AMC/AFNS/NUMS Physics-1 Test Preparation

Measurements, Vectors & Motion

1. Which of the following is a base physical quantity in SI system?
A. Force
B. Velocity
C. Length
D. Pressure
Correct Answer: C. Length
Explanation: Length is one of the seven SI base quantities. Other base quantities include mass, time, electric current, temperature, amount of substance, and luminous intensity. Force, velocity, and pressure are derived quantities because they are formed from base quantities.

2. The SI unit of force is:
A. kg m s^{-1}
B. kg m s^{-2}
C. kg m^2 s^{-2}
D. kg m^{-1} s^{-2}
Correct Answer: B. kg m s^{-2}
Explanation: Force is defined by Newton's second law, F = ma. Mass has unit kg and acceleration has unit m s^{-2}, so the unit of force becomes kg m s^{-2}, which is also called newton.

3. The dimensional formula of velocity is:
A. $[LT^{-1}]$
B. $[LT^{-2}]$
C. $[MLT^{-1}]$
D. $[ML^2T^{-2}]$
Correct Answer: A. $[LT^{-1}]$
Explanation: Velocity is displacement per unit time. Displacement has dimension length [L], and time has dimension [T]. Therefore, velocity has dimensional formula $[LT^{-1}]$.

4. The dimensional formula of acceleration is:
A. $[LT^{-1}]$
B. $[LT^{-2}]$
C. $[MLT^{-2}]$
D. $[ML^2T^{-2}]$
Correct Answer: B. $[LT^{-2}]$
Explanation: Acceleration is the rate of change of velocity with time. Velocity has dimension $[LT^{-1}]$. Dividing it by time gives $[LT^{-2}]$.

5. Which instrument is used to measure very small length accurately?
A. Measuring tape
B. Vernier calipers
C. Spring balance
D. Stopwatch
Correct Answer: B. Vernier calipers
Explanation: Vernier calipers are used to measure small lengths, internal diameter, external diameter, and depth accurately. Their least count is usually 0.1 mm or 0.01 cm, depending on the instrument.

6. Least count of an instrument means:
A. Maximum reading it can measure
B. Smallest measurement it can accurately measure
C. Average of all readings
D. Error due to observer
Correct Answer: B. Smallest measurement it can accurately measure
Explanation: Least count is the minimum value that an instrument can measure accurately. Smaller least count means greater precision. For example, a screw gauge has smaller least count than a meter scale.

7. Zero error occurs when:
A. Instrument is broken completely
B. Instrument does not read zero when actual measurement is zero
C. Measurement is repeated many times
D. Observer reads from correct position
Correct Answer: B. Instrument does not read zero when actual measurement is zero
Explanation: Zero error is a systematic error that occurs when an instrument gives a non-zero reading even when the actual value should be zero. It must be corrected by adding or subtracting the zero correction.

8. The number of significant figures in 0.00450 is:
A. 2
B. 3
C. 4
D. 5
Correct Answer: B. 3
Explanation: Leading zeros are not significant. In 0.00450, the significant digits are 4, 5, and the final zero after decimal. Therefore, it has 3 significant figures.

9. Which of the following has the same dimensions as impulse?
A. Force
B. Work
C. Momentum

D. Power
Correct Answer: C. Momentum
Explanation: Impulse is force × time. Its dimensions are $[MLT^{-2}] \times [T] = [MLT^{-1}]$. Momentum is mass × velocity, so its dimensions are also $[MLT^{-1}]$. Therefore, impulse and momentum have the same dimensions.

10. A scalar quantity has:
A. Magnitude only
B. Direction only
C. Both magnitude and direction
D. No unit
Correct Answer: A. Magnitude only
Explanation: A scalar quantity is completely described by magnitude only. Examples include mass, time, speed, distance, energy, and temperature. It does not require direction.

11. Which of the following is a vector quantity?
A. Speed
B. Distance
C. Displacement
D. Temperature
Correct Answer: C. Displacement
Explanation: Displacement is a vector quantity because it has both magnitude and direction. Speed, distance, and temperature are scalar quantities because they have magnitude only.

12. The resultant of two equal vectors acting at an angle of 120° is:
A. Zero
B. Equal to one vector
C. Twice one vector
D. Half of one vector
Correct Answer: B. Equal to one vector
Explanation: Resultant of two vectors is $R = \sqrt{(A^2 + B^2 + 2AB\cos\theta)}$. If A = B and $\theta = 120°$, then $R = \sqrt{(A^2 + A^2 + 2A^2\cos120°)}$. Since $\cos120° = -1/2$, $R = \sqrt{(2A^2 - A^2)} = A$. So the resultant equals one vector.

13. If two vectors are perpendicular, their scalar product is:
A. Maximum
B. Minimum
C. Zero
D. Equal to their vector product
Correct Answer: C. Zero
Explanation: Scalar product is $A \cdot B = AB\cos\theta$. For perpendicular vectors, $\theta = 90°$ and $\cos90° = 0$. Therefore, their scalar product is zero.

14. The vector product of two parallel vectors is:
A. Maximum
B. Zero
C. Equal to dot product
D. Negative
Correct Answer: B. Zero
Explanation: Vector product is $A \times B = AB \sin\theta$. For parallel vectors, $\theta = 0°$ or $180°$, and $\sin 0° = \sin 180° = 0$. Therefore, the vector product is zero.

15. A unit vector has magnitude:
A. 0
B. 1
C. 9.8
D. Infinite
Correct Answer: B. 1
Explanation: A unit vector is a vector whose magnitude is exactly one. It is used to show direction only. Common unit vectors are i, j, and k along x, y, and z axes.

16. A body is said to be at rest if:
A. It changes position with time
B. It does not change position with respect to surroundings
C. It has acceleration only
D. It has velocity only
Correct Answer: B. It does not change position with respect to surroundings
Explanation: Rest and motion are relative terms. A body is at rest if its position does not change with time relative to a chosen reference point or surroundings.

17. Speed is defined as:
A. Displacement per unit time
B. Distance per unit time
C. Change in velocity per unit time
D. Force per unit mass
Correct Answer: B. Distance per unit time
Explanation: Speed is a scalar quantity and is defined as total distance covered per unit time. It does not include direction, unlike velocity.

18. Velocity is defined as:
A. Distance per unit time
B. Displacement per unit time
C. Mass per unit volume
D. Work per unit time
Correct Answer: B. Displacement per unit time

Explanation: Velocity is a vector quantity. It tells how fast displacement changes with time and also includes direction of motion.

19. Acceleration is produced when:
A. Speed remains constant in a straight line
B. Velocity changes with time
C. Distance is zero
D. Mass becomes zero
Correct Answer: B. Velocity changes with time
Explanation: Acceleration is the rate of change of velocity. Since velocity is a vector, acceleration can occur due to change in speed, change in direction, or both.

20. The slope of displacement-time graph gives:
A. Acceleration
B. Velocity
C. Force
D. Momentum
Correct Answer: B. Velocity
Explanation: In a displacement-time graph, slope = change in displacement / change in time. This is equal to velocity. A steeper slope means greater velocity.

21. The slope of velocity-time graph gives:
A. Displacement
B. Acceleration
C. Distance only
D. Speed only
Correct Answer: B. Acceleration
Explanation: In a velocity-time graph, slope = change in velocity / time. This is acceleration. A positive slope shows positive acceleration, while a negative slope shows retardation.

22. The area under a velocity-time graph represents:
A. Acceleration
B. Displacement
C. Force
D. Power
Correct Answer: B. Displacement
Explanation: Area under a velocity-time graph gives displacement because velocity × time = displacement. If the graph is below the time axis, displacement is negative.

23. A body moving with uniform velocity has:
A. Constant acceleration
B. Zero acceleration
C. Increasing acceleration

D. Negative mass
Correct Answer: B. Zero acceleration
Explanation: Uniform velocity means both speed and direction remain constant. Since acceleration is the rate of change of velocity, no change in velocity means acceleration is zero.

24. The first equation of motion is:
A. $v = u + at$
B. $s = ut + \frac{1}{2}at^2$
C. $v^2 = u^2 + 2as$
D. $s = vt$
Correct Answer: A. $v = u + at$
Explanation: The first equation of motion relates final velocity, initial velocity, acceleration, and time. It is valid only for motion with uniform acceleration.

25. In the equation $v = u + at$, "u" represents:
A. Final velocity
B. Initial velocity
C. Acceleration
D. Displacement
Correct Answer: B. Initial velocity
Explanation: In equations of motion, u represents initial velocity, v represents final velocity, a represents acceleration, and t represents time.

26. If a body starts from rest, its initial velocity is:
A. 1 m/s
B. 9.8 m/s
C. 0 m/s
D. Infinite
Correct Answer: C. 0 m/s
Explanation: Starting from rest means the body was not moving initially. Therefore, its initial velocity u is zero.

27. Free fall is motion under the effect of:
A. Friction only
B. Gravity only
C. Tension only
D. Air resistance only
Correct Answer: B. Gravity only
Explanation: Free fall is the motion of a body when gravity is the only force acting on it. Near Earth's surface, acceleration due to gravity is approximately 9.8 m/s^2 downward.

28. The value of acceleration due to gravity near Earth's surface is approximately:
A. 3.6 m/s^2

B. 6.9 m/s²
C. 9.8 m/s²
D. 12.5 m/s²
Correct Answer: C. 9.8 m/s²
Explanation: Near the Earth's surface, acceleration due to gravity is approximately 9.8 m/s². It is directed downward toward the center of Earth.

29. A projectile has constant horizontal velocity because:
A. Horizontal acceleration is zero
B. Vertical acceleration is zero
C. Gravity acts horizontally
D. Air resistance always increases speed
Correct Answer: A. Horizontal acceleration is zero
Explanation: In ideal projectile motion, air resistance is ignored. Gravity acts only vertically downward, so there is no horizontal acceleration. Therefore, horizontal velocity remains constant.

30. At the highest point of projectile motion, vertical velocity is:
A. Maximum
B. Zero
C. Equal to horizontal velocity always
D. Infinite
Correct Answer: B. Zero
Explanation: At the highest point, the projectile stops moving upward for an instant before coming down. Therefore, its vertical component of velocity becomes zero, but horizontal velocity remains constant.