Flight Testing Newton's Laws

National Standards

Grades 9 – 12 Science

Source: National Standards Science Literacy 2008

Lesson/Activity	Grades 9 – 12 Science Standards
Session-1 (1-17)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-1 (1-17)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-1 (1-17)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-1 (1-17)	4F/H4 henever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-1 (1-17)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-2 (1-10)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-2 (1-10)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-2 (1-10)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-2 (1-10)	4F/H4 henever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-2 (1-10)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-3 (1-6)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-3 (1-6)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-3 (1-6)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
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Session-3 (1-6)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-4 (1-11)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-4 (1-11)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-4 (1-11)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-4 (1-11)	4F/H4 henever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-4 (1-11)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-5 (1-6)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-5 (1-6)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.

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Lesson/Activity	Grades 9 – 12 Science Standards
Session-5 (1-6)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-5 (1-6)	4F/H4 whenever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-5 (1-6)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-6 (1-8)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-6 (1-8)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-6 (1-8)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-6 (1-8)	4F/H4 whenever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-6 (1-8)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-7 (1-5)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-7 (1-5)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-7 (1-5)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-7 (1-5)	4F/H4 whenever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-7 (1-5)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-8 (1-9)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-8 (1-9)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-8 (1-9)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-8 (1-9)	4F/H4 whenever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-8 (1-9)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-9 (1-7)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-9 (1-7)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-9 (1-7)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-9 (1-7)	4F/H4 henever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-9 (1-7)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.
Session-10 (1-5)	1B/H1 Investigations are conducted for different reasons, including to explore new phenomena, to check on previous results, to test how well a theory predicts, and to compare theories.
Session-10 (1-5)	1B/H3 Sometimes, scientists can control conditions in order to obtain evidence. When that is not possible, practical, or ethical, they try to observe as wide a range of natural occurrences as possible to discern patterns.
Session-10 (1-5)	4F/H1 The change in motion (direction or speed) of an object is proportional to the applied force and inversely proportional to the mass.
Session-10 (1-5)	4F/H4 whenever one thing exerts a force on another, an equal amount of force is exerted back on it.
Session-10 (1-5)	4F/H8 Any object maintains a constant speed and direction of motion unless an unbalanced outside force acts on it.

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National Standards

Grades 9 – 12 Science

Source: NSTA National Science Education Standards - 1996

Lesson/Activity	Grades K – 4 Science Standards
Session-1 (1-17)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-1 (1-17)	Between any two charged particles, electric force is vastly greater than the gravitational force. Most observable forces such as those exerted by a coiled spring or friction may be traced to electric forces acting between atoms and molecules.
Session-1 (1-17)	Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.
Session-1 (1-17)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-1 (1-17)	Newtonian mechanics
Session-2 (1-10)	A variety of technologies, such as hand tools, measuring instruments, and calculators, should be an integral component of scientific investigations. The use of computers for the collection, analysis, and display of data is also a part of this standard. Mathematics plays an essential role in all aspects of an inquiry. For example, measurement is used for posing questions, formulas are used for developing explanations, and charts and graphs are used for communicating results.
Session-2 (1-10)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-2 (1-10)	Between any two charged particles, electric force is vastly greater than the gravitational force. Most observable forces such as those exerted by a coiled spring or friction may be traced to electric forces acting between atoms and molecules.
Session-2 (1-10)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-2 (1-10)	Newtonian mechanics
Session-3 (1-6)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-3 (1-6)	Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.

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Grades 9 – 12 Science

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Lesson/Activity	Grades 9 – 12 Science Standards
Session-3 (1-6)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-3 (1-6)	Newtonian mechanics
Session-5 (1-6)	Chemical reactions can take place in time periods ranging from the few femtoseconds (10-15 seconds) required for an atom to move a fraction of a chemical bond distance to geologic time scales of billions of years. Reaction rates depend on how often the reacting atoms and molecules encounter one another, on the temperature, and on the properties--including shape--of the reacting species.
Session-5 (1-6)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-5 (1-6)	Heat consists of random motion and the vibrations of atoms, molecules, and ions. The higher the temperature, the greater the atomic or molecular motion.
Session-5 (1-6)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-5 (1-6)	Newtonian mechanics
Session-6 (1-8)	A variety of technologies, such as hand tools, measuring instruments, and calculators, should be an integral component of scientific investigations. The use of computers for the collection, analysis, and display of data is also a part of this standard. Mathematics plays an essential role in all aspects of an inquiry. For example, measurement is used for posing questions, formulas are used for developing explanations, and charts and graphs are used for communicating results.
Session-6 (1-8)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-6 (1-8)	Between any two charged particles, electric force is vastly greater than the gravitational force. Most observable forces such as those exerted by a coiled spring or friction may be traced to electric forces acting between atoms and molecules.
Session-6 (1-8)	Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.
Session-6 (1-8)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.

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Lesson/Activity	Grades 9 – 12 Science Standards
Session-6 (1-8)	Newtonian mechanics
Session-7 (1-5)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-7 (1-5)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-7 (1-5)	Newtonian mechanics
Session-8 (1-9)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-8 (1-9)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-8 (1-9)	Newtonian mechanics
Session-9 (1-7)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.
Session-9 (1-7)	Because all scientific ideas depend on experimental and observational confirmation, all scientific knowledge is, in principle, subject to change as new evidence becomes available. The core ideas of science such as the conservation of energy or the laws of motion have been subjected to a wide variety of confirmations and are therefore unlikely to change in the areas in which they have been tested. In areas where data or understanding are incomplete, such as the details of human evolution or questions surrounding global warming, new data may well lead to changes in current ideas or resolve current conflicts. In situations where information is still fragmentary, it is normal for scientific ideas to be incomplete, but this is also where the opportunity for making advances may be greatest.
Session-9 (1-7)	Newtonian mechanics
Session-10 (1-5)	A variety of technologies, such as hand tools, measuring instruments, and calculators, should be an integral component of scientific investigations. The use of computers for the collection, analysis, and display of data is also a part of this standard. Mathematics plays an essential role in all aspects of an inquiry. For example, measurement is used for posing questions, formulas are used for developing explanations, and charts and graphs are used for communicating results.
Session-10 (1-5)	Objects change their motion only when a net force is applied. Laws of motion are used to calculate precisely the effects of forces on the motion of objects. The magnitude of the change in motion can be calculated using the relationship F = ma, which is independent of the nature of the force. Whenever one object exerts force on another, a force equal in magnitude and opposite in direction is exerted on the first object.

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Lesson/Activity	Grades 9 – 12 Science Standards
Session-10 (1-5)	The electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel. The strength of the force is proportional to the charges, and, as with gravitation, inversely proportional to the square of the distance between them.
Session-10 (1-5)	Between any two charged particles, electric force is vastly greater than the gravitational force. Most observable forces such as those exerted by a coiled spring or friction may be traced to electric forces acting between atoms and molecules.
Session-10 (1-5)	Electromagnetic waves result when a charged object is accelerated or decelerated. Electromagnetic waves include radio waves (the longest wavelength), microwaves, infrared radiation (radiant heat), visible light, ultraviolet radiation, x-rays, and gamma rays. The energy of electromagnetic waves is carried in packets whose magnitude is inversely proportional to the wavelength.
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Session-10 (1-5)	Newtonian mechanics