

IOWA
End-of-Course
Assessment
Programs
Released Items

PHYSICAL SCIENCE

1 If the net force acting on a 5.0-kg object is 12 N, the object's acceleration is equal to which of the following?

A 0.24 m/s²

INCORRECT: Dividing 12 N by 50. kg gives an acceleration of 0.24 m/s².

B 0.60 m/s²

INCORRECT: Multiplying 12 N by 0.050 kg gives 0.60 kg²·m/s².

C 2.4 m/s²

CORRECT: The equation for acceleration is $a = f(\text{net force})/m$ (mass). When the net force of 12 N is divided by the given mass of 5.0 kg, the object's acceleration is equal to 2.4 m/s².

D 6.0 m/s²

INCORRECT: Multiplying 12 N by 0.50 kg gives 6.0 kg²·m/s².

ICC Essential Concept:

Motions and Forces

ICC Underlying Skill:

Newton's Laws

2 Turning up the volume on a car radio causes which of the following properties of the sound to change?

A Frequency

INCORRECT: The frequency of sound is a measure of how high or low the pitch is. Turning up the volume on a car radio does not change the pitch of the sound. Therefore, the frequency does not change.

B Amplitude

CORRECT: The amplitude of a sound wave corresponds to its intensity or loudness. Turning up the volume on a car radio increases the amplitude of the sound.

C Wavelength

INCORRECT: The wavelength of a sound wave is the distance between a trough and the next trough. Turning up the volume on a car radio does not change the wavelength of the sound.

D Velocity

INCORRECT: The velocity of sound is equal in magnitude to the speed of sound. Turning up the volume on a car radio does not change the speed of the sound. Therefore, the velocity does not change.

ICC Essential Concept:

Interactions of Energy and Matter

ICC Underlying Skill:

Wave Phenomena

3 A beam of white light is passed through a glass prism, generating a spectrum. A filter that allows only green light to pass through is placed in the path of the spectrum. If a second prism is now placed in the path of the green light, which of the following will emerge from this prism?

A Red light only

INCORRECT: Green light and red light are separate components of white light, each with a set of distinct frequencies. Passing the green light through the second prism will not convert it to red light.

B Green light only

CORRECT: Once separated from the other color components of white light, the green light will remain isolated. The second prism will make no difference.

C White light, not separated into a spectrum

INCORRECT: Green light is just one component of white light. Passing the green light through the second prism will not reform white light.

D White light, separated into a spectrum

INCORRECT: Green light is just one component of white light. Passing the green light through the second prism will not reform white light.

ICC Essential Concept:

Interactions of Energy and Matter

ICC Underlying Skill:

Electromagnetic Waves

4 In a vacuum, X-rays and gamma rays have the same:

A frequency.

INCORRECT: Gamma rays have a higher frequency than X-rays.

B wavelength.

INCORRECT: Gamma rays have a shorter wavelength than X-rays.

C energy.

INCORRECT: Gamma rays have more energy than X-rays.

D speed.

CORRECT: In a vacuum, all types of radiation within the electromagnetic spectrum travel at the same speed, which is called the speed of light.

ICC Essential Concept:

Interactions of Energy and Matter

ICC Underlying Skill:

Electromagnetic Waves

5 Which of the following elements is a nonmetal?

A Li

INCORRECT: Li is an alkali metal located in Group 1 in the periodic table.

B Ba

INCORRECT: Ba is an alkaline earth metal located in Group 2 in the periodic table.

C Mn

INCORRECT: Mn is a transition metal located in Group 7 in the periodic table.

D Se

CORRECT: Se is a nonmetal located in Group 16 in the periodic table.

ICC Essential Concept:

Structure and Properties of Matter

ICC Underlying Skill:

Periodic Table

6 Which, if either, of an object's potential and kinetic energies will directly depend on the object's position relative to the ground?

A Potential energy only

CORRECT: Potential energy of an object directly depends on the object's position relative to the ground. Potential energy = mgh , where m is the mass of the object, g is the acceleration due to gravity on Earth, and h is the height of the object from Earth's surface.

B Kinetic energy only

INCORRECT: Kinetic energy of an object is the energy of motion and does not directly depend on the object's position relative to the ground. Kinetic energy = $m \cdot v^2 / 2$, where m is the mass of the object and v is the velocity of the object.

C Potential energy as well as kinetic energy

INCORRECT: Kinetic energy of an object does not directly depend on the object's position relative to the ground.

D Neither potential energy nor kinetic energy

INCORRECT: Potential energy of an object directly depends on the object's position relative to the ground.

ICC Essential Concept:

Conservation of Energy and Increase in Disorder

ICC Underlying Skill:

Types of Energy

7 A beam of light strikes a mirror and is reflected. If the angle of incidence is equal to 35° , the angle of reflection is:

A less than 35° .

INCORRECT: The angle of reflection cannot be less than the angle of incidence according to the law of reflection.

B equal to 35° .

CORRECT: According to the law of reflection, the angle of incidence equals the angle of reflection. If the angle of incidence is equal to 35° , the angle of reflection must also be equal to 35° .

C greater than 35° but less than 55° .

INCORRECT: The angle of reflection cannot be greater than the angle of incidence according to the law of reflection.

D equal to 55° .

INCORRECT: The angle of reflection cannot be greater than the angle of incidence according to the law of reflection.

ICC Essential Concept:

Interactions of Energy and Matter

ICC Underlying Skill:

Wave Phenomena

8 The net force acting on a box at rest on a table top is:

A in the downward direction.

INCORRECT: If the net force acting on the box was in the downward direction, the box would not be at rest.

B in the upward direction.

INCORRECT: If the net force acting on the box was in the upward direction, the box would not be at rest.

C in the leftward direction.

INCORRECT: If the net force acting on the box was in the leftward direction, the box would not be at rest.

D zero.

CORRECT: When an object is at rest, there is no unbalanced force acting on it. As a result, the net force acting on the box is zero.

ICC Essential Concept:

Motions and Forces

ICC Underlying Skill:

Forces

9 Which of the following forces is NOT a fundamental force?

A Gravity

INCORRECT: One of the four fundamental forces is gravity.

B Friction

CORRECT: The four fundamental forces are gravity, electromagnetic force, weak nuclear force, and strong nuclear force. Gravity pulls two masses together and can only be attractive. Electromagnetic force is the interaction of particles with an electrical charge and can be attractive or repulsive. Weak nuclear force causes the radioactive decay of certain atomic nuclei. Strong nuclear force, among other things, holds the nucleus of an atom together. Friction is not one of the four fundamental forces.

C Electromagnetic force

INCORRECT: One of the four fundamental forces is electromagnetic force.

D Strong nuclear force

INCORRECT: One of the four fundamental forces is strong nuclear force.

ICC Essential Concept:

Motions and Forces

ICC Underlying Skill:

Forces

10 If the length of a frictionless ramp being used to lift a heavy box onto a porch is halved, the effort force will:

A quadruple.

INCORRECT: Work input equals the effort force times the effort distance. If the length of the frictionless ramp (the effort distance) is halved, the effort force will double.

B double.

CORRECT: Work input equals the effort force times the effort distance. If the length of the frictionless ramp (the effort distance) is halved, the effort force will double.

C halve.

INCORRECT: Work input equals the effort force times the effort distance. If the length of the frictionless ramp (the effort distance) is halved, the effort force will double.

D remain the same.

INCORRECT: Work input equals the effort force times the effort distance. If the length of the frictionless ramp (the effort distance) is halved, the effort force will double.

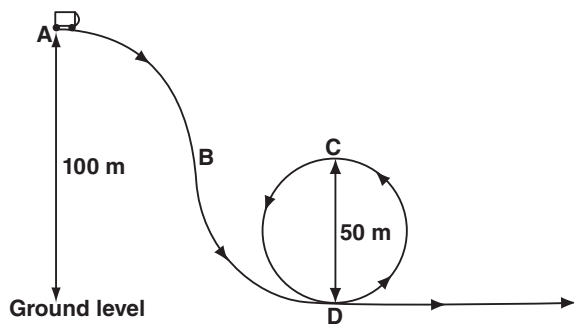
ICC Essential Concept:

Motions and Forces

ICC Underlying Skill:

Forces

Directions: Questions 11 through 13 are based on the following diagram in which a portion of a roller coaster track is shown. The roller coaster car will start from rest at Position A.



11 At which two positions will the kinetic energy of the roller coaster car be most similar?

A A and B

INCORRECT: At Position A, the roller coaster car will have no kinetic energy being at rest. At Position B, the roller coaster car will have almost as much kinetic energy as potential energy.

B A and C

INCORRECT: At Position A, the roller coaster car will have no kinetic energy being at rest. At Position C, the roller coaster car will have as much kinetic energy as potential energy.

C B and C

CORRECT: The sum of potential and kinetic energies remains constant. At positions B and C, the roller coaster car will be at about the same height. Therefore, the potential energy of the roller coaster car will be about the same at these two positions. As a result, the kinetic energy of the roller coaster car will be about the same at these two positions.

D B and D

INCORRECT: At Position D, the roller coaster car will have almost twice as much kinetic energy as at Position B.

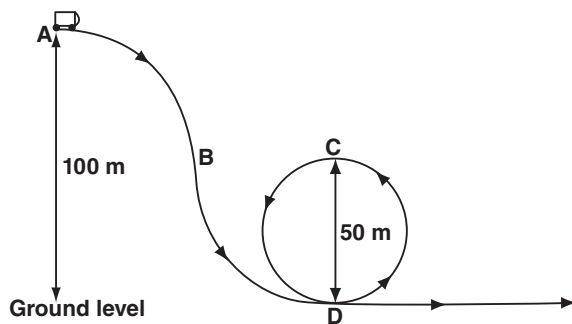
ICC Essential Concept:

Conservation of Energy and Increase in Disorder

ICC Underlying Skill:

Types of Energy

Directions: Questions 11 through 13 are based on the following diagram in which a portion of a roller coaster track is shown. The roller coaster car will start from rest at Position A.



12 At what position will the roller coaster car have the maximum kinetic energy?

A A

INCORRECT: At Position A, the roller coaster car will have no kinetic energy because it will be at rest.

B B

INCORRECT: At Position B, the roller coaster car will have almost half as much kinetic energy as at Position D.

C C

INCORRECT: At Position C, the roller coaster car will have half as much kinetic energy as at Position D.

D D

CORRECT: The sum of potential and kinetic energies remains constant. At Position D, the roller coaster car will be at a minimum height and will therefore have minimum potential energy and maximum kinetic energy.

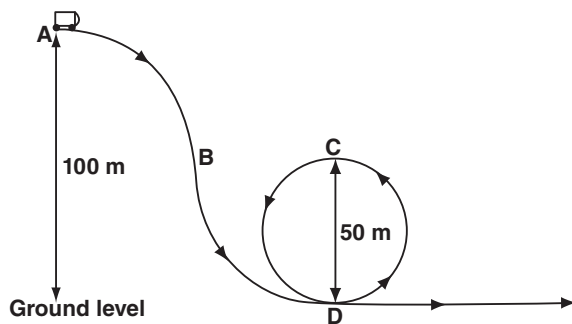
ICC Essential Concept:

Conservation of Energy and Increase in Disorder

ICC Underlying Skill:

Types of Energy

Directions: Questions 11 through 13 are based on the following diagram in which a portion of a roller coaster track is shown. The roller coaster car will start from rest at Position A.



13 The roller coaster car's potential energy at Position B will be closest to which of the following?

- A Half the roller coaster car's potential energy at Position A

CORRECT: At Position B, the roller coaster car will be almost at half the height it is at Position A. Therefore, the roller coaster car's potential energy at Position B will be almost half as much as at Position A.

- B Half the roller coaster car's potential energy at Position C

INCORRECT: The roller coaster car's potential energy will be about the same at positions B and C.

- C Twice the roller coaster car's potential energy at Position A

INCORRECT: The roller coaster car's potential energy at Position B will be almost half as much as at Position A.

- D Twice the roller coaster car's potential energy at Position C

INCORRECT: The roller coaster car's potential energy will be about the same at positions B and C.

ICC Essential Concept:

Conservation of Energy and Increase in Disorder

ICC Underlying Skill:

Types of Energy

14 An atom of $^{14}_6\text{C}$ contains how many neutrons in all?

A 6

INCORRECT: The atomic number or the number of protons is 6.

B 8

CORRECT: The sum of the number of protons and the number of neutrons is equal to the mass number. The mass number is 14 and the atomic number or the number of protons is 6. Thus, the number of neutrons is 8.

C 12

INCORRECT: The number of protons and the number of electrons add up to 12.

D 14

INCORRECT: The mass number is 14, which is the sum of the number of protons and the number of neutrons.

ICC Essential Concept:

Structure of Atoms

ICC Underlying Skill:

Isotopes

15 Which of the following best describes the chemical equation $\text{Mg} + \text{O}_2 \rightarrow \text{MgO}$?

A Balanced chemical equation for a decomposition reaction

INCORRECT: The chemical equation is unbalanced. A decomposition reaction is a one-reactant reaction in which the reactant breaks down into smaller products on absorbing energy.

B Balanced chemical equation for a combustion reaction

INCORRECT: The chemical equation is unbalanced.

C Unbalanced chemical equation for a decomposition reaction

INCORRECT: A decomposition reaction is a one-reactant reaction in which the reactant breaks down into smaller products on absorbing energy.

D Unbalanced chemical equation for a combustion reaction

CORRECT: The chemical equation is unbalanced. The balanced chemical equation would be $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$. The reaction is a combustion reaction in which magnesium reacts with oxygen to form magnesium oxide.

ICC Essential Concept:
Chemical Reactions

ICC Underlying Skill:
Types of Reactions