New Mexico Public Education Department

Assessment Blueprint

Physics

End-of-Course (EoC) Exam

SY 2016-17

Purpose Statement—Physics

The Physics End-of-Course assessment is designed to measure student proficiency of the NM Content Standards pertaining to physics. This course-level assessment is provided to all students who have completed Physics or related courses that are identified in the course assessment linkage document found at: http://ped.state.nm.us/ped/NMTeach_Toolbox.html.
Intended as a final exam for the course, this is a summative assessment covering a wide range of content, skills, and applications. Scores are reported at the teacher, school, district, and state levels for the purposes of student grades, curriculum review, [student graduation requirements], and—for optional use—as input into the Educator Effectiveness System.

A note about changes in EOC development process:

During the 2016-17 school year, New Mexico educators will be convened to make any necessary revisions to this blueprint. During the 2016-17 EOC operational assessment, 1-3 Technology Enhanced Items (TEIs) may be added to a form for field test purposes only. These TEI items will NOT be scored or used for the Educator Effectiveness System. These items will help New Mexico educators to create new forms in anticipation for the 2017-18 operational year.

Blueprint Table—Physics

NM Content Standards

Reporting Category	Standard/ Benchmark	Content Statement
Scientific Method	**I.I. Benchmark I: 1–4**	**Use accepted scientific methods to collect, analyze, and interpret data and observations and to design and conduct scientific investigations and communicate results.** 1. Describe the essential components of an investigation, including appropriate methodologies, proper equipment, and safety precautions. 2. Design and conduct scientific investigations that include: • testable hypotheses • controls and variables • methods to collect, analyze, and interpret data • results that address hypotheses being investigated • predictions based on results • re-evaluation of hypotheses and additional experimentation as necessary error analysis. 3. Use appropriate technologies to collect, analyze, and communicate scientific data (e.g., computers, calculators, balances, microscopes). 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.
	I.I. Benchmark II: 1–3	**Understand that scientific processes produce scientific knowledge that is continually evaluated, validated, revised, or rejected.** 1. Understand how scientific processes produce valid, reliable results, including:

Reporting Category	Standard/ Benchmark	Content Statement
Scientific Method (cont.)	**I.I. Benchmark II: 1–3 (cont.)**	• consistency of explanations with data and observations • openness to peer review • full disclosure and examination of assumptions • testability of hypotheses • repeatability of experiments and reproducibility of results. 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. 3. Understand how new data and observations can result in new scientific knowledge.
	I.I. Benchmark III: 1–5	**Use mathematical concepts, principles, and expressions to analyze data, develop models, understand patterns and relationships, evaluate findings, and draw conclusions.** 1. Create multiple displays of data to analyze and explain the relationships in scientific investigations. 2. Use mathematical models to describe, explain, and predict natural phenomena. 3. Use technologies to quantify relationships in scientific hypotheses (e.g., calculators, computer spreadsheets and databases, graphing software, simulations, modeling). 4. Identify and apply measurement techniques and consider possible effects of measurement errors. 5. Use mathematics to express and establish scientific relationships (e.g., scientific notation, vectors, dimensional analysis).

Reporting Category	Standard/ Benchmark	Content Statement
Newton's Laws of Motion/ Momentum	**II.I. Benchmark III: 7,8**	**Understand the motion of objects and waves and the forces that cause them.** 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). **Motion** 8. Apply Newton's Laws to describe and analyze the behavior of moving objects, including: • displacement, velocity, and acceleration of a moving object • Newton's Second Law, $F = ma$ (e.g., momentum and its conservation, the motion of an object falling under gravity, the independence of a falling object's motion on mass) • circular motion and centripetal force.
Linear Motion/Equilibrium and Vectors	**II. I. III: 9**	9. Describe relative motion using frames of reference.
	II.I.II: 11	11. Understand the concept of equilibrium (i.e., thermal, mechanical, and chemical).
Atomic Structure	**II.I. Benchmark I: 6, 11**	**Understand the properties, underlying structure, and reactions 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. 11. Know that some atomic nuclei can change, including: • spontaneous decay • half-life of isotopes • fission • fusion (e.g., the sun) • alpha, beta, and gamma radiation.

Reporting Category	Standard/ Benchmark	Content Statement
Atomic Structure (cont.)	**III.I.I: 14**	**Chemical Reactions** 14. Describe New Mexico's role in nuclear science (e.g., Manhattan Project, WIPP, national laboratories).
Energy and Work	**II.I. Benchmark II: 1,3,6**	**Understand the transformation and transmission of energy and how energy and matter interact.** 1. Identify different forms of energy, including kinetic, gravitational (potential), chemical, thermal, nuclear, and electromagnetic. 3. Understand that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes. 6. Understand that the ability of energy to do something useful (work) tends to decrease (and never increases) as energy is converted from one form to another.
Gravity (Newton's Law)/ Forces	**II.I. Benchmark III: 2,4**	**Understand the motion of objects and waves and the forces that cause them.** 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. 4. Understand the relationship between force and pressure, and how the pressure of a volume of gas depends on the temperature and the amount of gas.
Heat Transfer	**II.I. Benchmark II: 3,4,5,11**	**Understand the transformation and transmission of energy and how energy and matter interact.** 3. Understand that energy can change from one form to another (e.g., changes in kinetic and potential energy in a gravitational field, heats of reaction, hydroelectric dams) and know that energy is conserved in these changes. 4. Understand how heat can be transferred by conduction, convection, and radiation, and how heat conduction differs in conductors and insulators. 5. Explain how heat flows in terms of the transfer of vibrational motion of atoms and molecules from hotter to colder regions.

Reporting Category	Standard/ Benchmark	Content Statement
		Interactions of Energy and Matter 11. Understand the concept of equilibrium (i.e., thermal, mechanical, and chemical).
Waves	**II.I. Benchmark III: 10,11,12**	**Understand the motion of objects and waves, and the forces that cause them**. 10. Describe wave propagation using amplitude, wavelength, frequency, and speed. 11. Explain how the interactions of waves can result in interference, reflection, and refraction. 12. Describe how waves are used for practical purposes (e.g., seismic data, acoustic effects, Doppler effect).
EM Spectrum	**II.I. Benchmark II: 7, 8, 10**	**Understand the transformation and transmission of energy and how energy and matter interact.** 7. Understand that electromagnetic waves carry energy that can be transferred when they interact with 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. 10. Explain how wavelengths of electromagnetic radiation can be used to identify atoms, molecules, and the composition of stars.

Physics EoC Reporting Category Alignment Framework					
		DOK (Item # by DOK)			Grand Total
Reporting Category	Standard	1	2	3	
Scientific Method	I.I.I.1	1			1
	I.I.I.2	3	4, 6, 7		4
	I.I.I.4		5		1
	I.I.III.5		2		1
Forces and Motion	II.I.III.4		30		1
	II.I.III.7	10			1
	II.I.III.8	13, 14	9, 15,16	8, 17	7
	II.I.III.9		11		1
	II.I.III.11		12		1
Work / Energy	II.I.II.1	19, 23			2
	II.I.II.3	21	20, 24		3
	II.I.II.6		18, 22		2
Heat Transfer	II.I.II.3	26			1
	II.I.II.4	29			1
	II.I.II.5		25, 27, 28, 31		4
Waves	II.I.III.10	34, 38, 39,40			4
	II.I.III.11	32, 35, 37			3
	II.I.III.12		33,41	36	3
EM Spectrum/Atomic Structure	II.I.I.6		45,47		2
	II.I.II.7		48,50		2
	II.I.II.8	42,46,49	44		4
	II.I.III.10		43		1
	Grand Total	20	27	3	50