# ASSERTION AND REASON

## Physics for **NEET UG**

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## This edition includes

- ☑ Chapter-wise coverage
- ☑ NCERT based questions
- ☑ 1000+ questions for practice
- ☑ Useful for NEET UG & other medical entrance exams

# Table of Contents

## Physics

**1.** **Assertion (A):** A displacement can be added with a distance.
**Reason (R):** Adding a scalar to a vector of the same dimensions is a meaningful algebraic operation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** Mass, length and time may be taken as fundamental quantities.
**Reason (R):** Mass, length and time are independent of one another.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** If $\vec{r}$ is the position vector then dimensions of $\dfrac{d^2\vec{r}}{dt^2}$ is $[M^0L^1T^{-2}]$.

**Reason (R):** Dimensions of $\int\left(\dfrac{d^2\vec{r}}{dt^2}\right)dt$ is

$[M^0L^1T^{-1}]$ where $\vec{r} \rightarrow$ position vector, $t \rightarrow$ time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** The error in measurement of radius of the sphere is 0.3%. The permissible error in its surface area is 1.2%.
**Reason (R):** Area of sphere, $A = 4\pi r^2 \Rightarrow \dfrac{\Delta A}{A} = 4\dfrac{\Delta r}{r}$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** Mean absolute error of a measurement is always positive.
**Reason (R):** Mean absolute error is defined as the magnitude of difference between true value and measured value.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** In mechanics the method of dimensions can't be applied to derive formula of a physical quantity which depends on more than three physical quantities.
**Reason (R):** We can derive relation of a physical quantity with other physical quantities out of which two have same dimensions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** Only like quantities can be added or subtracted from each other.
**Reason (R):** Velocity can be subtracted from the velocity gradient.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8.** **Assertion (A):** If a physical quantity has a unit it must have dimension.
**Reason (R):** There may exist a physical quantity which has dimension but no unit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** Pressure at height (z) and temp (q) is given by $P = \frac{\alpha}{\beta} e^{\frac{\alpha z}{k\theta}}$, K is Boltzmann constant then b may represent volume.
**Reason (R):** Acceleration, force and work
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** When we change the unit of measurement of a quantity, its numerical value changes.
**Reason (R):** Smaller the unit of measurement smaller is its numerical value.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** If the measuring instruments used are perfect, then measurements made will be perfect.
**Reason (R):** Measurements depend upon only on the instruments.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** When an algebraic equation has been derived, it is advisable to check it for dimensional consistency.
**Reason (R):** This guarantees that the equation is correct.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** eV and joule are the S.I. units of energy used in modern physics and mechanics respectively.
**Reason (R):** Different types of energies require different units in S.I. units.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** Pressure and energy density have same units in SI.
**Reason (R):** Dimensions of energy density and pressure are same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** The dimensions of base (fundamental) quantity in other base quantities is always zero.
**Reason (R):** All derived quantities may be represented dimensionally in terms of fundamental quantities.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** A unitless quantity never has a non-zero dimension.
**Reason (R):** A dimensionless quantity never has a unit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** Light year and wavelength have same dimensions.
**Reason (R):** Light year represent time while wavelength represent distance.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** Angle and strain are dimensionless.
**Reason (R):** Angle and strain have no unit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

1.   **Assertion (A):**
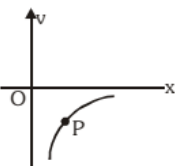


The acceleration(a) at P is negative

**Reason (R):** Acceleration $a = v\dfrac{dv}{dx}$; for

above situation v is −ve; $\dfrac{dv}{dx}$ is −ve.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2.   **Assertion (A):** Path of a projected ball is parabolic in uniform gravitational field for oblique projection in absence of air resistance.
**Reason (R):** Gravitational force is always act perpendicular to velocity during the motion of a projectile.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3.   **Assertion (A):** In any interval, the magnitude of displacement is always less than or equal to the distance travelled.
**Reason (R):** For a particle travelling in a straight line with constant acceleration, the magnitude of the change in the velocity during any interval is always less than or equal to the change in the speed during that interval.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

4.   **Assertion (A):** At point P object is slowing down.
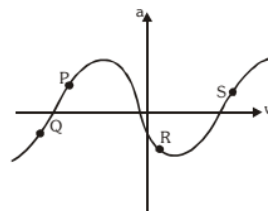


**Reason (R):** If acceleration is positive, object must speed up.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

5.   **Assertion (A):** A particle with constant acceleration always moves along a straight line.
**Reason (R):** A particle with constant acceleration will not change direction of motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6.   **Assertion (A):** If initial velocity is negative and acceleration is positive then motion is retarded (initially).
**Reason (R):** If initial velocity is negative but acceleration is positive then displacement of a particle can never be positive.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** A student performed an experiment by moving a certain block in a straight line. The velocity position graph cannot be as shown.



**Reason (R):** When a particle is at its maximum position in rectilinear motion its velocity must be zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8.** **Assertion (A):** When a particle is observed from two different inertial reference frames the general shape of the trajectory of particle is same.
**Reason (R):** The position vector of a particle and its velocity are frame independent quantities.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
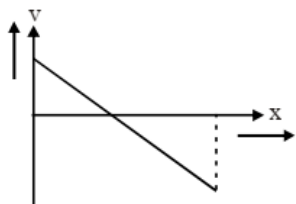(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**10.** **Assertion (A):** The speedometer of an automobile measures the average speed of the automobile.
**Reason (R):** Average velocity is equal to total distance divided by total time taken.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**11.** **Assertion (A):** Two bodies of masses M and m (M > m) are allowed to fall from the same height if the air resistance force for each be the same then both the bodies will reach the earth simultaneously.
**Reason (R):** For same air resistance, acceleration of both the bodies will be same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** The average speed of an object may be equal to arithmetic mean of individual speeds.
**Reason (R):** The average speed is equal to total distance travelled per total time taken.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** Displacement of a body is vector sum of the area under velocity-time graph.
**Reason (R):** Displacement is a vector quantity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** Figure shows sequence of large number of photographs of on object moving vertically under gravity. A motion picture of this photograph is run backward.



**Assertion (A):** A time reversal operation changes every $\vec{v}$ to $-\vec{v}$.

**Reason (R):** In time reversal sequence the gravitational acceleration will appear to be upward.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**15.** **Assertion (A):** If initial velocity is negative but acceleration is positive then displacement of a particle can never be positive.

**Reason (R):** If initial velocity is negative and acceleration is positive then motion must be retarded throughout.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**16.** **Assertion (A):** $\left|\dfrac{\Delta \vec{v}}{\Delta t}\right|$ and $\dfrac{\Delta|\vec{v}|}{\Delta t}$ are same if particle is moving in one dimension.

**Reason (R):** In one dimensional motion there is no component of acceleration perpendicular to velocity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**17.** **Assertion (A):** If velocity of a particle moving in a straight line is zero at a point, its acceleration will be zero at that point.

**Reason (R):** Wherever $a = v\dfrac{dv}{dx}$ holds, $v = 0 \Rightarrow a = 0$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**18.** **Assertion (A):** For a moving particle on a straight line magnitude of average velocity between any two points will be less than magnitude of instantaneous velocity at every point between them.

**Reason (R):** In x-t graph slope of chord joining two points gives average velocity between them.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**19.** The acceleration time graph of a body moving in a straight line is shown here.



**Assertion (A):** Velocity of the body is necessarily decreasing over the time interval shown.

**Reason (R):** Acceleration of the body is constant over the time interval shown.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**20.** **Assertion (A):** If $\vec{v}$ is the instantaneous velocity of a moving particle at time t then $\left|\int \vec{v}dt\right| \leq \int vdt$

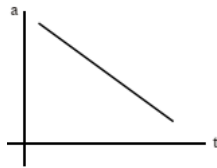**Reason (R):** Distance travelled by a particle is always less than or equal to displacement.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**21.** **Assertion (A):** A reference frame attached to the earth is an inertial frame of reference.

**Reason (R):** In practical, Newton's laws can be applied in a frame of reference. Which is attached to the earth.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**22.** **Assertion (A):** An observer confined to a windowless box cannot tell by any experiment whether he is stationary or in uniform motion with constant velocity w.r.t. the fixed stars.

**Reason (R):** The basic laws of Physics are identical in all reference systems that move with uniform velocity w.r.t. one another.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**23.** **Assertion (A):** A body is thrown vertically upwards with an initial speed 25 m/s from a position 1. It falls back to position 1 after some time. During this time duration, total change of velocity of the body is zero.

**Reason (R):** Average acceleration of the body during this time is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**24.** **Assertion (A):** For uniformly accelerated motion along straight line, the position versus time graph is a straight line.

**Reason (R):** For uniformly accelerated motion the position in equal intervals of time changes by same amount.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

25. **Assertion (A):** In one dimensional motion, area under velocity-time graph gives change in position i.e., displacement.

**Reason (R):** In one dimensional motion, area under acceleration-time graph gives final velocity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

26. **Assertion (A):** A body dropped from a height of 10 m from the ground will have the velocity 5 m/s at the height of 5 m.

**Reason (R):** At the height of 5 m from the ground, the acceleration due to gravity is 5 m/s$^2$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

27. **Assertion (A):** A particle moves in a straight line with constant acceleration. The average velocity of this particle can not be zero in any time interval.

**Reason (R):** For a particle moving in straight line, the average velocity in a time interval is always $\frac{u+v}{2}$, where u and v are initial and final velocities of the particle in given time interval.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

28. **Assertion (A):** At any instant, acceleration of a body can change its direction without any change in the direction of velocity.

**Reason (R):** At any instant, direction of acceleration is same as that of direction of change in velocity vector at that instant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

29. **Assertion (A):** For motion from rest with constant acceleration distance time graph is a parabola, always with increasing slope.

**Reason (R):** Speed of the body starting from rest with constant acceleration always increases linearly with time.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

30. **Assertion (A):** If a body moves on a straight line, magnitude of its displacement and distance covered by it must be same.

**Reason (R):** Along a straight line, a body can move only in one direction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

31. **Assertion (A):** An object moving with a velocity of magnitude 10 m/s is subjected to a uniform acceleration 2 m/s$^2$ at right angle to the initial motion. Its velocity after 5s has a magnitude nearly 14 m/s.

**Reason (R):** The equation $\vec{v} = \vec{u} + \vec{a}t$ can be applied to obtain $\vec{v}$ if $\vec{a}$ is constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

32. **Assertion (A):** A coin is allowed to fall in a train moving with constant velocity. Its trajectory is a straight line as seen by observer attached to the train.

**Reason (R):** An observer on ground will see the path of coin as a parabola.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

33. **Assertion (A):** Two particles start moving with velocities $\vec{v}_1$ and $\vec{v}_2$ respectively in a plane. They can meet only if component of their velocities perpendicular to line joining them are equal.

**Reason (R):** Relative velocity of a body w.r.t. other body is calculated along the line joining two bodies.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

34. **Assertion (A):** Two balls are dropped one after the other from a tall tower. The distance between them increases linearly with time (elapsed after the second ball is dropped and before the first hits ground).

**Reason (R):** In given situation relative acceleration is zero, whereas relative velocity is non-zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

1. **Assertion (A):** The magnitude of velocity of two boats relative to river is same. Both boats start simultaneously from same point on one bank. They may reach opposite bank simultaneously moving along different straight line paths.

   **Reason (R):** For above boats to cross the river in same time, the components of their velocity relative to river in direction normal to flow should be same.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** Horizontal component of velocity is constant in projectile motion under gravity.

   **Reason (R):** Two projectiles having same horizontal range must have the same time of flight.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. **Assertion (A):** Trajectory of an object moving under a constant acceleration is a straight line.

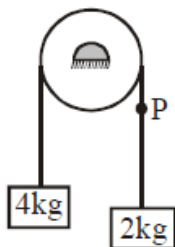   **Reason (R):** The shape of trajectory depends only on the acceleration.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** In any curved motion magnitude of dot product of unit acceleration vector & unit velocity vector $|\hat{a} \cdot \hat{v}|$ cannot be equal to 1.

   **Reason (R):** In all accelerated straight line motion $|\hat{a} \cdot \hat{v}|$ cannot be less than 1.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** Two stones are simultaneously projected from level ground from same point with same speeds but different angles with horizontal. Both stones move in same vertical plane. Then the two stones may collide in mid air.

   **Reason (R):** For two stones projected simultaneously from same point with same speed at different angles with horizontal, their trajectories must intersect at some point except projection point.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** The maximum range along the inclined plane, when thrown downward is greater than that when thrown upward along the same inclined plane with same speed at same angle from incline.

   **Reason (R):** The maximum range along inclined plane is independent of angle of inclination.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

**11.** **Assertion (A):** A particle is projected from ground on a horizontal plane with speed $10 \text{ ms}^{-1}$ and angle of projection 37° with horizontal. Its velocity vector will be perpendicular to initial velocity vector after $\frac{4}{3}$ s.

**Reason (R):** Two vectors $\vec{v}$ and $\vec{u}$ are perpendicular then $\vec{u}.\vec{v} = 0$

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** A particle moving at constant speed and constant magnitude of radial acceleration must be undergoing uniform circular motion.

**Reason (R):** In uniform circular motion speed cannot change as there is no tangential acceleration.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** If separation between two particles does not change then their relative velocity will be zero.

**Reason (R):** Relative velocity is the rate of change of position of one particle with respect to another.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** **Assertion (A):** The magnitude of velocity of A with respect to B will be always less than $V_A$.

**Reason (R):** The velocity of A with respect to B is given by $\vec{V}_{AB} = \vec{V}_A - \vec{V}_B$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**15.** **Assertion (A):** In projectile motion (from ground to ground projection), horizontal range is always same for angle of projection $\theta$ and $(90°- \theta)$.

**Reason (R):** Horizontal range is independent of angle of projection.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**16.** **Assertion (A):** In projectile motion, speed always decreases.

**Reason (R):** In presence of air drag, projectile motion is a uniformly accelerated motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17.** **Assertion (A):** When speed of projection of a body is made n times, its time of flight becomes n times.

**Reason (R):** At this speed, the range of projectile becomes $n^2$ times.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18.** **Assertion (A):** When the range of a projectile is maximum, the time of flight is the largest.

**Reason (R):** Horizontal range is maximum when angle of projection is 90°.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19.** Point P is on a massless thread in an ideal pulley arrangement as shown.



**Assertion (A):** As point P moves from right side to left side of pulley, the magnitude of it's acceleration changes.
**Reason (R):** The tension in massless thread remains uniform in magnitude.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** In non-uniform circular motion, velocity vector and acceleration vector are not perpendicular to each other.
**Reason (R):** In non-uniform circular motion, particle has normal as well as tangential acceleration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** If a body is in state of uniform circular motion then its velocity and acceleration both are varying.
**Reason (R):** If magnitude of velocity is v and radius of uniform circular motion is r then magnitude of acceleration is $v^2/r$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** A particle is moving in a circle with constant tangential acceleration such that its speed v is increasing. Angle made by resultant acceleration of the particle with tangential acceleration increases with time.
**Reason (R):** Tangential acceleration = $\left|\dfrac{d\vec{v}}{dt}\right|$ and centripetal acceleration = $\dfrac{v^2}{R}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** The equation of motion can be applied only if the acceleration is along the direction of velocity and is constant.
**Reason (R):** In circular motion, if velocity is constant then its motion is called uniform circular motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** In uniform circular motion, angular acceleration is zero.
**Reason (R):** In uniform circular motion, acceleration is constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**25.** **Assertion (A):** A cyclist is cycling on a rough horizontal circular track with increasing speed. Then the net frictional force on cycle is always directed towards centre of the circular track.
**Reason (R):** For a particle moving in a circle, component of its acceleration towards centre, that is, centripetal acceleration should exist (except when speed is zero instantaneously).
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**26.** Abhi and John are in a rotor at rest relative to wall of rotor.



**Assertion (A):** There is no relative motion between John and Abhi.
**Reason (R):** Angular velocity of Abhi with respect to John is different as compared to angular velocity of Abhi with respect to axis of rotation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**27.** **Assertion (A):** In circular motion acceleration is always towards centre.
**Reason (R):** In uniform circular motion velocity is constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**28.** **Assertion (A):** If a particle is moving on a curved path its $\dfrac{d|\vec{v}|}{dt}$ may be zero.
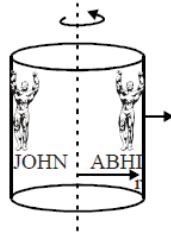**Reason (R):** A particle can move on curved path without any acceleration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**29.** **Assertion (A):** A cyclist must adopt a zig–zag path while ascending a steep hill.
**Reason (R):** The zig–zag path prevent the cyclist to slip down.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**30.** **Assertion (A):** Infinitesimally small angular displacement is a vector quantity.
**Reason (R):** Angular velocity doesn't depend upon reference frame.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**31.** **Assertion (A):** A bob of mass m is freely suspended from a light rod of length L. The minimum speed given to bob at lowest position to complete vertical circle is $2\sqrt{gL}$.
**Reason (R):** A bob of mass m is freely suspended from a light string of length L. If bob is given speed $\sqrt{6gL}$ at the lower position then bob will be complete vertical circle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**32.** **Assertion (A):** Average angular velocity is a scalar quantity.
**Reason (R):** Large angular displacements ($\Delta\theta$) is a scalar.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**33.** **Assertion (A):** During a safe turn, with constant speed the value of centripetal force should be less than or equal to the limiting frictional force.
**Reason (R):** The centripetal force is provided by the frictional force between the tyre and the road.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**34.** **Assertion (A):** In uniform circular motion of a particle, sum of power delivered to it by all the forces acting on the particle is zero.
**Reason (R):** In uniform circular motion dot product of two perpendicular vectors, force and velocity is always zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**35.** **Assertion (A):** A body having uniform speed in circular path has a variable acceleration.
**Reason (R):** Direction of acceleration is always away from the centre.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**36.** **Assertion (A):** In turning a vehicle safely with uniform speed in circular path friction is static in nature and towards centre.
**Reason (R):** In turning a vehicle in circular path with increasing speed friction is kinetic in nature and tangential in direction.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**37.** **Assertion (A):** In uniform circular motion, magnitude of acceleration is $\dfrac{V^2}{R}$ and direction is always towards the centre.
**Reason (R):** In uniform circular motion, acceleration is constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**38.** **Assertion (A):** Whenever a particle moves in a circular path with uniform speed, an acceleration exists which is directed towards the centre.
**Reason (R):** The net acceleration of a particle in circular motion is always radially inward.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**39.** **Assertion (A):** If the speed of a body is constant, the body cannot have a path other than a circular or straight line path.
**Reason (R):** It is not possible for a body to have a constant speed in an accelerated motion,
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**40.** **Assertion (A):** In circular motion, centripetal and centrifugal forces act in opposite directions and balance each other.
**Reason (R):** Centripetal force is a pseudo force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**41.** **Assertion (A):** In uniform circular motion of a body, its linear speed remains constant.
**Reason (R):** In uniform circular motion total acceleration of the body has no radial component.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**42.** **Assertion (A):** In non-uniform circular motion, linear speed of the body is variable.

**Reason (R):** In non-uniform circular motion, acceleration of the body is towards the centre.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**43.** **Assertion (A):** A body is moving along a circle with a variable angular speed. Work done by centripetal force will be zero.

**Reason (R):** In non-uniform circular motion, net force on the body is not in the radial direction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**44.** **Assertion (A):** A body tied to an end of a string is whirled along a vertical circle by giving some velocity at the lowest position. If the velocity becomes zero before the tension in the string is zero, the body will leave the circular path at the position of its zero velocity and then fall vertically downward.

**Reason (R):** In vertical circular motion, tension in the string at the highest position is maximum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**45.** **Assertion (A):** A body tied to an end of a string is whirled along a vertical circle with such a velocity at the lowest point that, at some position, tension in the string is zero but the speed at the position is non-zero. The body will leave the circular path at the position of zero tension.

**Reason (R):** In vertical circular motion, so as to cross the highest point along the circle, speed at the highest point, $v_H \geq 0$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**46.** **Assertion (A):** Cream gets separated out of milk when it is churned. It is due to gravitational force.

**Reason (R):** In all circular motions, centripetal force is provided by gravitational force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**47.** **Assertion (A):** When a stone attached to the string just rotates in a vertical circle, its apparent weight is zero at the highest point.

**Reason (R):** At the highest point, the apparent weight is equal to mg minus tension in string.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**48.** **Assertion (A):** The work done during a round trip is always zero.

**Reason (R):** No force is required to move a body in its round trip.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**49.** **Assertion (A):** When an automobile while going too fast around a curve overturns, its inner wheels leave the ground first.

**Reason (R):** The inner wheels are moving in a circle of smaller radius, the maximum permissible velocity for them is less.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**50.** **Assertion (A):** On an unbanked road, as the frictional force increases, the safe velocity limit for taking a turn also increases.

**Reason (R):** Banking of roads will increase the value of limiting velocity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**51.** **Assertion (A):** A coin is placed on the gramophone. When the motor starts, the coin moves along the gramophone. As the speed goes on increasing, the coin flies off after some time.

**Reason (R):** The gravitational force of gramophone provides the necessary centripetal force to the coin.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**52.** **Assertion (A):** Two identical trains move in opposite sense in equatorial plane with equal speed relative to earth's surface. They have equal magnitude of normal reaction.

**Reason (R):** The trains require same centripetal force although they have different speeds.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**1.** **Assertion (A):** According to Newton's third law of motion, action and reaction forces are equal in magnitude and opposite in direction.

**Reason (R):** Net force on a body due to action-reaction pair is always equal to zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** For an upward moving elevator (Lift), pseudo force on a block may be downward.

**Reason (R):** Pseudo force is the force applied by lift on block in opposite direction of motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** When a person walks on a rough surface, the net force exerted by surface on the person is in the direction of his motion.

**Reason (R):** Friction force by road on person is against motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** A moongphaliwala sells his moongphali using a weighing machine in an elevator.

**Assertion (A):** He gains more profit if the elevator is accelerating up.

**Reason (R):** The apparent weight of an object increases in an elevator while accelerating upward.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** The driver of a moving car sees a wall in front of him. To avoid collision, he should apply brakes rather than taking a turn away from the wall.

**Reason (R):** Friction force is needed to stop the car or taking a turn on a horizontal road.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** A bird sits on a stretched wire depressing it slightly. The increase in tension of the wire is more than the weight of the bird.

**Reason (R):** The tension must be more than the weight as it is required to balance weight.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** When two particles interact, net force on either particle is zero.

**Reason (R):** Both experience action and reaction which are equal and opposite.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8.** **Assertion (A):** Two smooth blocks are kept on a smooth inclined plane such that one block is kept over other. When a force is applied on upper block acceleration of lower block is unaffected.

**Reason (R):** Acceleration of a block on smooth inclined plane is $g \sin\theta$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**9.** **Assertion (A):** A man standing at rest on ground. Force exerted by man on ground is equal to weight of man.

**Reason (R):** Earth attracts man by force mg hence by Newton's third law, man also attracts earth by same force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**10.** **Assertion (A):** If a body has no acceleration, then there are no forces acting on it.

**Reason (R):** If a single force acts on a body, then the body will move in the direction of force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**11.** **Assertion (A):** Walking on horizontal slippery ice can be much more tiring than walking on ordinary pavement.

**Reason (R):** Walking on ice requires small steps to prevent slipping.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**12.** **Assertion (A):** A particle on earth found to be at rest when seen from a frame $U_1$ and moving with a constant velocity when seen from another frame $U_2$. Then both frames may be non-inertial.

**Reason (R):** A reference frame attached to the earth must be an inertial frame.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**13.** **Assertion (A):** A coin dropped in a closed trolley moving down the smooth inclined plane, appears to fall normal to the floor of the trolley to a man fixed with the trolley.



**Reason (R):** The acceleration of coin relative to trolley (i.e. man) is g cosθ downward and perpendicular to inclined plane.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** **Assertion (A):** The contact force is the net force applied by the surface on the body kept on it.

**Reason (R):** When a body is at rest on a horizontal surface then the contact force on the body by the surface must be equal to the weight of body.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** A horse has to pull a cart harder during the first few steps of his motion.
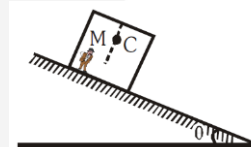**Reason (R):** The first few steps are always difficult.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Static friction acts between two surfaces in contact only when these surfaces are at rest with respect to ground.
**Reason (R):** Static friction opposes the motion of object.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** A lighter and a heavier body moving with same momentum and experiencing same retarding force have equal stopping distances.
**Reason (R):** For a given force and momentum, stopping time is independent of mass.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** A car is moving with acceleration on a straight road. Net force on a milestone with respect to car is zero.
**Reason (R):** Pseudo force acts on each body if observation is made with respect to a inertial reference frame.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** The apparent weight of a body in an elevator moving with some downward acceleration is less than the actual weight of body.
**Reason (R):** The part of the weight is spent in producing downward acceleration, when body is in elevator.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** Even though there is no relative motion between two surfaces, frictional force can be non-zero between these two surfaces.
**Reason (R):** Static frictional force can be non-zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** A particle has positive acceleration it means that its speed always increases.
**Reason (R):** Acceleration is the rate of change of speed with respect to time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** Trajectory of an object moving under a constant acceleration must be a straight line.
**Reason (R):** The shape of trajectory depends only on the acceleration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** A block is hanging from spring. Spring force on block and gravitational force on block are not action and reaction pair.

**Reason (R):** Action and reaction force acts in opposite direction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**24.** **Assertion (A):** A block is lying at rest on horizontal rough surface. A person moving with acceleration a in forward direction will observe a friction force acting on the block.

**Reason (R):** When there is relative motion between the two surface then only static friction acts between them.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**25.** **Assertion (A):** An insect is climbing up a vertical wall with constant speed then the force applied by the wall on the insect is vertically upwards and equal to its weight.

**Reason (R):** Friction is a self-adjusting force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**26.** A frame of reference A is moving rectilinearly and uniformly with a velocity $\vec{u}$ with respect to an inertial frame B. A body is moving with velocity $\vec{v}$ and acceleration $\vec{a}$ in an inertial system B.

**Assertion (A):** When we use Newtons second Law in frame B we write $\sum \vec{F}_{net} = m\vec{a}$. Now when we use the same in frame A we will write exactly same $\vec{F}_{net}$ and $\vec{a}$.

**Reason (R):** All inertial system are equally suitable for the description of physical phenomenon.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**27.** **Assertion (A):** According to the Newton's third law of motion, the magnitude of the action and reaction force in an action reaction pair is same only in an inertial frame of reference.

**Reason (R):** Newton's laws of motion are applicable only in inertial reference frame.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**28.** **Assertion (A):** A body is lying at rest on a rough horizontal surface. A person accelerating with acceleration a (where a is positive constant and $\hat{i}$ is a unit vector in horizontal direction) observes the body. With respect to him, the block experiences a kinetic friction.

**Reason (R):** There is relative motion between the block and surface in person's frame of reference.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**29.** **Assertion (A):** A block of mass m is placed on a block of mass M, which is placed on smooth fixed inclined plane. The two block system is released from rest as shown. Whatever be the coefficient of friction between both the blocks, the magnitude of friction force between the both the blocks will be zero (As long as they are on inclined surface).



**Reason (R):** In the given situation there is no tendency of relative motion between the blocks.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**30.** **Assertion (A):** A man and a block rest on smooth horizontal surface. The man holds a rope which is connected to block. The man can move on the horizontal surface.



**Reason (R):** There is no friction between man and horizontal surface

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**31.** **Assertion (A):** In an at wood machine, when the masses are in motion, for a heavy rough pulley, tension on both side of pulley are different.
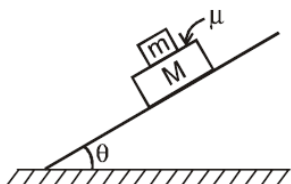


**Reason (R):** Acceleration of both masses are different.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**32.** **Assertion (A):** The acceleration of a body moving down on a rough inclined plane is greater than the acceleration due to gravity.

**Reason (R):** The body is able to slide on a inclined plane only when its acceleration is greater than acceleration due to gravity
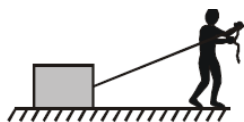
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**33.** **Assertion (A):** If pseudo force on a body is assumed as action then frictional force may be reaction for this action.

**Reason (R):** Action-reaction must acts on different bodies.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** A body starts moving from a point then after some time a constant force is applied on it then body can never pass from the starting point
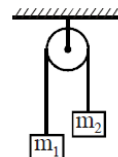    **Reason (R):** A constant force always produces a constant positive acceleration.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

35. **Assertion (A):** Greater is the mass, greater is the force required to change the state of body at rest or in uniform motion.
    **Reason (R):** The rate of change of momentum is the measure of the force.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

36. **Assertion (A):** Newton third law is that every action has equal and opposite reaction.
    **Reason (R):** Action is a cause and reaction is an effect that's why they are equal and opposite.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

37. **Assertion (A):** The time taken by a particle to slide down along different smooth chords of a sphere starting from highest point of the sphere is same.
    **Reason (R):** In above conditions, length of such a chord is proportional to acceleration of the particle along it.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

38. **Assertion (A):** If a particle is moving with uniform velocity, that means no external force is acting on the particle.
    **Reason (R):** According to Newton's first law, in absence of any force a particle in motion should continue moving with uniform velocity.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

39. **Assertion (A):** To apply Newton's second law, mass of the system must be constant.
    **Reason (R):** If force $\vec{F}$ is a acting on a particle of mass m then its acceleration will be given by $\vec{F} = m\vec{a}$ is an inertial frame.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

40. **Assertion (A):** In both cases shown in figures tension in the string will be same.



Figure-I   Figure-II
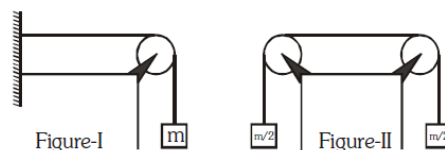
    **Reason (R):** Tension in the light strings shown is the force with which its ends are pulled.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**41.** **Assertion (A):** Pseudo force on m as observed by A will be 'ma' in downward direction.



observer A going downward with acceleration a

A

m

Block m is going upward with acceleration a

a

a

**Reason (R):** Pseudo force depends on observer's acceleration.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**42.** A block is suspended from an elevator at rest. Initially block is at equilibrium position. Suddenly elevator begins falling freely.
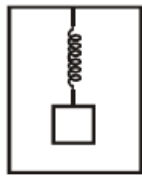


**Assertion (A):** A few moments after fall has begun the spring begins to contract.

**Reason (R):** Just after fall of elevator begins resultant force on block in reference frame of elevator is upward.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**43.** **Assertion (A):** A man starts walking towards west. Friction force on him acts towards east.

**Reason (R):** Friction opposes relative motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**44.** **Assertion (A):** If a particle is found to be in equilibrium in two different frames of reference implies that both frames are inertial.

**Reason (R):** Newton's second law can be used for motion of a particle in any reference frame.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**45.** **Assertion (A):** A rocket moves forward by pushing the surrounding air backward.

**Reason (R):** There is an equal and opposite reaction to every action.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**46.** **Assertion (A):** Magnitude of the contact force on a rough surface is always greater than the magnitude of normal reaction.

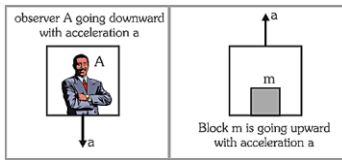**Reason (R):** Contact force is the resultant of the friction force and normal reaction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**47.** **Assertion (A):** While walking on ice, one should take small steps to avoid slipping.

**Reason (R):** This is because smaller steps ensure smaller friction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**48.** **Assertion (A):** An air tight cage in which a bird is sitting, is suspended from a spring balance. If the bird starts flying upwards with some acceleration, then the reading of the balance will increase.

**Reason (R):** The weighing machine measures the actual weight of a body.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.** **Assertion (A):** A block of weight 10 N is pushed against a vertical wall by a horizontal force of 15 N. The coefficient of friction between the wall and the block is 0.6. Then the magnitude of maximum frictional force is 9 N.

**Reason (R):** For given system block will remain stationary.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** Due to frictional force acting on a body, the body is always retarded by friction.

**Reason (R):** Friction force opposes the motion of object.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** A man standing in a lift which is moving upward, will feel his weight to be greater than when the lift was at rest.

**Reason (R):** If the acceleration of the lift is 'a' upward, then the man of mass m shall feel his weight to be equal to normal reaction (N) exerted by the lift given by N = m(g - a) (where g is acceleration due to gravity)

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** A man of mass 80 kg pushes a box of mass 20 kg horizontally. The man moves the box with a constant acceleration of 2 m/s$^2$ but his foot does not slip on the ground. There is no friction between the box and the ground, whereas there is sufficient friction between the man's foot and the ground to prevent him from slipping.

**Assertion (A):** The force applied by the man on the box is equal and opposite to the force applied by the box on the man.

**Reason (R):** Friction force applied by the ground on the man is 200 N.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** When a man climbs the rope friction force acts in downward direction.

**Reason (R):** Friction force opposes relative motion or tendency of relative motion between two contact surfaces.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** **Assertion (A):** The apparent weight of a person standing in a lift, which speed up is always greater than his true weight.

**Reason (R):** The gravity force due to earth always acts downwards.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1.** **Assertion (A):** Work done by conservative force along closed path is zero.
**Reason (R):** When an object is moved along closed path beginning and ending are at same point its displacement is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** A body with negative energy cannot have linear momentum.
**Reason (R):** Magnitude of linear momentum can be negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** The potential energy of a particle varies with distance x as shown in the graph. The force acting on the particle is zero at point B and C.
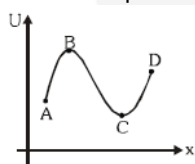


**Reason (R):** The slope of the U–x curve is zero at point B and C.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** When a non–conservative force is involved in a system, it may dissipate energy.
**Reason (R):** The work done by a non–conservative force is always negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** The sum of potential and kinetic energy for a system of moving objects is conserved only when no net external force acts on the objects
**Reason (R):** If no nonconservative force acts on a system of objects, the work done by external forces on a system of objects is equal to change in potential energy plus change in kinetic energy of the system.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** One end of ideal massless spring is connected to fixed vertical wall and other end to a block of mass m initially at rest on smooth horizontal surface. The spring is initially in natural length. Now a horizontal force F acts on block as shown. Then the maximum extension in spring is equal to maximum compression in spring.



**Reason (R):** To compress and to expand an ideal unstretched spring by equal amount, different work is to be done on spring.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** An athlete accelerates from rest to its maximum speed due to friction between his shoes and track.
**Reason (R):** Positive work done by frictional force increases the kinetic energy of athlete.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Net work done by all the internal force of a system is independent of choice of reference frame.
   **Reason (R):** Value of force is independent of choice of reference frame.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

9. **Assertion (A):** Work done by a force is always same in all inertial frame of references.
   **Reason (R):** Work is an invariant physical quantity.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

10. **Assertion (A):** Total energy is negative for a bounded system.
    **Reason (R):** Potential energy of a bound system is negative and its magnitude is more than kinetic energy.
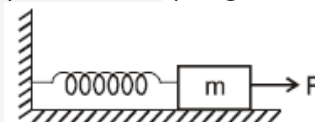    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

11. **Assertion (A):** Work done by frictional force may be sometimes path independent.
    **Reason (R):** Frictional force is a non-conservative force.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

12. **Assertion (A):** Work done is positive when force acts in the direction of displacement.
    **Reason (R):** Work done by frictional force can not be positive.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

13. **Assertion (A):** The work done by a non–conservative force is always negative.
    **Reason (R):** When a non–conservative force is involved in a system, it always dissipates energy.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

14. **Assertion (A):** A particle is rotated in a vertical circle with the help of a string. Work done by tension in the string on particle is zero.
    **Reason (R):** Tension is always perpendicular to instantaneous velocity.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

15. **Assertion (A):** Two balls of different masses are thrown vertically upwards with same speed. They will pass through their point of projection in the downward direction with the same speed in absence of air resistance.
    **Reason (R):** In absence of air resistance, the mechanical energy of a projectile is conserved.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**16.** **Assertion (A):** The work done by external agent in bringing (slowly) a body down from the top to the base along a frictionless inclined plane is the same as the work done by external agent in slowly bringing it down along the vertical side.
**Reason (R):** The gravitational force on the body along the inclined plane is the same as that along the vertical side.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17.** **Assertion (A):** A particle is projected vertically upwards then as it ascends, its kinetic energy decreases uniformly with distance.
**Reason (R):** Its speed decreases uniformly with time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18.** **Assertion (A):** Work done by all external forces on a system of particles is equal to change in kinetic energy of the system.
**Reason (R):** Work done by a force has different dimensions from kinetic energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19.** **Assertion (A):** Magnitude of linear momentum cannot be negative.
**Reason (R):** A body with negative energy cannot have linear momentum.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** For an object in a conservative force field moving along x− axis, the potential energy of the system is shown in figure. The speed of the object will be same at points A and D.
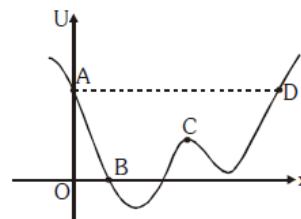


**Reason (R):** For internal conservative forces, work done by internal forces is equal to minus of change in potential energy i.e. $W_{int} = -\Delta U$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** If in a round trip work done by a force is zero then force is conservative.
**Reason (R):** Work done by conservative force field is independent of path.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** Karnam Malleshwari famous Indian weight lifter lifts a weight up and returns it to same initial position along the same path. Net work done by muscles of weight lifter is positive.
**Reason (R):** Net displacement of weight is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** The mechanical energy of earth–moon system remains same when a heavenly body passes nearby the earth–moon system.

**Reason (R):** Force exerted by heavenly body on the earth–moon system is non-conservative.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

24. **Assertion (A):** A body cannot have kinetic energy without having linear momentum but it can have momentum without having mechanical energy.

**Reason (R):** Linear momentum and energy have same dimensions.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

25. **Assertion (A):** A spring has potential energy, both when it is compressed or elongated.

**Reason (R):** In compressing or stretching, work is done on the spring against the restoring force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

26. **Assertion (A):** There is no term like instantaneous work similar to instantaneous velocity.

**Reason (R):** For work to be done, the force must act for a displacement.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

27. **Assertion (A):** A man of mass m, standing on a frictionless surface pushes a wall and acquires a velocity $v_0$. The work done by the wall on the man is non-zero.

**Reason (R):** Work done by all the forces is equal to change in kinetic energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

28. **Assertion (A):** Power delivered by all forces acting on a particle moving in a uniform circular motion is always zero.

**Reason (R):** Work done by all forces acting on a particle moving in a uniform circular motion is zero as KE remains constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**29.** **Assertion (A):** Comets move around the sun in elliptical orbits. The gravitational force on the comet due to sun is not normal to the comet's velocity but the work done by the gravitation force over every complete orbit of the comet is zero.

**Reason (R):** Gravitational force is a conservative force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**30.** **Assertion (A):** Work done by or against force of friction in moving a body in any round trip is always zero.

**Reason (R):** Frictional force is a conservative force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**31.** **Assertion (A):** No work is done when an electron completes a circular or an elliptical orbit around the stationary nucleus of an atom.

**Reason (R):** Electrostatic force is a conservative force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**32.** **Assertion (A):** A man carrying a load on his head and walking with uniform velocity on a street does not work against gravity.

**Reason (R):** When a body moves with uniform velocity, work done by all forces on this body is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**33.** **Assertion (A):** The potential energy of a particle varies with distance x as shown in figure.



The force acting on the particle is zero at points C and E.

**Reason (R):** Conservative force f(x) associated with potential energy U(x) is related with U(x) as $F = -\dfrac{dU(x)}{dx}$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**34.** **Assertion (A):** The kinetic energy of a particle continuously increases with time if the resultant force on the particle must be at an angle less than 90° to the velocity at all instants.

**Reason (R):** The work done by the external forces on a system equals to change in total energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

35. **Assertion (A):** The work done by the net force on a particle during non-uniform circular motion is not equal to zero.
**Reason (R):** In case of non-uniform circular motion net force and elementary displacement are not perpendicular to each other.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** Kinetic energy of a system can be increased without applying any external force on the system.
**Reason (R):** If external forces are absent then work done by internal forces is equal to change in kinetic energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** If a spring is compressed, energy is stored in spring and when it is elongated, energy is released.
**Reason (R):** Work done by spring force is equal to change in potential energy of the spring.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** Work done by gravitational force on a block for moving P to A and Q to A are equal.


Fixed

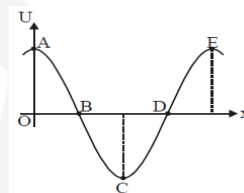**Reason (R):** Potential energy is defined for gravitational force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** Frictional forces are conservative forces.
**Reason (R):** Potential energy can be associated with frictional forces.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

1. **Assertion (A):** In any kind of collision, kinetic energy cannot be same throughout.
   **Reason (R):** In elastic collision kinetic energy remains constant throughout.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** In a perfectly inelastic collision there is a limit to the loss of kinetic energy of colliding bodies.
   **Reason (R):** In perfectly inelastic collision, linear momentum of system is conserved.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. **Assertion (A):** Centre of mass of a body in pure rolling on a horizontal surface always moves in a straight line.
   **Reason (R):** Centre of mass of a body must be inside the body.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** In two particle system when viewed from center of mass reference frame, if one particle stops then other one will also stop simultaneously, irrespective of external forces acting on system
   **Reason (R):** Centre of mass of a system is a point about which total momentum of system is always constant and non-zero.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** Two particles undergo rectilinear motion along different straight lines. Then the centre of mass of system of given two particles also always moves along a straight line.
   **Reason (R):** If direction of net momentum of a system of particles (having nonzero net momentum) is fixed, the centre of mass of given system moves along a straight line.
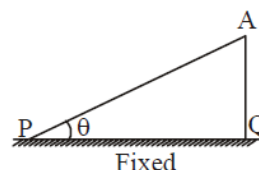   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** A half filled bottle is more stable than a fully filled identical bottle when kept in upright position.
   **Reason (R):** A half filled bottle has lesser mass than a fully filled bottle. (The fluid and bottles are identical).
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7. **Assertion (A):** Two objects are moving towards each other due to mutual attraction. The kinetic energy of the system remains constant.
   **Reason (R):** Total linear momentum of the system consisting both the objects remain constant even in the presence of external forces.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
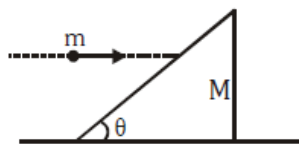   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

**8.** A particle of mass m strikes a wedge of mass M horizontally as shown in the figure.



**Assertion (A):** If collision is perfectly inelastic then, it can be concluded that the particle sticks to the wedge.
**Reason (R):** In perfectly inelastic collision velocity of both bodies is same along common normal just after collision.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**9.** Consider a one-dimensional head on collision of two balls.
**Assertion (A):** The loss in kinetic energy of the system during the collision does not depend on the velocity of the observer.
**Reason (R):** Kinetic energy of a body is independent of velocity of observer.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**10.** **Assertion (A):** When one object collides with another object, the impulse during deformation and reformation will be in same direction on one particular object.
**Reason (R):** Due to deformation impulse the objects first deform and due to the same reformation impulse, they again try to regain its original shape.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**11.** Assertion and Reason are on a situation of a frog jumping vertically up on a rigid floor.
**Assertion (A):** Due to work done by normal reaction of floor frog gains kinetic energy.
**Reason (R):** Normal reaction by ground accelerates centre of mass of frog.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** Maximum energy loss occurs when the particles get stuck together as a result of collision.
**Reason (R):** A point particle of mass m moving with speed v collides with stationary point particle of mass M. Then the maximum energy loss possible is given $\left(\dfrac{m}{m+M}\right)\left(\dfrac{1}{2}mv^2\right)$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** In case of bullet fired from a gun, the ratio of kinetic energy of gun and bullet is equal to ratio of masses of bullet and gun.
**Reason (R):** In firing of bullet, linear momentum of system is conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** The centre of mass of a system of two particles is closer to the heavier particle.
**Reason (R):** Algebraic sum of mass moments about centre of mass is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** Value of radius of gyration of a body depends on axis of rotation.
**Reason (R):** Radius of gyration is rms distance of particles of the body from the axis of rotation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Kinetic energy of a rigid body can be greater than $\frac{1}{2}mv^2$, where m is mass of rigid body & v is speed of centre of mass of body.
**Reason (R):** Kinetic energy of a particle (point mass) cannot be greater than $\frac{1}{2}mv^2$, where m is mass of particle & v is speed of particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** A disc rolls without slipping on a fixed rough horizontal surface. Then there is no point on the disc whose velocity is in vertical direction.
**Reason (R):** Rolling motion can be taken as combination of translation and rotation. Due to the translational part of motion a velocity (translational component) exist in horizontal direction for any point on the disc rolling on a fixed rough horizontal surface.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** By definition, pure rolling of a body occurs when velocity of its point of contact is zero relative to the surface on which it rolls.
**Reason (R):** A body is purely rolling (rolling without slipping). The velocity of point of contact (of body) must be zero with respect to ground.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** Two cylinders, one hollow (metal) and the other solid (wood) with the same mass and identical dimensions are simultaneously allowed to roll without slipping down an inclined plane from the same height. The solid cylinder will reach the bottom of the inclined plane first.
**Reason (R):** By the principle of conservation of energy, the total kinetic energies of both the cylinders are identical when they reach the bottom of the incline.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
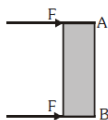(4) Both (A) and (R) are false

20. **Assertion (A):** When the body is rolling purely, the velocity of the point of contact should be zero relative to the surface in contact.
**Reason (R):** Friction is necessary for a body to roll purely on a level horizontal ground.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** Net torque about point B is of all real forces is not zero.



**Reason (R):** Because it will rotate about point B.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** The condition of equilibrium for a rigid body is –

Translational equilibrium: $\sum \vec{F} = 0$, ( i.e. sum of all external forces equal to zero.)
Rotational equilibrium: $\sum \vec{\tau} = 0$, (i.e. sum of all external torques equal to zero.)
**Reason (R):** A rigid body must be in equilibrium under the action of two equal and opposite forces.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** A cyclist always bends inwards while negotiating a curve
**Reason (R):** By bending he lowers his centre of gravity
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** A wheel slides downward on frictionless inclined plane, without rolling.
**Reason (R):** In pure rolling work done against friction always zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** If a sphere starts pure rolling down a rough incline plane, work done by friction is zero.
**Reason (R):** Work done by friction for translational motion is negative and work done by friction for rotational motion is positive and equal in magnitude.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** A solid copper and solid aluminium sphere of same masses are spinning about their axes with same angular velocities copper sphere has more angular momentum than aluminium.
**Reason (R):** Both copper and aluminium sphere have same radius.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** In a conical pendulum angular momentum of bob $\vec{L}$ remains constant with respect to O centre of circle swept by it.



**Reason (R):** Net torque $(\vec{\tau}_{net})$ about centre O is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**28.** **Assertion (A):** Speed of any point on a rigid body in pure rolling can be calculated by expression $v = r\omega$, where $r$ = distance of point from instantaneous centre of rotation.
**Reason (R):** Pure rolling of rigid body can be considered as a pure rotation about instantaneous centre of rotation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**29.** **Assertion (A):** A sphere rolls down a rough inclined plane without slipping. It gains rotational K.E due to friction.
**Reason (R):** In this situation, work done by static friction is negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**30.** **Assertion (A):** If there is no external torque on a body about its centre of mass, then the velocity of the center of mass remains constant.
**Reason (R):** The angular momentum of a system always remains constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**31.** **Assertion (A):** When a sphere is rolls on a horizontal table it slows down and eventually stops.
**Reason (R):** When the sphere rolls on the table, both the sphere and the surface deform near the contact. As a result, the normal force does not pass through the centre and provide an angular deceleration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**32.** **Assertion (A):** A ladder is more likely to slip when a person is near the top than when he is near the bottom.
**Reason (R):** The friction between the ladder and floor decreases as he climbs up.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**33.** A sphere is performing pure rolling on a rough horizontal surface with constant angular velocity.
**Assertion (A):** Frictional force acting on the sphere is zero.
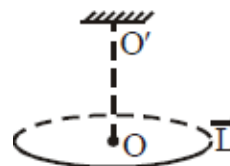**Reason (R):** Velocity of contact point is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**34.** **Assertion (A):** Moment of inertia about an axis passing through center of mass is maximum.
**Reason (R):** Theorem of parallel axis can be applied only for two dimensional body of negligible thickness.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**35.** **Assertion (A):** If earth shrink (without change in mass) to half its present size, length of the day would become 6 hours.
**Reason (R):** As size of the earth changes its moment of inertia changes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** When the disc rolls without slipping, friction is required because condition of pure rolling is velocity of point of contact is zero.
**Reason (R):** The force of friction in the case of a disc rolling without slipping down an inclined plane is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** It is more difficult to open the door by applying the force near the hinge.
**Reason (R):** Torque is maximum at hinge.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** Angular momentum of a body may remain conserved even when moment of inertia of body changes.
**Reason (R):** Angular momentum of a body does not depend upon moment of inertia of the body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** In case of rolling without sliding, friction force can act in forward and backward direction both.
**Reason (R):** The angular momentum of a system will be conserved only about that point about which external angular impulse is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

40. **Assertion (A):** A body is rolling without slipping on a surface. There must be frictional force to start such a motion.
**Reason (R):** In rolling without slipping, work done against the frictional force is zero on rolling body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** If the moment of inertia of a non-uniform thin circular ring is same about two different axes parallel to each other and lying in the plane of ring, then both the axis can be at same distance from geometrical centre of the ring.
**Reason (R):** From parallel axis theorem $I = I_{cm} + md^2$, (where terms have usual meaning). Moment of inertia of a body about two axes parallel to each other and at a same distance from centre of mass of the body is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** A ballet dancer increases or decreases the angular velocity of spin, about the vertical axis by pulling in or extending out her limbs.
**Reason (R):** $L = I\omega$ which is constant about rotational axis where symbols have their usual meaning.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**43.** **Assertion (A):** It will be much easier to accelerate a merry-go-round full of children if they stand close to its axis then if they all stand at the outer edge.
**Reason (R):** For larger moment of inertia, the angular acceleration is small for riven torque.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**44.** **Assertion (A):** Inertia and moment of inertia are same quantities.
**Reason (R):** Moment of inertia represents the capacity of a rigid body to oppose its state of translatory motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**45.** **Assertion (A):** For the purpose of calculation of moment of inertia, body's mass can be assumed to be concentrated at its centre of mass.
**Reason (R):** Moment of inertia of a rigid about an axis passing through its centre of mass is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**46.** **Assertion (A):** A sphere is placed such that is its centre is at origin of coordinate system. If $I_x$ and $I_y$ be the moment of inertia about x-axis and y-axis respectively then moment of inertia about z-axis is $I_x + I_y$
**Reason (R):** For any body according to perpendicular axis theorem $I_z = I_x + I_y$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**47.** A sphere is rotating about a diameter with constant angular acceleration $\alpha$.
**Assertion (A):** All the particles on the surface have same linear acceleration.
**Reason (R):** All the particles on the surface have same linear speed.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**48.** **Assertion (A):** A disc is rolling on a rough horizontal surface without slipping. The velocity of centre of mass is v. Then all the other points on the disc lying on a circular arc with point of contact as the center and this arc passing through center of mass of disc will have the same speed v.
**Reason (R):** When a disc is rotating without sliding on a rough horizontal surface the magnitude of velocities of all the points at a distance r from point of contact is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.** **Assertion (A):** Moment of inertia of a rigid body is not unique.
**Reason (R):** Moment of inertia of a rigid body depends on the distribution of mass about the axis of rotation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** A body rolling without slipping has only rotational kinetic energy.
**Reason (R):** The centre of mass of a rolling body docs not move forward.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** Angular velocity of the seconds hand of a watch is $\frac{\pi}{30}$ rad/s.

**Reason (R):** Angular velocity is equal to $\frac{2\pi}{T}$ where T is the time period.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** **Assertion (A):** If two different axes are at same distance from the centre of mass of a rigid body then moment of inertia of the given rigid body about both the axes will always be equal.

**Reason (R):** According to perpendicular axis theorem $I = I_{cm} + Md^2$ where symbols have their usual meaning.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** A wheel moving down a perfectly frictionless inclined plane will undergo slipping (not rolling),

**Reason (R):** For pure rolling, work done against frictional force is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** A sphere moving with a velocity $v_0$ on a smooth surface suddenly enters on a rough horizontal surface as shown in figure.
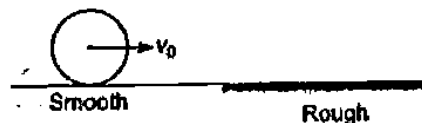


**Assertion (A):** The sphere loses translational kinetic energy and gains rotational kinetic energy.

**Reason (R):** Friction force acts in forward direction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**55.** **Assertion (A):** If total external torque on a rigid system is zero, its angular momentum remains constant.

**Reason (R):** The change in angular momentum is equal to the angular impulse of the resultant torque,

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**56.** **Assertion (A):** For a system of particles under central force field, the total angular momentum is conserved.

**Reason (R):** The torque acting on such a system is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1.** **Assertion (A):** Two satellites A and B are in the same orbit around the earth, B being behind A. Satellite B can overtake satellite A by increasing its speed.
**Reason (R):** Orbital speeds of two satellite in same orbit may different
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** At the centre of the earth, a body has centre of mass, but no centre of gravity.
**Reason (R):** Acceleration due to gravity is zero at the centre of the earth.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** The mechanical energy of earth–moon system remains same when another heavenly body passes nearby the earth–moon system.
**Reason (R):** Force exerted by heavenly body on the earth–moon system is non-conservative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** An astronaut in an orbiting space station above the earth experiences weightlessness.
**Reason (R):** An object orbiting around the earth under the influence of the earth's gravitational force is in a state of free fall.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** Gravitational potential of earth at every place upon it is negative.
**Reason (R):** Every body on earth is bound by the attraction of earth.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** For a system of masses at some finite distance, gravitational field can be zero but gravitational potential can not be zero.
**Reason (R):** Gravitational field is a scalar quantity while gravitational potential is a vector quantity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** Period of revolution of satellite in circular orbit around earth is inversely proportional to cube of its orbital speed.
**Reason (R):** Period of revolution in uniform circular motion is given by
$T = \dfrac{2\pi r}{v}$ where r is radius of orbit and v is speed.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8.** **Assertion (A):** Assuming zero potential at infinity, the gravitational potential at a point can never be positive.
**Reason (R):** The magnitude of gravitational force between two particles has inverse square dependence on the distance between two particles.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** Gravitational field of a uniform spherical shell outside it is same as that of particle of same mass placed at its centre of mass.
**Reason (R):** For the calculation of gravitational force between any two uniform spherical shells, they can always be replaced by particles of same mass placed at respective centres.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** The force of attraction between a hollow spherical shell of uniform density and a point mass situated out side is just as if the entire mass of the shell is concentrated at the centre of the shell.
**Reason (R):** Gravitational forces caused by the various regions of the shell have components along the line joining the point mass to the centre as well as along a direction perpendicular to this line.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** The gravitational force between two finite bodies is necessarily along the line joining their centre of mass.
**Reason (R):** The gravitational force between two particles is not central.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** If the law of gravitation, instead of being inverse square law becomes an inverse cube law then planets will still have elliptical orbits.
**Reason (R):** In that case also, $T^2 \propto r^3$ (symbols having usual meanings)
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** Gravitational potential energy of any mass particle may not be zero at earth centre.
**Reason (R):** Gravitational field intensity at earth centre is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** If the product of surface area and density is same for two planets, escape velocities at surface will be same for both planets.
**Reason (R):** For given mass of a planet $v_e \propto R^{-1/2}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** When planet moves in elliptical orbit around Sun. Its angular momentum about sun remains conserved.
**Reason (R):** Total mechanical energy of planet – sun system remains conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Moon revolving around earth does not come closer despite earth's gravitational attraction.
**Reason (R):** A radially outward force balances earth's force of attraction during revolution of moon.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** Earth has an atmosphere but the moon does not.
**Reason (R):** Moon is small in comparison to earth.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
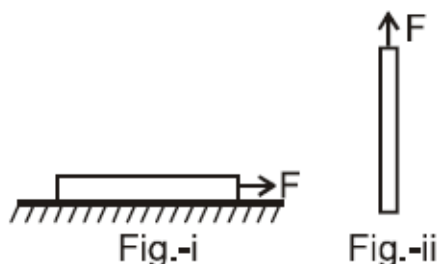(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** Potential energy of a planet increases as it moves from perihelion to aphelion.
**Reason (R):** As planet moves from perihelion to aphelion work done by gravitational pull of sun on planet is negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** An artificial satellite of earth releases a packet. It will hit the earth exactly below the satellite.
**Reason (R):** Packet will move along a straight line towards earth's centre with respect to satellite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** Charged particles experience both electrical and gravitational force. But gravitational force is ignored.
**Reason (R):** Gravitational force is due to mass of particles while electrical force is due to charge of particles.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** If earth stops rotating about its axis, then the value of acceleration due to gravity increases every where, except at the poles.
**Reason (R):** The value of acceleration due to gravity is maximum at the poles
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** Even when orbit of a satellite is elliptical, its plane of rotation passes through the centre of earth.
**Reason (R):** According to law of conservation of angular momentum plane of rotation of satellite always remain same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** The radius vector from the sun to a planet sweeps out equal areas in equal times interval.
**Reason (R):** Transverse (perpendicular to radius vector) acceleration of the planet is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** Earth is continuously pulling moon towards its centre but moon does not fall to earth,
**Reason (R):** Attraction of sun on moon is greater than that of earth on moon.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** An artificial satellite is moving in a circular orbit of the earth. If the gravitational pull suddenly disappears, then it moves with the same speed tangential to the original orbit.
**Reason (R):** The orbital speed of a satellite decreases with the increase in radius of the orbit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** If a body is taken from earth to moon, its gravitational mass becomes one-sixth on moon.
**Reason (R):** Gravitational mass depends upon acceleration due to gravity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** A person in an artificial satellite revolving around the earth feels weightlessness.
**Reason (R):** There is no gravitational force on the satellite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** A spherically symmetric shell produces no gravitational field anywhere.
**Reason (R):** The field due to various mass elements cancel out, everywhere for a spherically symmetric shell.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** The plane of the orbit of an artificial satellite must contain the centre of the earth.
**Reason (R):** For the orbital motion of satellite, the necessary centripetal force is provided by gravitational pull of earth on satellite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** Escape velocity of a satellite is greater than its orbital velocity.
**Reason (R):** Orbit of a satellite is within the gravitational field of planet whereas escaping is beyond the gravitational field of planet.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** Escape velocity from surface of a planet is $V_e$. If a tunnel is made inside the surface, the escape velocity from a point inside the tunnel must be greater than $V_e$.
**Reason (R):** Gravitational force is a conservative central force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** Total energy is conserved in moving a satellite to higher orbit.
**Reason (R):** Sum of change in potential energy and kinetic energy is same in magnitude and opposite in nature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1.** **Assertion (A):** A uniform elastic rod lying on smooth horizontal surface is pulled by constant horizontal force of magnitude F as shown in figure (i). Another identical elastic rod is pulled vertically upwards by a constant vertical force of magnitude F (see figure ii). The extension in both rods will be same.



Fig.-i        Fig.-ii

**Reason (R):** In a uniform elastic rod, the extension depends only on forces acting at the ends of rod.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**2.** **Assertion (A):** Two identical uniform elastic rods are lying horizontally on smooth horizontal surface under the action of forces as shown in figure. The elongation in two rods will be same.

**Reason (R):** The acceleration of rod will be same in both cases.
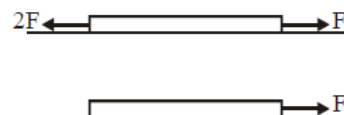


(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**3.** **Assertion (A):** Identical springs of steel and copper are equally stretched. More work will be done on the steel spring.

**Reason (R):** Steel is more elastic than copper.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

1. **Assertion (A):** Blood pressure of heart is same whether you lie down or stand up.

   **Reason (R):** Pressure varies with height in a fluid under gravity.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

2. A barometer made of a very narrow tube (see fig.) is placed at normal temperature and pressure. The coefficient of volume expansion of mercury is 0.00018/°C and that of the tube is negligible. The temperature of mercury in the barometer is now raised by 1°C but the temperature of the atmosphere does not change. Then

   **Assertion (A):** The mercury height in the tube remains unchanged.

   **Reason (R):** The atmospheric pressure remains same.

   

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

3. **Assertion (A):** When a body floats such that its parts are immersed into two immiscible liquids, then force exerted by liquid 1 is of magnitude $\rho_1 V_1 g$

   **Reason (R):** Total buoyant force = $\rho_1 V_1 g + \rho_2 V_2 g$
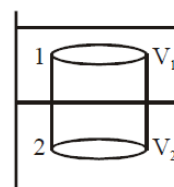
   

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

4. **Assertion (A):** A raindrop after falling through some height attains a constant velocity.

   **Reason (R):** At constant velocity the viscous drag plus buoyant force is just equal to its weight.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

5. **Assertion (A):** In streamline flow streamlines never intersect each other.

   **Reason (R):** If streamline intersect then their must two velocities of fluid particle at the point of intersection, which is impossible.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

6. **Assertion (A):** A mercury barometer always reads less than actual pressure.
   **Reason (R):** The density of liquid varies with rise of temp.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7. **Assertion (A):** Floating condition of needle does not depend on length of needle.
   **Reason (R):** In floating condition, weight of needle balance by force due to surface tension.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

8. **Assertion (A):** The stream of water flowing at high speed from a garden hose pipe tends to spread like a fountain when held vertically up, but tends to narrow down when held vertically down.
   **Reason (R):** In any steady flow of an incompressible fluid, the volume flow rate of the fluid remains constant.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

9. **Assertion (A):** If liquid is equilibrium, the pressure is same at all the points in a horizontal plane
   **Reason (R):** In equilibrium pressure in a fluid is same at all the points if they are at same height.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

10. **Assertion (A):** At same horizontal level of same liquid pressure is always same.
    **Reason (R):** When any fluid travels from a region of higher pressure to lower pressure. It gains some speed.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
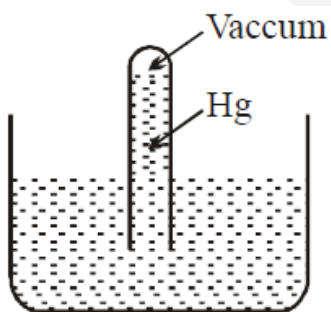    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

11. **Assertion (A):** Aeroplanes having wings fly at low altitudes while jet planes fly at high altitudes.
    **Reason (R):** At low altitudes air is dense, whereas at high altitude air is less-dense.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

12. **Assertion (A):** A Basilisk lizard can run across the top of a water surface.
    **Reason (R):** water does not stick to its legs.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

13. **Assertion (A):** The stream of water emerging from a water tap "necks down" as it falls.

    **Reason (R):** The volume flow rate at different levels is same.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

14. **Assertion (A):** Water flows faster than honey.

    **Reason (R):** The co-efficient of viscosity of water is less than honey.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

15. **Assertion (A):** Weight of a empty balloon measured in air is $W_1$. If air at atmospheric pressure is filled inside balloon and again weight of the balloon is measured. Weight of balloon in second case is equal to $W_1$.

    **Reason (R):** Upthurst is equal to weight of the fluid displaced by the body.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

16. **Assertion (A):** The angle of contact of a liquid decreases with increase in temperature.

    **Reason (R):** With increase in temperature, the surface tension of liquid increases.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

17. **Assertion (A):** The shape of a liquid drop is spherical.

    **Reason (R):** The pressure inside the drop is greater than that of outside.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

18. **Assertion (A):** Surface energy of an oil drop is same whether placed on glass or water surface.

    **Reason (R):** Surface energy is dependent only on the properties of oil.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

**1.** **Assertion (A):** As the temperature of the blackbody increases, the wavelength at which the spectral intensity ($E_\lambda$) is maximum decreases.
**Reason (R):** The wavelength at which the spectral intensity will be maximum for a black body is proportional to the fourth power of its absolute temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** Two metallic spheres of same size, one of copper and the other of aluminium, heated to the same temperature, will cool at the same rate when they are suspended in the same enclosure.
**Reason (R):** The rate of cooling of a body depends only on the excess of temperature of the body over the surroundings.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** Colour of a glowing black body changes on increasing its temperature.
**Reason (R):** Spectral emissive power associated with each wavelength does not increase in same proportion on increasing temperature of the Black Body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

**4.** **Assertion (A):** Specific heat capacity of a substance in cal/g°C is greater than its specific heat capacity in cal/g°F.
**Reason (R):** Magnitude (temperature difference) of 1°C is greater than the magnitude of 1°F.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** Water is considered unsuitable for use in thermometers.
**Reason (R):** Thermal Expansion of water is non-uniform.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** The temperature of a metallic rod is raised by a temperature $\Delta t$ so that its length becomes double. The value of $\alpha$ (coefficient of linear expansion) is given by $\dfrac{\log_e(2)}{\Delta t}$.
**Reason (R):** Coefficient of linear expansion is defined as $\dfrac{1}{\ell}\dfrac{d\ell}{dt}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** Liquids usually expand more than solids.
**Reason (R):** The intermolecular forces in liquids are weaker than in solids.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8.** **Assertion (A):** Temperature of a rod is increased and again cooled to same initial temperature then its final length is equal to original length.
**Reason (R):** For a small temperature change, length of a rod varies as $\ell = \ell_0$ $(1+\alpha\Delta T)$ provided $\alpha\Delta T <<1$. Here symbol have their usual meaning.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**9.** **Assertion (A):** When you touch two bodies, the body which is felt warmer must be of higher temperature than the other one.
**Reason (R):** The heat flows from lower temperature to higher temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**10.** **Assertion (A):** High thermal conductivity of metals is due to presence of free electrons.
**Reason (R):** Electrons at same temperature have very high average velocity than atoms.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**11.** A solid sphere of copper of radius R and a hollow sphere of the same material of inner radius r and outer radius R are heated to the same temperature and allowed to cool in the same environment.
**Assertion (A):** Hollow sphere cools faster than solid sphere.
**Reason (R):** $\left(-\dfrac{d\theta}{dt}\right) \propto \dfrac{1}{m}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** A sphere, a cube and a thin circular plate made of same material and of same mass are initially heated to 200°C, the plate will cool at fastest rate.
**Reason (R):** Rate of cooling =
$\dfrac{\rho A\sigma}{ms}(T^4 - T_0^4) \propto$ surface area. Surface area is maximum for circular plate.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** A body is emitting primarily red light. As the temperature of body is increased it may emit primarily yellow light.
**Reason (R):** Rate of radiation emitted by a body increases as the temperature increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** **Assertion (A):** A hot iron bar placed under a running tap loses heat by convection.
**Reason (R):** Convection involves flow of matter within a fluid due to unequal temperature of its parts.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**15.** **Assertion (A):** A temperature change which increases the length of a steel rod by 1% will increase its volume by 3%.
**Reason (R):** The coefficient of volume expansion is nearly three times the coefficient of linear expansion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** Latent heat of vaporization is more than the latent heat of fusion.
**Reason (R):** When a substance gets converted from liquid to vapour, there is large increase in volume. Hence more amount of heat is required.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** The coefficients of expansion are not constant for a given solid. Their values depend on the temperature range in which they are measured
**Reason (R):** Values of $\alpha, \beta, \gamma$ are independent of the of length, area and volume respectively.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** All substances expand on increasing the temperature.
**Reason (R):** Energy of molecules may decrease on increasing the temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** Radiation of longer wavelengths are predominant at lower temperature.
**Reason (R):** When a body is heated, only radiation of wavelength corresponding to infrared waves are emitted.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** If two bodies are in thermal equilibrium in one frame, they will be in thermal equilibrium in all frames.
**Reason (R):** The transfer of energy from a hot body to a cold body is a non-mechanical process.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** Specific heat of substance is property of material.
**Reason (R):** Specific heat also depends on the condition of the experiment. The way in which heat is supplied to the body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** When hot water is suddenly poured in cold beaker of thick glass, the beaker cracks.
**Reason (R):** Glass is bad conductor of heat and outer surface of the beaker does not expand.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** Ice is placed at top of the bucket to cold the water.
**Reason (R):** Heat transfer by convection takes place in upward direction.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** Snow is better insulator than ice.
**Reason (R):** Snow contain air packet and air is bad conductor of heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**25.** **Assertion (A):** Specific heat for melting Ice is infinite.
**Reason (R):** In isothermal process specific heat of substance is infinite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**26.** **Assertion (A):** For small temperature difference between body and surrounding, the rate of cooling directly proportional to the difference in temperature, known as Newton's law of cooling.
**Reason (R):** Newton's law of cooling is valid for heat transfer by radiation mode only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**27.** **Assertion (A):** Two bodies at different temperatures, if brought in contact do not necessary settle to the mean temperature.
**Reason (R):** The two bodies may have different thermal capacities.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**28.** **Assertion (A):** During phase change temperature of the substance remains constant.
**Reason (R):** Internal energy of the substance during change of phase remains constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**29.** **Assertion (A):** The land surfaces get heated and cooled quickly compared to oceans.
**Reason (R):** Land surfaces are practically opaque to solar radiation and only few inches of the ground is affected.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**30.** **Assertion (A):** Woolen clothes keep the body warm in winter.
**Reason (R):** Woolen fibres enclose a large amount of air in them & both air and wool are the bad conductors of heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**31.** **Assertion (A):** Salt is mixed with ice in an ice-cream box.
**Reason (R):** Salt lowers the temperature of ice.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** An ice skater can slide over ice smoothly if the skate blades are sharp.
**Reason (R):** Melting point of ice decreases with increase in pressure.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** On the sea shore, cool breeze flows in the evening.
**Reason (R):** Convection currents are set up from sea to the land since land cools slower than water.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** Two thin blankets put together are less warmer than a single blanket of double the thickness.
**Reason (R):** Thickness increases because of vacuum layer enclosed between the two blankets.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** Water in a container is to be cooled by putting an ice cube in it. Water will get cooled fastest in case 'A'.



A          B          C

**Reason (R):** Water is cooled mostly through convection currents and it is highest in case A.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** Density of humid air is less then density of dry air at the same temperature and pressure.
**Reason (R):** Mass of humid air is more than mass of dry air.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** Temperature near the sea-coast are moderate.
**Reason (R):** Water has a high thermal conductivity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** Bodies radiate heat at all temperature.
**Reason (R):** Rate of radiation of heat is proportional to the fourth power of absolute temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** For an ideal black body, both absorption coefficient and reflection coefficient are one.
**Reason (R):** Perfect absorbers are perfect reflectors.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

40. **Assertion (A):** Heat radiations and light have identical properties.
**Reason (R):** A cold body does not radiate heat to the hotter surroundings.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** A body with large reflectivity is a poor emitter of heat radiations.
**Reason (R):** A body with large reflectivity is a poor absorber of heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** If temperature of any body is increased by 10%, then there will be 40% increase in amount of radiation from its surface.
**Reason (R):** Equation $\frac{\Delta E}{E} = 4\frac{\Delta T}{T}$ also the for large percentage increase where $E \propto T^4$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

43. **Assertion (A):** A hot body is kept in surrounding. As it cools, its temperature falls from 80°C to 78°C in a time duration $t_1$ and from 50°C to 48°C in time duration $t_2$. The temperature of surrounding is constant 20°C, then $t_1 > t_2$.
**Reason (R):** According to Newton's law of cooling, rate of cooling depends only on the difference of temperature of the body and the surrounding.
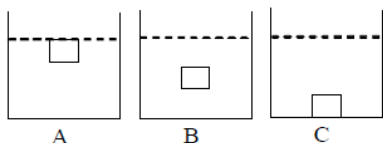(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

44. **Assertion (A):** Most of the heat transfer that is taking place on earth is by convection.
**Reason (R):** Mostly heat radiation from sun are obtained in infrared region.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

45. **Assertion (A):** Conduction usually takes place in solids, convection in liquids and gases and no medium is required for radiation.
**Reason (R):** In conduction and convection, heat is transferred from one place to other by actual motion of heated material.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

46. **Assertion (A):** The equivalent thermal conductivity of two plates of same thickness in contact (series) is less than the smaller value of thermal conductivity.
**Reason (R):** For two plates of equal thickness in contact (series), the equivalent thermal conductivity is given by $\frac{1}{K} = \frac{1}{K_1} + \frac{1}{K_2}$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

47. **Assertion (A):** The amount of radiation from sun's surface varies as the fourth power of its absolute temperature.
**Reason (R):** The sun is a black body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

48. **Assertion (A):** Two spheres of same material have radius $r_1$ and $r_2$ respectively and temperature 4000K and 2000K respectively. The energy radiated per second by first sphere is more than second sphere.
**Reason (R):** In thermal conduction, energy is transferred by transference of particles of conducting body.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.** **Assertion (A):** When temperature difference across the two sides of a wall is increased, its thermal conductivity increases.
**Reason (R):** Thermal conductivity depends upon the temperature difference across the two sides of a wall.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** Specific heat of a body may be greater than its thermal capacity.
**Reason (R):** Mass of a body may be less than unity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** Melting of solid causes no change in internal kinetic energy.
**Reason (R):** Latent heat is the heat required to melt a unit mass of solid.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** **Assertion (A):** If one gram of ice at 0°C is mixed with one gram of water at 80°C, then the final temperature of mixture will be 0°C.
**Reason (R):** Latent heat of ice is 540 cal/g.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** Water can be made to boil without heating.
**Reason (R):** Boiling point of water is lowered by decreasing pressure.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** **Assertion (A):** When a hot liquid is mixed with a cold liquid, the temperature of the mixer is undefined for some time and then becomes nearly constant.
**Reason (R):** If two bodies at different temperature are mixed in a calorimeter, the total energy of the two bodies remains conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**55.** **Assertion (A):** A bottle is filled with water at 40°C on opening it at moon, water will boil.
**Reason (R):** Atmospheric pressure on the surface of moon is zero and boiling point is proportional to pressure.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**56.** **Assertion:** The expanded length $\ell$ of a rod of original length $\ell_0$ is not correctly given by (assuming $\alpha$ to be constant with T) $\ell = \ell_0 (1 + \alpha \Delta T)$, if $\alpha \Delta T$ is large.
**Reason:** It is given by $\ell = \ell_0 e^{\alpha \Delta T}$, which cannot be treated as being approximately equal to $\ell_0 (1 + \alpha \Delta T)$ for large value of $\alpha \Delta T$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1.** **Assertion (A):** It is possible for both the pressure and volume of a monoatomic ideal gas of a given amount to change simultaneously without causing the internal energy of the gas to change.
**Reason (R):** The internal energy of an ideal gas of a given amount remains constant if temperature does not change. It is possible to have a process in which pressure and volume are changed such that temperature remains constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** A system of certain amount of an ideal gas is taken from state A to state B once by process I and next by process II. The amount of heat absorbed by gas is $Q_1$ and $Q_2$ respectively in the two processes.
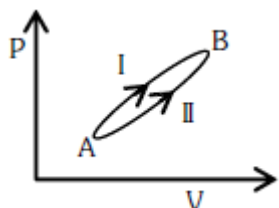


**Assertion (A):** $Q_1 = Q_2$
**Reason (R):** Change in internal energy and work done in both processes are unequal.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** Energy of molecules increase on increasing the temperature.
**Reason (R):** All substances expand on increasing the temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** Work done by a gas in isothermal expansion is more than the work done by the gas in the same expansion adiabatically.
**Reason (R):** Temperature remains constant in isothermal expansion but not in adiabatic expansion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** During the melting of a slab of ice at 273 K at 1 atm, positive work is done on the ice-water system by the atmosphere.
**Reason (R):** In above process, the internal energy of ice–water system increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** During free expansion of an Ideal gas, entropy is zero.
**Reason (R):** Internal energy of an ideal gas is zero during free expansion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** In an ideal monoatomic gas, The Internal energy of gas is equal to translational Kinetic energy of all its molecules
**Reason (R):** The Internal energy may get contributes from Translational, Rotatory, vibrationally as well as from the Potential energy corresponding to the molecular force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Bursting of balloon is not a equilibrium state.

**Reason (R):** Equilibrium state of a thermodynamic system is completely described by specific values of some macroscopic properties.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** Work and heat both can be converted into each other in any condition.

**Reason (R):** Work and Heat both are different form of energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** If volume of a gas is increasing but temperature of the gas is decreasing, then heat given to the gas may be positive, negative or zero.

**Reason (R):** Heat given to a gas is a path function, it is not a state function.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Molar heat capacity of a gas in any process can have any value – $\square$ to $+\square$

**Reason (R):** Molar heat capacity of a gas in an isothermal process is $\square$

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** The area of entropy versus temperature graph of a cyclic process, is equal to work done.

**Reason (R):** Change in internal energy of cyclic process is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** Absolute zero temperature is not the zero energy temperature.

**Reason (R):** At absolute zero temperature the gas may possess potential energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** For gas molecules absolute zero temperature is not the temperature of zero energy.

**Reason (R):** Only the kinetic energy of the molecules is represented by temperature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** On sudden expansion a gas cools.

**Reason (R):** On sudden expansion, no heat is supplied to system and hence gas does work at the expense of its internal energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**16.** **Assertion (A):** At low density, variables of gases P, V and T follows the equation $PV = \mu RT$
**Reason (R):** At low density real gases are more closely to ideal gases
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17.** **Assertion (A):** The internal energy of a given sample of an ideal gas depends only on its temperature according to kinetic theory of gases.
**Reason (R):** The ideal gas molecules do not exert intermolecular forces, thus its potential energy is always zero and internal energy only depends on the temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18.** **Assertion (A):** Internal energy change is zero if the temp is constant, irrespective of the process being cyclic or non-cyclic.
**Reason (R):** $dU = n\,C_v dT$ for all process and is independent of path.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19.** **Assertion (A):** A gas is taken from state A to state B through two different paths. Molar specific heat capacity in path (1) is more as compared to (2).
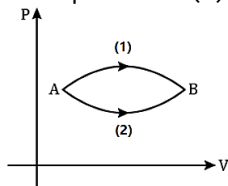


**Reason (R):** $C = \dfrac{\Delta Q}{n\Delta T}$

$\Delta Q = \Delta U + W$
and W is equal to area under P-V diagram.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** In isothermal process whole of the heat energy supplied to the body is converted into internal energy.
**Reason (R):** According to the first law of thermodynamics $\Delta Q = \Delta U - P\Delta V$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** Total entropy change in one cycle of carnot engine is zero.
**Reason (R):** Entropy is a state function.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** The efficiency of a carnot cycle depends on the nature of the gas used.
**Reason (R):** Adiabatic process is a part of carnot cycle and work done in adiabatic process does not depend on nature of gas.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** It is not possible for a system, unaided by an external agency to transfer heat from a body at lower temperature to another body a higher temperature.
**Reason (R):** According to Clausius statement "No process is possible whose sole result is the transfer of heat from a cooled object to a hotter object".
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** Air quickly leaking out of a balloon becomes cooler.

**Reason (R):** The leaking air undergoes adiabatic expansion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**25.** **Assertion (A):** If heat is supplied to an ideal gas in an isothermal process, the internal energy of the gas increases.

**Reason (R):** When an ideal gas expands adiabatically, it does positive work and its internal energy increases.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**26.** **Assertion (A):** In adiabatic expansion of monoatomic ideal gas, if volume increases by 12%, then pressure decreases by 20%.

**Reason (R):** In adiabatic process $PV^{5/3}$ = constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**27.** **Assertion (A):** In an isochoric process, work done by the gas is zero.

**Reason (R):** In a process, if initial volume is equal to the final volume, work done by the gas is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**28.** **Assertion (A):** The specific heat of a gas in an adiabatic process is zero but it is infinite in an isothermal process.

**Reason (R):** Specific heat of a gas is directly proportional to heat exchanged with the system and inversely proportional to change in temperature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**29.** **Assertion (A):** In adiabatic compression, the temperature of system gets decreased.

**Reason (R):** Adiabatic compression is a slow process.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**30.** **Assertion (A):** All processes in which P and V are proportional, take place at constant temperature.

**Reason (R):** Work done in a thermodynamical process is path independent.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**31.** **Assertion (A):** During adiabatic expansion of an ideal gas, temperature falls but entropy remains constant.

**Reason (R):** During adiabatic expansion, work is done by the gas using a part of internal energy and no heat exchange takes place the system and the surrounding.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

32. **Assertion (A):** In a free adiabatic expansion of an ideal gas, the final state is the same is the initial state.
**Reason (R):** As temperature of a gas increases work done by it is positive.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** In adiabatic process, work done on the system is equal to negative of change in internal energy.
**Reason (R):** In adiabatic process change of heat zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** In cyclic process change in internal energy is zero.
**Reason (R):** In cyclic process net work done is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** State variables (P, V and T) of any gas at low densities obey the equation PV = nRT.
**Reason (R):** Real gases are good approximation of an ideal gas at low density.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** The internal energy of a real gas is function of both, temperature and volume.
**Reason (R):** For any gas internal kinetic energy depends on temperature and internal potential energy depends on volume.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** The curve A and B in figure, show P-V graphs for an isothermal and an adiabatic process for an ideal gas. The isothermal process is represented by B.



**Reason (R):** On P-V graph, modulus of slope of the adiabatic curve is greater than the modulus of the slope of the isothermal curve.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** An ideal gas expands isothermally, during this process, it absorbs 25 J heat. In the first law of thermodynamics, work done on the gas will be −25J.
**Reason (R):** There will be no change in the internal energy of the gas during isothermal expansions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1.** **Assertion (A):** Vibrational energy of molecule at temperature T is kT.

**Reason (R):** For every molecule, vibrational degree of freedom is 2.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**2.** **Assertion (A):** There is no change in internal energy for ideal gas at constant temperature.

**Reason (R):** Internal energy of an ideal gas is a function of temperature only.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**3.** **Assertion (A):** The atoms of a monoatomic gas have less degrees of freedom as compared to molecules of the diatomic gas.

**Reason (R):** The ratio of $\dfrac{C_p}{C_v}$ for an ideal diatomic gas is more than that for an ideal monoatomic gas (where $C_p$ and $C_v$ have usual meaning).

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**4.** **Assertion (A):** A gas is kept in an insulated cylinder with a movable piston, in compressed state. As the piston is suddenly released, temperature of the gas decreases.

**Reason (R):** According to the kinetic theory of gas, a molecule colliding with the piston must rebound with less speed than it had before the collision. Hence average speed of the molecules is reduced.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**5.** **Assertion (A):** At 0K, pressure of an ideal gas becomes zero.

**Reason (R):** At 0K, according to ideal gas equation PV = 0, volume cannot be zero hence pressure should be zero to satisfy this equation.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**6.** **Assertion (A):** Molar heat capacity of an ideal monoatomic gas at constant volume is a constant at all temperatures.

**Reason (R):** As the temperature of an monoatomic ideal gas is increased, number of degrees of freedom of gas molecules remains constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

7. **Assertion (A):** According to kinetic theory of gases the internal energy of a given sample of an ideal gas is only kinetic.
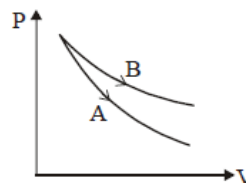**Reason (R):** The ideal gas molecules exert force on each other only when they collide.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Internal energy of an ideal gas U = $nC_v$T is due to random motion of gas molecules.
**Reason (R):** A container is moving with speed v. It is suddenly stopped by a force, temperature of gas increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** Experimental results indicate that the molar specific heat of hydrogen gas at constant volume below 50 K is equal to 5/2 R, where R is the universal gas constant.
**Reason (R):** A diatomic hydrogen molecule possesses three translational and two rotational degrees of freedom at all temperatures.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** When an ideal gas is heated in a rigid non conducting container then pressure becomes double if the temperature is doubled.
**Reason (R):** Both the frequency of collisions and momentum transferred per collision becomes $\sqrt{2}$ times.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** The total translational kinetic energy of all the molecules of a given mass of an ideal gas is 1.5 times the product of its pressure and its volume
**Reason (R):** The molecules of a gas collide with each other and the velocities of the molecules change due to the collision.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** Molar heat capacity at constant pressure can be less than molar heat capacity at constant volume.
**Reason (R):** $C_p - C_v = R$ is valid only for ideal monoatomic gas.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** An ideal gas is enclosed within a container fitted with a piston when volume of this enclosed gas is increased at constant temperature. The pressure exerted by the gas on the piston decreases.
**Reason (R):** In the above situation the rate of molecules striking the piston decreases. Therefore pressure exerted by gas on piston decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** Gas is suddenly compressed, its temperature rises.

**Reason (R):** Work done in compression of gas increases internal energy of the gas.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

15. **Assertion (A):** If temperature of gas in a closed container in increased, its mean free path remains unchanged.

**Reason (R):** Mean free path is inversely proportional to number of molecules per unit volume.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

16. **Assertion (A):** The average translational kinetic energy per molecule of a gas for various gases at the same temperature is the same.

**Reason (R):** if a given temperature, all molecules move with nearly the same speed.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

17. **Assertion (A):** When temperature rises the coefficient of viscosity of gases decreases.

**Reason (R):** Gases behave more like ideal gases at lower temperature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

18. **Assertion (A):** Maxwell speed distribution graph is symmetric about most probable speed

**Reason (R):** rms speed of ideal gas, depends upon it's type (monoatomic, diatomic and polyatomic)

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

19. **Assertion (A):** Internal energy of an ideal gas does not depend upon volume of the gas

**Reason (R):** Internal energy of ideal gas depends on temperature of gas.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

20. **Assertion (A):** An ideal gas has infinitely many molar specific heats.

**Reason (R):** Molar specific heat is amount of heat needed to raise the temperature of 1 mole of gas by 1 K.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

21. **Assertion (A):** The specific heat of a monatomic gas may have value between 0 and ∞.

 **Reason (R):** $C_P = \dfrac{5}{2}R$ and $C_V = \dfrac{3}{2}R$ for a monoatomic gas.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

22. **Assertion (A):** A real gas behaves as an ideal gas at high temperature and low pressure.

 **Reason (R):** At low pressure and high temperature intermolecular forces vanish away and volume of gas molecules is negligible.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

23. **Assertion (A):** P-T graph of all gases at low density meet at 0 K.

 **Reason (R):** Absolute zero kelvin is less than 0°C in celsius scale.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

24. **Assertion (A):** An ideal gas has infinitely many molar specific heats.

 **Reason (R):** Specific heat is amount of heat needed to raise the temperature of 1 mole of gas by 1K.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

25. **Assertion (A):** On increasing the temperature, the height of the peak of the Maxwell's velocity distribution curve increases.

 **Reason (R):** The height of the peak of the Maxwell's velocity distribution curve represents most probable speed.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

26. **Assertion (A):** All molecular motion ceases at −273.15°C.

 **Reason (R):** Temperature 0K cannot be attained.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

27. **Assertion (A):** In Maxwell's speed distribution graph, for a given amount of gas, the area under the graph increases as the temperature of the gas increases.

 **Reason (R):** Decrease in temperature broadening the curve.

 (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

 (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

 (3) (A) is true but (R) is false

 (4) Both (A) and (R) are false

28. **Assertion (A):** The pressure exerted by an enclosed ideal gas does not depend on the shape of the container.

**Reason (R):** The pressure of an ideal gas depends on the number of moles, temperature and volume of the enclosure.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

29. **Assertion (A):** The ratio $\dfrac{C_P}{C_V}$ is more for helium gas than for hydrogen gas.

**Reason (R):** Atomic mass of helium is more than that of hydrogen.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

30. **Assertion (A):** On a V-T graph, the slope of an isobar increases with pressure.

**Reason (R):** At constant temperature, for an ideal gas its volume is directly proportional to its pressure.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

31. **Assertion (A):** Internal energy of real gas is always negative at absolute zero temperature.

**Reason (R):** Potential energy of a bounded system is negative.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

32. **Assertion (A):** The average translational kinetic energy of the molecules in one mole of all ideal gases, at the same temperature is the same.

**Reason (R):** The average kinetic energy of one mole of any ideal gas at temperature T is given by $<E> = \dfrac{3}{2}RT$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

33. **Assertion (A):** For an ideal gas, at constant temperature, the product of the pressure and volume is constant.

**Reason (R):** The mean square velocity of gas molecules is inversely proportional to mass of molecule.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**1.** **Assertion (A):** A hole were drilled through the centre of earth and a ball is dropped into the hole at one end, it will not get out of other end of the hole.
**Reason (R):** Ball will execute simple harmonic motion inside the hole.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** In SHM let x be the maximum speed, y the frequency of oscillation and z the maximum acceleration, then $\left(\dfrac{xy}{z}\right)$ is a constant quantity.
**Reason (R):** This is because $\left(\dfrac{xy}{z}\right)$ becomes a dimensionless quantity
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** A vertical spring block system is made to oscillate.
**Assertion (A):** Its time period on earth is more than that on the moon.
**Reason (R):** Its extension on moon (in equilibrium) is more than that on the earth .
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** Total mechanical energy in SHM is conserved.
**Reason (R):** Kinetic energy of SHM at mean position is equal to potential energy at ends for a particle moving in SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** A SHM may be assumed as composition of many SHM's.
**Reason (R):** Superposition of many SHM's (along same line) of same frequency will be a SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** Displacement–time equation of a particle moving along x–axis is x = 4 + 6 sinωt. Under this situation, motion of particle is not simple harmonic.
**Reason (R):** $\dfrac{d^2x}{dt^2}$ for the given equation is not proportional to –x.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** For a particle performing SHM, its speed decreases as it goes away from the mean position.
**Reason (R):** In SHM, the acceleration is always opposite to the velocity of the particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Motion of a ball bouncing elastically in vertical direction on a smooth horizontal floor is a periodic motion but not an SHM.
**Reason (R):** Motion is SHM when restoring force is proportional to displacement from mean position.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** A particle, simultaneously subjected to two simple harmonic motions of same frequency and same amplitude, will perform SHM only if the two SHM's are in the same direction.
**Reason (R):** A particle, simultaneously subjected to two simple harmonic motions of same frequency and same amplitude, perpendicular to each other the particle can be in uniform circular motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** x = A sin ωt
y = B cos ωt
In the above co-ordinates particle moves in elliptical path.
**Reason (R):** A periodic motion can always be expressed as a sum of infinite number of harmonic motions with appropriate amplitude
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Under forced oscillation external periodic force apply to sustain the motion.
**Reason (R):** Under forced oscillation phase of harmonic motion of the particle differs from the phase of the driving force.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** For large angle in simple pendulum $T > 2\pi\sqrt{\dfrac{\ell}{g}}$
**Reason (R):** sinθ < θ, if the restoring force. mg sinθ is replaced by mgθ, this amounts to effective reduction in g for large angle, hence an increase in T.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** We can assume damped oscillation to be approximately periodic motion for small damping
**Reason (R):** Small damping means $\dfrac{b}{\sqrt{km}} \ll 1$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** When a simple pendulum is made to oscillate on the surface of moon, its time period increases.
**Reason (R):** Gravity at moon is less than gravity at earth.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**15. Assertion (A):** The spring constant of a spring is 'K'. When it is divided into "n" equal parts, then spring constant of one piece is 'K/n'.
**Reason (R):** The spring constant is independent of material used.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**16. Assertion (A):** The amplitude of an oscillating pendulum in air decreases gradually with time.
**Reason (R):** The frequency of the pendulum decreases with time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17. Assertion (A):** The time period of spring mass system is greater at equator then at poles.
**Reason (R):** Time period of spring mass system depends on gravity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18. Assertion (A):** In simple pendulum performing SHM net acceleration is always between tangential and radial acceleration except its lowest point and extreme points.
**Reason (R):** At lowest point tangential acceleration is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19. Assertion (A):** Mechanical energy of a particle executing SHM is E, maximum KE of particle may be greater than E.
**Reason (R):** Minimum 'PE' of a system may be negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20. Assertion (A):** In common practice undamped spring block system is an example of oscillation as well as and periodic motion.
**Reason (R):** Every oscillating motion is necessarily a periodic motion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21. Assertion (A):** $x = \sin^2(\omega t)$ represents a SHM about mean position $x = \dfrac{1}{2}$.
**Reason (R):** $(a \propto -x)$ is the necessary condition for SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22. Assertion (A):** If PE of a particle executing SHM is given by $U = x^2 - 10x + 27$, then it is executing SHM about $x = 5$.
**Reason (R):** At mean position, restoring force is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** In resonance amplitude is infinity, in presence of dissipative forces.
**Reason (R):** At resonance driving frequency is equal to natural frequency of the system.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** In damped oscillation, the motion is periodic.
**Reason (R):** In damped oscillation, the amplitude decreases due to dissipative forces.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** The amplitude of damped oscillation depends on damping constants.
**Reason (R):** The angular frequency for a damped oscillation depends on damping constant only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** General vibrations of a polyatomic molecule about its equilibrium position is periodic but not SHM.
**Reason (R):** A periodic motion can always be expressed as a sum of infinite number of harmonic motion with appropriated amplitude.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** In SHM acceleration leads displacement by phase $\pi$.
**Reason (R):** In SHM velocity leads displacement by phase $\pi/2$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Amplitude of SHM
$x = 4\sin^2\omega t + 2\cos^2\omega t + 2\sin\omega t \cos\omega t$ is $\sqrt{2}$
**Reason (R):** Angular frequency of given equation is $2\omega$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** For a physical pendulum period of oscillation is maximum about an axis passes through centre of mass.
**Reason (R):** A physical pendulum is in neutral equilibrium about centre of mass.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. 
Perfectly smooth          Sufficiently rough to sustain rolling
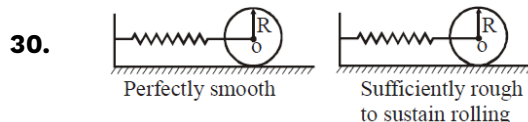
**Assertion (A):** Period of oscillation of rolling body is more than sliding body.
**Reason (R):** Frictional force always opposes the spring force in given case.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** Two particles are in SHM with same time period, same amplitude, same position and same speed are in the same phase.
**Reason (R):** Phase of particle depends on position and speed of particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** In damped oscillation both amplitude and frequency change with time.
**Reason (R):** Both amplitude and frequency vary exponentially.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** Time period of partially immersed spring block system is less than full immersed spring block system.
**Reason (R):** Time period of spring system is independent of changing values of g.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** In forced oscillations, the steady state motion of the particle (after natural oscillations die out) is SHM whose frequency is the frequency of the driving frequency $\omega_d$, not the natural frequency w of the particle.
**Reason (R):** In forced oscillation $\omega_d$ should be greater than natural frequency $\omega$ of the particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** For a physical pendulum if distance of point of suspension from centre of mass increases time period first decreases then increases.
**Reason (R):** For a physical pendulum there is some distance from centre of mass at which frequency of oscillation is maximum.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** A spring block watch gives the correct time in orbiting satellite.
**Reason (R):** Time period of a spring block watch is independent of g and depends only on spring factor and mass of the block.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** If a pendulum clock is taken to a mountain top, its time period decreases.
**Reason (R):** Value of acceleration due to gravity is more at heights.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** In simple harmonic motion total mechanical energy can be negative also.
**Reason (R):** Potential energy is always negative and if it is greater than kinetic energy total mechanical energy will be negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**39.**



**Assertion (A):** In an ideal spring mass system, block was given some charge & placed in uniform electric field which is along the spring, it's time period & frequency of oscillation does not change.

**Reason (R):** In an ideal oscillating spring mass system constant force does not change its time period & frequency and it only changes the mean position & amplitude.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**40.** **Assertion (A):** The graph between velocity and displacement for a harmonic oscillator is a parabola.

**Reason (R):** Velocity does change uniformly with displacement in harmonic motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**41.** **Assertion (A):** A small body suspended by a light spring performing SHM. When the entire system is immersed in a nonviscous liquid period of oscillation does not change.

**Reason (R):** The angular frequency of oscillation of the particle does not change.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**42.** **Assertion (A):** The graph of potential energy and kinetic energy of a particle in SHM with respect to position is a parabola.

**Reason (R):** The potential energy and kinetic energy of a particle in SHM, do not vary linearly with position.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**43.** **Assertion (A):** A simple pendulum is attached on a roof of a elevator. Time period of SHM is T when elevator is at rest. Time period of SHM must be greater than T if elevator start moving upward.

**Reason (R):** Time period of simple pendulum does not depend on acceleration due to gravity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**44.** **Assertion (A):** Maximum potential energy in simple harmonic motion is equal to net mechanical energy.

**Reason (R):** Maximum kinetic energy in simple harmonic motion is equal to net mechanical energy.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**45. Assertion (A):** Sine and cosine functions are periodic functions.
**Reason (R):** Sinusoidal functions repeat its values after a definite interval of time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**46. Assertion (A):** In SHM the velocity is maximum when the acceleration is minimum.
**Reason (R):** Displacement and velocity in SHM differ in phase by $\frac{\pi}{2}$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**47. Assertion (A):** The periodic time of a hard spring is less as compared to that of a soft spring.
**Reason (R):** The spring constant is large for hard spring.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**48. Assertion (A):** Vibration of polyatomic molecules is not simple harmonic motion.
**Reason (R):** The vibrations are superposition of SHMs of different frequency.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49. Assertion (A):** If the amplitude of a simple harmonic oscillator is doubled, its total energy also becomes doubled.
**Reason (R):** In harmonic oscillation, the total energy is directly proportional to the amplitude of vibration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50. Assertion (A):** For a system executing SHM, the mechanical energy remains constant.
**Reason (R):** In SHM, kinetic energy and potential energy vary periodically with double the frequency of SHM.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

1. **Assertion (A):** When a pulse on string reflects from free end, the resultant pulse is formed in such a way that slope of string at free end is zero.
**Reason (R):** Zero resultant slope ensures that there is no force component perpendicular to string.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

2. **Assertion (A):** The pitch of wind instruments rises and that of string instruments falls as an orchestra warms up.
**Reason (R):** When temperature rises, speed of sound in air increases but speed of wave in a string fixed at both ends decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

3. **Assertion (A):** Sound travels faster on a rainy day than on a dry day.
**Reason (R):** With increase in humidity pressure increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

4. **Assertion (A):** Node of pressure wave is formed at the open end of an organ pipe.
**Reason (R):** Reflected pressure wave from an open end will have phase difference of $\pi$ w.r.t. to the incident pressure wave.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

5. **Assertion (A):** When a wave enters from one medium to another, its frequency is not changed.
**Reason (R):** Speed of a wave in a medium is property of the source.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

6. **Assertion (A):** Two waves moving in a uniform string having uniform tension cannot have different velocities.
**Reason (R):** Elastic and inertial properties of string are same for all waves in same string. Moreover, velocity of wave in a string depends on its elastic and inertial properties only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

7. **Assertion (A):** Two sound waves of same intensity in a particular medium will have displacement amplitude in ratio of 2**:**1 if they have frequency in the ratio 1 **:** 2.
**Reason (R):** Two wave of same velocity and amplitude in a particular medium have equal intensity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** Every small part of string does SHM in sinusoidal travelling wave.
**Reason (R):** In this small segment of string total energy is conserved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** If two waves of same amplitude produce a resultant wave of same amplitude, then the phase difference between them will be 120°.

**Reason (R):** The resultant amplitude of two waves is equal to sum of amplitude of two waves.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

10. **Assertion (A):** In a sinusoidal travelling wave on a string potential energy of deformation of string element at extreme position is maximum.

**Reason (R):** The particles in sinusoidal travelling wave perform SHM.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

11. **Assertion (A):** $Y = 2A \sin kx \cos wt$ refers to a travelling wave along –ve x-direction.

**Reason (R):** When a continuous travelling wave interacts with its reflection from a rigid support, forms a standing wave.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

12. Two person A and B sound whistle. The person A is stationary and heard sound after reflection from a wall which is moving toward him; while person B is moving in a circle and heard the sound after reflection from a small object at the centre of circle.

**Assertion (A):** The person A observe change in frequency but no Doppler's effect while person B observed Doppler's effect but no change in frequency.

**Reason (R):** Doppler's effect is phenomena of observing change in frequency due to motion of either source or observer or both. While change in frequency can be observed due to change of wavelength or change of speed of wave-front relative to observer.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

13. In situation A, an observer moves with a certain velocity towards a stationary source of sound, In situation B, the source moves towards the stationary observer with the same velocity,

**Assertion (A):** The frequency heard would be the same in both the situations.

**Reason (R):** The velocity of the source as observed by the observer in both the situations is the same.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

14. **Assertion (A):** Speed of longitudinal wave in solid and liquid is higher than gases.

    **Reason (R):** Modulus of elasticity is more for solids as compared to liquid & gas.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

15. **Assertion (A):** The velocity of sound decreases with increase in humidity.

    **Reason (R):** Velocity of sound does not depend on medium.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

16. **Assertion (A):** The change in air pressure, effect the speed of sound at constant temperature.

    **Reason (R):** The speed of sound in a gas is directly proportional to pressure.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

17. **Assertion (A):** Sound produced by an open organ pipe has good quality than sound produced by a loosed organ pipe.

    **Reason (R):** In OOP both even & old harmonics are present.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

18. **Assertion (A):** The fundamental frequency of an open organ pipe increases as the temperature is increased.

    **Reason (R):** As the temperature increases, the velocity of sound increases more rapidly than length of the pipe.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

19. **Assertion (A):** Transverse mechanical waves can propagate in solid, liquid and gas.

    **Reason (R):** Transverse mechanical waves needs rigidity in the medium to propagate.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

20. **Assertion (A):** When there is no relative velocity between source and observer then observed frequency is same as emitted.

    **Reason (R):** Velocity of sound is zero when there is no relative velocity between source and observer.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

**21.** **Assertion (A):** A 80 dB sound has twice the intensity of a 40 dB sound.

**Reason (R):** Loudness of a sound of a certain intensity 'I' is defined as

$$L = 100\log_{10}\left(\frac{I}{I_0}\right)$$

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** For a closed organ resonating pipe, the first resonance length is 60 cm. The second resonating length will be 180 cm.

**Reason (R):** For a particular closed pipe $n_2 = 3n_1$

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** If two sounds of frequencies 256 Hz and 260 Hz reach our ear simultaneously then we hear a sound of frequency 258 Hz.

**Reason (R):** We hear a striking variation in the intensity of sound that repeat at a frequency of 4 Hz.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** When a high pressure pulse of air travelling down an open pipe reaches the other end, turns into a pulse of low pressure pulse travelling up the tube.

**Reason (R):** Node of pressure means antinode of displacement in case of open pipe.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**25.** **Assertion (A):** y-x graph of transverse wave on a string is as shown in figure. At a point 'A' potential energy and kinetic energy both are minimum.
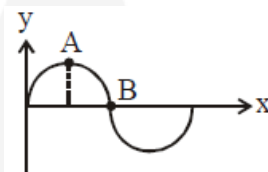


**Reason (R):** At a point 'A' slope of graph is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**26.** **Assertion (A):** A person hear maximum sound at displacement node.

**Reason (R):** Pressure change is maximum at displacement node.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** When observer is at rest with respect to medium and source is moving away from the observer the wavelength of sound observed by observer is more than its actual wavelength.

    **Reason (R):** Wavelength appears to increase or decrease respectively if observer is moving towards or away from stationary source.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

28. **Assertion (A):** In mechanical waves energy transfer takes place because of the coupling through elastic forces between neighbouring oscillating parts of the medium.

    **Reason (R):** Propagation of wave in medium is due to only elastic properties of medium.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

29. **Assertion (A):** In a hoop revolving with some angular speed $\omega$ in horizontal plane, transverse wave may appear to be stationary.

    **Reason (R):** Velocity of transverse wave pulse w.r.t. string may be equal and opposite to string velocity.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

30. **Assertion (A):** Transverse mechanical waves cannot be generated within the volume of liquids.

    **Reason (R):** Liquids does not have modulus of rigidity.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

31. **Assertion (A):** In longitudinal wave propagation the distance between two consecutive compression is equal to wavelength of wave.

    **Reason (R):** Standing wave is not a wave as it does not transport energy.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

32. **Assertion (A):** Sound travels faster in air than in water.

    **Reason (R):** Air is always rarer medium with respect to water medium.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

33. **Assertion (A):** Sound waves cannot propagate through vacuum but light waves can.

    **Reason (R):** Sound waves cannot be polarised but light waves can be.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

**34.** **Assertion (A):** When two vibrating tuning forks having frequencies 240 Hz and 300 Hz are held near each other, beats cannot be heard by us.

**Reason (R):** This is because beats cannot be distinctly heard due to the property of persistence of hearing.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**35.** **Assertion (A):** In a harmonic wave of a given frequency all particles have the same amplitude but different phases at a given time.

**Reason (R):** In a stationary wave, all particles have the same phase at a given instant but have different amplitudes.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**36.** **Assertion (A):** Interference is position dependent phenomenon.

**Reason (R):** Beats is time dependent phenomenon.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**37.** **Assertion (A):** Sound waves can be used to explore the soft tissue of the human body.

**Reason (R):** Oscillations in the real world are usually damped.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**38.** **Assertion (A):** An acoustic guitar depends for its sound on the acoustic resonance produced in the hollow body of the instrument by the oscillations of the strings.

**Reason (R):** Electric guitar is a solid instrument that based upon resonance. (In electric guitar the oscillations of the metal strings are sensed by electric "pickups" that send it to an amplifier).

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**39.** **Assertion (A):** When two tuning fork of frequency 256 Hz and 324 Hz are vibrating together. Beats will not be heard.

**Reason (R):** Superposition of sound waves is possible for all frequencies of sound.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**40.** **Assertion (A):** In a stationary–wave system, displacement nodes are pressure antinodes, and displacement antinodes are pressure nodes.

**Reason (R):** When a closed organ pipe vibrates, the pressure of the gas at the closed end remains constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

41. **Assertion (A):** Interference can happen in sound waves.
**Reason (R):** In Quincke's tube, interference is present due to initial phase difference as well as the phase difference due to path difference.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** When we start filling an empty bucket with water, the pitch of sound produced goes on decreasing.
**Reason (R):** The frequency of man voice is usually higher than that of woman.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

43. **Assertion (A):** For a given medium in a wave, particle velocity varies w.r.t. time, while the wave velocity is independent of time.
**Reason (R):** For propagation of mechanical wave, medium must have the properties of elasticity and inertia.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

44. **Assertion (A):** Sound is produced due to vibratory motion, but a vibrating pendulum does not produce audible sound.
**Reason (R):** A vibrating source always produce audible sound.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

45. **Assertion (A):** With increase in temperature, the speed of sound in a gas increases.
**Reason (R):** When temperature increases, the gas molecules move faster.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

46. **Assertion (A):** Sound waves travel faster on a hot summer day than on a cold winter day.
**Reason (R):** Velocity of sound is directly proportional to the temperature of medium.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

47. **Assertion (A):** Both arms of a tuning fork vibrate with the same frequency.
**Reason (R):** The two arms of a tuning fork vibrate in phase.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

48. **Assertion (A):** Beats are not observed in case of light waves from two independent sources.
**Reason (R):** The phase difference between two light sources changes randomly.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.** **Assertion (A):** A vibrating tuning fork sounds louder, when its stem is pressed against a desk top.
**Reason (R):** When a sound wave is incident on the surface of a desk, it is totally reflected.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** The energy stored by a stationary wave is zero.
**Reason (R):** When two identical waves travelling in opposite directions superimpose, their whole energy is converted into heat.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** Doppler effect for sound waves is symmetrical.
**Reason (R):** With the help of Doppler effect we can determine the distance between source and observer.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** **Assertion (A):** Whistle of the approaching railway engine is shriller than the receding engine.
**Reason (R):** Apparent frequency of railway engine in both cases is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** In $n^{th}$ normal mode of a stretched string, there are n antinodes and (n +1) nodes.
**Reason (R):** The ends of string are nodes, so the number of nodes is one more than the number of antinodes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** **Assertion (A):** It is not possible to have interference between the waves produced by two violins of different frequency.
**Reason (R):** For interference of two waves, the phase difference between the waves must remain constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**55.** **Assertion (A):** In everyday life, the Doppler effect is observed readily for sound waves than light waves.
**Reason (R):** Velocity of light is greater than the sound.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**56.** **Assertion (A):** A tuning fork is in resonance with a closed pipe in fundamental mode, but the same tuning fork cannot be in resonance in fundamental mode with an open pipe of same length.
**Reason (R):** The same tuning fork will not be in resonance with open pipe of same length due to end correction of pipe.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

1.      **Assertion (A):** The tyres of aircrafts are slightly conducting.
        **Reason (R):** If a conductor is connected to ground, the extra charge induced on conductor will flow to ground.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

2.      **Assertion (A):** Both the charge and mass are invariant.
        **Reason (R):** Charge is always associated with mass.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

3.      **Assertion (A):** The electric field due to a charge configuration with total charge zero may not be zero.
        **Reason (R):** Electric field obeys the principle of superposition.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

4.      **Assertion (A):** Vehicles carrying highly inflammable materials have hanging chains, slightly touching the ground.
        **Reason (R):** The body of a vehicle gets charged when moving through air at high speed.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

5.      **Assertion (A):-** The tyres of aeroplanes are slightly conducting.
        **Reason (R):** During take off and landing of aeroplanes, the friction between tyres and the runway may cause electrification of tyres.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

6.      **Assertion (A):** We can shield a charge from electric fields by putting it inside a hollow conductor but we can not shield a body from the gravitational influence of near by matter by putting it inside a hollow sphere.
        **Reason (R):** Gravitational force in between two point mass bodies is independent of the intervening medium them.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

7.      **Assertion (A):** A metal sphere of radius 1 cm cannot hold a charge of 1 coulomb in air.
        **Reason (R):** The dielectric strength of air (minimum field required for ionisation of a medium) is 3 MV/m.
        (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
        (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
        (3) (A) is true but (R) is false
        (4) Both (A) and (R) are false

**8.** **Assertion (A):** In any electrostatic field, a charge cannot be in stable equilibrium.
**Reason (R):** An electrostatic field is a conservative force field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**9.** **Assertion (A):** A positively charged rod is held near a neutral conducting solid sphere as illustrated below. The sphere lies on a insulated stand. The potential of ground (or earth) is zero. The potential at point A (point A need not be centre of the sphere) is higher compared to potential of ground (earth).
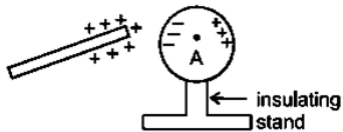


**Reason (R):** In the situation of assertion, the potential at the centre of conducting sphere is positive. The solid sphere being conducting, potential at each point in the sphere is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**10.** **Assertion (A):** A point charge q is placed near an arbitary shaped solid conductor as shown in figure. The potential difference between the points A and B within the conductor remain same irrespective of the magnitude of charge q.



**Reason (R):** The electric field inside a solid conductor is zero under electrostatic conditions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**11.** **Assertion (A):** If a proton and an electron are placed in the same uniform electric field one by one, they experience different accelerations (The only force acting on proton and electron is that exerted by uniform electric field).
**Reason (R):** Electric force on a test charge is independent of its mass.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** When a negative charge – q is released at a distance R from the centre and along the axis of a uniformly and positively charged fixed ring of radius R, the negative charge does oscillation but not SHM.
**Reason (R):** The force on negative charge is always towards the centre of the ring but it is not proportional to the displacement from the centre of the ring.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** Two point charges +Q are fixed some distance apart. O is a point exactly in middle of both fixed charges. A charge +q is released from rest at a certain distance left of O as shown in figure. The speed of charge +q is maximum at O.



**Reason (R):** The speed of a moving particle is maxima at stable equilibrium position.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** There is an isolated system of two charged conducting spheres A and B. The resultant electric field at point P is the sum of electric field at P due to charged sphere A only (that is, assuming sphere B and all its effects to be absent) and the electric field at P only due to sphere B (that is, assuming sphere A and all its effects to be absent).
**Reason (R):** Superposition theorem for electric field due to point charges states that resultant electric field at a point due to point charges is the sum of electric field at that point due to individual charges.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** A small uncharged solid conducting sphere is suspended from a fixed point O by a light insulating string (fig-1). The system is in equilibrium. Now an horizontal uniform electric field E is switched on. As a result the conducting sphere is deflected towards left as shown(fig-2).



(fig.1)    (fig.2)
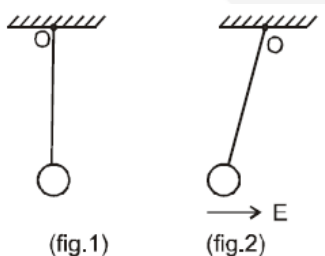
**Reason (R):** When a solid conducting sphere having zero net charge is placed in uniform electric field, charges are induced on the surface of sphere.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** The electric field due to point charge configuration with total charge zero is not zero.
**Reason (R):** Gauss law does not hold for a configuration with total charge zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
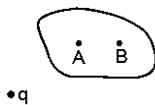(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** Electric field is always zero in a cavity inside a conductor.
**Reason (R):** All points in a cavity inside a conductor are always at same potential.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** If a charge is released from rest in an electric field, it will always move along an electric field line.
**Reason (R):** Force on a charged particle is always in the direction of electric field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** A charged particle is free to move in an electric field. It may or may not move along an electric line of force.
**Reason (R):** Initial conditions affect the motion of charged particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** If a positron and an electron are placed in same uniform electric field, they experience same acceleration.

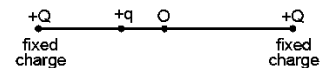**Reason (R):** Electric force on a test charge is independent of its mass.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**21.** **Assertion (A):** Two rigid, identical and uniformly charged non conducting spheres with same charge are placed on a sufficiently rough surface, then spheres must be in equilibrium.
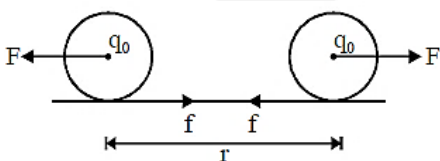


**Reason (R):** If net force on a point charge is zero it is in equilibrium.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**22.** **Assertion (A):** We cannot produce electric field in a neutral conductor.

**Reason (R):** Neutral conductor cannot produce electric field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**23.** **Assertion (A):** In a given situation of arrangement of charges, an additional charge is placed outside the Gaussian surface. In this situation, in the Gauss theorem $\oint \vec{E}.d\vec{s} = \dfrac{q_{in}}{\in_0}, q_{in}$ remains unchanged whereas electric field $\vec{E}$ is changed.

**Reason (R):** Electric field $\vec{E}$ at any point on the Gaussian surface is due to inside charge only.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**24.** **Assertion (A):** When a charge is placed at rest in an electric field its path will always be along electric line of force.

**Reason (R):** The force on the charge is along the tangent drawn on electric field line.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**25.** **Assertion (A):** Angular momentum of the two dipole system is not conserved.

**Reason (R):** There is a net torque on the system.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

26. **Assertion (A):** Continuity equation explains conservation of electric charge.
**Reason (R):** Gauss law shows diversion when inverse square law is not obeyed.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** A moving charge particle may gets energy from electric field.
**Reason (R):** Electric field works on moving charge.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Electric field intensity at surface of a uniformly charged spherical shell is E. If shell is punctured at a point then intensity at punctured point becomes E/2.
**Reason (R):** Electric field intensity due to a spherical charge distribution can be found out by using Gauss law.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** If X-ray is allowed to fall on uncharged gold leaf in evacuated glass chamber of electroscope, leaves will diverge.
**Reason (R):** Uncharged gold leaves will get charged positively when x-ray falls on it.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

30. **Assertion (A):** When a dipole is placed in a non- uniform electric field dipole must experience non zero force and torque.
**Reason (R):** Electric dipole is in stable equilibrium in non uniform electric field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** When charges are shared between two bodies, there occurs no loss of charge, but there does occur a loss of energy.
**Reason (R):** In case of sharing of charges energy of conservation fails.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** If dipole $(\vec{p}_1)$ is moved along the line normal to the axis (dotted line shown) of another dipole $(\vec{p}_2)$, their interaction energy does not change.



**Reason (R):** Electric field of $\vec{p}_2$ at the position of $\vec{p}_1$ is normal to $\vec{p}_1$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**33.** **Assertion (A):** Excess charge on a conductor resides entirely on the outer surface.

**Reason (R):** Like charges repel each other.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**34.** **Assertion (A):** The whole charge of a conductor cannot be transferred to another conductor.

**Reason (R):** The total transfer of charge from one to another is not possible.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**35.** **Assertion (A):** At a point in space, the electric field points toward east. In the region, surrounding this point the potential will be constant along north and south.

**Reason (R):** Electric field at a point in space is proportional to rate of change of potential with distance.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**36.** **Assertion (A):** A point charge is brought in an electric field. The field at a nearby point will increases, whatever be the nature of charge.

**Reason (R):** The direction of electric field lines is independent of the nature of charge.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**37.** **Assertion (A):** If a point charge be rotated in a circle around another stationary charge at the centre of the circle, the work done by electric field will be zero.

**Reason (R):** Work done by centripetal force is always zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

1.  **Assertion (A):** Consider a conducting sphere of radius R. Now a charge q is placed in front of sphere. Electric potential at point O is $\dfrac{Kq}{r}$.



    **Reason (R):** Electric potential at the centre of sphere due to induced charges is zero.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

2.  **Assertion (A):** When a isolated charged body is connected to earth, all its charge flows to earth and it becomes electrically neutral.
    **Reason (R):** Electric potential of earth is non zero, so the body connected to earth should also attain zero potential.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

3.  **Assertion (A):** Potential difference between two points in space is zero if electric field at all points in space is zero.
    **Reason (R):** Electric field E at a point P is zero if potential at that point is zero.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

4.  **Assertion (A):** Electrostatic field inside a conducting shell is always zero.
    **Reason (R):** The electrostatic potential is always same from center to surface of a conducting shell.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

5.  The electrostatic potential on the surface of a charged solid conducting sphere is 100 volts. Two statements are made in this regard :-
    **Assertion (A):** At any point inside the sphere, electrostatic potential is 100 volt.
    **Reason (R):** At any point inside the sphere, electric field is zero.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

6.  **Assertion (A):** If electric field in x-y plane is given by $\vec{E} = y\hat{i} + x\hat{j}$ then equipotential curve is given by xy = constant.
    **Reason (R):** Electric field may not be perpendicular to equipotential surface/curve/line.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

7.  **Assertion (A):** Distance of closest approach for free target is more than that for fixed target.
    **Reason (R):** Total energy is conserved for free target but not for fixed target.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

8.  **Assertion (A):** When two positive point charges move away from each other, their electrostatic potential energy decreases.

    **Reason (R):** Change in potential energy between two points is equal to the work done by electrostatic forces.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

9.  **Assertion (A):** Electric potential of earth is taken as zero.

    **Reason (R):** Electric field strength on the surface of earth is zero.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

10. **Assertion (A):** A charge 3 μ C is moved from a point A that is on the equatorial line of an electric dipole to the centre of the dipole along a path as shown in figure. For this motion, work done by electric force will be zero.

    

    **Reason (R):** Electric force is a conservative force.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

11. **Assertion (A):** If capacitor is filled with, same thickness t (t < d) of dielectric and conducting sheet one after another, then capacitance are $C_1$ and $C_2$ respectively then $C_1 < C_2$

    **Reason (R):** Capacitance is more in presence of metal sheet in compare to dielectric sheet as

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
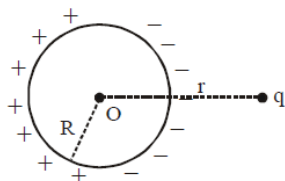
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

12. **Assertion (A):** Circuits containing high capacity capacitors, charged to high voltage should be handled with caution, even when the current in the circuit is switched off.

    **Reason (R):** When an isolated capacitor is touched by hand or any other part of the human body, there is an easy path to the ground available for the discharge of the capacitor.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

13. **Assertion (A):** Time constants of the circuits shown in the figure are same.
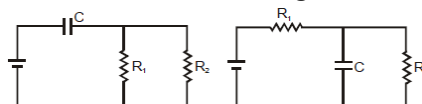
    

    **Reason (R):** Instantaneous current through the capacitor branch is same at any instant for both the circuits, if batteries are inserted in the circuits at t = 0

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

**14.** **Assertion (A):** Charges are given to plates of two plane parallel plate capacitors $C_1$ and $C_2$ (such that $C_2 = 2C_1$) as shown in figure. Then the key K is pressed to complete the circuit. Finally the net charge on upper plate and net charge on lower plate of capacitor $C_1$ is positive.
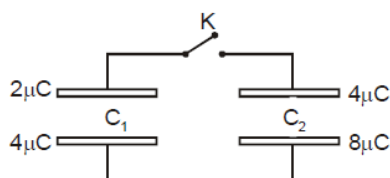


**Reason (R):** In a parallel plate capacitor both plates always carry equal and opposite charge.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**15.** **Assertion (A):** A charged plane parallel plate capacitor has half interplanar region (I) filled with dielectric slab. The other half region II has air. Then the magnitude of net electric field in region I is less than that in region II.



**Reason (R):** In a dielectric medium induced (or polarised) charges tend to reduce the electric field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**16.** **Assertion (A):** A parallel plate capacitor is charged to a potential difference of 100V, and disconnected from the voltage source. A slab of dielectric is then slowly inserted between the plates. Compared to the energy before the slab was inserted, the energy stored in the capacitor with the dielectric is decreased.

**Reason (R):** When we insert a dielectric between the plates of a capacitor, the induced charges tend to draw in the dielectric into the field (just as neutral objects are attracted by charged objects due to induction). We resist this force while slowly inserting the dielectric, and thus do negative work on the system, removing electrostatic energy from the system.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**17.** **Assertion (A):** If one plate of a charged parallel plate capacitor is dipped in water and other plate is above it, then water level will rise in capacitor.

**Reason (R):** Total charge on plates increases.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**18.** **Assertion (A):** When outer grounded shell of a two charged concentric shell system is removed, the capacitance of system decreases.

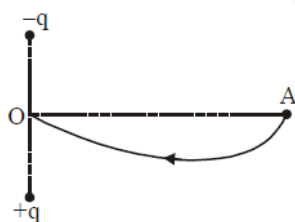**Reason (R):** Electric field will spread in vast region till infinity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**19.** **Assertion (A):** If a capacitor (fully charged) is discharged through an ideal inductor then the charge makes SHM between the capacitor and inductor.
**Reason (R):** Current in the circuit, when a capacitor discharges through an inductor reverses its direction periodically.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** In dielectric, the electric field due to polarization, is weaker than external field.
**Reason (R):** Free movement of charge is not possible in dielectric.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** If separation between plates of a parallel plate isolated charged capacitor is increased, its energy stored will be increased.
**Reason (R):** Work done to separate the plates get converted in electrostatic potential energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** When a dielectric slab is kept near an isolated parallel plate charged capacitor, it will pull the dielectric slab between the plates.
**Reason (R):** Energy of system decreases when dielectric slab enters between plates of charged parallel plate capacitor.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** When two capacitors of capacitance 300 pF and 600 pF which can work upto maximum potential of 4 kV and 3 kV respectively, are connected in series, their combination can work upto maximum potential of 7 kV.
**Reason (R):** In series combination, maximum working potential will be sum of maximum working potential of individual capacitors.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** After charging a capacitor of capacitance C from a battery, It is connected to the same battery of potential difference V with reverse polarity. Loss of energy in this process is $2CV^2$ of
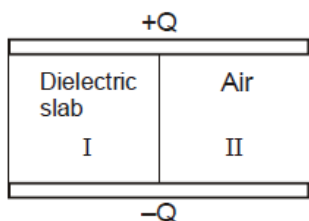**Reason (R):** Work done by the battery is equal to loss of energy in the given case.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false
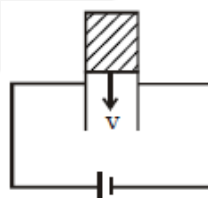
**25.**



**Assertion (A):** If a dielectric is inserted between plates of capacitor with constant velocity a constant current is flowing in circuit.
**Reason (R):** Rate of change of capacitance is constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** In a system of two concentric shell of inner radius a and outer radius b. If outer is grounded and inner shell is given charge has less capacitance than inner has grounded and outer is given charge.
**Reason (R):** Electric field is zero outside outer shell when inner shell is grounded.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** Two parallel plates having unequal charges have same capacitance as that of equal and opposite charges on same plates and same configuration.
**Reason (R):** Capacitance of system/ configuration is independent of charge on plates.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** When a dielectric slab is gradually inserted between the plates of an isolated parallel-plate capacitor, the energy of the system decreases.
**Reason (R):** The force between the plates decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** A parallel plate capacitor is connected across battery through a key. A dielectric slab of dielectric constant K is introduced between the plates. The energy which is stored becomes K times
**Reason (R):** The surface density of charge on the plate remains constant or unchanged.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** A dielectric slab is slightly inserted in charged parallel plate capacitor and then released slab will execute oscillation.
**Reason (R):** Electrostatic field is conservative field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** Capacitor reduces sparks in induction coil.
**Reason (R):** Capacitor provides alternative path to current when circuit is broken.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** If temperature is increased, the dielectric constant of a polar dielectric decreases whereas that of a non-polar dielectric does not change significantly.
**Reason (R):** The magnitude of dipole moment of individual polar molecule decreases significantly with increase in temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** A capacitor of a certain capacity, whenever charged, will always store the same amount of charge.
**Reason (R):** A definite capacity implies always a same definite value of charge.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**34.** **Assertion (A):** Two protons placed at different distances, between the plates of a parallel plate capacitor experience the same force.
**Reason (R):** The electric field between the plates of parallel plate capacitor is constant.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**35.** A capacitor of capacitance C is connected across a battery of potential difference V.
**Assertion (A):** The energy stored in capacitor is $\frac{1}{2}CV^2$.
**Reason (R):** The energy supplied by the battery is $CV^2$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**36.** Two metal plates each of area A forms a parallel plate capacitor.
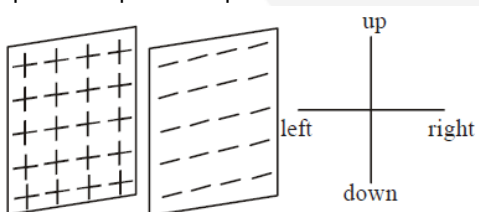


**Assertion (A):** If one plate is displaced up, then the capacitance of capacitor decreases.
**Reason (R):** Due to displacing one plate up, the overlapping area decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**37.** **Assertion (A):** If the distance between parallel plates of a capacitor is halved and dielectric constant is three times, then the capacitor becomes 6 times.
**Reason (R):** Capacity of a capacitor depends upon the nature of the plate material.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**38.** **Assertion (A):** It is not possible to make a spherical conductor of capacitor one farad.
**Reason (R):** It is possible for earth as its radius is 6400 km.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**39.** **Assertion (A):** Electrolytic capacitors have larger capacities.
**Reason (R):** Electrolytic capacitors have a positive and a negative terminal.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**40.** **Assertion (A):** In parallel plate capacitor separation 'd' should be smaller than the linear dimension of the plates ($d^2 << A$).
**Reason (R):** For $d^2 << A$ fringing effect can be ignored in the region sufficiently far from the edge.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1.** **Assertion (A):** When constant current is passing through a conductor of variable area of cross section, electric field inside conductor is inversely proportional to cross sectional area.

**Reason (R):** Microscopic form of Ohm's law is $\vec{E} = \rho \vec{J}$. where $\vec{E}$ stands for electric field, $\rho$ stands for resistivity and $\vec{J}$ stands for current density.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**2.** An electric current flows along strip PQ of a metallic conductor.
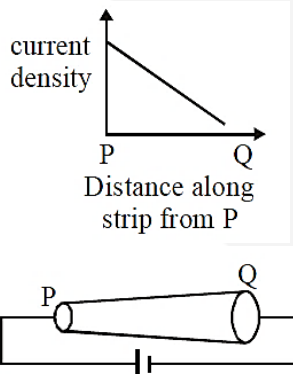


**Assertion (A):** The resistance per unit length of the strip is constant.

**Reason (R):** The current density in the strip varies as shown in the graph.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**3.** **Assertion (A):** In the circuit shown both cells are ideal and of fixed emf, the resistor of resistance $R_1$ has fixed resistance and the resistance of resistor $R_2$ can be varied (but the value of $R_2$ is not zero). Then the electric power delivered to resistor of resistance $R_1$ is independent of value of resistance $R_2$.
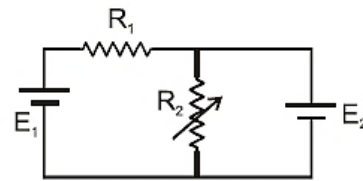


**Reason (R):** If potential difference across a fixed resistance is unchanged, the power delivered to the resistor remains constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**4.** **Assertion (A):** The current density $\vec{J}$ at any point in ohmic resistor is in direction of electric field $\vec{E}$ at that point.

**Reason (R):** A point charge when released from rest in a region having only electrostatic field always moves along electric lines of force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

5.  **Assertion (A):** The rate at which energy is being delivered to a light bulb is lower after it has been on for a few seconds than just after it is turned on.
    **Reason (R):** As the filaments warms up, its resistance rises and the current falls.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

6.  **Assertion (A):** Ohm's law holds only for small currents in metallic wire not for high currents.
    **Reason (R):** For metallic wire resistance increases with increase in temperature.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

7.  **Assertion (A):** The drift speed of electrons in metals is small (in the order of a few mm/s) and the charge of an electron is also very small $(= 1.6 \times 10^{-19}C)$, yet we can obtain a large current in a metal.
    **Reason (R):** At room temperature, the thermal speed of electron is very high (about $10^7$ times the drift speed).
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

8.  **Assertion (A):** If a resistor is connected to a battery, the current decreases when the temperature increases.
    **Reason (R):** For most of the resistors, resistance increases with increase in temperature.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

9.  **Assertion (A):** When two conducting wires of different resistivity having same cross section area are joined in series, the electric field in them would be equal when they carry current.
    **Reason (R):** When wires are in series they carry equal current.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

10. **Assertion (A):** In a Meter Bridge experiment, null point for an unknown resistance is measured. Now, the unknown resistance is put inside an enclosure maintained at a higher temperature. The null point can be obtained at the same point as before by decreasing the value of the standard resistance.
    **Reason (R):** Resistance of a metal decreases with increase in temperature.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

11. **Assertion (A):** Two identical cells are connected in (a) series (b) parallel then maximum power transferred to the load is same in both cases.
    **Reason (R):** Value of load resistance for maximum power transfer for series and parallel combination of cells are same
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**12.** **Assertion (A):** Kirchoff's loop law represents conservation of energy

**Reason (R):** If the sum of "Potential Differences" around a closed loop is not zero, unlimited energy could be gained by repeatedly carrying a charge around a loop

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):**  total power consumed in circuit is maximum when current in circuit is maximum.

**Reason (R):** Current in circuit is maximum when power consumed by load is maximum.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** **Assertion (A):** As drift velocity increases current flowing through conductor decreases.

**Reason (R):** Current flowing through conductor is inversely proportional to drift velocity
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**15.** **Assertion (A):** Drift velocity of $e^-$ in a metallic wire will decrease if temperature of wire is increased

**Reason (R):** On increasing temperature conductivity of metallic wire decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**16.** **Assertion (A):** In $R = R_0(1 + \alpha\Delta T)$ when temp. is increased from 27°C to 227°C resistance increases from 100 to 150 $\Omega$ this implies $\alpha = 2.5 \times 10^{-3}$/°C.

**Reason (R):** $R = R_0(1 + \alpha\Delta T)$ is valid only when change in temp ($\Delta T$) is very small i.e. $\Delta R = (R-R_0) << R_0$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17.** **Assertion (A):** Potential difference across the battery can be greater than its emf

**Reason (R):** When current is taken from battery $V = \varepsilon - ir$
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18.** **Assertion (A):** Current flows in conductor only when there an electric field is applied to a conductor

**Reason (R):** Drift velocity of $e^-$ decreases in presence of electric field
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19.** **Assertion (A):** When a battery is supplying power to a circuit, work done by electrostatic force on electrolyte ions inside the battery is +ve.

**Reason (R):** Electric field is directed from positive to –ve electrode inside a battery.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

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**20.** **Assertion (A):-**  when switch S is ON reading of ammeter and voltmeter will increase.

**Reason (R):** In parallel combination net resistance will reduce.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**21.** **Assertion (A):**  In circuit R is variable, value of I is maximum when r = R

**Reason (R):** At r = R power produced across R is minimum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**22.** **Assertion (A):**  If $V_b > V_a$ current flows from b to a.

**Reason (R):** Direction of current inside battery is always from –ve to +ve terminal.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**23.** **Assertion (A):** Resistance of ammeter is less than resistance of milliammeter, (If made from same galvanometer)

**Reason (R):** Value of shunt resistance in case of ammeter is more than a milliammeter.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**24.** **Assertion (A):** When a wire is stretched, then its resistance changes directly as square of its length.

**Reason (R):** When wire is stretched its thickness/ radius decreases and volume remains constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**25.** **Assertion (A):** The brightness of light bulb in a room decreases when heavy current appliance is switched on.

**Reason (R):** There will be no change in brightness of bulb if source is ideal and for non ideal source voltage drop across bulb decreases.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**26.** **Assertion (A):** 100 W, 60 W and 20 W bulbs, each marked 220 volt, are connected in series with a voltage source, then 20 W bulb gives maximum illumination.

**Reason (R):** Resistance of filament 20 W bulb is maximum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**27.** **Assertion (A):** A car engine can be started more easily on a warm day than on a cold day.

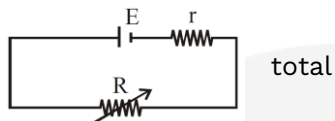**Reason (R):** EMF of battery is more on a cold day.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**28.** **Assertion (A):** The electric bulb glows immediately when switch is on.

**Reason (R):** The drift velocity of electrons in a metallic wire is very high (near speed of light).

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**29.** **Assertion (A):** Though the same current flows through the line wires and the filament of the bulb but the rate of heat produced in the filament is much higher than that in line wires.

**Reason (R):** The filament of bulbs is made of a material of high resistance and low melting point.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**30.** **Assertion (A):** Electrolyte are more conducting than metal.

**Reason (R):** Ions moves faster than electrons

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**31.** **Assertion (A):** A voltmeter is an inherently inaccurate instrument.

**Reason (R):** A voltmeter is always connected in parallel in a circuit.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**32.** **Assertion (A):** Electric field is present in the vicinity of a current carrying wire.

**Reason (R):** The principle of conservation of charge is not followed, when charges are in motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**33.** **Assertion (A):** In real battery total chemical energy lost in the battery can not be obtained at load resistance.

**Reason (R):** Two heaters with different resistance are connected in parallel. Higher resistance heater will glow more.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**34.** **Assertion (A):** Consider a current carrying wire whose cross section area decreases gradually along the direction of current, like as shown in figure. As one goes from cross-section A to cross-section B, the drift speed of electron increases.



**Reason (R):** Electric field intensity at any cross-section in a current carrying wire is inversely proportional to its cross sectional area.
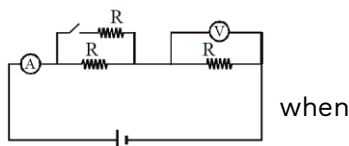(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**35.** **Assertion (A):** Thick metallic strips are used to join wires in a potentiometer.
**Reason (R):** Metallic strips are used to provide mechanical support to potentiometer wires.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**36.** **Assertion (A):** The emf of the driver cell in the potentiometer experiment should be greater than the e.m.f. of the cell to be determined.
**Reason (R):** The fall of potential drop across the potentiometer wire should be less than the e.m.f. of the cell to be determined.
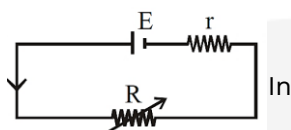(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**37.** **Assertion (A):** The coil of a heater is cut into two equal halves and only one of them is used into heater. The heater will now require half the time to produce the same amount of heat.
**Reason (R):** The heat produced is directly proportional to the square of current.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**38.** **Assertion (A):** The bending of an insulated wire increases the resistance of wire.
**Reason (R):** The drift velocity of electrons in bent wire decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**39.** **Assertion (A):** A potentiometer of longer length is used for accurate measurement.
**Reason (R):** The potential gradient for a potentiometer of longer length with a given source of e.m.f. becomes small.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**40.** **Assertion (A):** The average thermal velocity of the electrons in the conductor is zero.
**Reason (R):** Direction of motion of electrons are randomly oriented.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** In series combination of electrical bulb, lower power bulb emits more light than that of higher power bulb.
**Reason (R):** The lower power bulb in series gets more current than the higher power bulb.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** A galvanometer can be used as an ammeter only.
**Reason (R):** A galvanometer can be used in electric circuit to detect the electric current only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

43. **Assertion (A):** The average thermal velocity of the electrons in a conductor is zero.
**Reason (R):** In the absence of an electric field, the electrons are at rest.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

44. **Assertion (A):** The resistivity of a semiconductor increases with temperature.
**Reason (R):** The atoms of a semiconductor vibrate with larger amplitude at higher temperature thereby increasing its resistivity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

45. **Assertion (A):** The connecting wires are made of copper.
**Reason (R):** Copper is a superconductor at room temperature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

46. **Assertion (A):** In a metallic conductor, current is due to free electrons moving in a definite direction.
**Reason (R):** A current carrying conductor is negatively charged.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

47. **Assertion (A):** Fuse wire should have low melting temperature and high resistivity.
**Reason (R):** Fuse saves an appliance from damage by increasing its current passing capacity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

48. **Assertion (A):** As temperature of a metallic current carrying conductor is increased, its resistance increases.
**Reason (R):** Decrease of temperature results in decrease of electric field strength along the conductor so that current reduces.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.** **Assertion (A):** As a wire is stretched to four times its length, its resistivity becomes four times, such that resistance also increases.

**Reason (R):** $R = \dfrac{\rho A}{l}$ where symbols have their usual meaning.
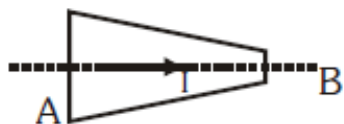
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** Arrows indicating current in different branches of a circuit follow vector- addition laws.

**Reason (R):** Current is a scalar quantity but it adds like vector

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** As temperature of an electrolyte is increased, its conductivity increases.

**Reason (R):** Increase of temperature makes the electrolyte less viscous.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** **Assertion (A):** Electric appliances with a metallic body have three pin connections whereas an electric bulb has two pin connections.

**Reason (R):** Three pin connection reduces heating of connecting cable.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** The resistivity of a semiconductor decreases with increase in temperature.

**Reason (R):** In a conductor, the rate of collisions between free electrons and ions increases with increase of temperature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** A filament emits electrons at a constant rate as shown in figure. The electrons are then subjected to a constant electric field.
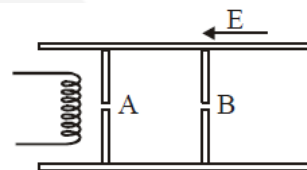


The two stops ensure that the electron beam has a uniform cross-section.

**Assertion (A):** The speed of the electrons is greater at B than at A.

**Reason (R):** The current at cross-section B is greater than the current at A.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**55.** **Assertion (A):** Terminal potential difference of a cell is always less than its emf.

**Reason (R):** Potential drop across internal resistance of cell increases terminal potential difference.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**56.** **Assertion (A):** A larger dry cell has higher emf.
**Reason (R):** The emf of a dry cell is proportional to its size.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**57.** **Assertion (A):** A car battery is of 12 V. Eight dry cells of 1.5 V connected in series can give 12 V. Still such cells are not used in starting a car.
**Reason (R):** It is easier to start a car engine on a warm day than on a rainy day.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**58.** **Assertion (A):** In the circuit of figure, maximum power transferred by the source of emf to the external circuit is 1 W.
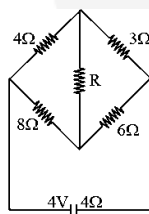


**Reason (R):** Maximum power is transferred when external resistance equals the internal resistance of the source.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**59.** **Assertion (A):** When identical cells are connected in parallel to the external load, the effective emf increases.
**Reason (R):** All the cells will be sending unequal current to the external load in the same direction.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**60.** **Assertion (A):** In balanced Wheatstone bridge, the current through cell depends on resistance of galvanometer.
**Reason (R):** At balanced condition current through galvanometer is non-zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**61.** **Assertion (A):** In the shown circuit if lamp B or C fuses then brightness of lamp A decreases.



**Reason (R):** It is due to decrement in voltage on bulb A.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

1. **Assertion (A):** Magnetic force between two charge is generally much smaller than the electric force between them.

   **Reason (R):** Speeds of charges are much smaller than the free-space speed of light.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

2. **Assertion (A):** Pole pieces of the magnet used in a moving coil galvanometer are given a concave shape to achieve a radial magnetic field.

   **Reason (R):** A radial magnetic field ensures a better current sensitivity and also makes possible to use a linear scale for current measurement.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

3. **Assertion (A):** Parallel current in wires attracts to each other due to magnetic force.

   **Reason (R):** Two electron beams moving paralled to each other repels to each other due to electric force.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

4. **Assertion (A):** Two long parallel conductors carrying currents in the same direction experience a force of attraction.

   **Reason (R):** The magnetic fields produced in the space between two long parallel current carrying conductors (by each of these conductors) are in the same direction.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

5. **Assertion (A):** Force on a current carrying wire of length $\vec{dl}$ placed in magnetic field $\vec{B}$ is given by $\vec{dF} = i\vec{dl} \times \vec{B}$

   **Reason (R):** Net force on a current carrying loop in a non-uniform magnetic field must be non-zero.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

6. **Assertion (A):** If an observer is moving with drift speed of electrons in direction opposite to current, observer will not experience any magnetic field.

   **Reason (R):** In the frame of observer charged particles in conductor are at rest.

   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

   (3) (A) is true but (R) is false

   (4) Both (A) and (R) are false

7. **Assertion (A):** The nature of electromagnetic force acting on a moving charged particle in external magnetic field is frame dependent.
**Reason (R):** The force acting on a charged particle always varies with shift of frame.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** When a straight wire carrying current is placed along the axis of a current carrying ring, it starts rotating about the wire.
**Reason (R):** Charged ring will experience a torque when current carrying cable will pass through its axis.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. A small coil lies inside a larger coil as shown in the figure. The two coils are horizontal, concentric and carry currents in the same sense.



**Assertion (A):** The small coil will not experience resultant force.
**Reason (R):** The small coil will experience a torque about a vertical axis.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** A system can not have magnetic moment when its net charge is zero.
**Reason (R):** Magnetic field arises due to charge in motion
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** Magnetic field also represent the lines of force on a moving charged particle at every point.
**Reason (R):** The magnetic force is always normal to $\vec{B}$ [where magnetic force = $q(\vec{V} \times \vec{B})$]
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** When external magnetic field is parallel to plane of current carrying circular loop then its potential energy is maximum.
**Reason (R):** From U = −MB cosθ and when
θ = 0° or 180°, |cosθ| = 1
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** A planar circular coil of area A and current I is equivalent to magnetic dipole of dipole moment M = IA
**Reason (R):** At large distances, magnetic field of circular loop and magnetic dipole is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** A point charge moving with constant velocity may produce radial magnetic field.

**Reason (R):** Rest point charge produces radial electric field.
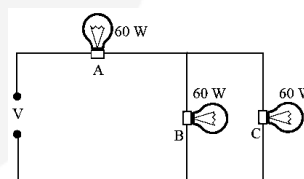
(1) Both (A) & (R) are true and the (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

15. **Assertion (A):** The surface integral of magnetic field over any closed surface is always zero.

**Reason (R):** Magnetic poles are always exists in pairs.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

16. **Assertion (A):** The magnetic field induction due to an infinite long current carrying solid cylindrical conductor of radius R, at a distance R/2 and 2R from its axis is same.

**Reason (R):** An infinite long current carrying solid cylindrical conductor is a source of uniform magnetic field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

17. **Assertion (A):** To produce high magnetic moment from a current carrying cable, it should be turned in maximum number of circular loops.

**Reason (R):** Magnetic moment is directly proportional to number of turns of circular loop for a given length of wire.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

18. **Assertion (A):** If a uniform current carrying loop is placed in uniform magnetic field perpendicular to plane of loop. Tension or compression is created in loop.

**Reason (R):** Net force on any closed loop in uniform magnetic field is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

19. **Assertion (A):** If a flexible loop (irregular shape) carrying current is located in an external uniform magnetic field then it may be changed to circular shape.

**Reason (R):** A current carrying loop in uniform magnetic field has zero net force.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**20.** **Assertion (A):** A solenoid tends to expand, when a current passes through it.
**Reason (R):** Two straight parallel metallic wires carrying current in same direction repel each other.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** If two beams of protons move parallel to each other in same direction then these beams repel each other.
**Reason (R):** Like charges repel while opposite charges attract each other.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** When a magnet is brought near iron nails, only translatory force act on it.
**Reason (R):** The field due to a magnet is generally uniform.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** The Lorentz force is a non-conservative force.
**Reason (R):** The work done by the Lorentz force is always zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** A rectangular current loop is in an arbitrary orientation in an external uniform magnetic field. No work is required to rotate the loop about an axis perpendicular to its plane.
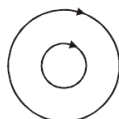**Reason (R):** All positions represent the same level of energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**25.** **Assertion (A):** In Ampere's law for magnetostatics $\oint \vec{B}.d\vec{\ell} = \mu\Sigma i$, the current outside the amperian loop is not included on the right side.
**Reason (R):** Magnetic field calculated using Ampere's law is due to inside as well outside the current of closed loop.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**26.** **Assertion (A):** If an electron is not deflected while passing through a certain region of space, then only possibility is that there is no magnetic region.
**Reason (R):** Force is directly proportional to the magnetic field applied.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** A charged particle is moving in a circle with constant speed in uniform magnetic field. If we increase the speed of particle to twice, its acceleration will become four times.

**Reason (R):** A charge particle in circular path with constant speed in magnetic field, acceleration is given by centripetal acceleration. If speed is doubled centripetal acceleration will become four times.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

28. **Assertion (A):** Work done by magnetic force on any moving charge is zero.

**Reason (R):** Magnetic force is perpendicular to velocity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

29. **Assertion (A):** When a charged particle is projected in a uniform magnetic field with certain angle to it, during its motion in helical path it will never move parallel or perpendicular to field.

**Reason (R):** When the charged particle is projected at a certain angle to the magnetic field, the force experienced by the charged particle is neither in the direction of field nor in the perpendicular direction of the field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

30. **Assertion (A):** If a proton and an $\alpha$-particle enter a uniform magnetic field perpendicularly, with the same speed, then the time period of revolution of the $\alpha$-particle is double than that of proton.

**Reason (R):** In a magnetic field, the time period of revolution of a charged particle is directly proportional to mass.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

31. **Assertion (A):** The direction of magnetic moment and orbital angular momentum are opposite to each other for electron.

**Reason (R):** Electron is negatively charged.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

32. **Assertion (A):** A charged particle moves perpendicular to magnetic field. Its kinetic energy will remain constant but momentum changes.

**Reason (R):** Magnetic force acts perpendicular to velocity of particle.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

33. **Assertion (A):** A charged particle moving in a magnetic field in general, experiences a force but its kinetic energy remains constant.
    **Reason (R):** Work done by magnetic force is always zero.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

34. **Assertion (A):** Electric force between two like charged particles is repulsive but magnetic force between them could be attractive or repulsive or absent depending on the features of their motion.
    **Reason (R):** Magnetic field does not interact with static charges.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

35. **Assertion (A):** An electron and a proton enter a uniform magnetic field at right angles to the field with equal velocities, then, deviation of both from the original path will be the same.
    **Reason (R):** In the situation described above, electron and proton will experience magnetic forces of different magnitude.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

36. **Assertion (A):** A charged particle enters a uniform magnetic field with a velocity inclined to the field direction at 60°. The particle will move along a circular path inside the magnetic field.
    **Reason (R):** Magnetic force on a charge inside a magnetic field provides centripetal force for the circular motion of the charge.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

37. **Assertion (A):** A current-carrying coil placed in a uniform magnetic field experiences a force which depends on the orientation of plane of the coil relative to the field direction.
    **Reason (R):** A current-carrying conductor placed in a magnetic field experiences a force $F = iIB \sin \theta$.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**1.** **Assertion (A):** Magnetic field arises due to charge in motion but a system may have magnetic moment even though its net charge is zero.

**Reason (R):** Uncharged magnetic material may have dipole moment.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**2.** **Assertion (A):** Permeability of a ferromagnetic material is independent of the applied magnetic field.

**Reason (R):** Permeability of ferromagnetic substances is lower for higher value of applied field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**3.** **Assertion (A):** A system displaying a hysteresis loop, such as a ferromagnet is a device for storing memory.

**Reason (R):** A ferromagnetic substance remains magnetised even after external field is removed.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**4.** **Assertion (A):** The product of magnetic susceptibility and absolute temperature of a paramagnetic substance is a constant.

**Reason (R):** Paramagnetic substances obey Curie's law.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**5.** **Assertion (A):** The permanent magnetic moment of the atoms of a material is zero. The material must be diamagnetic

**Reason (R):** Hard magnetic materials have high retentivity, high coercivity and large hysteresis- loss and are suitable for permanent magnetism.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**6.** **Assertion (A):** The poles of magnet cannot be separated by breaking into two pieces.

**Reason (R):** The magnetic moment will be reduced to half when a magnet is broken into two equal pieces.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**7.** **Assertion (A):** A paramagnetic sample shows greater degree of magnetisation when cooled.

**Reason (R):** Magnetisation of paramagnetic material is inversely proportional to temperature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**8.** **Assertion (A):** Ferromagnetic materials of high retentivity are used to form permanent magnet.

**Reason (R):** Ferromagnetic materials have positive intensity of magnetisation.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**9.** **Assertion (A):** For a perfectly diamagnetic substance, permeability is always 1.

**Reason (R):** Small pieces of any magnetic substance are attracted by a strong magnetic field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**10.** **Assertion (A):** The properties of paramagnetic and ferromagnetic substances are not affected by heating.

**Reason (R):** As temperature changes, the alignment of molecular magnets does not change.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**11.** **Assertion (A):** Soft iron is used as transformer core.

**Reason (R):** Soft iron has narrow hysteresis loop.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**12.** **Assertion (A):** All magnetic materials lose their magnetic properties when strongly heated.

**Reason (R):** Most of the substances show diamagnetism.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

1. **Assertion (A):** A changing magnetic flux induces an electric field.
   **Reason (R):** An inductor always tends to keep the flux constant.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** A vertical iron rod has a coil of wire wound over it at the bottom end. An alternating current flows in the coil. The rod goes through a conducting ring as shown in the figure. The ring can float at a certain height above the coil

   

   **Reason (R):** In the above situation, a current is induced in the ring which interacts with the horizontal component of the magnetic field to produce an average force in the upward direction.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. **Assertion (A):** When a circuit having large inductance is switched off sparking occurs at the switch.
   **Reason (R):** Emf induced in an inductor is given by $|\varepsilon| = L\left|\dfrac{di}{dt}\right|$.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** A metal ring is kept on a cardboard on top of a fixed current carrying solenoid. If current in the solenoid is switched off, the upward reaction of card board on the ring will increase.
   **Reason (R):** Induced current in the ring will be in the same direction as in the solenoid.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** If an iron rod is inserted into a steady current carrying solenoid, the current in solenoid decreases.
   **Reason (R):** Magnetic flux linked with solenoid increases
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** If a cylindrical bar magnet is dropped through a metallic pipe, it takes more time to come down the a similar unmagnetised cylindrical iron bar dropped through the same metallic pipe.
   **Reason (R):** For the magnet, eddy currents are produced in the metallic pipe.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7.  **Assertion (A):** The self inductance of a solenoid can be increased by decreasing length if number of turns are fixed.
    **Reason (R):** Self inductance of a solenoid is directly proportional to current passing through it.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

8.  **Assertion (A):** If a coil carrying current in counter clockwise direction moves towards another stationary coil in the same plane, current induced in stationary coil will be counter clock wise.
    **Reason (R):** Mutual induction between coils is independent of direction of current
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

9.  **Assertion (A):** If a bar magnet is moved towards a conducting coil in a direction perpendicular to the plane of coil, the work done in moving the magnet will be more if it is moved faster rather than slower.
    **Reason (R):** If the magnet is moved at a faster rate towards the circular coil, then the induced current in the circular coil is more.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

10. **Assertion (A):** The probability of burn out of a dc motor is maximum, when the motor is just switched on.
    **Reason (R):** No back emf is developed in the armature of dc motor, when it is just switched on.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

11. **Assertion (A):** If a closed loop is kept in a space having time varying magnetic field, emf is always induced in the loop.
    **Reason (R):** Induced emf in the loop is conservative in nature.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

12. **Assertion (A):** If a magnet is allowed to fall co-axially through a long copper tube, its acceleration decreases with time.
    **Reason (R):** The direction of force on magnet doesn't change when it pass through a tube.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**13. Assertion (A):** At the instant when magnetic flux is zero, emf induced in the coil is maximum when it is rotating in uniform magnetic field w.r.t. axis in the plane of coil.

**Reason (R):** emf induced in the coil is equal to rate of change of magnetic flux.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**14. Assertion (A):** Inductance coil are made of copper.

**Reason (R):** Induced current is more in wire having less resistance.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**15. Assertion (A):** A transformer cannot work on D.C. supply.

**Reason (R):** D.C. changes neither in magnitude nor in direction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**16. Assertion (A):** ac current flows through a bulb and a solenoid connected in series. If a soft iron core is inserted in the solenoid, the bulb glows much brighter.

**Reason (R):** The inductance of solenoid decreases on inserting soft iron core in it.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**17. Assertion (A):** A choke coil has the characteristic of high inductance and low resistance

**Reason (R):** More is the inductive property of the choke coil, Power factor of the circuit approaches maximum.
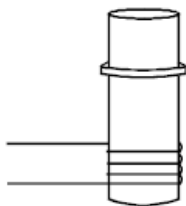
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**18. Assertion (A):** Magnetic flux is a vector quantity.

**Reason (R):** Value of magnetic flux cannot be negative.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

19. **Assertion (A):** Change in magnetic flux w.r.t. time produces an induced emf.
**Reason (R):** Faraday established induced emf experimentally.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** An emf is induced in a closed loop where magnetic flux is varied. The induced electric field is not a conservative field.
**Reason (R):** For induced electric field, the line integral $\oint \vec{E} \cdot \vec{dl}$ around a closed path is non-zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** It is more difficult to push a magnet into a coil with more loops.
**Reason (R):** This is because emf induced in each current loop resists the motion of the magnet.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** When a coil is rotated in a uniform magnetic field about an axis perpendicular to the field, emf is induced in it which is maximum for the orientation of coil in which magnetic flux through the coil is zero.
**Reason (R):** In an electric generator, electrical energy is generated by rotating a coil in a magnetic field.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** Two identical coaxial circular coils carry equal currents circulating in same direction. If coils approach each other, the current in each coil decreases.



**Reason (R):** When coils approach each other, the magnetic flux linked with each coil increases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** If we use a battery across the primary of a step up transformer, no voltage is obtained across secondary.
**Reason (R):** Battery gives a steady current.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**25.** **Assertion (A):** Only a change of magnetic flux with time, will maintain an induced current in the coil.

**Reason (R):** The presence of a large magnetic flux will maintain an induced current in the coil.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**26.** **Assertion (A):** The mutual inductance of two coils is doubled if the self-inductance of the primary and secondary coil is doubled.

**Reason (R):** Mutual inductance $M \propto \sqrt{L_1 L_2}$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**27.** **Assertion (A):** If a charged particle is released from rest in a time varying magnetic field, it moves in a circle.

**Reason (R):** In a time varying magnetic field, conservative electric field is induced.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**28.** **Assertion (A):** A system cannot have mutual inductance without having self inductance.

**Reason (R):** If mutual inductance of system is zero, its self-inductance must be zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**29.** **Assertion (A):** At any instant, if the current through an inductor is zero, then the induced emf may not be zero.

**Reason (R):** An inductor tends to keep the flux constant.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**30.** In shown circuit, switch is closed at t = 0.

**Assertion (A):** At t = 0, current through battery $I = \dfrac{E}{2R}$ and at $t = \infty$, current through battery will be $I = \dfrac{E}{R}$.
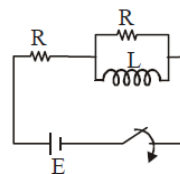


**Reason (R):** At t = 0, inductor will behave like open circuit and at t = ∞, inductor will behave like short circuit.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

1. **Assertion (A):** In a series LCR circuit at resonance, the voltage across the capacitor or inductor may be more than the applied voltage.
   **Reason (R):** At resonance in a series LCR circuit, the voltages across inductor and capacitor are out of phase.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** Average power consumed in an ac circuit is equal to average power consumed by resistors in the circuit.
   **Reason (R):** Average power consumed by capacitor and inductor is zero
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. **Assertion (A):** Peak voltage across the resistance can be greater than the peak voltage of the source in an series LCR circuit.
   **Reason (R):** Peak voltage across the inductor can be greater than the peak voltage of the source in an series LCR circuit.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** The power rating of an element in AC circuit refers to average power rating.
   **Reason (R):** A given value for AC voltage or current is usually its average value.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** Average power consumed in a circuit is never negative.
   **Reason (R):** Instantaneous power is always positive.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** At an airport, a person is made to walk through the doorway of a metal detector.
   **Reason (R):** Metal detector works on the principle of resonance in AC circuits.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7. **Assertion (A):** Smaller the band width, sharper the resonance and easier it is to tune an LCR circuit.
   **Reason (R):** Resonant frequency is arithmetic mean of half power frequencies.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

**8.** **Assertion (A):** At resonance in AC circuits current and emf are in phase.

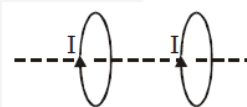**Reason (R):** At resonance in AC circuits, current is maximum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**9.** **Assertion (A):** At frequency greater than resonant frequency, circuit is inductive in nature.

**Reason (R):** Reciprocal of reactance is called susceptance.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**10.** **Assertion (A):** If the resistance of a series resonant LCR circuit is decreased, then the peak current versus frequency graph will be taller and narrower.

**Reason (R):** If the resistance of a series resonant LCR circuit decreased, then its resonance will be unaffected.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**11.** **Assertion (A):** The impedance of series L-C-R circuit can be greater, equal or less than the resistance.

**Reason (R):** The minimum impedance of series LCR circuit depends over angular frequency of applied emf.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**12.**
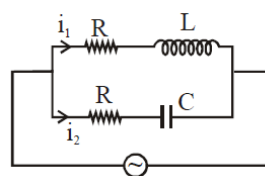


**Assertion (A):** Current $i_1$ & $i_2$ can not be in same phase.

**Reason (R):** If $X_L = X_C$, $i_1$ & $i_2$ may be in same phase.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**13.** **Assertion (A):** A capacitor of suitable capacitance can be used in an A.C. circuit in place of the choke coil.

**Reason (R):** A capacitor blocks D.C. and allows A.C. only.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

14. **Assertion (A):** For series RLC network, power factor of circuit in region (1) is positive and in region (2) is negative.

**Reason (R):** Overall nature of circuit in region (1) is inductive while in region (2) is capacitive.



(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

15. **Assertion (A):** KVL rule is also being applied in AC circuit shown below.



**Reason (R):** $V_C$ in the circuit = 2V.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

16. **Assertion (A):** When frequency is greater than resonance frequency in a series LCR circuit, it will be an inductive circuit.

**Reason (R):** Resultant voltage will lead the current.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

17. **Assertion (A):** The moving coil ammeters or voltmeters can't be employed to measure alternating current or voltage respectively.

**Reason (R):** If an alternating current is passed through a moving coil ammeter or voltmeter, then the average value of torque experienced by the coil is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

18. **Assertion (A):** In ac supply we cannot feel any fluctuations of current in bulbs.

**Reason (R):** House hold ac supply has very low frequency.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

19. **Assertion (A):** 220V, 50 Hz appliance implies that potential difference in bulb is always 220V.

**Reason (R):** Every appliance is specified with its peak tolerable voltage.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**20.** **Assertion (A):** Transformer does not work on dc

**Reason (R):** dc neither changes in magnitude nor in direction.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**21.** **Assertion (A):** Choke coil is preferred over a resistor to adjust current in an ac circuit.

**Reason (R):** Power factor for inductance is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**22.** **Assertion (A):** The divisions are equally marked on the scale of ac ammeter.

**Reason (R):** Heat produced is directly proportional to the current.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**23.** **Assertion (A):** An electric lamp is connected in series with a long solenoid of copper with air core and then connected to ac source. If an iron rod is inserted in solenoid, the lamp will become dim.

**Reason (R):** If an iron rod is inserted in solenoid, the inductance of solenoid increases.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**24.** **Assertion (A):** For an electric lamp connected in series with a variable capacitor and ac source, its brightness increases with increase of capacitance.

**Reason (R):** Capacitive reactance decreases with increase in capacitance of capacitor.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**25.** **Assertion (A):** In series RL ac circuit voltage leads the current.

**Reason (R):** In series LCR circuit current may lead the voltage.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

1.   **Assertion (A):** When cooking in microwave ovens, metal containers are used.
     **Reason (R):** Energy of microwaves can be easily transferred to the food through metal.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

2.   **Assertion (A):** Infrared waves are often called heat waves.
     **Reason (R):** Infrared waves vibrate not only electrons but entire atoms or molecules.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

3.   **Assertion (A):** Conduction and displacement current may be present in the same region of space.
     **Reason (R):** There is no perfectly conducting or perfectly insulating medium.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

4.   **Assertion (A):** Electromagnetic waves cannot penetrate through a perfect conductor and hence are totally reflected.
     **Reason (R):** The speed of electromagnetic waves in any dielectric medium is less as compared to vacuum.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

5.   **Assertion (A):** Electromagnetic radiations like UV, visible and IR coming from Sun towards earth's surface can't be trapped by earth's magnetic field where as cosmic rays coming towards earth's surface are trapped by the magnetic field of earth.
     **Reason (R):** Electromagnetic wave doesn't contain any live charge where the cosmic rays is a huge storage of charged particle.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
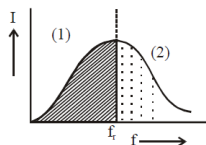     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

6.   **Assertion (A):** An E.M. wave has constantly interchanging electric and magnetic fields, which are perpendicular to each other.
     **Reason (R):** The direction of propagation is given by $(\vec{B} \times \vec{E})$.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

7.   **Assertion (A):** Average value of electric field and magnetic field in one cycle is same in electromagnetic waves.
     **Reason (R):** The ratio of electric field intensity and magnetic field intensity of EM waves is equal to speed of EM waves.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
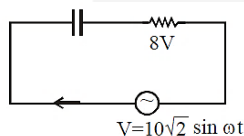     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

8.   **Assertion (A):** Comet tail points away from the sun.
     **Reason (R):** Solar radiation vapourise the volatile materials within the comet.
     (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
     (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
     (3) (A) is true but (R) is false
     (4) Both (A) and (R) are false

9. **Assertion (A):** When electromagnetic waves are incident on a surface, exert radiation pressure on the surface.

**Reason (R):** Electromagnetic waves carry energy as well as momentum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

10. **Assertion (A):** In an electromagnetic wave, both the electric and magnetic field vibrates with same phase and frequency.

**Reason (R):** Amplitude of vibration of electric and magnetic field are equal in an electromagnetic wave.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

11. **Assertion (A):** The energy in a small volume through which an EM wave is passing oscillates with double the frequency of wave.

**Reason (R):** The electric field and magnetic field can not have equal average numerical value in each half cycle.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

12. **Assertion (A):** A magnetic needle when placed in between the plates of a parallel plate capacitor under charging, the needle shows deflection.

**Reason (R):** As the charge on the capacitor plates increases, the electric field and the electric flux between the plates changes which generates a magnetic field.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

13. **Assertion (A):** In an electromagnetic wave, magnitude of magnetic field vector is much smaller than the magnitude of electric field vector.

**Reason (R):** Energy of electromagnetic waves is shared equally by the electric and magnetic fields.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

14. **Assertion (A):** The gyrating electron can be a source of EMW.

**Reason (R):** The electron in circular motion is accelerated motion.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**1.** **Assertion (A):** A simple microscope may have different magnification for different persons.
**Reason (R):** All persons must have the same near point distance of 25 cm.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** If an object placed on the optic axis of a lens is illuminated by white light, then image formed will be coloured and not exactly white.
**Reason (R):** The lens has different focal lengths for different colours.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** Paraxial rays are always parallel to the principal axis.
**Reason (R):** A parallel beam parallel to principal axis converges at the focal point.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** The image focus ($2^{nd}$ focus) and the object focus (1st focus) are on the opposite side of the biconvex or biconcave lens.
**Reason (R):** The radii of curvature of a biconvex lens and biconcave lens are on the opposite side of the lens.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** Keeping a point object fixed, if a plane mirror is moved, the image will also move.
**Reason (R):** In case of a plane mirror, distance of object and its image is equal from any point on the mirror.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** A small square loop is kept in front of the concave mirror as shown in the figure. It's image will also be a square. (Assume paraxial rays)



**Reason (R):** All dimensions will be magnified equally because all dimensions are almost at the same distance from the mirror.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** A lens has two principal focal lengths which may be different in magnitude.
**Reason (R):** The distance of both principal focus from optical centre of lens depend on the two radii of curvature of the lens. Distance of both principal focus from optical centre a lens are same only if radii of curvature of both sides of lens are same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8.** **Assertion (A):** A parallel beam of light is incident on a thin convex lens and is also parallel to the principal axis of convex lens as shown. The magnitude of deviation of each ray of this beam produced by given convex lens is different.



**Reason (R):** A thin convex lens can be assumed to be made of prisms of small angles. The magnitude of deviation produced by prism of small angle for small angles of incidence depends on angle of prism. Each ray of the beam in situation of assertion is incident on a prism of different angles, hence the magnitude of deviation for each ray is different.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**9.** **Assertion (A):** If there is relative motion between a point object & a plane mirror then there must be relative motion between object and image formed by mirror.

**Reason (R):** If the gap between object and mirror will change, the gap between object and image remains same.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**10.** **Assertion (A):** When the upper half of a converging lens is missing, a real image formed by the lens for a real object will lack its lower half.
**Reason (R):** The real image formed by a thin lens for a real object will be always erected.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**11.** **Assertion (A):** A parallel beam of light travelling in air can be displaced laterally by a parallel transparent slab by distance more than the thickness of the plate.
**Reason (R):** The lateral displacement of light travelling in air increases with fall in value of refractive index of slab.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** A virtual image formed by plane mirror may be inverted.
**Reason (R):** Longitudinal magnification in this case of plane mirror is −1.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** A convex lens of glass ($\mu$ = 1.5) behaves as a diverging lens when immersed in a medium of refractive index $\mu$ = 1.65.
**Reason (R):** A diverging lens is thinner in the middle and thicker at the edges.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** **Assertion (A):** Biconvex lens can form virtual image of a virtual object.

**Reason (R):** Nature of lens depends on refractive index of surrounding.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**15.** **Assertion (A):** The minimum length of mirror required to form complete image of man of height H is H/2.

**Reason (R):** Image of an object is obtained if incident light ray reaches the reflecting surface.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**16.** **Assertion (A):** Concave mirror can not form real image of real object.

**Reason (R):** Concave mirror behave as a diverging mirror.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**17.** **Assertion (A):** Radius of curvature of a concave mirror is 20 cm. If a real object is placed in front of a mirror at 10cm from pole of the mirror, image is formed at infinity.

**Reason (R):** When object is placed at focus of a converging optical system then its image is formed at infinity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**18.** **Assertion (A):** The Snell's law $\mu\sin\theta$ = constant is valid at different boundaries irrespective of the shape of the boundaries.

**Reason (R):** When light enters from vacuum into a medium of refractive index $\mu$, its speed and wavelength increases by $\mu$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**19.** **Assertion (A):** A solid glass sphere is placed in air. A light ray enters into the sphere from outside. The ray cannot undergo total internal reflection inside the sphere.

**Reason (R):** The angle of incidence at $1^{st}$ surface cannot be greater than the critical angle for air-glass system.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**20.** **Assertion (A):** Wavelength of light changes on changing medium.

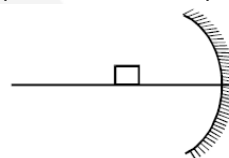**Reason (R):** Light ray always deviates from its path when refracted.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**21.** **Assertion (A):** Turpentine is denser medium than water for light

**Reason (R):** Unit volume of turpentine is heavier than unit volume of water

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

22. **Assertion (A):** The sun appears oval shape at sunrise.
**Reason (R):** At the time of sunrise sun appears a little before the actual sunrise
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** An object placed at a distance less than 25 cm, infront of a normal eye. The image of this object on retina is blurred.
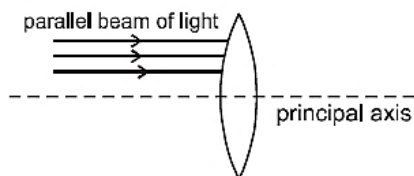**Reason (R):** Image is formed before retina.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** In telescopes objective lens is taken of large diameter or aperture
**Reason (R):** Larger aperture remove spherical aberration.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** Splitting of light into its component colours is possible in refraction at plane surface of two media.
**Reason (R):** On each refraction dispersion is possible but in prism at both surface dispersion is in same direction so it is clearly seen.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** In case of a concave mirror if a point object is moving towards the mirror along its principal axis then its image will always move away from the mirror.
**Reason (R):** In case of reflection (along the principal axis of mirror) object and image always travel in same directions.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** Any ray of light suffers a deviation of 180°−2i after one reflection from plane mirror .
**Reason (R):** For normal incidence of light on the plane mirror deviation is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Rear view mirror of a vehicle is a convex mirror.
**Reason (R):** It never makes real image of real objects.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** There is refracting glass slab between Ram and Anoop, then Ram appears nearer to Anoop as Compared to the actual distance between them.
**Reason (R):** Ray of light starting from Ram will undergo two times refraction before reaching to Anoop.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** In case of single refraction by plane surface image and object are on the same side.
**Reason (R):** If object is real, image will be virtual and vice-versa.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

31. **Assertion (A):** In displacement method of finding focal length of a convex lens, if magnification in a position of lens is – 2, then magnification in another position of lens should be –1/2.
**Reason (R):** This method can not be applied for diverging lens.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

32. **Assertion (A):** White light is incident on face AB of an isosceles right angle prism as shown in figure. Colours for which refractive index of the material of prism is more than 1.414 will be able to emerge from the face AC.



**Reason (R):** Total internal reflection can take place for the light travelling from rarer medium to denser medium.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

33. **Assertion (A):** If one half of a mirror is covered by an opaque material, then only half image of the object is formed.
**Reason (R):** By covering one half of the mirror, focal length of mirror will be halved.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

34. **Assertion (A):** In medical technology endoscopy, optical fibres are used to facilitate visual examination of internal organs of the body.
**Reason (R):** Optical fibres are fabricated so that there should be very less absorption of light and hence no appreciable loss of light intensity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** When light passes through a prism, it disperses while if the same light passes through a rectangular glass slab of same material, it doesn't disperse.
**Reason (R):** Dispersive power of prism is non zero while that of glass slab is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** When white light passes successively through two identical prisms, one inverted with respect to other, then in emergent side, again white light is obtained.
**Reason (R):** Prism has no ability to create colour but it only separates the colours already present in white light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** Secondary rainbow is fainter than primary rainbow.
**Reason (R):** Secondary rainbow is seen due to the scattering of primary rainbow through water molecules.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** In clear weather, sky appears to be blue not violet.
**Reason (R):** In clear atmosphere, light of shorter wavelength is scattered more as compared to light of longer wavelength.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** During sunset and sunrise sun appears to be red.
**Reason (R):** During sunrise or sunset, sun emits electromagnetic radiations of comparatively higher wavelength only.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

40. **Assertion (A):** Iris of the eye contains rods and cones which transmits electric signal to brain through optic nerve.
**Reason (R):** Rods sense colour of object and cone sense intensity of light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** A virtual image can't be caught on screen, yet we see a virtual image. We are obviously bringing it on to the screen, i.e. the retina.
**Reason (R):** The retina is a special type of screen present in the back of eye consisting of nerve fibre which can catch both real & virtual image.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

42. **Assertion (A):** In a magnifying glass, the angle subtended by an object at the eye is equal to the angle subtended by its virtual image at the eye. Still the magnifying glass provides angular magnification.
**Reason (R):** Magnifying glass produce a virtual magnified image of the object.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

43. **Assertion (A):** Concave mirror can't form virtual image of a virtual object.
**Reason (R):** Convex mirror can't form real image of a real object.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**44.** **Assertion (A):** In total internal reflection reflected light is in the phase with incident light.
**Reason (R):** Reflecting surface is rarer in TIR.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**45.** **Assertion (A):** For a Concave mirror, if object is made to accelerate uniformly toward the mirror from infinity, then its image will also show uniform acceleration in opposite direction.
**Reason (R):** Concave mirror may act as a diverging mirror.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**46.** **Assertion (A):** When two thin equiconvex lens are placed in contact, the effective power of combination may decrease.
**Reason (R):** Power of lens is defined as ability of bending of light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**47.** **Assertion (A):** Although the surface of goggle lens are curved, it does not have any power
**Reason (R):** In case of goggle, both the curved surfaces have equal radius of curvature and have centre of curvature on the same side
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**48.** **Assertion (A):** Lens formula can be applied only for thin lenses
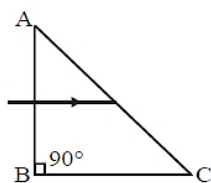**Reason (R):** For thick lenses one cannot find image position.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.** **Assertion (A):** For better resolution, in microscope we prefer "Oil immersed object".
**Reason (R):** Refractive index of oil is closer to the refractive index of objective glass.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** Rainbow is an example of the dispersion of sunlight by the water droplets.
**Reason (R):** Light of shorter wavelength is scattered much more than light of larger wavelength.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** The focal length of a spherical mirror does not depend on the wavelength of light.
**Reason (R):** In case of reflection of light from a denser medium the phase changes by $\pi$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** **Assertion (A):** A healthy man wearing glasses of focal length + 1m cannot see beyond 1m.
**Reason (R):** A convex lens can form a real image of a point object placed on its principal axis. If the upper half of the lens is painted black, the intensity of the image will decrease but the image will not be shifted upward or downward.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** Sky appears blue.
**Reason (R):** Sensitivity of eye is higher for blue colour as compare to violet colour.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** **Assertion (A):** Blue colour of sky is due to scattering.
**Reason (R):** According to Rayleigh blue colour shows more scattering as compare to violet colour.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**55.** **Assertion (A):** A convex lens of glass ($\mu$ = 1·5) behave as a diverging lens when immersed in carbon disulphide of higher refractive index    ($\mu$ = 1·65)
**Reason (R):** A diverging lens is thinner in the middle and thicker at the edges.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**56.** **Assertion (A):** A ray of white light shows no dispersion on emerging from a glass slab although there occurs dispersion inside the glass slab.
**Reason (R):** The velocity of light inside the glass slab is same for all different colours.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**57.** **Assertion (A):** A completely transparent material will be invisible in vacuum, when the refractive index is unity.
**Reason (R):** The ratio of the refractive index of red light to blue light in vacuum is less than unity.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**58.** **Assertion (A):** For every observer rainbow is a personal one.
**Reason (R):** Every observer intercepts light from same water drops.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**59.** **Assertion (A):** The persistence of vision (1/16 second) is used in cinematography.
**Reason (R):** The human eye forms the real image of an object at its retina.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**60.** **Assertion (A):** Warning signals installed at the top of tall buildings and monuments employ red light.
**Reason (R):** Human eye is most sensitive to red colour.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**61.** **Assertion (A):** A single lens cannot be free from chromatic aberration.
**Reason (R):** When light passes through single lens dispersion must occur.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**62.** **Assertion (A):** When white light passes through a prism, deviation of violet light is more than green light.
**Reason (R):** In a prism average deviation is measured as deviation of yellow light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**63.** **Assertion (A):** A light ray is incident on a glass slab. Some portion of it is reflected and some is refracted. Refracted and reflected rays are always perpendicular to each other.



**Reason (R):** Angle of incidence is not equal to angle of reflection.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**64.** **Assertion (A):** Law of reflection is applicable for all type of mirrors.
**Reason (R):** Rays which are parallel to principal axis are known as paraxial rays.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**65.** **Assertion (A):** A convex lens suffers from chromatic aberration.
**Reason (R):** All parallel rays of monochromatic light passing through a convex lens do not come to a focus at the same point.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**66.** **Assertion (A):** If an object moves in front of a concave mirror parallel to principal axis. The angle between the object velocity and image velocity can never be acute.
**Reason (R):** Object velocity and image velocity per-pendicular to principal axis for spherical mirror is not same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**67.** **Assertion (A):** The Focal length of lens is same for all colours of light
**Reason (R):** The focal length depends only upon the material of the lens
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**68.** **Assertion (A):** When light moves from a denser medium to rarer medium then snell's law can't satisfied for all angle of incidence.

**Reason (R):** When light moves from denser to rarer medium, for angle of incidence greater than the critical angle, no refraction is possible.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**69.** **Assertion (A):** On hot summer days, optical density of different layer of air increases with height from ground.

**Reason (R):** Refractive index of air increases with its density.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**70.** **Assertion (A):** For observing a rainbow, sun should be shining in one part of the sky and it is raining in the opposite part of sky, and observer should stand with his back towards raining side.

**Reason (R):** Rainbow appears due to directly reflection of sunlight from water drops of rain.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**71.** **Assertion (A):** If an object is placed between f and 2f of a convex lens, a real image can be seen on a screen placed at image location. If the screen is removed then image will not be seen.

**Reason (R):** Real image of a object can not formed in air.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**72.** **Assertion (A):** Optical fibre communication is fastest way of communication.

**Reason (R):** Optical interference between fibres is zero.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**73.** **Assertion (A):** A white parallel beam of light is incident on a plane glass-vacuum interface as shown. The beam may undergo dispersion after suffering deviation at the interface (The beam is not incident normally on the interface.)



**Reason (R):** Vacuum has same refractive index for all colours of white light.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**74.** **Assertion (A):** The formula $\left(\dfrac{1}{v} + \dfrac{1}{u} = \dfrac{1}{f}\right)$ connecting u and v for a spherical mirror is valid only for mirrors whose sizes are very small compared to their radii of curvatures.
**Reason (R):** Laws of reflection are strictly valid for smaller size of optical system.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**75.** **Assertion (A):** A point object is placed at a distance of 26 cm from a convex mirror of focal length 26 cm. The image will form at infinity.
**Reason (R):** For above given system the equation $\dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{f}$ gives position of image.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**76.** **Assertion (A):** Focal length of a convex mirror may be negative.
**Reason (R):** Distances measured in the direction of incident rays may be taken as negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**77.** **Assertion (A):** A rectangular glass slab produces no deviation and no dispersion.
**Reason (R):** Dispersive power of glass slab is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**78.** **Assertion (A):** Diamond in air shine brightly and when dipped in transparent oil, its shine reduces.
**Reason (R):** Diamond shines due to multiple total internal reflections.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**79.** **Assertion (A):** A plano-convex lens is silvered at plane surface. It can act as a converging mirror.
**Reason (R):** Focal length of concave mirror is independent of medium.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**80.** **Assertion (A):** Biconvex lens can form virtual image of a virtual object.
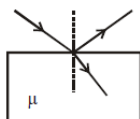**Reason (R):** Nature of lens depends on refractive index of surrounding.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**81.** **Assertion (A):** Optical path length is always greater than or equal to geometrical path length.
**Reason (R):** Light travels with speed of $3 \times 10^8$ m/s in vacuum.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**82.** **Assertion (A):** It is never possible to produce a real image using a plane mirror.
**Reason (R):** Radius of curvature of a plane mirror is negative.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**83.** **Assertion (A):** A dentist uses a concave mirror to examine a small cavity.
**Reason (R):** A concave mirror always forms a magnified and erect image.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**84.** **Assertion (A):** Law of reflection is applicable for all type of mirrors.
**Reason (R):** Rays which are parallel to the principal axis are known as paraxial rays.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**85.** **Assertion (A):** When an object is placed between two plane parallel mirrors, all the images formed are of equal intensity.
**Reason (R):** In above situation of two plane parallel mirrors, only two images are possible.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**86.** **Assertion (A):** The focal length of spherical mirror does not depend on the wavelength of light.
**Reason (R):** The number of wavelengths in the visible region of spectrum are infinite.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**87.** **Assertion (A):** A real object is placed on the optic axis of a lens such that an erect image of twice the size of the object is obtained. The lens must then be a convergent lens.
**Reason (R):** Erect image of a real object can be produced by a concave lens and also by a convex lens.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**88.** **Assertion (A):** A real object is placed on the optic axis of a lens such that magnification of the image is +0.5. The lens must then be a divergent lens.
**Reason (R):** A concave lens always produces a virtual image of a real object.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**89.** **Assertion (A):** A lens L (shown in the figure) kept in a surrounding medium X has a power + 10D. If the same lens is kept in a surrounding medium Y, its power is found to be +12.5D. Also if the same lens is placed in a surrounding medium Z, its power is now measured to be −3.5D, then $m_Z > m_X > m_Y$.

**Reason (R):** In different surroundings, power of a given lens has different values but the same sign.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

90. **Assertion (A):** Minimum distance between a real object and its real image formed by a convex lens is three times the focal length of lens.

**Reason (R):** Distance between an object and its real image formed by convex lens is minimum when magnification produced by the lens has minimum value.
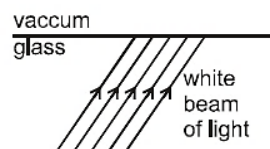
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

91. **Assertion (A):** Resolving power of a microscope is different for different colours of illuminating light.

**Reason (R):** Resolving power of a microscope is directly proportional to the wavelength of illuminating light.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

92. **Assertion (A):** A concave mirror and a concave lens have the same focal length in air. When dipped in water, the focal length of the two are equal.

**Reason (R):** The focal length depends only on the radii of curvature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

93. **Assertion (A):** Light of wavelength 5500 Å travelling in medium I is incident on an interface and gets refracted into medium 2. Due to refraction, if it deviates by an angle 15°, then its wavelength in medium 2 could be greater than or smaller than 5500 Å but never the same.

**Reason (R):** As light is refracted, its colour changes.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

94. **Assertion (A):** If an air bubble is trapped in a glass slab will not produce any lens action.

**Reason (R):** Behaviour of a shape like a lens is in dependent of surrounding medium.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

95. **Assertion (A):** A prism of refracting angle 60° is made of a material of refractive index $\sqrt{2}$ for a certain wavelength. As light of this wavelength passes through the prism, angle of minimum deviation is 30°.

**Reason (R):** At minimum deviation, angle of refraction of the first face is $r_1 = \dfrac{A}{2} = 30°$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**96.** **Assertion (A):** When a glass prism is immersed in water, the deviation caused by prism decrease.

**Reason (R):** Refractive index of glass prism relative to water is less than relative to air.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**97.** **Assertion (A):** When a light wave travels from a rarer to a denser medium, it loses energy.

**Reason (R):** When a light wave travels from a rarer to a denser medium, it loses speed and energy carried by the wave is proportional to its speed.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**98.** **Assertion (A):** When a monochromatic beam of light is incident from one medium to another, the frequency of incident, reflected and refracted rays are equal.

**Reason (R):** The incident, reflected and refracted rays are co-planar.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**99.** **Assertion (A):** The refractive index of diamond is $\sqrt{6}$ and that of liquid is $\sqrt{3}$. If the light travels from diamond to the liquid, it will totally reflected when the angle of incidence is 30°.

**Reason (R):** For total internal reflection, angle of incidence should be less than critical angle $\theta_c = \sin^{-1}\left(\dfrac{1}{\mu}\right)$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**100.** **Assertion (A):** The speed of light in an optically rarer medium is greater than that in an optically denser medium.

**Reason (R):** One light year equals to $9.5 \times 10^{12}$ km

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**101.** **Assertion (A):** Consider a prism A of refracting angle 5° and another prism B of refracting angle 10°. Both prisms are made of crown glass, If white light is incident on each prism, angular dispersion caused by prism B will be more.

**Reason (R):** Dispersive power depends on the nature material.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**1.** **Assertion (A):** When a width of one of the slits of Young's double slit experiment is double that of the other than brighter frings are nine times brighter than the dark fringes.
**Reason (R):** The amplitude of the wave is proportional to the width of the slit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2.** **Assertion (A):** When tiny circular obstacle is placed in the path of light from some distance, a bright spot is seen at the centre of shadow of the obstacle.
**Reason (R):** Constructive interference occurs at the centre of the shadow.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3.** **Assertion (A):** In the figure shown zero order maxima will be above point "O".



**Reason (R):** Zero order maxima means a point where the path difference is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4.** **Assertion (A):** If width of one of the slit in YDSE is slightly increased, then maximum and minimum both Intensity will increase.
**Reason (R):** Intensity reaching from that slit on screen will slightly increase.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5.** **Assertion (A):** If white light is used in place of monochromatic light in YDSE then central point is white. Although at other places coloured fringes will be obtained.
**Reason (R):** At centre path difference is zero for all wave lengths. Hence all wave will interfere constructively.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6.** **Assertion (A):** White light is used in YDSE now a glass slab is inserted infront of the slit, then red fringe will shift less (in upward direction) compared to violet.



**Reason (R):** Refractive index of violet colour will be more
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7.** **Assertion (A):** Distance between two coherent sources $S_1$ and $S_2$ is $4\lambda$. A large circle is drawn around these sources with centre of circle lying on centre of $S_1$ and $S_2$. there are total 16 maxima on the circle.
**Reason (R):** Total number of minima on this circle are less compare to total number of maximas.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

8. **Assertion (A):** As the separation between the two slits is increased width of fringes decreases.
**Reason (R):** On increasing separation between two slits, angular separation of fringes decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** In case of young double slit experiment width of all fringes were equal.
**Reason (R):** Angular width of fringes were equal.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** In case of single slit diffraction intensity of higher order maxima decreases.
**Reason (R):** Higher order maxima are at larger distance.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** If black strips of width w are separated by white strips of width d (d < w) are just distinguishable from a distance D. Then resolving power of eye will be higher for smaller d.
**Reason (R):** Resolution of eye is d/D and resolving power inversely proportional to resolution.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** If light incident on surface of two different media. The refracted beam may be partially polarized.
**Reason (R):** If sum of angle of incidence and angle of refraction is $\pi/2$ then a reflected light is totally polarised.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** On increasing wavelength of light used, resolving power increases.
**Reason (R):** On increasing wavelength, width of central maxima decreases.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** If three polarisers are arranged such that the axis of any two successive polarisers make equal angle with each other. If unpolarised light of intensity $I_0$ incident on first polariser then intensity of emergent light after 3rd polariser is $\frac{I_0}{8}$. If angle between them is 45°.
**Reason (R):** Each time intensity becomes 50% by Malus law.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** If in YDSE $\frac{d}{\lambda} = 200$ and screen is semicylinderical as shown. Axis of semicylinder is passing through mid point between slits.
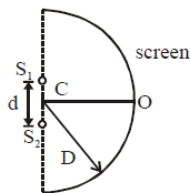


then number of bright fringes are 200.

**Reason (R):** Maximum path difference is $n\lambda = d$ between lowest and highest position and $n = \frac{d}{\lambda} = 200$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** If in YDSE, wavelength of light used is increased, angular width remain unchanged only linear width of fringes increases.

**Reason (R):** Only linear fringe width proportional to wavelength and angular fringe width does not depends on wavelength.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** As angle subtended by the diameter of objective lens at the focus of microscope increased, resolving limit also increases.

**Reason (R):** Resolving limit proportional to tangent of the angle subtended by the diameter of objective lens at the focus of microscope.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** When refractive index of medium is increased resolving power also increases.

**Reason (R):** In medium of higher refractive index wavelength is higher

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** The resolving power of a telescope is more if the diameter of the objective in more.

**Reason (R):** Objective lens of larger focal length collect more light.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** In single slit diffraction arrangement, instead of keeping the screen far away, often a converging lens is placed after the slit and a screen is placed at its focus.

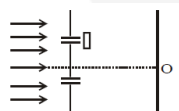**Reason (R):** Lens doesn't introduce any extra path difference for a parallel beam.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** The stars which are not resolved in the image produced by the objective of a telescope can't be further resolved by its eye piece.

**Reason (R):** The primary purpose of eyepiece of telescope is to provide the magnification of image produced by the objective.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22. Assertion (A):** When a monochromatic light beam is incident normally on a reflective surface, under some condition it is possible that all lights is transmitted without any reflection.

**Reason (R):** When light after passing through a polaroid is incident on a reflecting surface at angle of incidence equals to polarizing angle, then all light gets transmitted without any reflection.
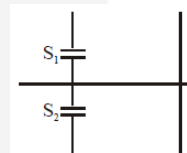
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**23. Assertion (A):** Two persons separated by a 7m partition wall in a room of 10 m high can heard each other easily but cannot see each other.

**Reason (R):** Any sound wave can bend by the obstacle while light can't.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**24. Assertion (A):** The fringe pattern in Young's double slit experiment is result of both phenomena of interference and diffraction.

**Reason (R):** Diffraction results from superposition of wavelets of same wavefront.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**25. Assertion (A):** Wave nature can be proved by phenomena of interference and diffraction.

**Reason (R):** Only transverse wave can show the phenomena of polarization.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**26. Assertion (A):** Huygens's principle can explain converging nature of convex lens.

**Reason (R):** Snell's law can be derived from Huygens's principle.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**27. Assertion (A):** In a YDSE, the two slits are at distance 'a' apart. Interference pattern is observed on a screen at a distance D from the slits. At a point on the screen which is directly opposite to the slit, a dark fringe is observed. Then the wavelength of wave is proportional to square of distance between slits.

**Reason (R):** The light ray coming from two slits do not interfere at the screen.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**28.**


Screen

$S_1$ and $S_2$ are two pinhole coherent point sources and screen is perpendicular to line joining source.

**Assertion (A):** Shape of a fringe on screen is circular.

**Reason (R):** Fringe is locus of all points having common path difference.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**29.** **Assertion (A):** In a Young's double slit experiment if slit separation is slightly greater than nl if n is integer No. of maxima on screen is 2n + 1 & no of minima is 2n.

**Reason (R):** In Young's double slit experiment path difference at different position are different.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**30.** **Assertion (A):** In standard YDSE experiment if upper slit is slightly moved downward then central maxima shifts downward.

**Reason (R):** Fringe width in such case will increase.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**31.** **Assertion (A):** If the phase difference between the light waves emerging from the slits of the Young's experiment is $\pi$ radian, then central fringe will be dark.

**Reason (R):** Phase difference is equal to $\frac{2\pi}{\lambda}$ times the effective path difference.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**32.** **Assertion (A):** In YDSE central maxima means the maxima formed with zero optical path difference. It may be formed anywhere on the screen.

**Reason (R):** In an interference pattern, whatever energy disappears at the minimum, appears at the maximum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**33.** **Assertion (A):** Diffraction takes place for all types of waves mechanical or non-mechanical, transverse or longitudinal.

**Reason (R):** Diffraction's effects are perceptible only if wavelength of wave is comparable to dimensions of diffracting device.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

34. **Assertion (A):** Light is diffracted around the edges of obstacles and it bend such a way which is not easily observed.
**Reason (R):** The wavelength of light is very small.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

35. **Assertion (A):** In Young's double slit experiment if intensity of each source is $I_0$ then minimum and maximum intensity is zero and $4I_0$ respectively.
**Reason (R):** In Young's double slit experiment energy conservation is not followed.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

36. **Assertion (A):** Radio waves cannot be diffracted by the buildings.
**Reason (R):** The wavelength of radio waves is very small.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

37. **Assertion (A):** In standard YDSE set up with visible light, the position on screen where phase difference is zero appears bright.
**Reason (R):** In YDSE set up amplitude of electromagnetic field at central bright fringe is not varying with time.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

38. **Assertion (A):** In Young's experiment, the fringe width for dark fringes is different from that for bright fringes.
**Reason (R):** In Young's double slit experiment with a source of white light, only black and white fringes are observed.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

39. **Assertion (A):** The plane of polarization of reflected ray is parallel to the refracting surface, when light is incident at polarising angle.
**Reason (R):** Vibration of electric field in refracted ray ceases about plane parallel to refracting surface.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

40. **Assertion (A):** Diffraction is common in sound but not common in light waves.
**Reason (R):** Wavelength of light wave is more than the wavelength of sound.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

41. **Assertion (A):** If a glass slab is placed in front of one of the slits, then fringe width will decrease.
**Reason (R):** Glass slab will produce no path difference.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**42.** **Assertion (A):** If incident wavefront is plane, then after reflection or refraction the emerging wave front also must be plane.
**Reason (R):** Wavefronts are in the direction of energy propagation by light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**43.** **Assertion (A):** If two sodium lamps are used illuminating two pinholes, interference fringes will not be observed.
**Reason (R):** Light waves coming from an ordinary source like sodium lamp are unpolarised in nature.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**44.** **Assertion (A):** In a Young's double slit experiment (YDSE), if the screen is move away from the plane of slits, Angular fringe width remains unchanged.
**Reason (R):** Linear and Angular fringe width is directly proportional to D.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**45.** **Assertion (A):** In case of YDSE, if monochromatic light is replaced by white light then closest on either side of central white fringe will be blue and farthest will appear red.
**Reason (R):** Fringe width for blue will be greater than that for red for same bright fringe.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**46.** **Assertion (A):** In everyday life, we do not encounter diffraction of light in contrast to that for sound.
**Reason (R):** Diffraction characteristic is not exhibited by all kind of waves.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**47.** **Assertion (A):** In the double slit experiment, if one of the slit is closed, no fringe pattern will be observed on the screen.
**Reason (R):** In interference, phenomenon of diffraction is also included.
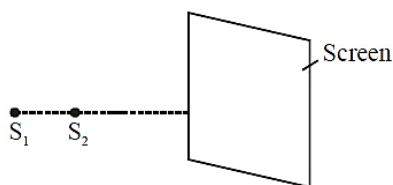(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**48.** **Assertion (A):** Incoherent sources do not produce an interference pattern.
**Reason (R):** Light from two coherent sources that are not in phase does not produce an interference pattern.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**49.**



**Assertion (A):** In YDSE, as shown in figure, central bright fringe is formed at O. If path difference at O increases y-coordinate of central bright fringe will change.
**Reason (R):** In YDSE, as shown in figure, central bright fringe is formed at O. If a liquid is filled between plane of slits and screen, the central bright fringe is shifted in upward direction.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**50.** **Assertion (A):** Light is a wave phenomenon.
**Reason (R):** Light requires a material medium for its propagation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**51.** **Assertion (A):** Two sources of light emit light waves of same frequency but of different amplitudes. Also the phase difference between light waves from the two sources at any point is time independent. Therefore, observable interference will be obtained when light waves from the two sources superimpose.
**Reason (R):** The sources are not coherent due to unequal amplitudes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**52.** **Assertion (A):** Interference pattern is obtained on a screen due to two identical coherent sources of monochromatic light. The intensity at the central part of the screen becomes one-fourth if one of the sources is blocked.
**Reason (R):** The resultant intensity at any point is the algebraic sum of the intensities due to two sources.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**53.** **Assertion (A):** Energy is created during constructive interference and destroyed during destructive interference.
**Reason (R):** The positions of constructive interference are sources of energy while the positions of destructive interference are sinks of energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**54.** **Assertion (A):** In Young's double slit experiment, assuming slits to be of equal widths, intensity at interference maxima is four times the intensity due to each slit.
**Reason (R):** Intensity is proportional to the square of amplitude.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**55.** **Assertion (A):** If Young's double slit experiment is performed with white light, the bright fringes produced are white and the dark fringes black.
**Reason (R):** In case of interference, there is no colour splitting.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**56.** **Assertion (A):** In Young's double slit experiment, if one of the slits is closed, intensity at the position of central fringe becomes half.
**Reason (R):** Resultant intensity, being sum of intensities from individual slits, becomes half as one slit is closed.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**57.** **Assertion (A):** In YDSE, fringes with blue light are thicker than those for red light.
**Reason (R):** In YDSE, the $n^{th}$ maxima always comes before the $n^{th}$ minima.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**58.** **Assertion (A):** The best contrast of the interference pattern is obtained when the intensity of the emerging lights from the two slits of the Young's experimental set-up are equal.

**Reason (R):** Intensity is proportional to the square of the amplitude.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**59.** **Assertion (A):** The central fringe is bright or dark, it dependents on the initial phase difference between the two coherent sources.

**Reason (R):** The pattern and position of fringes always remains same even after the introduction of transparent medium in a path of one of the slit.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**60.** **Assertion (A):** Diffraction is a sure indication of wave nature.

**Reason (R):** Only transverse waves can be diffracted.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**61.** **Assertion (A):** We cannot get diffraction pattern from a wide slit illuminated by monochromatic light.

**Reason (R):** In diffraction pattern, all the bright bands are not of the same intensity.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**62.** **Assertion (A):** Diffraction of light is due to dispersion.

**Reason (R):** Change in path of light around "the corners separates the wavelength of various colours.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**63.** **Assertion (A):** Sound waves in air cannot be polarised.

**Reason (R):** Polarisation is the characteristic of light wave only.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**64.** **Assertion (A):** Two polaroids are crossed to each other. When either of them is rotated through 30°, then only one eighth of the incident unpolarised light passes through the combination.

**Reason (R):** According to Malus's law, $I \propto \cos^2 \theta$ where I is the resultant intensity transmitted and $\theta$ is the angle between the optical axis of analyser and polariser.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**65.** **Assertion (A):** At the first glance the top surface of a Morpho's butterfly's wing appears a beautiful blue-green. If the wing moves, the colour changes.

**Reason (R):** Different pigments in the wing reflect light at different angles.

[Hint: It is due to interference of light rays reflected from different layers of wing.]

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

1. **Assertion (A):** Two photons having equal wavelengths have equal linear momentum.
   **Reason (R):** When monocloromatic light shows its photon character, each photon has a linear momentum $p = \dfrac{h}{\lambda}$ .
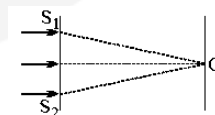   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

2. **Assertion (A):** If the accelerating potential of a X-Ray tube is increased then the characteristic wavelength decreases.
   **Reason (R):** The cut-off wavelength for a X-ray tube is given by $\lambda_{min} = \dfrac{hc}{eV}$, where V is accelerating potential.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

3. A photon and an electron both have energy 50 eV.
   **Assertion (A):** Both have different wavelengths.
   **Reason (R):** Wavelength depends on energy and not on mass.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

4. **Assertion (A):** Wave velocity is equal to group velocity in a non-dispersive medium.
   **Reason (R):** A non dispersive medium is one in which the wave velocity is frequency dependent.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

5. **Assertion (A):** In photoelectric effect, cathode or emitter plate is usually coated with barium oxide, barium sulphide or strontium oxide.
   **Reason (R):** Coating prevents cathode from erosion.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

6. **Assertion (A):** A particle at rest breaks into two particles of different masses. They fly off in different directions. Their de Broglie wavelengths will be different.
   **Reason (R):** Their speed will be different.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

7. **Assertion (A):** Photo cell is also called electric eye.
   **Reason (R):** Photo cell can see the things placed in front of it.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

8. **Assertion (A):** In photon-particle collision the total energy and total momentum are conserved.
**Reason (R):** The number of photons are conserved in a collision.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9. **Assertion (A):** Cut-off wavelength of x-ray is independent of type of target metal
**Reason (R):** Wavelength of $K_\alpha$ x-ray depends upon type of target metal.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

10. **Assertion (A):** The stopping potential increases, when frequency of incident rays are increased.
**Reason (R):** Stopping potential is directly proportional to the frequency of incident radiation.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

11. **Assertion (A):** A metallic surface is irradiated by monochromatic light of frequency $\upsilon > \upsilon_0$ (the threshold frequency). The maximum kinetic energy and stopping potential are $K_{max}$ and $V_S$ respectively. If the frequency of incident on the surface is doubled, both $K_{max}$ & $V_S$ are more than doubled.
**Reason (R):** The maximum kinetic energy and the stopping potential of photoelectrons emitted from a surface are linearly dependent on the frequency of incident light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

12. **Assertion (A):** When ultraviolet light incident on a photo cell, its stopping potential is VS and the maximum kinetic energy of photoelectrons is $K_{max}$. When the ultraviolet light is replaced by X-rays, both $V_S$ and $K_{max}$ increases
**Reason (R):** Photo electrons are emitted with speed ranging from zero to a maximum value because of the range of frequencies present in the incident light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

13. **Assertion (A):** By de-Broglie hypothesis, $p = h/\lambda$ for both the electron and the photon.
**Reason (R):** If an electron has the same wavelength as a photon, they have the same energy.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

14. **Assertion (A):** Charge of a photon is zero.
**Reason (R):** Rest mass of a photon is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

15. **Assertion (A):** The relative velocity of two photons travelling in opposite directions is c.
**Reason (R):** The rest mass of a photon is zero.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

16. **Assertion (A):** In the process of photo electric emission, all the emitted photoelectrons have same KE.
**Reason (R):** According to Einstein's photo electric equation KE= $h\upsilon - \phi$.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

17. **Assertion (A):** In photo electric effect, photo electrons come out from inner orbits of atom.
**Reason (R):** Free electrons of the metal can not absorb energy of a photon.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

18. **Assertion (A):** In photoelectric effect, on increasing the intensity of light, both the number of electrons emitted and kinetic energy of each of them get increased but photoelectric current remains unchanged.
**Reason (R):** The photoelectric current depends only on wavelength of light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

19. **Assertion (A):** The smaller the wavelength of a photon, the more energy it has.
**Reason (R):** The smaller the wavelength of a photon, the less momentum it has.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

20. **Assertion (A):** An electron microscope is based on de Broglie's hypothesis of matter waves.
**Reason (R):** Higher the accelerating potential, smaller is the de Broglie wavelength of the electron.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

21. **Assertion (A):** Photons do not carry momentum
**Reason (R):** A photon is a material particle.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

22. **Assertion (A):** Increase in intensity of light increases the kinetic energy of photoelectrons.
**Reason (R):** At stopping potential, no current flows in the circuit.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

23. **Assertion (A):** Work function of a metal increases with increase in intensity of incident light.
**Reason (R):** Maximum kinetic energy of ejected photoelectrons depends upon the intensity of incident light.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** Kinetic energy of photoelectrons emitted by a photosensitive surface depends upon the intensity of incident photon.

**Reason (R):** The ejection of electrons from metallic surface is possible with frequency of incident photon below the threshold frequency.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** Photoelectrons have a range of kinetic energy.

**Reason (R):** The work function varies as a function of depth from the surface.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** Photoelectric effect demonstrates the wave nature of light.

**Reason (R):** The number of photoelectrons is proportional to the frequency of light.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** On increasing the frequency of incident light, the photoelectric current increases.

**Reason (R):** Photoelectric current depends upon the wavelength of incident light.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** In photoelectric effect, the number of photoelectrons emitted is always equal to number of photons incident.

**Reason (R):** All the photons falling on the surface will eject photoelectrons.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** Electron from metal surface ejects only when light of particular wavelength will fall on surface.

**Reason (R):** Light shows wave nature.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1. Assertion (A):** On the atomic scale, mass is measured in atomic mass units (u).
**Reason (R):** 1u is $1/12^{th}$ mass of one atom of $C^{12}$ (1u = $1.66 \times 10^{-27}$ kg)
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2. Assertion (A):** Bohr model can explain spectra of hydrogen or hydrogen like species.
**Reason (R):** Bohr model is the best atomic model.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3. Assertion (A):** Zeeman effect is strong evidence of magnetic quantum number.
**Reason (R):** Magnetic quantum number is the result of space quantization.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4. Assertion (A):** Wavelength of continuous X-ray varies from a minimum value to infinity.
**Reason (R):** Continuous X-rays are emitted due to transition of electron from higher to lower energy level.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5. Assertion (A):** Penetration power of hard X-ray is more than that of soft X-ray.
**Reason (R):** Hard X-ray is used for engineering purpose while soft X-ray is used for medical purpose.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6. Assertion (A):** An electron and a positron moving towards each other with equal and opposite velocities can annihilate into photons.
**Reason (R):** A photon has non zero energy and momentum
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7. Assertion (A):** For the scattering of $\alpha$–particles at a large angles only the nucleus of the atom is responsible.
**Reason (R):** Nucleus is very heavy in comparison to electrons.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8. Assertion (A):** When white radiations (visible light) are passed through a sample of hydrogen gas at room temperature, absorption lines corresponding to Lyman series only are obtained.
**Reason (R):** At room temperature hydrogen atom is in the ground state.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

9.  **Assertion (A):** In H-atom, according to Bohr's theory, electron revolves around the nucleus in orbits in which the angular momentum of electron is as integral multiple of h/2π.
    **Reason (R):** Mass of electron is equal to the mass of proton.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

10. **Assertion (A):** The ratio of wavelength in first transition of lyman series for H atom and He$^+$ atom is exactly equal to four
    **Reason (R):** In all atoms electron revolve around fixed nucleus.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

11. **Assertion (A):** If the accelerating potential in an X-ray tube is increased, the wavelength of the characteristic X-rays does not change.
    **Reason (R):** When an electron beam strikes the target in an X-ray tube, part of the kinetic energy is converted into X-ray energy.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

12. **Assertion (A):** It is essential that all the lines available in the emission spectrum will also be available in the absorption spectrum.
    **Reason (R):** The spectrum of hydrogen atom is only absorption spectrum.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

13. **Assertion (A):** Bohr postulates that the electrons in stationary orbits around the nucleus do not radiate.
    **Reason (R):** According to classical physics all moving electrons radiate.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

14. **Assertion (A):** Anode of Coolidge tube gets heated up at time of emission of X-rays.
    **Reason (R):** The anode of Coolidge tube is made of a material of high melting point.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**15.** **Assertion (A):** In a Bohr's atom, frequency of revolution of an electron in its orbit is same as frequency of spectral line, for transition between large quantum numbers.

**Reason (R):** As Principal quantum number increases in a Bohr's atom, energy gap between the energy levels decreases.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**16.** **Assertion (A):** When the speed of an electron increases its specific charge decreases.

**Reason (R):** Specific charge is the ratio of the mass to charge.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**17.** **Assertion (A):** A beam of charged particles is employed in the treatment of cancer.

**Reason (R):** Charged particles on passing through a material medium lose their energy by causing ionization of the atoms along their path.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**18.** **Assertion (A):** Wavelength of Lyman scries is less than of Balmer series.

**Reason (R):** In hydrogen spectrum Balmer scries belongs to visible spectrum.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**19.** **Assertion (A):** The frequency of $K_\alpha$ X-radiations is greater than $K_\beta$ for a given target.

**Reason (R):** $K_\alpha$ radiation is produced when an electron from $n = 2$ jumps into the vacancy in $n = 1$ orbit, whereas in $K_\beta$ radiation the transition takes place from $n = 3$ to $n = 2$.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**20.** **Assertion (A):** Frequency of characteristic X-ray will change if atomic number of target is changed.

**Reason (R):** When high energy electron strikes on target then characteristics and continuous X-rays are emitted.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

21. **Assertion (A):** A hydrogen atom can absorb a photon whose energy is greater than 13.6 eV.

    **Reason (R):** The binding energy of a hydrogen atom is 13.6 eV.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

22. **Assertion (A):** A welder uses mouth mask for protection of eyes.

    **Reason (R):** Welding arc produces X-rays.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

23. **Assertion (A):** The electron will be ejected from a hydrogen atom when electron beam of kinetic energy 10.6 eV falls on it.

    **Reason (R):** The difference between $n_1$ and $n_2$ is 10.2 eV.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

24. **Assertion (A):** Laser has very height intensity.

    **Reason (R):** Light from laser overlap constructively.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

25. **Assertion (A):** In sodium nucleus $^{23}_{11}\text{Na}$, there are no electrons.

    **Reason (R):** Atomic number of sodium is 11.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

26. **Assertion (A):** It is easier to release an orbital electron, but quite difficult to release a nucleon.

    **Reason (R):** An electron is much lighter than a nucleon.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

27. **Assertion (A):** Atoms of greater mass number are more stable,

    **Reason (R):** Their mass defects are more.

    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

    (3) (A) is true but (R) is false

    (4) Both (A) and (R) are false

1.  **Assertion (A):** When a beam of highly energetic neutrons is incident on a tungsten target, X-rays will be produced.
    **Reason (R):** Neutrons do not exert any electrostatic force on electrons or nucleus of an atom.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

2.  **Assertion (A):** Strong nuclear force holds protons inside nucleus.
    **Reason (R):** Strong nuclear force is not a fundamental force.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

3.  **Assertion (A):** Consider the following nuclear reaction of an unstable $_{6}^{14}\text{C}$ nucleus initially at rest. The decay $_{6}^{14}\text{C} \longrightarrow {}_{7}^{14}\text{N} + {}_{-1}^{0}\text{e} + \bar{\text{v}}$. In a nuclear reaction total energy and momentum is conserved experiments show that the electrons are emitted with a continuous range of kinetic energies upto some maximum value.
    **Reason (R):** Remaining energy is released as thermal energy.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

4.  **Assertion (A):** The Q value of nuclear process is Q = total final binding energy – total initial binding energy.
    **Reason (R):** The Q value of nuclear reaction initially appears in form of kinetic energy of products.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

5.  **Assertion (A):** The effective mass of β-particles when they are emitted is higher than the mass of electrons obtained by Milikan oil-drop experiment.
    **Reason (R):** β -particle and electron, both are similar particles.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

6.  **Assertion (A):** If number of protons in a nucleus is more than number of neutrons present, the nucleus is unstable.
    **Reason (R):** Electrostatic force between two protons in a nucleus dominates over the nuclear force between them.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

7.  **Assertion (A):** Nucleus having more binding energy is more stable
    **Reason (R):** Stability increases with increase in number of nucleons.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

8. **Assertion (A):** $Fe^{56}$ nucleus is more stable than $U^{235}$ nucleus.
   **Reason (R):** Binding energy of $Fe^{56}$ nucleus is more than binding energy of $U^{235}$
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

9. **Assertion (A):** Electron capture occurs more often than positron emission in heavy elements.
   **Reason (R):** Heavy elements exhibit radioactivity.
   (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
   (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
   (3) (A) is true but (R) is false
   (4) Both (A) and (R) are false

10. **Assertion (A):** Strong nuclear force is fundamental quark-quark interaction.
    **Reason (R):** Strong nuclear force is shortest range force in nature.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

11. **Assertion (A):** The value of Rydberg constant is independent of mass of nucleus.
    **Reason (R):** Electrons revolve around stationary nucleus of atom.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

12. **Assertion (A):** Fragments produced in the fission of $_{92}^{235}U$ are radioactive.
    **Reason (R):** The fragments have abnormally high proton to neutron ratio.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

13. **Assertion (A):** The binding energy per nucleon, for nuclei with atomic mass number A > 100 decreases with A.
    **Reason (R):** The nuclear forces become weaker for heavier nuclei.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

14. **Assertion (A):** All protons have non zero magnetic moment.
    **Reason (R):** All nuclei have non zero magnetic moment.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

15. **Assertion (A):** Rydberg constant varies with mass number of a given element.
    **Reason (R):** The reduced mass of electron depends on the mass of the nucleus.
    (1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
    (2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
    (3) (A) is true but (R) is false
    (4) Both (A) and (R) are false

**16.** **Assertion (A):** Although elements are different, their nuclei are of the same size.
**Reason (R):** Nuclear density is not same for all nuclei.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17.** **Assertion (A):** Neutrons penetrate matter more readily as compared to protons.
**Reason (R):** Neutrons are slightly more massive than protons.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18.** **Assertion (A):** Energy released in one fusion process is less than the energy released in a single fission event.
**Reason (R):** Fusion is a weaker source of energy than fission.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19.** **Assertion (A):** Fragments produced in fission of $^{235}$U are radioactive.
**Reason (R):** The entire mass of atom is concentrated in the nucleus.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** Nuclear forces are charge dependent forces.
**Reason (R):** Nuclear forces are attractive forces.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** A nuclei has more mass than the sum of the masses of the individual nucleons in them.
**Reason (R):** In nuclei, number of neutrons is less than the number of electrons.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** Isotopes of an element can be separated by using a mass spectrometer.
**Reason (R):** Separation of isotopes is possible because of the difference in electron numbers of isotopes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** Nuclear binding energy per nucleon is in the $^{9}_{4}\text{Be} > ^{7}_{3}\text{Li} > ^{4}_{2}\text{He}$.
**Reason (R):** Binding energy per nucleon increases linearly with difference in number of neutrons and protons.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

24. **Assertion (A):** Energy is released when heavy nuclei undergo fission or light nuclei undergo fusion.
**Reason (R):** For heavy nuclei, binding energy per nucleon increases with increasing Z while for light nuclei, it decreases with increasing Z.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** Size of nucleus determined electron scattering and $\alpha$-scattering are same.
**Reason (R):** Electron scattering or by $\alpha$-scattering is controlled by distribution of charge in nucleus.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

26. **Assertion (A):** It is very easy to detect neutrino in nature.
**Reason (R):** It has high affinity to interact with matter.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

27. **Assertion (A):** More energy is released in fusion than fission per nucleon.
**Reason (R):** More number of nucleons takes part in fusion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

28. **Assertion (A):** Deuterium is a good moderator of fast neutrons.
**Reason (R):** Fast neutrons transfer 90% of their kinetic energy to the nuclei of the moderator in an elastic collision.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

29. **Assertion (A):** Beryllium, can be used as a moderator in nuclear fission reactor.
**Reason (R):** A fast moving electron on collision with a light stationary particle loses most of its energy in nuclear reactor.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

30. **Assertion (A):** Nuclear force is short range while gravitation and electric force are universal.
**Reason (R):** Nuclear force does not follow inverse square law.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**1. Assertion (A):** NPN transistor is preferred over PNP transistor.
**Reason (R):** Mobility of hole is more than free electron.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**2. Assertion (A):** The number of electrons in n-type semiconductor is higher than the number of electrons in a pure silicon semiconductor.
**Reason (R):** The law of mass action is applicable only to n-type semiconductors.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**3. Assertion (A):** A transistor amplifier in common emitter configuration has a low input impedance.
**Reason (R):** The base to emitter region is forward biased.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**4. Assertion (A):** In solid each electron will have a different energy level.
**Reason (R):** In solid crystal each electron has a unique position and no two electrons see exactly the same pattern of surrounding charges.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**5. Assertion (A):** The conductivity of an intrinsic semiconductor depends on its temperature.
**Reason (R):** No important electronic device can be developed using intrinsic semi conductor.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**6. Assertion (A):** Width of depletion region is reduced in forward bias.
**Reason (R):** In forward bias external battery reduced the internal electric field in depletion layer.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**7. Assertion (A):** Bridge full wave rectifier is more used than centre tap full wave rectifier.
**Reason (R):** In bridge full wave rectifier four diodes are used.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**8. Assertion (A):** The semiconductor used for fabrication of visible LED must at least have a band gap of 1.8 eV.
**Reason (R):** The spectral range of visible light is from 0.4 eV to 1.8 eV.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**9.** **Assertion (A):** In an OR gate if any of the input is high the output is high.
**Reason (R):** OR gate is the basic gate.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**10.** **Assertion (A):** In an oscillator, the feedback is in the same phase which is called as positive feedback.
**Reason (R):** If the feedback voltage is in opposite phase the gain is greater than one.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**11.** **Assertion (A):** Working principle of photodiode and photocell is same.
**Reason (R):** Biasing circuit for photodiode and photocell is same.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**12.** **Assertion (A):** GaAs is preferred for making solar panels.
**Reason (R):** $\Delta E_g$ for GaAs is 1.5 eV and sun's radiation has highest intensity around this energy level.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**13.** **Assertion (A):** In LED $e^-$-hole pair recombination gives us photon.
**Reason (R):** In LED $e^-$-hole pair recombination occurs in depletion region.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**14.** **Assertion (A):** As we increase applied voltage on LED intensity of emitted light first increases then decreases.
**Reason (R):** We use LED in forward bias.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**15.** **Assertion (A):** In a N-type semiconductor, the number of holes get reduced.
**Reason (R):** Rate of recombination of holes would increase due to the increase in the number of electrons
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**16.** **Assertion (A):** Electron hole recombination takes place in P-region and N-region of PN Junction diode except in depletion region.
**Reason (R):** Electric field in depletion region oppose the diffusion.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**17.** **Assertion (A):** In a transistor, collector current in active state is almost independent of potential difference of collector and emitter.
**Reason (R):** Base emitter junction of a transistor is in forward bias in active state
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**18.** **Assertion (A):** Output frequency of time varying DC voltage in a full wave rectifier is twice of input frequency.
**Reason (R):** A center tap transformer increases the frequency of input.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**19.** **Assertion (A):** A NAND gate can be obtained by using NOR gates.
**Reason (R):** NOR, NAND and XOR gates are called universal gates.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**20.** **Assertion (A):** Width of depletion region is reduced in forward bias.
**Reason (R):** In n-type semiconductor majority charge carriers are free electrons while in p-type they are holes.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**21.** **Assertion (A):** Transistor can be used as an amplifier & oscillator.
**Reason (R):** In transistor, collector is larger in size as compared to the emitter.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**22.** **Assertion (A):** The drift current in a p–n junction is from n-side to p-side.
**Reason (R):** The diffusion current in a p–n junction is from p–side to n–side.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**23.** **Assertion (A):** P-type semiconductor has high density of holes in valence band while N-type semiconductor has high density of electrons in conduction band.
**Reason (R):** In N-type semiconductor, as the density of donor atoms $N_D$ is increased, the fermi energy level shifts towards the valence band.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**24.** **Assertion (A):** Generally npn transistors are widely used.
**Reason (R):** In npn transistor the mobility of majority charge carriers is more.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

25. **Assertion (A):** Light emitting diode (LED) emits self radiation.

**Reason (R):** LED are reverse biased p-n junctions.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

26. **Assertion (A):** Conductivity of intrinsic semiconductor is less as compared to extrinsic semiconductor.

**Reason (R):** With increase in temperature conductivity of semiconductor increases.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

27. **Assertion (A):** Avalanche breakdown dominates when the doping concentration is high and depletion layer is thin.

**Reason (R):** Zener breakdown occurs due to the collision of minority charge carrier.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

28. **Assertion (A):** Semiconductors do not obey Ohm's law.

**Reason (R):** Electric current is determined by the rate of flow of charge carriers.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

29. **Assertion (A):** The temperature coefficient of resistance is positive for metals and negative for semiconductors.

**Reason (R):** On raising the temperature, in metals drift velocity increases but in semiconductors more charge carriers are released.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

30. **Assertion (A):** The temperature coefficient of resistance is positive for p-type semiconductors and negative for n-type semiconductors.

**Reason (R):** The effective charge carriers in p-type semiconductors are electrons and in n-type semiconductors are holes.

(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)

(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)

(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**31.** **Assertion (A):** The probability of electrons to be found in the conduction band of an intrinsic semiconductor at a finite temperature decreases exponentially with increasing band gap.
**Reason (R):** It is more difficult for the electrons to jump to the conduction band from the valence band if the band gap between them is large.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**32.** **Assertion (A):** The logic gate NOT can not built using diode.
**Reason (R):** The output voltage and the input voltage of the diode does not have 180° phase difference.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false

(4) Both (A) and (R) are false

**33.** **Assertion (A):** Two p-n junction diodes placed back to back, will work as an n-p-n transistor.
**Reason (R):** The p-region of two p-n junction diodes back to back will form the base of n-p-n transistor.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

**34.** **Assertion (A):** When base region has larger width, the collector current decreases.
**Reason (R):** In transistor, sum of base current and collector current is equal to emitter current.
(1) Both (A) & (R) are true and the (R) is the correct explanation of the (A)
(2) Both (A) & (R) are true but the (R) is not the correct explanation of the (A)
(3) (A) is true but (R) is false
(4) Both (A) and (R) are false

# 1. Units and Measurements

## ANSWER KEY ꗢꗢ Chulbuli Ch@h@t ꗢꗢ

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|
| Ans. | 4 | 1 | 2 | 4 | 3 | 3 | 3 | 4 | 4 | 3  | 4  | 3  | 4  | 1  | 2  | 3  | 3  | 3  |

# 2. Motion in a Straight Line

## ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 3 | 3 | 3 | 3 | 4 | 3 | 2 | 4 | 3 | 4  | 4  | 1  | 2  | 3  | 4  | 4  | 4  | 4  | 4  | 3  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | | | | | | |
| Ans. | 4 | 1 | 4 | 4 | 3 | 4 | 4 | 1 | 1 | 4 | 1 | 2 | 3 | 1 | | | | | | |

# 3. Motion in a Plane

## ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 1 | 3 | 4 | 2 | 4 | 3 | 4 | 1 | 4 | 1  | 4  | 4  | 4  | 4  | 4  | 4  | 2  | 4  | 2  | 1  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 2 | 3 | 4 | 3 | 4 | 4 | 4 | 3 | 1 | 3 | 2 | 1 | 1 | 1 | 3 | 3 | 3 | 3 | 4 | 4 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | | | | | | | | |
| Ans. | 3 | 3 | 2 | 4 | 3 | 4 | 3 | 4 | 2 | 2 | 3 | 4 | | | | | | | | |

# 4. Laws of Motion

## ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 3 | 3 | 4 | 1 | 2 | 1 | 4 | 2 | 2 | 4  | 1  | 3  | 1  | 3  | 3  | 4  | 4  | 4  | 1  | 1  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 4 | 4 | 2 | 4 | 4 | 1 | 4 | 4 | 1 | 2 | 2 | 4 | 4 | 4 | 4 | 3 | 1 | 4 | 4 | 4 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | | | | | | |
| Ans. | 4 | 1 | 4 | 4 | 4 | 4 | 1 | 3 | 3 | 4 | 4 | 2 | 4 | 4 | | | | | | |

# 5. Work, Energy and Power

## ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 2 | 4 | 1 | 3 | 1 | 4 | 3 | 2 | 4 | 1  | 4  | 3  | 4  | 1  | 1  | 3  | 2  | 4  | 3  | 1  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | |
| Ans. | 4 | 2 | 4 | 3 | 1 | 1 | 4 | 1 | 1 | 4 | 1 | 2 | 1 | 2 | 1 | 1 | 3 | 2 | 4 | |

## 6. System of Particles and Rotational Motion

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 3 | 1 | 4 | 3 | 4 | 2 | 4 | 4 | 3 | 3 | 4 | 3 | 1 | 1 | 3 | 2 | 4 | 3 | 2 | 3 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 3 | 3 | 2 | 2 | 3 | 4 | 1 | 1 | 3 | 4 | 1 | 3 | 2 | 4 | 2 | 4 | 3 | 3 | 2 | 4 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | | | |
| Ans. | 1 | 1 | 1 | 4 | 4 | 4 | 4 | 1 | 1 | 4 | 1 | 4 | 2 | 3 | 1 | 1 | | | | |

## 7. Gravitation

ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 4 | 1 | 4 | 1 | 1 | 3 | 1 | 2 | 3 | 3 | 4 | 4 | 2 | 2 | 2 | 3 | 2 | 1 | 4 | 2 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | | | | | | | | |
| Ans. | 2 | 1 | 1 | 2 | 2 | 4 | 3 | 4 | 1 | 1 | 2 | 4 | | | | | | | | |

## 8. Mechanical Properties of Solids

| ANSWER KEY | | |
|---|---|---|
| Que. | 1 | 2 | 3 |
| Ans. | 3 | 1 | 3 |

## 9. Mechanical Properties of Fluids

ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 2 | 4 | 4 | 1 | 1 | 2 | 1 | 1 | 1 | 4 | 4 | 1 | 3 | 2 | 2 | 3 | 2 | 4 |

## 10. Thermal Properties of Matter

ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 3 | 4 | 2 | 1 | 1 | 1 | 1 | 2 | 4 | 3 | 1 | 1 | 2 | 4 | 1 | 1 | 2 | 4 | 3 | 1 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 2 | 1 | 4 | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 4 | 1 | 3 | 3 | 1 | 4 | 3 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | | | |
| Ans. | 1 | 4 | 4 | 2 | 3 | 4 | 1 | 4 | 4 | 1 | 2 | 3 | 1 | 2 | 1 | 1 | | | | |

## 11. Thermodynamics

ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 1 | 4 | 3 | 2 | 2 | 4 | 2 | 1 | 4 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 4 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | | |
| Ans. | 1 | 4 | 1 | 1 | 4 | 4 | 3 | 1 | 4 | 4 | 1 | 4 | 4 | 3 | 1 | 1 | 1 | 1 | | |

## 12. Kinetic Energy

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 1 | 1 | 3 | 1 | 3 | 1 | 1 | 2 | 4 | 1 | 2 | 3 | 1 | 1 | 1 | 3 | 4 | 4 | 2 | 2 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | | | | | | | |
| Ans. | 2 | 1 | 2 | 2 | 4 | 2 | 4 | 1 | 2 | 4 | 1 | 3 | 2 | | | | | | | |

## 13. Oscillations

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 1 | 2 | 4 | 3 | 1 | 4 | 3 | 1 | 4 | 2 | 2 | 1 | 1 | 1 | 4 | 3 | 4 | 2 | 1 | 3 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 1 | 1 | 4 | 4 | 3 | 2 | 2 | 2 | 1 | 2 | 4 | 4 | 2 | 3 | 2 | 1 | 4 | 3 | 1 | 4 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | | | | | | | | | | |
| Ans. | 2 | 2 | 4 | 3 | 1 | 2 | 1 | 1 | 4 | 2 | | | | | | | | | | |

## 14. Waves

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 1 | 1 | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 4 | 4 | 4 | 4 | 1 | 4 | 4 | 1 | 1 | 4 | 3 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 4 | 2 | 2 | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 4 | 2 | 2 | 3 | 2 | 2 | 3 | 2 | 3 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | | | | |
| Ans. | 3 | 4 | 2 | 3 | 2 | 3 | 3 | 1 | 3 | 4 | 4 | 3 | 1 | 1 | 2 | 3 | | | | |

## 15. Electric Charge and Fields

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 1 | 4 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 4 | 4 | 3 | 4 | 4 | 1 | 4 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | | | |
| Ans. | 4 | 3 | 3 | 4 | 4 | 2 | 1 | 2 | 1 | 4 | 3 | 1 | 2 | 4 | 1 | 4 | 1 | | | |

## 16. Electrostatic Potential and Capacitance

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 1 | 3 | 4 | 4 | 1 | 3 | 3 | 3 | 3 | 2 | 1 | 1 | 3 | 3 | 1 | 1 | 3 | 1 | 1 | 1 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 1 | 1 | 4 | 1 | 1 | 3 | 1 | 3 | 3 | 2 | 1 | 3 | 4 | 1 | 2 | 1 | 3 | 3 | 2 | 1 |

# 17. Current Electricity

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANSWER KEY** | | | | | | | | | | | | | | | | | | | | |
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Ans.** | 1 | 3 | 1 | 3 | 1 | 1 | 2 | 1 | 4 | 4 | 3 | 1 | 3 | 4 | 2 | 3 | 2 | 3 | 4 | 1 |
| **Que.** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | **38** | **39** | **40** |
| **Ans.** | 4 | 3 | 3 | 1 | 1 | 1 | 3 | 3 | 3 | 4 | 2 | 4 | 3 | 1 | 2 | 3 | 2 | 4 | 1 | 1 |
| **Que.** | **41** | **42** | **43** | **44** | **45** | **46** | **47** | **48** | **49** | **50** | **51** | **52** | **53** | **54** | **55** | **56** | **57** | **58** | **59** | **60** |
| **Ans.** | 3 | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 4 | 4 | 1 | 3 | 2 | 3 | 4 | 4 | 2 | 1 | 4 | 4 |
| **Que.** | **61** | | | | | | | | | | | | | | | | | | | |
| **Ans.** | 1 | | | | | | | | | | | | | | | | | | | |

# 18. Moving Charge and Magnetism

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANSWER KEY** | | | | | | | | | | | | | | | | | | | | |
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Ans.** | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 1 | 4 | 1 | 3 | 4 | 2 | 2 | 4 |
| **Que.** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | **31** | **32** | **33** | **34** | **35** | **36** | **37** | | | |
| **Ans.** | 2 | 4 | 3 | 1 | 2 | 4 | 4 | 1 | 3 | 2 | 3 | 1 | 1 | 2 | 4 | 4 | 4 | | | |

# 19. Magnetism and Matter

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANSWER KEY** | | | | | | | | | | | | |
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **Ans.** | 1 | 4 | 1 | 1 | 2 | 2 | 1 | 2 | 4 | 4 | 1 | 2 |

# 20. Electromagnetic Induction (EMI)

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANSWER KEY** | | | | | | | | | | | | | | | | | | | | |
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Ans.** | 2 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 1 | 1 | 4 | 2 | 1 | 1 | 1 | 4 | 3 | 4 | 2 | 1 |
| **Que.** | **21** | **22** | **23** | **24** | **25** | **26** | **27** | **28** | **29** | **30** | | | | | | | | | | |
| **Ans.** | 1 | 2 | 1 | 1 | 3 | 1 | 4 | 3 | 2 | 1 | | | | | | | | | | |

# 21. Alternating Current (AC)

| | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANSWER KEY** Chulbuli Ch@h@t | | | | | | | | | | | | | | | | | | | | |
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** | **15** | **16** | **17** | **18** | **19** | **20** |
| **Ans.** | 2 | 1 | 4 | 3 | 3 | 2 | 3 | 3 | 2 | 2 | 4 | 3 | 2 | 4 | 3 | 1 | 1 | 3 | 4 | 3 |
| **Que.** | **21** | **22** | **23** | **24** | **25** | | | | | | | | | | | | | | | |
| **Ans.** | 1 | 4 | 1 | 1 | 2 | | | | | | | | | | | | | | | |

# 22. Electromagnetic Waves

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ANSWER KEY** | | | | | | | | | | | | | | |
| **Que.** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **14** |
| **Ans.** | 4 | 1 | 1 | 2 | 1 | 3 | 2 | 2 | 1 | 3 | 2 | 1 | 2 | 1 |

## 23.  Ray Optics and Optical Instruments

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 2 | 1 | 4 | 2 | 3 | 3 | 2 | 1 | 4 | 4 | 4 | 1 | 3 | 1 | 3 | 4 | 1 | 4 | 3 | 3 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 3 | 2 | 3 | 3 | 2 | 4 | 3 | 2 | 1 | 2 | 2 | 4 | 4 | 2 | 1 | 2 | 3 | 2 | 3 | 4 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| Ans. | 3 | 2 | 2 | 1 | 4 | 4 | 1 | 3 | 1 | 2 | 2 | 2 | 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| Que. | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 |
| Ans. | 1 | 2 | 4 | 3 | 2 | 2 | 4 | 2 | 1 | 4 | 1 | 2 | 2 | 3 | 1 | 4 | 3 | 1 | 2 | 1 |
| Que. | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 | 100 |
| Ans. | 2 | 4 | 3 | 3 | 4 | 2 | 2 | 2 | 3 | 4 | 3 | 4 | 3 | 4 | 2 | 1 | 4 | 2 | 4 | 2 |
| Que. | 101 | | | | | | | | | | | | | | | | | | | |
| Ans. | 2 | | | | | | | | | | | | | | | | | | | |

## 24. Wave Optics

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 4 | 1 | 1 | 1 | 1 | 1 | 3 | 2 | 2 | 2 | 1 | 2 | 4 | 1 | 4 | 4 | 4 | 3 | 3 | 2 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 |
| Ans. | 2 | 3 | 3 | 2 | 2 | 2 | 3 | 4 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 4 | 2 | 4 | 3 | 4 |
| Que. | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| Ans. | 4 | 4 | 2 | 3 | 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 2 | 4 | 4 | 2 | 3 | 3 |
| Que. | 61 | 62 | 63 | 64 | 65 | | | | | | | | | | | | | | | |
| Ans. | 2 | 4 | 3 | 1 | 3 | | | | | | | | | | | | | | | |

## 25. Dual Nature of Radiation and Matter

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 4 | 4 | 3 | 3 | 4 | 4 | 3 | 3 | 2 | 3 | 2 | 3 | 3 | 1 | 2 | 4 | 4 | 4 | 3 | 2 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | | | | | | | | | | | |
| Ans. | 4 | 4 | 4 | 4 | 3 | 4 | 4 | 4 | 4 | | | | | | | | | | | |

## 26. Atoms

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 2 | 3 | 2 | 3 | 2 | 2 | 2 | 4 | 3 | 3 | 2 | 4 | 3 | 2 | 2 | 3 | 2 | 2 | 4 | 2 |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | | | | | | | | | | | | | |
| Ans. | 3 | 3 | 4 | 3 | 2 | 2 | 4 | | | | | | | | | | | | | |

## 27. Nuclei

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 2 | 3 | 3 | 2 | 2 | 3 | 4 | 3 | 2 | 4  | 2  | 3  | 3  | 3  | 1  | 4  | 2  | 3  | 2  | 4  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | | | | | | | | | | |
| Ans. | 4 | 3 | 4 | 3 | 4 | 4 | 2 | 3 | 3 | 2 | | | | | | | | | | |

## 28. Semiconductor Electronics: Materials, Devices and Simple Circuits

### ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
|------|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Ans. | 3 | 3 | 1 | 1 | 2 | 1 | 2 | 3 | 2 | 3  | 3  | 1  | 3  | 2  | 1  | 2  | 2  | 3  | 3  | 2  |
| Que. | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | | | | | | |
| Ans. | 2 | 2 | 3 | 1 | 4 | 2 | 4 | 2 | 3 | 4 | 1 | 1 | 4 | 2 | | | | | | |

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