

Following questions are based on assertion and reasoning. Two statements are made here as statement 1 and statement 2. In each of the following question, read the two statements and choose the most appropriate answer from the options given below:

Q1. Statement 1: a cyclist always bends inwards while negotiating a curve.

Because

Statement 2 : by bending he lowers his centre of gravity

- (1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
- (2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
- (3) Statement 1 is correct but statement 2 is false
- (4) Statement 1 is false but statement 2 is correct.

Q2. Statement 1: the angular speed of the planet is smallest in its elliptical path when it is farthest from the Sun.

Because

Statement 2 : In rotational motion of the planets around the Sun, the law of conservation of angular momentum is obeyed.

- (1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
- (2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
- (3) Statement 1 is correct but statement 2 is false
- (4) Statement 1 is false but statement 2 is correct.

Q3. Statement 1 : Aeroplane always fly at low altitude

Because

Statement 2 : according to newton's third law of motion ,for every action there is an equal and opposite reaction.

- (1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
- (2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
- (3) Statement 1 is correct but statement 2 is false
- (4) Statement 1 is false but statement 2 is correct.

Q4. Statement 1 : the fundamental frequency of an open organ pipe increases as the temperature is increased.

Because

Statement 2 : as the temperature increases,the velocity of sound increases more rapidly than length of the pipe.

- (1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
- (2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
- (3) Statement 1 is correct but statement 2 is false
- (4) Statement 1 is false but statement 2 is correct.

Q5. Statement 1 : In the upper part of the atmosphere ,the temperature of air is of the order of 1000K, even then it is quite cold there .

Because

Statement 2 : molecule density at high altitudes is low.

- (1) Both statement 1 and 2 are correct and statement 2 is the correct explanation of statement 1
- (2) Both statement 1 and 2 are correct but statement 2 is not the correct explanation of statement 1
- (3) Statement 1 is correct but statement 2 is false
- (4) Statement 1 is false but statement 2 is correct.

Question (Q6-Q7) are based on short paragraph. Read the paragraph carefully and answer the questions that follow.

Paragraph : A cubical vessel (open from top) of side L is filled with a liquid of density ρ .

Q6. What is the torque of hydrostatic force on a side wall about an axis passing through one of the bottom edges ?

- (1) $\frac{\rho g L^4}{4}$
- (2) $\frac{\rho g L^4}{6}$
- (3) $\frac{2\rho g L^4}{3}$
- (4) $\frac{\rho g L^4}{3}$

Q7. What is the ratio of magnitude of torque on one side wall to the torque on base about the same axis :

- (1) 1 : 1
- (2) 1 : 2
- (3) 1 : 3
- (4) 1 : 4

Question (Q8-Q9) are based on short paragraph. Read the paragraph carefully and answer the questions that follow.

Paragraph : a planet is revolving round the sun in elliptical orbit. Velocity at perigee position (nearest) is v_1 and at apogee (farthest) is v_2 . both these velocities are perpendicular to the line joining centre of Sun and planet. r_1 and r_2 are the minimum and maximum distance .

Q8. When the planet is at perigee position, it wants to revolve in a circular orbit by itself. For this value of G :

- (1) Should increase
- (2) Should decrease
- (3) Will not depend on the value of G
- (4) Data is insufficient

Q9. At apogee position suppose speed of planet is slightly decreased from v_2 , then what will happen to minimum distance r_1 and maximum distance r_2 in the subsequent motion.

- (1) r_1 and r_2 both will decrease
- (2) r_1 and r_2 both will increase
- (3) r_2 will remain as it is while r_1 will increase
- (4) r_2 will remain as it is while r_1 will decrease

Q10. One of the following points, which does not have the same dimension is :

- (1) Moment of inertia and moment of force
- (2) Work and torque
- (3) Angular momentum and planck's constant
- (4) Impulse and momentum

Q11. A body is projected at $t=0$ from a certain point on a planet's surface with a certain velocity at a certain angle with planet's surface (assumed horizontal). the horizontal and vertical co-ordinates vary with time as

$x = 10\sqrt{3}t$ and $y = 10t - t^2$. then the maximum height attained is :

- (1) 25 m
- (2) 50 m
- (3) 75 m
- (4) 100 m

Q12. a rigid spherical body is spinning around an axis without any external torque. Due to change in temperature, its volume increases by 1%. its angular speed ?

- (1) Will increase by nearly 1%
- (2) Will decrease by nearly 1%
- (3) Will decrease nearly by 0.67%
- (4) Will decrease nearly by 0.33%

Q13. A stone attached to one end of a string is revolved around a stick so that the string winds upon the stick and gets shortened. what is conserved ?

- (1) Angular momentum
- (2) Linear momentum
- (3) Kinetic energy
- (4) None of the above

Q14. Speed of a planet in an elliptical orbit with semi major axis a about sun of mass M at a distance r from sun is :

- (1) $\sqrt{GM \left(\frac{2}{r} - \frac{1}{a} \right)}$
- (2) $\sqrt{GM \left(\frac{1}{r} - \frac{1}{a} \right)}$
- (3) $\sqrt{GM \left(\frac{1}{r} - \frac{2}{a} \right)}$
- (4) $\sqrt{\frac{GMr}{2a^2}}$

Q15. If a liquid neither rises nor decreases in a capillary, then it means that :

- (1) Angle of contact is 0°
- (2) Angle of contact may be 90°
- (3) Surface tension of the liquid must be zero
- (4) None of these

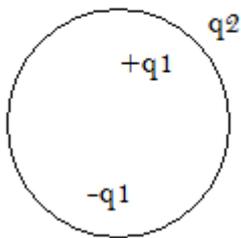
Q16. A particle moves such that its acceleration is given by : $\mathbf{a} = -\beta(\mathbf{x} - 2)$, here β is a positive constant and \mathbf{x} is the position from origin. time period of oscillations is :

- (1) $2\pi\sqrt{\beta}$
- (2) $2\pi\sqrt{\frac{1}{\beta}}$
- (3) $2\pi\sqrt{\beta + 2}$
- (4) $2\pi\sqrt{\frac{1}{\beta+2}}$

Q17. An ideal gas ($\gamma = 1.5$) is expanded adiabatically . how many times has the gas to be expanded to reduce the root mean square velocity of the molecules 2.0 times:

- (1) 4 times
- (2) 16 times
- (3) 8 times
- (4) 2 times

Q18. Consider the charge configuration and a spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to :



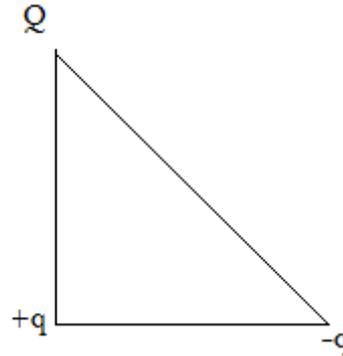
- (1) q_2
- (2) only the positive charges
- (3) All the charges
- (4) $+q_1$ and $-q_1$

Q19. A non-conducting ring of radius 0.5m carries a total charge of $1.11 \times 10^{-10} C$ distributed non-uniformly on its circumference producing an electric field E everywhere in space. The value of the integral $\int_{l=\infty}^{l=0} -E \cdot dl$

($l=0$ being centre of the ring) in volts is:

- (1) +2
- (2) -1
- (3) -2
- (4) Zero

Q20. Three charges Q, -q and +q are placed at the vertices of a right angle triangle (isosceles triangle) as shown. The net electrostatic energy of the configuration is zero if Q is equal to:

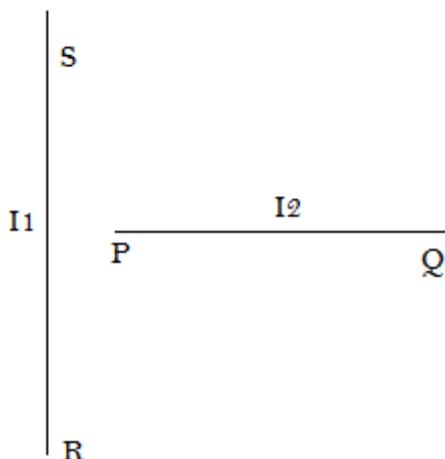


- (1) $\frac{-q}{1+\sqrt{2}}$
- (2) $\frac{-2q}{2+\sqrt{2}}$
- (3) $-2q$
- (4) $+q$

Q21. A uniform magnetic field $\vec{B} = B_0\hat{j}$ exists in space. A particle of mass m and charge q is projected towards negative x-axis with speed v from a point (d,0,0) . the maximum value of v for which the particle does not hit the y-z plane is :

- (1) $\frac{2Bq}{dm}$
- (2) $\frac{Bqd}{m}$
- (3) $\frac{Bq}{m}$
- (4) $\frac{2dm}{Bqd}$

Q22. A current carrying wire PQ is placed near another long current carrying wire RS. The current in the wire RS is I_1 and flows from R to S while the current in the wire PQ is I_2 and flows from P to Q. if free to move .wire PQ will have :



- (1) Translational motion only
- (2) Rotational motion only
- (3) Translational as well as rotational motion
- (4) Neither translational nor rotational motion.

Q23. Magnetic moment of an electron in n th orbit of hydrogen atom is :

- (1) $neh/m\pi$
- (2) $\frac{neh}{4m\pi}$
- (3) $meh/2n\pi$
- (4) $meh/4n\pi$

Q24. A particle of charge q and mass m moves in a circular orbit of radius R with angular speed ω . The ratio of the magnitude of its magnetic moment to that of its angular momentum depends on :

- (1) ω and q
- (2) ω , m and q
- (3) m and q
- (4) ω and m

Q25. A charged particle is released from rest in region of steady and uniform electric and magnetic fields which are parallel to each other. The particle will move in a :

- (1) Straight line
- (2) Circle
- (3) Helix
- (4) Cycloid

Q26. Velocity of charged particle can remain unchanged if :

- (1) It is moving only in magnetic field
- (2) It is moving both in electric and magnetic field
- (3) Neither in electric and magnetic fields
- (4) All the above three.

Q27. Charges distribute themselves over the metallic surface, whatever be the shape :

- (1) Giving equal charge density over the whole surface
- (2) Giving higher charge density round the points and highly curved parts on the surface
- (3) Giving lower potential to the highly curved parts of the surface
- (4) Forming points of high potential at the curved part regions

Q28. A resistance is connected to an AC source. If a capacitor is included in the series circuit the average power provided by the resistance :

- (1) Will increase
- (2) Will decrease
- (3) May increase or decrease
- (4) Will remain constant

Q29. An inductor L is allowed to discharge through a capacitor C . The emf induced across the inductor, when the capacitor is fully charged is :

- (1) Maximum
- (2) Minimum
- (3) Zero
- (4) Infinite

Q30. Lenz's law is a consequence of the law of conservation of :

- (1) Charge
- (2) Mass
- (3) Energy
- (4) Momentum

Q31. A hollow convex lens of glass will behave like a :

- (1) Convex lens
- (2) Concave lens
- (3) Glass plate
- (4) Mirror

Q32. A real image is formed by a convex lens, then it is connected with concave lens and again a real image is formed. this image will :

- (1) Shift towards the lens system.
- (2) Shift away from the lens system
- (3) Remain in its original position
- (4) Shift to infinity.

Q33. . When a ray of light enters a glass from air :

- (1) Its wavelength decreases
- (2) Its wavelength increases
- (3) Its frequency increases
- (4) Neither its wavelength nor its frequency changes.

Q34 light waves travels in vaccum along the y-axis . which of the following may represents the wavefront ?

- (1) $X = \text{constant}$
- (2) $Y = \text{constant}$
- (3) $Z = \text{constant}$
- (4) $X+y = \text{constant}$

Q35. Ratio of maximum kinetic energies of two projectiles of same mass is 4: 1. The ratio of the maximum height attained by them is also 4 :1 .The ratio of their ranges would be :

- (1) 16 : 1
- (2) 4 : 1
- (3) 8 : 1
- (4) 2 : 1

