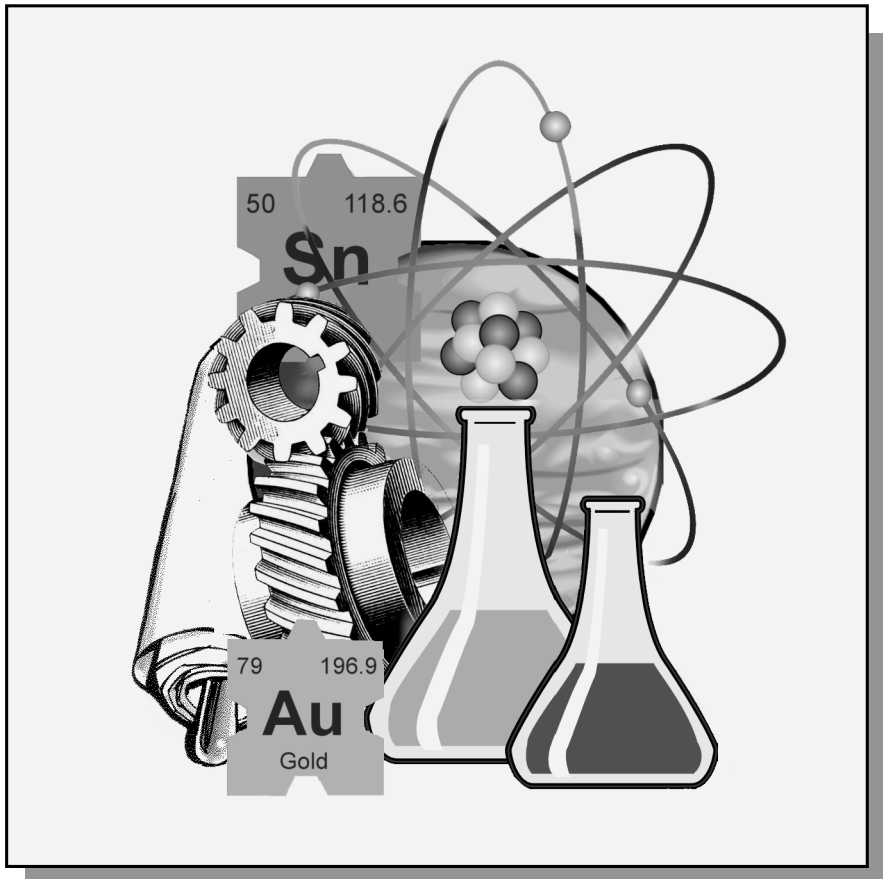
Integrated Physics & Chemistry

ACTIVITIES



Chapter 2

IPC 76174 Revision: 01-21-05-1

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ACTIVITIES
Lesson 1:
Inventions & Discoveries

Galileo and the Pendulum

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Physics goes back to the time of the Egyptians.
   (a) True or (b) False

2. Aristotle lived: _____.
   (a) about 200 years ago (c) more than 2,000 years ago
   (b) about 1,000 years ago (d) almost 2,000 years ago

3. The natural philosophers learned more about the natural world by reasoning and: _____.
   (a) power (b) observation (c) experimentation (d) application

4. The word that means "love of learning" is: _____.
   (a) philanthropy (b) ***philosophy*** (c) logic (d) Lyceum

5. The letters Ph.D. stand for: _____.
   (a) Physics Degree (c) phone a doctor
   (b) Philosophy Degree (d) Doctor of Philosophy

6. Biology, geology and chemistry are all part of physics.
   (a) True or (b) False

*7. Physics is the study of ***matter*** and ***energy*** and their interaction.
   (a) True or (b) False

8. Aristotle saw differences in the types of sea life.
   (a) True or (b) False

*9. An essential step in science is to _____ information so it is easier to understand.

10. Aristotle was the _____ of Alexander the Great.
    (a) student (b) tutor (c) son (d) father

11. The only records of what Aristotle taught are the notes of his students.
    (a) True or (b) False

12. The ones who were better at science were: _____.
    (a) Greeks (b) Romans (c) Egyptians (d) Naturalists

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13. In Europe, what immediately followed the collapse of the Roman Empire was the: _____.
(a) Dark Ages (c) Renaissance
(b) Revival of Learning (d) Greek Empire

14. Gutenberg's printing press helped revive learning.
(a) True or (b) False

15. Aristotle instructed his students to observe and to think.
(a) True or (b) False

16. Galileo: _____.
(a) invented the telescope
(b) used the telescope to study the heavens
(c) gave a telescope to his brother as a gift
(d) used a telescope to build roads

17. Galileo made his first discovery while he was still a student.
(a) True or (b) False

18. A pendulum: _____.
(a) is free to swing (c) is an unsharpened pencil
(b) is a lamplighter (d) vibrates between two fixed points

19. Galileo discovered the *Principle of the Pendulum.*
(a) True or (b) False

20. The ***period*** is the time a pendulum takes to: _____.
(a) come to rest (c) make a complete ***arc***
(b) swing more than 7 times (d) swing all the way around its center

21. The length of a pendulum and its period are _____ related.

22. ***Experiments*** seldom reveal new scientific discoveries.
(a) True or (b) False

23. The purpose of this lesson is to: _____
_____.
(a) show how the Greeks used science to conquer the world
(b) trace the history of ideas up to Galileo's discovery and research of the principle of the pendulum
c) show how Galileo used the telescope to study the motion and patterns found in the heavens
(d) show how Aristotle's influence of Alexander the Great changed the history of science

24. Write the **Life Principle:** *"*_____
_____
_____.*"*

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ACTIVITIES
Lesson 2:
Motion

Galileo and Motion: Speed

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Aristotle's ***logic*** proved to be in error in most of his writings.
   (a) True or (b) False

2. By Galileo's time, Aristotle's ideas had been: _____.
   (a) forgotten (c) lost
   (b) misunderstood (d) taught in school

3. When Galileo tested Aristotle's idea that ball-shaped objects sank in water, he found the idea to be: _____.
   (a) entirely correct (c) Aristotle's secret key to the universe
   (b) only true for some objects (d) true for everything but wax

4. Aristotle stated that if a heavier object weighed ten times as much as a lighter one, the heavier object would fall: _____.
   (a) at the same speed as the lighter one
   (b) so fast that it would burn up in Earth's atmosphere
   (c) ten times as fast
   (d) twice as fast

5. Galileo found that all objects fall at the same ***speed*** regardless of their weight provided air resistance is eliminated. (a) True or (b) False

*6. Two objects of different weights are dropped from the top of a tall building. They hit the ground at the same time. We can conclude that the speed of falling bodies and their weight are: _____.
   (a) related to one another (c) faster than the speed of light
   (b) ***independent*** of one another (d) inversely proportional to each other

*7. The period of a pendulum and the amount of weight at the end of the pendulum are: _____.
   (a) inversely proportional to each other
   (b) all you need to know to build a pendulum clock
   (c) independent of one another
   (d) related to one another

8. Galileo's statement that a lump of lead and a feather would fall at the same speed in a vacuum has never been tested. (a) True or (b) False

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9. As a teacher, Galileo was not very successful and had to teach to nearly empty classrooms.
(a) True or (b) False

10. Galileo believed an object in motion came to a stop because: _____
_____.
(a) a force such as friction acted upon it (c) it wanted to
(b) being at rest was its natural state (d) gravity always makes objects stop

*11. The quantity distance/time is a measure of a body's: _____.
(a) speed (b) mass (c) acceleration (d) stamina

12. If a hundred-yard dash is completed in 8 seconds, the average speed of the runner is:
_____.
(a) 100 yards divided by 8 seconds (c) 100 yards in 8 seconds
(b) 8 seconds divided by 100 yards (d) 8 seconds divided by 100

*13. To measure the speed, Galileo needed to measure distance and _____.

*14. The expression "miles per hour" is an example of a(n): _____.
(a) unit of speed (c) unit of weight
(b) meaningless quantity (d) scientific method

15. The purpose of the ***inclined plane*** in Galileo's experiment was to: _____.
(a) slide down when he got tired (c) allow balls to roll more slowly
(b) increase the force of gravity (d) increase the force of friction

16. The speed of a runner when measured over a distance from the starting block to the finish line is an example of: _____.
(a) ***average speed*** (c) ***instantaneous speed***
(b) beginning speed (d) average distance

17. An automobile's speedometer measures: _____.
(a) average speed (c) average distance
(b) instantaneous speed (d) total distance

18. A radar gun can measure: _____.
(a) full range of motion (c) average speed
(b) instantaneous speed (d) distance

19. The point of this lesson was to: _____.
(a) prove that Aristotle was one of the greatest scientists who ever lived
(b) illustrate Galileo's contributions to science in the motion of earthly bodies
(c) instruct the student how to tell the difference between instantaneous and average speed
(d) show how important Galileo's role was in understanding how fast he could make objects roll

20. Write the **Life Principle:** *"*_____
_____
_____.*"*

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ACTIVITIES
Lesson 3:
Motion

Galileo and Motion: Acceleration

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

*1. Speed = change in distance/change in _____.

2. A unit that measures speed is: _____.
   (a) ft/sec (b) grams/cubic cm (c) ft/sec^2 (d) liter/gram

3. ***Velocity*** includes speed and _____ of motion.

4. Galileo never succeeded in measuring instantaneous velocity.
   (a) True or (b) False

5. When friction is eliminated, a ball rolling across a horizontal surface will: _____.
   (a) come to rest at 9.8m
   (b) come to rest within 32 feet
   (c) gain speed at the rate of 32 ft/sec^2
   (d) continue to roll at a constant speed in a straight line

*6. Only the ***force*** of _____ acts upon an object in ***free fall***.

7. *Acceleration* is the change of speed with respect to _____.

*8. For acceleration to occur, velocity must change.
   (a) True or (b) False

9. The two quantities that must be known to calculate acceleration are change in velocity and: _____.
   (a) mass of the object (c) change in time
   (b) distance from Earth's center (d) distance in a straight line

10. A car that goes from 0 mi/hr to 60 mi/hr has an acceleration of 60 mi/hr.
   (a) True or (b) False

*11. The acceleration due to ***gravity*** is: _____.
   (a) 32 ft/sec^2 (b) 3.14 ft/sec^2 (c) 9.8 ft/sec^2 (d) 32 ft/sec

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12. Which object will fall faster in a vacuum? _____.
    (a) a feather
    (b) a bowling ball
    (c) a concrete block
    (d) The feather, the bowling ball, and the concrete block together will fall at the same rate.

13. A brick falls more quickly than a concrete block, ignoring friction.
    (a) True or (b) False

*14. The acceleration due to gravity in the metric system is: _____.
    (a) 760 mm (b) 9.80 m/sec^2 (c) 9.8 ft/sec^2 (d) 760 mm/sec^2

15. Galileo made use of Aristotle's idea for solving a complicated problem by breaking it down into individual components.
    (a) True or (b) False

16. Horizontal velocity is greatly affected by the vertical velocity due to gravity.
    (a) True or (b) False

*17. A projectile follows a: _____.
    (a) circular path (c) straight path
    (b) parabolic path (d) elliptical path

18. Which of the following cannons has the greatest range? _____
    (a) a cannon level with the ground pointing left
    (b) a cannon pointing straight up
    (c) a cannon level with the ground, pointing right
    (d) a cannon pointing up at 45°

19. The main idea of this section is: _____
    (a) Velocity and speed are two different quantities.
    (b) Acceleration can never be understood.
    (c) The origins of the universe can easily be understood.
    (d) Galileo's experiments helps us to understand the nature of acceleration.

20. Write the **Life Principle:** *"*_____
    _____.*"*

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ACTIVITIES
Lesson 4:
Light & Sound

Galileo, Roemer and the Speed of Light

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The speed of light is faster than the speed of sound.
   (a) True or (b) False

2. The Greeks believed the speed of sound to be: _____.
   (a) finite
   (b) infinite
   (c) faster than the speed of light
   (d) slower than the speed of light

3. The equation for speed is: speed = _____.

4. When a cannon fires, the first to reach a distant observer is the: _____.
   (a) light (b) sound (c) cannonball (d) gunpowder

5. Galileo and the other scientists of his day agreed that light traveled at a ***finite*** speed.
   (a) True or (b) False

6. During his experiment to measure the speed of light, Galileo recognized the time delay to be a measure of: _____.
   (a) the shutter speed
   (b) gravitational force
   (c) the speed of light
   (d) human reaction time

7. Galileo decided the speed of light was: _____.
   (a) "extraordinarily rapid"
   (b) ***instantaneous***
   (c) immeasurable
   (d) exceptionally slow

*8. Christiaan Huygens invented the: _____.
   (a) pendulum
   (b) balance spring
   (c) first accurate clock
   (d) smokeless gunpowder

9. Accurate instruments improved scientific discoveries.
   (a) True or (b) False

10. In the 1670s, Olaus Roemer, a Danish astronomer, discovered four large moons.
    (a) True or (b) False

11. The ***eclipses*** of Io, one of the moons of Jupiter, fell behind schedule because of: _____.
    (a) the gravitational pull of the Sun
    (b) Io's orbit had an accident
    (c) the finite speed of light
    (d) the powerful gravity of Jupiter

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*12. Roemer's value for the ***speed of light*** was incorrect because: _____
_____.

(a) light changes speed as Jupiter goes around the Sun
(b) the distance across Earth's orbit was not accurately known
(c) the speed of light was slower in those days
(d) he made an educated guess

13. In calculating the speed of light, Roemer used the equation: _____.

(a) speed = distance/time
(b) speed = wavelength * frequency
(c) distance/time
(d) wavelength * speed/frequency

14. Galileo's effect upon the progress of physics was slight.

(a) True or (b) False

15. Albert Michelson measured the speed of light by reflecting a laser beam off the Moon.

(a) True or (b) False

*16. The speed of light stated in miles per second is _____.

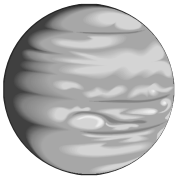
*17. The speed of light stated in meters per second is _____.

18. The main idea of this lesson is: _____
_____

(a) Galileo and Roemer knew that light traveled at the same speed as sound, and their ingenious experiments showed this to be true.
(b) The speed of light can never be measured accurately, though many have tried.
(c) Albert Michelson was a wealthy man, so he financed the study of the speed of light.
(d) Many experiments had to be performed to understand and arrive at the correct speed of light.

19. Write the **Life Principle:** *"*_____
_____
_____
_____.*"*

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Brahe, Kepler and Copernicus: Motion in the Heavens

ACTIVITIES
Lesson 5:
Planets

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Tycho Brahe grew interested in astronomy when he:_____.
   (a) saw a comet (c) met Galileo
   (b) had a dream about a star (d) observed an eclipse of the Sun

2. Some astronomers held the ***theory*** that Earth was the center of the universe.
   (a) True or (b) False

3. Copernicus believed the planets orbited the: _____.
   (a) Earth (b) Sun (c) Mars (d) Milky Way

4. Tycho Brahe built his observatory: _____.
   (a) on a high mountain in Spain
   (b) on a private island owned by the king of Denmark
   (c) in the city of Prague
   (d) entirely out of glass

5. Brahe's observations were proven worthless by the invention of the telescope.
   (a) True or (b) False

6. Mars is especially difficult to observe with the unaided eyes.
   (a) True or (b) False

*7. Astronomers of Brahe's day based the orbits of the planets on: _____.
   (a) circles or combinations of circles (c) hyperbolas
   (b) parabolas (d) ***ellipses***

8. John Kepler met Tycho Brahe in: _____.
   (a) Denmark (b) Paris (c) Prague (d) London

9. The one who composed a yearly calendar and almanac was: _____.
   (a) Tycho Brahe (b) John Kepler (c) Isaac Newton (d) Aristotle

10. John Kepler used the sun-centered planetary system because: _____
   _____.
   (a) he wanted a better tan (c) Galileo suggested it
   (b) Aristotle recommended it (d) it made his calculations easier

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11. Copernicus used the sun-centered planetary system because: _____
_____.
(a) he wanted a better tan (c) Galileo recommended it
(b) Aristotle recommended it (d) it made his calculations easier

*12. Evidence that both the Earth and Mars orbit the Sun is the fact that:
_____.
(a) Mars changes in brightness
(b) Mars is obstructed from Earth's view
(c) Mars is a planet
(d) Mars is eclipsed by Earth's rays

13. Copernicus did not publish his book, *On the Revolution of the **Celestial** Sphere,* until near the end of his life because: _____.
(a) he could not find a publisher
(b) he feared going to prison
(c) he had writer's cramp
(d) of peer pressure from rival scientists

14. Copernicus lived only two years after his book, *On the Revolution of the Celestial Sphere*, was published.
(a) True or (b) False

15. Copernicus' book, *On the Revolution of the Celestial Sphere*, was published several years after Galileo investigated the laws of motion of objects on Earth.
(a) True or (b) False

16. When Tycho Brahe died, he gave his greatest treasure to: _____
(a) Galileo (b) John Kepler (c) Isaac Newton (d) his best friend, Bob

17. Tycho Brahe's great treasure was his: _____.
(a) collection of scientific instruments (c) observatory
(b) years of data (d) journal

18. John Kepler calculated the correct orbit of Mars in: _____.
(a) 1473 (b) 1783 (c) twelve days (d) six years

*19. The orbit of Mars is: _____.
(a) a perfect circle (c) an ellipse
(b) a combination of circles (d) shorter than Earth's orbit

20. The one who discovered the Three Laws of Planetary Motion was: _____.
(a) Copernicus (b) John Kepler (c) Galileo (d) Tycho Brahe

21. The First Law of Planetary Motion states that the planets travel in _____ orbits around the Sun.

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22. The moons of Jupiter follow the Three Laws of Planetary Motion: _____.

(a) with Jupiter at one focus
(b) when tides are ignored
(c) if your telescope works
(d) if the big red spot faces north

23. The main idea of this lesson is: _____

_____

(a) Kepler formulated the Three Laws of Planetary Motion using the work of Tyco Brahe and Copernicus.
(b) Tycho Brahe used the ideas of Kepler and Copernicus to formulate his observations of Mars.
(c) Kepler was able to formulate the Three Laws of Planetary Motion because of his detailed observations.
(d) Kepler predicted an eclipse of the Sun in 1860, and this prediction made him very famous.

24. Write the **Life Principle:** *"*_____

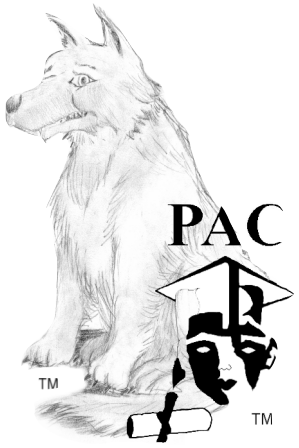
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_____.*"*

Note: Ask your teacher for the quiz over topics 1-5 before proceeding to the next section. Reminder: If you score 85% or higher on the three section quizzes, you may be exempt from the chapter test!



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ACTIVITIES
Lesson 6:
Motion

Velocity, Mass, Acceleration and Force

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Isaac Newton was born the same year that Galileo: _____.
   (a) was born (c) dropped the lead weights off the Leaning Tower of Pisa
   (b) died (d) discovered the principles of acceleration

2. Isaac Newton learned a lot about science from his father.
   (a) True or (b) False

3. Isaac Newton grew up when the ruler of England was: _____.
   (a) King James I (c) Pope John Paul I
   (b) Oliver Cromwell (d) Queen Victoria

4. Isaac Newton's childhood could be described as: _____.
   (a) royal (b) athletic (c) ordinary (d) filled with terrible poverty

5. When Isaac Newton was seventeen years old, everyone recognized that he would make an exceptional farmer.
   (a) True or (b) False

6. Isaac Newton paid for his college education by: _____.
   (a) tutoring physics (c) academic scholarships
   (b) a loan from his step father (d) waiting on tables

7. Cambridge University closed and sent Isaac Newton home because of: _____ _____.
   (a) political unrest (c) his academic failures
   (b) the bubonic plague (d) bad weather

8. The ***Black Death*** was transmitted by rat bites.
   (a) True or (b) False

9. During the 18 months on his mother's farm, Isaac Newton studied: _____.
   (a) light (c) the nature of gravity
   (b) mathematics (d) all of these

*10. The formula for speed = _____.

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11. An example of an object that is changing *velocity* is a: _____.
    (a) train running at constant speed on a straight track
    (b) ball rolling on a level plane
    (c) horse running on a circular racetrack
    (d) car going 55 mi/hr along a road that is not curved

12. Because the Moon is constantly changing direction, it is also constantly changing its velocity.
    (a) True or (b) False

*13. *Acceleration* = change in velocity/ _____.

*14. The one that measures the amount of matter in an object is: _____.
    (a) ***weight*** (b) mass (c) neither a nor b (d) both a and b

15. How strongly gravity acts on a body is the body's: _____.
    (a) weight (b) mass (c) average speed (d) muscular resistance

*16. A safe that is on Earth, on the surface of the Moon or floating in space has the same: _____.
    (a) weight (b) mass (c) both a and b (d) speed

17. In the metric system, the measure of *mass* is a: _____.
    (a) newton (b) foot-pound (c) ***kilogram*** (d) liter

*18. ***Force*** is anything that can change an object's: _____.
    (a) mass (b) velocity (c) length (d) volume

19. In the metric system, the ***newton*** is a measure of: _____.
    (a) mass (b) velocity (c) sweetness (d) force

20. The main idea of this lesson is: _____
    _____
    (a) Newton was a great man of science who loved to sit under apple trees and watch the Moon.
    (b) Newton studied the nature of light and color during his 18 months at his mother's farm.
    (c) Newton's Laws of Motion can be understood by first understanding velocity, mass, acceleration and force.
    (d) Newton could not distinguish between velocity, mass, acceleration and force; therefore, he could not formulate the Laws of Motion.

21. Write the **Life Principle:** *"*_____
    _____*."*

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ACTIVITIES
Lesson 7:
Motion

Motion, Gravity and the Stars

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The Black Death ended shortly after the Great Fire of London.
   (a) True or (b) False

2. Isaac Newton invented the first telescope that brought light to a focus with a:
   _____.
   (a) glass lens (b) mirror (c) magnifying glass (d) fiber optics rod

3. The defect of ***refracting telescopes*** was that they: _____.
   (a) caused the image to be inverted
   (b) required a clumsy eyepiece
   (c) caused false color fringes around an object
   (d) could only be made in Italy

4. Today, the most powerful ***reflecting telescopes*** bring light to a focus with: _____
   _____.
   (a) lenses (b) mirrors (c) magnifying glasses (d) fiber optics rods

5. Isaac Newton lived at Cambridge University for about: _____.
   (a) 18 months (b) 2 years (c) 25 years (d) 60 years

6. Isaac Newton wrote books about science and no other subject.
   (a) True or (b) False

7. Many of Newton's investigations into astronomy stemmed from reading the books of _____ and _____ in the Bible.

8. Isaac Newton's book, *Principia Mathematica Philosophiae Naturalis*, is generally considered to be: _____.
   (a) the greatest book ever written on science
   (b) a book filled with errors from the Greek scientists
   (c) a manual for school principals
   (d) a textbook used to learn Latin

9. The idea that an artificial satellite could be put in orbit around the Earth dates from 1955.
   (a) True or (b) False

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10. *Newton's First Law of Motion* states: "_____ _____."

11. "If $F = 0$ then $a = 0$" is a mathematical shorthand expression of the: _____ _____.
    (a) First Rule of Calculus
    (b) relationship between apples and the Law of Gravity
    (c) First Law of Motion
    (d) Law of Action-Reaction

12. For an object at rest to stay at rest: _____.
    (a) it must lie in a vacuum (c) no forces can act on it
    (b) it must be in outer space (d) the unbalanced net force must be zero

*13. ***Inertia*** is the property of matter that causes it to: _____.
    (a) resist changes in motion (c) bend without breaking
    (b) slow because of friction (d) be weightless in space

14. The trick of pulling a tablecloth from a table without upsetting the dinnerware is an example of: _____.
    (a) inertia (b) the Law of Gravity (c) magic (d) constant velocity

*15. *Newton's Second Law of Motion* states: "_____ _____."

16. If two quantities are directly ***proportional*** and one increases, then the other will: _____.
    (a) increase (b) decrease (c) stay the same (d) none of these

*17. According to the Second Law of Motion, if the force on a body doubles, the acceleration: _____.
    (a) doubles (c) stays the same
    (b) is divided by two (d) none of these

*18. According to the Second Law of Motion, if the same force acts on a mass twice as great, the acceleration will: _____.
    (a) double (c) stay the same
    (b) be reduced in half (d) none of these

*19. In order for the same size engine to make a vehicle accelerate faster, one could: _____.
    (a) add more mass to the car (c) place another mass in front of the car
    (b) eliminate mass from the car (d) press the breaks

20. For force to be in newtons, mass must be in kilograms and acceleration in: _____.
    (a) kg/m (b) cm/sec (c) mi/hr (d) m/sec^2

*21. The force equation states that F = _____.

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22. Force is equal to mass times: _____.
    (a) velocity (b) acceleration (c) speed (d) gravity

23. *Newton's Third Law of Motion* states: "_____
_____."

24. The main purpose of this lesson is: _____
_____.
    (a) to show how Newton achieved great success despite his severe mental handicap
    (b) to illustrate how Newton's improvements to the telescope helped him figure out the distance from the Earth to the Sun
    (c) to show how force, acceleration, mass and velocity are important concepts in understanding the movements of the planets
    (d) to illustrate Newton's scientific contributions to the telescope and to understanding the Laws of Motion

25. Write the **Life Principle:** *"*_____
_____
_____
_____."

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ACTIVITIES
Lesson 8:
Motion

The Three Laws of Motion

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Speed is found by dividing change in distance by _____.
2. Acceleration is found by dividing change in velocity by _____.
3. The mass of a body is a measure of the amount of _____ in the body.
4. In the metric system, mass is measured in: _____.
   (a) pounds (b) meters (c) kilograms (d) newtons
5. Force can change an object's: _____.
   (a) state of mind (b) inertia (c) acceleration (d) mass

*6. State the First Law of Motion: "_____
_____
_____."

*7. The ancient Greeks believed objects naturally: _____.
   (a) came to rest (c) rotated
   (b) maintained their speed (d) all of these

*8. The ancient Greeks of Aristotle's time believed the Earth: _____.
   (a) did not orbit the Sun (c) was at the center of the universe
   (b) was motionless (d) all of these

9. At the equator, the rotation of the Earth gives objects on its surface a speed about: _____.
   (a) 2 mi/hr (b) 1,000 mi/hr (c) 18.5 mi/sec (d) 186,000 mi/sec
10. Because of the revolution of Earth about the Sun, the Earth and everything on it are moving at about: _____.
   (a) the same speed as a race car (c) 1,000 mi/hr
   (b) 2 mi/hr (d) 18.5 mi/sec
11. Galileo believed the ancient Greeks were wrong to say that a body naturally sought to be at rest.
   (a) True or (b) False

*12. The First Law of Motion is also known as the Law of _____.

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*13. Seat belts and air bags are needed to overcome the: _____.
(a) force of gravity (c) vacuum caused by the collision
(b) inertia of a person's body (d) incline of the road

14. The First Law of Motion avoids the question of "What is rest?"
(a) True or (b) False

*15. State the Second Law of Motion: "_____
_____
_____."

16. Force is equal to mass times _____.

17. If several forces act on a body in such a way that they cancel each other out, the body has: _____.
(a) a net force of zero (c) to feel heavier
(b) an unbalanced force (d) an increase in acceleration

18. The four forces that act on an airplane are thrust, drag, lift and _____.

19. It is impossible to measure the mass of astronauts who are in weightlessness.
(a) True or (b) False

*20. State the Third Law of Motion: "_____
_____
_____."

21. When two bodies act upon each other with equal but opposite forces, they will give each other identical accelerations.
(a) True or (b) False

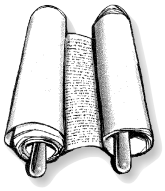
22. According to Newton's third law, rockets could not operate in space because they would have nothing to push against.
(a) True or (b) False

23. ***Muzzle velocity*** and ***recoil velocity*** illustrate Newton's _____ Law of Motion.
(a) First (b) Second (c) Third

24. The purpose of this lesson is to: _____
_____.
(a) show how the Three Laws of Motion are speed, velocity and acceleration
(b) persuade you that Newton's Laws of Motion are the greatest laws ever discovered
(c) explain how the Three Laws of Motion are used by rocket scientists to build and design new rockets
(d) clearly state, explain and provide examples of the Three Laws of Motion

25. Write the **Life Principle:** *"*_____
_____
_____.*"*

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ACTIVITIES
Lesson 9:
Scientific Laws

Newton and Gravity

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. The person who discovered the Law of Gravity was: _____.
   (a) Galileo (b) Robert Boyle (c) Edmund Halley (d) Isaac Newton

2. The person who wrote, "If two stones were placed anywhere in space near each other, they would come together at an intermediate point" was: _____.
   (a) Copernicus (c) Sir Christopher Wren
   (b) John Kepler (d) Robert Boyle

3. Galileo showed that objects on Earth would move in straight lines if it were not for other forces altering the object's paths.
   (a) True or (b) False

4. Kepler showed that objects in space move in straight lines.
   (a) True or (b) False

5. Isaac Newton concluded that the Moon's straight-line path is changed into a closed orbit because of: _____.
   (a) wind (b) a force (c) the man in the Moon (d) friction

6. Both an apple and the Moon share falling motions directed toward the Earth.
   (a) True or (b) False

*7. Although a cannon may fire a cannonball horizontally, gravity will cause its path to curve toward the surface of the: _____.
   (a) Moon (b) Sun (c) Earth (d) center of the universe

8. According to Isaac Newton's calculations, in one second the cannonball fell _____ times as far as the Moon fell.

9. An object near the surface of the Earth is about _____ miles from the center of Earth.

10. The Moon is about _____ miles from the center of the Earth.

11. Isaac Newton found that the force of gravity acting on the cannonball was about _____ times as great as the force of gravity acting on the Moon.
   (a) 1 (b) 60 (c) 3,600 (d) 360,000

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*12. Gravity follows the ***Inverse*** *Square Law*.
(a) True or (b) False

*13. The Inverse Square Law relates two quantities by the inverse of the _____ of the distance separating them.

*14. Light follows the Inverse Square Law.
(a) True or (b) False

*15. If the Moon was three times as far away, the gravitational attraction between it and the earth would be: _____.
(a) the same
(b) three times as great
(c) only one-ninth as great
(d) only one-third as great

16. Gravity between two objects is directly proportional to the product of their: _____.
(a) masses
(b) distance separating them
(c) speed away from each other
(d) distance from the Sun

17. Gravity between two objects is inversely proportional to the: _____ _____.
(a) distance
(b) square of the distance separating them
(c) speed away from each other
(d) sum of their mass

18. Isaac Newton rushed his ***Law of Universal Gravitation*** into publication so no one else would get credit for the discovery.
(a) True or (b) False

19. Edmund Halley became known as: _____.
(a) prince of astronomers
(b) Tycho of the South
(c) the Great Discoverer
(d) the King of Comets

20. Both Robert Hooke and Edmund Halley proved how gravity acts between the Sun and the planets.
(a) True or (b) False

21. Isaac Newton developed his Three Laws of Motion from: _____ _____.
(a) the value for the speed of light
(b) Galileo's law of falling objects
(c) proof that the Sun orbits the Earth
(d) Kepler's Three Laws of Planetary Motion

22. The person who took responsibility for seeing the *Principia Mathematica Philosophiae Naturalis* through the printers was: _____.
(a) Robert Hooke
(b) Sir Christopher Wren
(c) Edmund Halley
(d) the President of the Royal Society

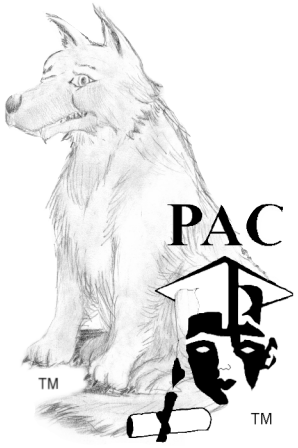
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23. The main idea of this lesson is: _____
_____

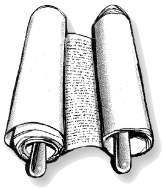
(a) Edmund Halley observed the stars of the Southern Hemisphere and became known as the "Tycho of the South" because of the observations.
(b) Newton solved the great question concerning how the Sun's rays were pulled to Earth by the force of gravity.
(c) Thanks to the suggestions of the Royal Society, Newton discovered the Law of Universal Gravitation.
(d) Newton solved many problems related to the force of gravity and published his work with the help of Edmund Halley.

24. Write the **Life Principle:** *"*_____
_____*."*

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ACTIVITIES
Lesson 10:
Scientific Laws

The Law of Gravity

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. A proportionality constant changes a proportion into a(n): _____.
   (a) ***equality*** (b) ratio (c) π (d) inequality

2. The *circumference* and *diameter* of a circle are directly proportional.
   (a) True or (b) False

3. The circumference and diameter of a circle are equal.
   (a) True or (b) False

4. The formula for the circumference of a circle is C = _____.

5. In the Law of Gravity, written in symbols, *G* is the symbol for the gravitational proportionality _____.

6. In the Law of Gravity, written in symbols, *F* is the symbol for _____.

7. In the Law of Gravity, written in symbols, m_1 and m_2 are the symbols for _____.

8. In the Law of Gravity, written in symbols, *r* is symbol for the _____ separating the *centers of the masses*.

*9. The Law of Gravity measures distance from the _____ of the mass.
   (a) top (b) outside (c) surface (d) centers

*10. One key statement of the Law of Gravity is that the force of attraction between two objects is inversely proportional to the _____ of the distance separating them.

11. If the distance of 12 miles between two objects is reduced to ¼ (or divided by 4), the gravitational attraction between them will be: _____.
   (a) ¼ as great (c) 8 times as great
   (b) 4 times as great (d) 16 times as great

*12. The second statement in the Law of Gravity states that the force of attraction between two bodies is directly proportional to the product of their _____.

13. Both apple and Earth have a gravitational attraction for one another.
   (a) True or (b) False

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14. Both Moon and Earth have a gravitational attraction for one another.
    (a) True or (b) False

15. ***Density*** is the mass of an object compared to its _____.

16. The Moon orbits the center of the Earth.
    (a) True or (b) False

17. Compared to a less massive ball, a more massive ball has: _____.
    (a) no inertia (b) less inertia (c) the same inertia (d) greater inertia

18. Weight is: _____.
    (a) the amount of mass a body contains
    (b) the force exerted by gravitational attraction
    (c) what you do at a bus stop
    (d) the acceleration due to gravity

*19. To calculate weight, multiply mass by the acceleration due to _____.

*20. The third key statement of the Law of Gravity states that it: _____
    _____.
    (a) is local (c) only works at short distances
    (b) is universal (d) attracts all physical matter except stars

21. The Law of Gravity applies to all bodies in space except comets.
    (a) True or (b) False

22. Halley's comet is no longer expected to return.
    (a) True or (b) False

23. Science builds on the discoveries made by earlier scientists.
    (a) True or (b) False

24. Isaac Newton built his work on the discoveries of Galileo and: _____.
    (a) Edmund Halley (c) Albert Einstein
    (b) John Kepler (d) Robert Hooke

25. Newton's statement, "*If I have been able to see farther, it is because I have stood on the shoulders of giants*," reflects which character quality? _____
    (a) pride (b) compassion (c) arrogance (d) humility

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26. The main idea of this lesson is: _____
_____.

(a) to provide a detailed description and explanation of the Law of Gravity
(b) to show how Edmund Halley discovered his comet
(c) to provide an account of how Newton's frustration that gravity always held him to the ground caused him to give up on trying to explain gravity altogether
(d) to illustrate that the Law of Gravity explains how humans should all obey the attraction we feel towards Earth, even if we do not want to obey

27. Write the **Life Principle:** *"*_____
_____
_____*."*

Note: Ask your teacher for the quiz over topics 6-10 before proceeding to the next section. Reminder: If you score 85% or higher on the three section quizzes, you may be exempt from the chapter test!



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ACTIVITIES
Lesson 11:
Motion

Momentum and Impulse

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Isaac Newton spent his entire life at Cambridge.
   (a) True or (b) False

2. Isaac Newton received knighthood for his work at the London mint.
   (a) True or (b) False

3. ***Momentum*** is defined as the mass of an object times its: _____.
   (a) acceleration (b) time applied (c) inertia (d) velocity

4. If an object doubles its mass, the momentum: _____.
   (a) becomes 3 times as great (c) becomes 2 times as great
   (b) doubles (d) becomes four times as great

5. If an object doubles its speed, the momentum: _____.
   (a) becomes 3 times as great (c) becomes 2 times as great
   (b) doubles (d) becomes four times as great

*6. Whenever one body gains momentum, another body must receive an equal momentum in the _____ direction.
   (a) same (b) opposite (c) north (d) skyward

7. Momentum includes direction.
   (a) True or (b) False

8. The longer a batter follows through with his swing, the greater the impulse applied to the ball.
   (a) True or (b) False

*9. An ***impulse*** applies a _____ for a period of time to an object, which causes a change in the velocity of the object.

10. If an object is given an impulse, it is also given a change in its momentum.
   (a) True or (b) False

11. When something appears to be created from nothing, scientists: _____.
   (a) start laughing (c) become cautious
   (b) call it a law of conservation (d) calculate the gravitational force

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12. State the Law of Conservation of Matter: "_____ _____."

13. State the Law of Conservation of Energy: "_____ _____."

*14. State the Law of Conservation of Momentum: "_____ _____ _____."

15. The main idea of this lesson is: _____ _____.

(a) to show how momentum, impulse and the Third Law of Motion are related to the conservation laws
(b) to provide a detailed account of how closed systems can only happen in outer space, where gravity has no affect
(c) to explain that conservation laws hold sometimes but are usually of no value to scientists trying to apply them to the world
(d) to show how momentum is defined as matter times velocity and to show that momentum is related to gravity

16. Write the **Life Principle:** *"*_____ _____ _____*."*

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ACTIVITIES
Lesson 12:
Inventions & Discoveries

Simple Machines

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Of all the ancient scientists, the one who appears to be the most modern was: _____.
   (a) Archimedes (b) Aristotle (c) Plato (d) Socrates

2. Archimedes did experiments with ***levers*** and ***pulleys***.
   (a) True or (b) False

*3. A ***simple machine*** allows a resistance to be overcome at one point by applying a force: _____.
   (a) from a high pressure water hose (c) at some other point
   (b) once in a while (d) from a claw hammer

*4. The Law of Simple Machines states: "_____ _____."

5. ***Load*** and *effort* are stated in units of: _____.
   (a) distance (b) force (c) acceleration (d) incline

*6. The inclined plane, pulley and wheel and axle are all simple machines.
   (a) True or (b) False

7. The claw hammer, pry bar and ramp are all simple machines.
   (a) True or (b) False

8. The wedge and screw are both examples of simple machines.
   (a) True or (b) False

9. The mechanical advantage of a simple machine is equal to the load divided by the _____.

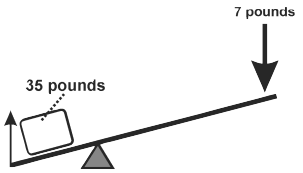
10. Mechanical advantage is never equal to one.
    (a) True or (b) False

*11. *Torque* is a force that: _____.
    (a) adds pressure (c) causes a twisting motion
    (b) increases the effort (d) prevents holes from forming

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*12. *Mechanical advantage* is equal to the distance effort is applied _____ the distance the load moves.

(a) subtracted by (b) multiplied by (c) divided by (d) added to



*13. In the above illustration, the mechanical advantage is: _____.

(a) 5 (b) 7 (c) 35 (d) 245

*14. A single pulley suspended overhead: _____ _____.

(a) allows a person to change the direction of the effort force
(b) gives a mechanical advantage of 2
(c) gives a greater mechanical advantage than a screw
(d) allows a person to change the amount of force necessary to lift the object

15. No simple machine has a mechanical advantage less than one.

(a) True or (b) False

16. Archimedes was executed for treason for letting the Roman Army enter his home city of Syracuse.

(a) True or (b) False

17. If a simple machine has a mechanical advantage of 26, to move the load by 3 feet, the effort must be applied through: _____.

(a) 3 feet (b) 26/3 feet (c) 26 feet (d) 78 feet

18. Simple machines are seldom found around the house.

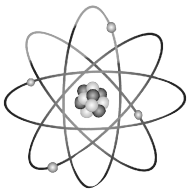
(a) True or (b) False

19. The main idea of this lesson is: _____ _____

(a) Archimedes died a cruel and troubled death after solving the problem of pulleys.
(b) Archimedes demonstrated the principles of simple machines while inventing a range of helpful inventions.
(c) Archimedes built a system of pulleys that he used to pull a barge up on the beach, pleasing his superiors.
(d) No amount of resistance could stop Archimedes' plan to have a simple machine in every home with his name on it.

20. Write the **Life Principle:** *"*_____ _____ _____ _____.*"*

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ACTIVITIES
Lesson 13:
Energy

Efficiency of Simple Machines

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

*1. Most simple machines have an ***efficiency*** that is: _____.
(a) 0 (b) 1.00 (c) less than 1.00 (d) greater than 1.00

2. ***Theoretical*** mechanical advantages can be calculated from the distance the effort and load each move.
(a) True or (b) False

*3. If effort is applied 9 m while the load moves 1.5 m, the theoretical mechanical advantage is: _____.
(a) 6.00 (b) 7.5 (c) 10.5 (d) 13.5

*4. If an effort force of 50 newtons moves a load of 300 newtons, the mechanical advantage is: _____.
(a) 6.00 (b) 60 (c) 350 (d) 15,000

5. If the actual mechanical advantage is 5 and the theoretical mechanical advantage is 6, the efficiency of the machine is: _____.
(a) 6 divided by 5 (b) 5 times 6 (c) 6 minus 5 (d) 5 divided by 6

6. ***Work*** is the force times the distance the force is applied.
(a) True or (b) False

7. Work input is equal to work output for: _____.
(a) all simple machines
(b) those simple machines with 50 percent efficiency
(c) those simple machines with 100 percent efficiency
(d) every simple machine except pulleys

8. The meaning of work in physics is that a force is applied through a _____.

9. The amount of *work* a student does in carrying a heavy book bag at constant speed over level terrain is: _____.
(a) equal to the weight of the books times the distance walked
(b) equal to the weight of the books
(c) zero
(d) equal to the friction between his shoes and the floor

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10. Work is defined as force times distance. This is written in symbols as w = _____.

11. A *joule* is a measure of: _____.
    (a) acceleration (b) force (c) work (d) power

12. A joule is equal to the force of one newton acting through a distance of one: _____.

13. A foot-pound is a measure of: _____.
    (a) acceleration (b) force (c) work (d) *power*

14. If a person lifts a one pound weight a distance of one foot, the amount of work done is one: _____.
    (a) foot-pound (b) horsepower (c) newton (d) joule

15. James Watt is credited with inventing the: _____.
    (a) disposable diaper (c) steam locomotive
    (b) steam engine (d) block and tackle

16. The steam engines that James Watt examined were: _____.
    (a) used to power locomotives (c) too small
    (b) running well until he worked on them (d) very inefficient

17. One horsepower equals: _____
    (a) 7 man power (c) 1.00 ft-lbs/min
    (b) the weight of the average stallion (d) 33,000 ft-lbs/min

18. A ***horsepower*** is a measure of: _____.
    (a) work per time interval (c) work times distance
    (b) work (d) force

19. Power is how quickly _____ is done.

20. A well-trained human being can develop about: _____.
    (a) 1/4 horsepower (c) 25 horsepower
    (b) 7 horsepower (d) 33,000 horsepower

21. Except for pumping water from mines, no other uses were found for James Watt's steam engines.
    (a) True or (b) False

22. Power = work/ _____.

*23. In the metric system, the unit of force is the _____.

*24. Work is equal to force times _____.

25. In the metric system, the unit of work is the _____.

*26. Power is equal to the work divided by _____

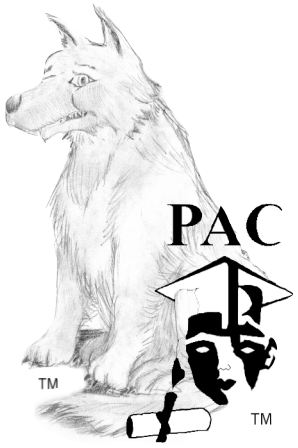
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27. In the metric system, the unit of power is the _____.

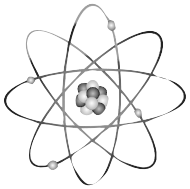
28. Given that a person lifts a 200 pound barbell to a height of six feet, power cannot be calculated because _____ is not known.
    (a) how many times the barbell was lifted
    (b) the force of gravity
    (c) how much work was used
    (d) how much time it took

29. Write the **Life Principle:** *"*_____
    _____.*"*

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ACTIVITIES
Lesson 14:
Energy

Kinetic and Potential Energy

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

1. Heat can do work.
   (a) True or (b) False

2. Electricity can do work.
   (a) True or (b) False

*3. *Energy* is the capacity to do _____.

4. The metric unit for energy is the _____.

5. The English unit for energy is the _____.

6. Work occurs when energy is: _____.
   (a) stored in a battery (c) transferred from one object to another
   (b) lost into another dimension (d) available whether it is being used or not

*7. *Latent* energy, such as that of water behind a dam, is called _____ energy.
   (a) moving (b) kinetic (c) dangerous (d) potential

8. ***Kinetic energy*** is energy due to: _____.
   (a) batteries (b) motion (c) position (d) granola bars

*9. The formula for kinetic energy is K.E. = _____.

*10. The kinetic energy of an object is directly proportional to its: _____.
   (a) mass (c) heat
   (b) volume (d) distance from the center of the Earth

11. If a bus has ten times the mass of a car traveling at the same speed, its kinetic energy will be _____ times as great.
   (a) five (b) ten (c) 100 (d) 1,000

12. The kinetic energy of an object is directly proportional to the square of the: _____.
   (a) mass (c) heat
   (b) velocity (d) distance from the center of the Earth

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13. The quantity that has the greater effect on the kinetic energy of an object is a change in the: _____.
    (a) mass (b) velocity (c) direction (d) acceleration

14. The braking distance of a car is directly proportional to its kinetic energy.
    (a) True or (b) False

15. Should a car increase its speed by a ***factor*** of three, its kinetic energy increases by a factor of: _____.
    (a) one (b) three (c) six (d) nine

16. Meteors have a great deal of kinetic energy because of their: _____.
    (a) bright light (c) great mass
    (b) high temperature (d) high velocity

*17. The energy of motion can be changed into potential energy.
    (a) True or (b) False

18. During some point in its swing, a pendulum has only potential energy.
    (a) True or (b) False

19. *Gravitational potential energy* is equal to product of mass, gravity and _____.

20. If the mass of an object doubles and the acceleration due to gravity and the height remain the same, the gravitational potential energy of the object: _____.
    (a) would be divided by two (c) multiplied by four
    (b) doubles (d) stays the same

21. On the Moon, an object's gravitational potential energy would be less because: _____.
    (a) its mass is less
    (b) the acceleration due to gravity is less
    (c) the green cheese negates potential energy
    (d) of the lack of air friction on the Moon

22. The main purpose of this lesson is: _____ _____.
    (a) to describe potential and kinetic energy while showing their relationship to work
    (b) to explain why kinetic and potential energy have nothing to do with work
    (c) to show that work, kinetic energy and potential energy are just figments of the imagination
    (d) to describe the difference between potential and kinetic energy, which is that only kinetic energy is related to mass

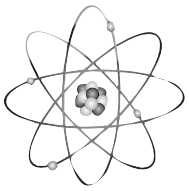
23. Write the **Life Principle:** *"*_____ _____ _____.*"*

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Name: _____ *Integrated Physics & Chemistry*

Chapter 2, Section 3

Date: _____ Grade: _____



ACTIVITIES
Lesson 15:
Energy

Mechanical and Heat Energy

You are making progress! ***Answer the following questions. Circle the correct answers or fill in the blanks with words, letters or numbers as each question indicates. Check your answers from the Answer Key. Correct all errors, then complete your next goal.***

*1. A wound-up spring is an example of: _____.
(a) heat energy (c) mechanical energy
(b) life energy (d) nuclear energy

2. Kinetic energy can be changed into heat energy.
(a) True or (b) False

3. James Prescott Joule made very accurate: _____.
(a) clocks (c) weight measurements
(b) thermometers (d) astronomical predictions

4. James Prescott Joule found that the temperature of water at the bottom of the waterfall was _____ than water at the top of the waterfall.
(a) warmer (b) cooler (c) the same as (d) less energetic

5. A *British thermal unit* is the amount of heat required to raise the temperature of one _____ of water one degree Fahrenheit.

6. James Prescott Joule failed in his effort to find the mechanical ***equivalent*** of heat.
(a) True or (b) False

*7. In both the English system and metric system, heat is measured by how much it raises the temperature of a fixed amount of water.
(a) True or (b) False

8. Calories of heat can be converted into *joules* of energy.
(a) True or (b) False

*9. Heat energy is due to the motion of: _____.
(a) calories (b) joules (c) atoms and molecules (d) light photons

10. As energy changes from one form to another, some of the energy: _____.
(a) explodes (b) becomes matter (c) becomes heat (d) disappears

11. Einstein's ***Special Theory of Relatively*** is expressed in the equation _____.

12. Einstein's energy equation proved the Law of Conservation of Mass to be correct.
(a) True or (b) False

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*13. State the Law of Conservation of Energy: "_____
_____."

14. The study of nuclear reactions is a part of _____ physics.
(a) *classical* (b) *modern* (c) elementary (d) astronomical

15. Isaac Newton's Three Laws of Motion are part of _____ physics.
(a) classical (b) modern (c) elementary (d) particle

16. Science is a process that: _____.
(a) never changes
(b) adapts to new information
(c) never stays the same
(d) is without error

17. The main idea of this lesson is: _____
_____.
(a) to show how Joule started the scientific revelation
(b) to explain how waterfalls work
(c) to explain the difference between classical and modern physics
(d) to explain the relationship between heat and energy

18. Write the **Life Principle:** *"*_____
_____*."*

Note: Ask your teacher for the quiz over topics 11-15 before proceeding to the next section. Reminder: If you score 85% or higher on the three section quizzes, you may be exempt from the chapter test!



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