: II.I.II.1**  
**DOK Level: 1**
### II.I.II.8

**Strand II: The Content of Science**

**Standard I (Physical Science):** Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark II:** Understand the transformation and transmission of energy and how energy and matter interact.

### Standard with Test Item Specifications:

#### Interactions of Energy and Matter

8. Describe the characteristics of electromagnetic waves (e.g., visible light, radio, microwave, X-ray, ultraviolet, gamma) and other waves (e.g., sound, seismic waves, water waves), including:
   - origin and potential hazards of various forms of electromagnetic radiation
   - energy of electromagnetic waves carried in discrete energy packets (photons) whose energy is inversely proportional to wavelength.

#### Specifications:

- Visual (image) will be provided in stimulus to show the different electromagnetic wave spectrum. See sample question
- Determine the wavelength and frequency from left to right on the electromagnetic wave spectrum image
- Know how the electromagnetic wave spectrum correlates to wave frequency (radio-gamma) (inversely related)
- Know where visible light is found on the spectrum

#### Item Types:

*MC = multiple choice with or without stimulus*

#### Sample Question:
Which of the wavelengths above would have the highest frequency?

A) visible
B) radio
C) infrared
D) X-ray*

Standard: II.I.II.8
DOK Level: 2

II.IIII.1

Strand II: The Content of Science

Standard I (Physical Science): Understand the structure and properties of matter, the characteristics of energy, and the interactions between

Standard with Test Item Specifications:

Forces
1. Know that there are four fundamental forces in nature: gravitation, electromagnetism, weak nuclear force, and strong nuclear force.

Specifications:
- Given a specific example, determine which type of fundamental force in nature it is
**Benchmark III: Understand the motion of objects and waves, and the forces that cause them.**

<table>
<thead>
<tr>
<th>Item Types:</th>
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<tbody>
<tr>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Sample Question:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Which of the following is the attractive force between two objects that is dependent on their masses and the distance between them?</td>
</tr>
</tbody>
</table>

A) electromagnetic force  
B) strong nuclear force  
C) weak nuclear force  
D) gravitational force*

*Standard: II.I.III.1  
DOK Level: 1*

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**II.I.III.2**

<table>
<thead>
<tr>
<th>Strand II: The Content of Science</th>
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**Standard I (Physical Science):** 
Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark III: Understand the motion of objects and waves, and the forces that cause them.**

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<table>
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<tr>
<th>Sample Question:</th>
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<tbody>
<tr>
<td>Which body exerts the strongest gravitational force on a person?</td>
</tr>
</tbody>
</table>

**Forces**

2. Know that every object exerts gravitational force on every other object, and how this force depends on the masses of the objects and the distance between them

**Specifications:**

- Use the speed (formula) of gravity
- Understand that gravity depends on size and distance between the objects
### Standard: II.I.III.6

**DOK Level:** 1

**Benchmark III:** Understand the motion of objects and waves, and the forces that cause them.

### Sample Question:

If an object is acted upon by a force of 14 N to the east, and a second force of 15 N to the east, calculate the magnitude and direction of the resultant force.

- A) 421 N, E
- B) 29 N, E *
- C) 210 N, E
- D) 21 N, E

**Standard: II.I.III.6**  
**DOK Level:** 2

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### Standard with Test Item Specifications:

**Forces**

6. Represent the magnitude and direction of forces by vector diagrams.

**Specifications:**

- Calculate displacement vectors using basic math

**Item Types:**

*MC = multiple choice with or without stimulus*
<table>
<thead>
<tr>
<th>Strand II: The Content of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard I (Physical Science): Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.</td>
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<table>
<thead>
<tr>
<th>Benchmark III: Understand the motion of objects and waves, and the forces that cause them.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forces 7. Know that when one object exerts a force on a second object, the second object exerts a force of equal magnitude and in the opposite direction on the first object (i.e., Newton’s Third Law).</td>
</tr>
</tbody>
</table>

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<tr>
<th>Specifications:</th>
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<tbody>
<tr>
<td>- Identify the 4 types of friction (static, sliding, rolling, and fluid friction)</td>
</tr>
<tr>
<td>- Using a real-life example, be able to describe how friction affects motion</td>
</tr>
</tbody>
</table>

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<th>Sample Question:</th>
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<tbody>
<tr>
<td>Which type of friction is in play when a force is applied to an object but the object is not in motion?</td>
</tr>
<tr>
<td>A) rolling friction</td>
</tr>
<tr>
<td>B) sliding friction</td>
</tr>
<tr>
<td>C) static friction*</td>
</tr>
<tr>
<td>D) fluid friction</td>
</tr>
</tbody>
</table>

*Standard: II.I.III.7  
*DOK Level: 1

<table>
<thead>
<tr>
<th>II.I.III.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard with Test Item Specifications:</td>
</tr>
<tr>
<td>Motion 8. Apply Newton’s Laws to describe and analyze the behavior of moving objects, including:</td>
</tr>
<tr>
<td>- displacement, velocity, and acceleration of a moving object</td>
</tr>
<tr>
<td>- Newton’s Second Law, ( F = ma ) (e.g., momentum and its conservation, the...</td>
</tr>
</tbody>
</table>
properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark III:** Understand the motion of objects and waves, and the forces that cause them.

- *motion of an object falling under gravity, the independence of a falling object’s motion on mass*
  - circular motion and centripetal force

**Specifications:**
- Calculate acceleration given force and mass

**Item Types:**
*MC = multiple choice with or without stimulus*

**Sample Question:**
Using Newton’s second law, when a force of 350 N is applied to a 125 kg object, calculate the object’s acceleration. (Disregard friction)

A) 0.36 m/s²  
B) 3.6 m/s²  
C) 12.5 m/s²  
D) 2.8 m/s² *

*Standard: II.I.III.8  
DOK Level: 2*

**II.I.III.10**

**Strand II: The Content of Science**

**Standard I (Physical Science):** Understand the structure and properties of matter, the

**Standard with Test Item Specifications:**

**Motion**
10. Describe wave propagation using amplitude, wavelength, frequency, and speed.

**Specifications:**
- Understand that wavelength and frequency are inversely related
characteristics of energy, and the interactions between matter and energy.

**Benchmark III:** Understand the motion of objects and waves, and the forces that cause them.

- Know that the speed of light is equal to frequency x acceleration
- Conceptual questions, no calculations

**Item Types:**
*MC = multiple choice with or without stimulus*

**Sample Question:**
The speed of a wave is dependent upon which of the following?

A) frequency and amplitude
B) wavelength and amplitude
C) frequency and wavelength*
D) wavelength and velocity

*Standard: II.I.III.10*
*DOK Level: 1*

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**II.I.III.11**

**Strand II: The Content of Science**

**Standard I (Physical Science):** Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

**Benchmark III:** Understand the motion of objects and waves, and the forces that cause them.

**Standard with Test Item Specifications:**

**Motion**
11. Explain how the interactions of waves can result in interference, reflection, and refraction.

**Specifications:**
- Given a variety of real-life examples, identify which type of wave interaction occurs

**Item Types:**
*MC = multiple choice with or without stimulus*

**Sample Question:**
Which of the following describes what happens to the wave that travels around obstacles or through openings in obstacles?

A) reflection  
B) deflection  
C) refraction  
D) diffraction*

*Standard: II.I.III.11  
DOK Level: 1
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### NMPED Reference Sheet

#### Physical Science

- **Acceleration**: \[ a = \frac{v_f - v_i}{t} \]
- **Speed**: \[ v = \frac{d}{t} \]
- **Density**: \[ D = \frac{m}{V} \]
- **Force**: \[ F = ma \]
- **Acceleration of gravity**: \[ g \approx 10 \text{ m/s}^2 \]
- **Kelvin**: \[ K = ^\circ C + 273 \]
- **Weight**: \[ w = mg \]
- **Volume of a rectangular solid**: \[ V = lwh \]

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#### Electromagnetic Spectrum

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The spectrum includes:
- **Radio waves**
- **Microwaves**
- **Infrared**
- **Visible light**
- **Ultraviolet**
- **X-rays**
- **Gamma rays**