Name: _____ **Class:** _____ **Date:** _____ **ID: A**

Relativity

Multiple Choice

Identify the choice that best completes the statement or answers the question.

____ 1. When we move around through space just a little bit, we are moving _____.
   a. through time only
   b. only through space
   c. mostly through time and only a little bit through space
   d. mostly through space and only a little bit through time
   e. none of the above

____ 2. Light is different from objects with mass in that no matter how fast the source of light is moving, light always _____.
   a. has the same color
   b. has the same period
   c. has the same speed
   d. travels in the same direction
   e. all of the above

____ 3. Einstein reasoned that _____.
   a. all motion is relative
   b. a spaceship cannot measure its speed relative to empty space
   c. a spaceship can only measure its speed relative to other objects
   d. all of the above

____ 4. A spaceship moves away from a space station at one-half the speed of light. If a person in the space station flashes a light beacon, people in the ship will see light traveling toward them at a speed of _____.
   a. $\frac{1}{4}$ the speed of light
   b. $\frac{1}{2}$ the speed of light
   c. $\frac{2}{3}$ the speed of light
   d. $\frac{3}{2}$ the speed of light
   e. the speed of light

____ 5. Suppose we observe light bouncing back and forth between two vertical clock mirrors in a spaceship that is whizzing past us at a very high speed. Compared to what the person in the spaceship sees, we see the spaceship clock as running _____.
   a. just the same b. fast c. slow

____ 6. If you are moving in a high-speed spaceship relative to the Earth, you would _____.
   a. notice your pulse slowing down
   b. be able to do much more in an hour than ever before
   c. notice all your clocks have slowed down
   d. all of the above
   e. none of the above

____ 7. According to the special theory of relativity, all laws of nature are the same in reference frames
   a. that move at constant speeds.
   b. that accelerate.
   c. that vibrate.
   d. that oscillate.
   e. none of the above

____ 8. Clocks on a spaceship moving very fast appear to run slow when viewed from _____.
   a. the spaceship
   b. Earth
   c. both A and B
   d. neither A nor B

____ 9. When you approach a light source that in turn is moving towards you, your speed relative to the emitted light waves _____.
   a. decreases
   b. increases
   c. stays the same

____ 10. We are actually looking into the past when we look at _____.
   a. starlight
   b. our physics book
   c. both A and B
   d. none of the above

____ 11. When you approach a light source, the wavelength of emitted light appears _____.
   a. shorter
   b. the same
   c. longer

____ 12. The frequency of a light source doubles as the light approaches you. As the same light source moves away from you at the same speed, its frequency _____.
   a. is doubled
   b. is halved
   c. stays the same

____ 13. As a blinking light source approaches you at an increasing speed, the frequency of the flashes
   a. increases.
   b. stays the same.
   c. decreases.

____ 14. In some reference frame in the universe, you, right now, are traveling at a speed close to the speed of light.
   a. False
   b. True

____ 15. Compared to time kept on Earth, there is a physical slowing of time when you travel at _____.
   a. everyday low speeds.
   b. relativistic speeds.
   c. both A and B
   d. none of the above

____ 16. A friend is riding on the back of a truck that is going away from you at 25 km/hr. After the truck passes, your friend throws a ball toward you at 55 km/h relative to her. How fast is the ball going relative to you?
   a. 25 km/h
   b. 30 km/h
   c. 55 km/h
   d. 80 km/h
   e. 105 km/h

____ 17. To a person who is inside a spaceship moving close to the speed of light, a meter stick held horizontally inside the ship looks
   a. squashed in the direction of motion.
   b. taller.
   c. wider in the direction of motion.
   d. shorter.
   e. just the same as always.

____ 18. To calculate how much rest energy an object contains, you multiply
   a. its mass times its velocity.
   b. the force on it times the length of time the force acts.
   c. its mass times its acceleration.
   d. its mass times the speed of light squared.
   e. one half its mass times its velocity squared.

____ 19. The reason the correspondence between mass and energy has been only recently discovered is that
   a. the changes involved on Earth are very small.
   b. we only recently have had accurate enough instruments.
   c. conventional methods cannot measure the changes involved.
   d. all of the above
   e. none of the above

____ 20. Objects accelerated to relativistic speeds appear to
   a. grow bigger.
   b. gain momentum.
   c. live a shorter time.
   d. all of the above
   e. none of the above

____ 21. A woman standing on the ground sees a rocket ship move past her at 95% the speed of light. Compared to the rocket at rest, the woman sees the rocket's length as
   a. longer.
   b. the same.
   c. shorter.

____ 22. When an object is pushed to relativistic speeds, its momentum is measured to be
   a. smaller than mv.
   b. greater than mv.
   c. the same as mv.

____ 23. According to the well-known equation "energy equals mass times the speed of light squared,"
   a. mass and energy travel at the speed of light squared.
   b. mass and energy travel at twice the speed of light.
   c. energy is actually mass traveling at the speed of light squared.
   d. mass and energy are related.
   e. none of the above

____ 24. Relativity equations for time, length, and momentum hold true for
   a. everyday low speeds.
   b. relativistic speeds.
   c. both A and B
   d. none of the above

____ 25. If you were to travel at speeds close to the speed of light, you would notice that your
   a. shape changes.
   b. mass increases.
   c. pulse decreases.
   d. all of the above
   e. none of the above

____ 26. To outside observers, objects traveling at relativistic speeds look
   a. larger.
   b. smaller.
   c. the same size.

____ 27. A spaceship whizzes past a space station at close to the speed of light. An observer on the station measures the length of the spaceship as less than when the ship is at rest, and an observer on the spaceship measures the length of the space station as
   a. the same as when the spaceship isn't moving.
   b. greater than when the spaceship isn't moving.
   c. less than when the spaceship isn't moving.

____ 28. There is an upper limit on the speed of a particle. This means there is also an upper limit on its
   a. kinetic energy.
   b. momentum.
   c. both A and B
   d. none of the above

____ 29. A 10-meter-long spear is thrown at a relativistic speed through a 10-meter-long pipe (both measured when at rest.) When the spear passes through the pipe,
   a. the pipe shrinks so the spear extends at both ends.
   b. both shrink equally so the pipe barely covers the spear.
   c. the spear shrinks so the pipe completely covers it.
   d. any of the above, depending on the motion of the observer
   e. none of the above

____ 30. The correspondence principle says that
   a. any new theory must correctly predict observations.
   b. the new theory is correct.
   c. the old theory is correct.
   d. any new theory must agree with the old correct theory.

____ 31. If Einstein's equations of special relativity are valid, they must
   a. reduce to Newton's equations when the speed is small.
   b. give correct answers for speeds much less than the speed of light.
   c. agree with the correct results of Newton's equations.
   d. both A and C
   e. A, B, and C