PHYSICS
AIIMS PATTERN

1. The dimensions of the modulus of rigidity is

(A) $[ML^{-2}T^{-2}]$ (B) $[MLT^{-2}]$ (C) $[ML^{-1}T^{-1}]$ (D) $[ML^{-1}T^{-2}]$

2. One nanometre is equal to

(A) 10^{-7} cm (B) 10^{9} mm (C) 10^{-9} m (D) 10^{-6} cm.

3. The displacement of a body is given to be proportional to the cube of time elapsed. The magnitude of the acceleration of the body, is

(A) constant but not zero (B) increasing with time

(C) zero (D) decreasing with time.

4. The ratio of magnitudes of average speed to average velocity, is

(A) always less than one (B) always equal to one

(C) always more than one (D) equal to or more than one

5. A body A is dropped vertically from the top of a tower. If another identical body B is projected horizontally from the same point at the same instant, then

(A) both A and B will reach the ground simultaneously

(B) A will reach the ground earlier than B

(C) B will reach the ground earlier than A

(D) either A or B can reach the ground earlier depending on their speeds .

6. A particle revolves round a circular path with constant kinetic energy. The acceleration of the particle is inversely proportional to

(A) mass of particle (B) radius (C) velocity (D) both (a) and (b)

7. If the normal contact force is doubled, the coefficient of friction at the contact surface gets

(A) doubled (B) halved (C) not changed (D) tripled

8. The motion of a rocket is based on the principle of conservation of

(A) linear momentum (B) mass (C) angular momentum (D) kinetic energy

9. Kinetic energy, with any reference, must be

(A) negative only (B) zero only (C) positive only (D) non negative

10. A body of mass 5 kg is raised vertically to a height of 10 m by a force of 170 N. The velocity of the body at this height will be nearly

(A) 15 m/s (B) 37 m/s (C) 9.8 m/s (D) 22 m/s

11. Radius of gyration of a body does not depends upon

(A) shape of the body (B) axis of rotation

(C) mass of constituent particles of system (D) rotational motion

12. The moment of inertia of a uniform disc of mass M and radius R about an axis which is tangential to the circumference of the disc and parallel to its diameter, is

(A) $\frac{5}{4}MR^2$ (B) $\frac{3}{2}MR^2$ (C) $\frac{4}{5}MR^2$ (D) $\frac{2}{3}MR^2$

13. Two satellites of mass m_1 and m_2 ($m_1 > m_2$) are going around the earth in orbits of radius r_1 and r_2 ($r_1 > r_2$). Which statement about their velocities is correct?

(A) $v_1 < v_2$ (B) $v_1 > v_2$ (C) $v_1/r_1 = v_2/r_2$ (D) $v_1 = v_2$

14. In what manner does the escape velocity of a particle depend upon its mass ?

(A) m^o (B) m^2 (C) m^{-1} (D) m

15. If S is stress and Y is Young's modulus of a wire material, then energy stored in the wire per unit volume, is

(A) $\frac{S^2}{2Y}$ (B) $\frac{2Y}{S^2}$ (C) $\frac{S}{2Y}$ (D) $2S^2Y$

16. Longitudinal strain is possible in

(A) gases (B) liquids (C) solids (D) all of these

17. The surface tension of liquid decreases with a rise in

(A) diameter of container (B) temperature of the liquid

(C) thickness of container (D) viscosity of the liquid

18. The radius of a soap bubble is r and the surface tension of soap solution is T. Keeping the temperature constant, the extra energy needed to double the radius of the soap bubble slowly by blowing air is

(A) $16\pi r^2T$ (B) $32\pi r^2T$ (C) $8\pi r^2T$ (D) $24\pi r^2T$

19. The bulb of one thermometer is spherical,other is oval, while that of another is cylindrical. If both of them have equal amounts of mercury, which one will respond quickly to the temperature ?

(A) oval (B) Spherical (C) Cylindrical (D) Both (B) and (C) equally

20. A metal rod at a temperature of 150ºC, radiates energy at a rate of 20 W. If its temperature is increased to 300ºC, then it will radiate at the rate of

(A) 40.8 W (B) 17.5 W (C) 67.3 W (D) 80 W

21. If C_P and C_V are the molarspecific heats for a gas at constant pressure and at constant volume respectively, then the relation $C_P - C_V = R$ is exact for

(A) ideal gas and nearly true for real gases at high pressure.

(B) ideal and real gases at all pressure

(C) ideal gas at all pressure and nearly true for real gases at high temperature and low pressure

(D) ideal gas at all pressure and real gas at low temperature and at high temperature and low pressure

22. A certain mass of an ideal gas at 273 K is expanded to 81 times its volume under adiabatic conditions. If $\gamma = 1.25$ for the gas then its final temperature is

(A) –182ºC (B) 0ºC (C) –235ºC (D) –91ºC

23. For Boyle's law to hold good, the gas should be

(A) perfect and at constant temperature but variable mass

(B) perfect and of constant mass and temperature

(C) real and at constant temperature but variable mass

(D) real and of constant mass and temperature.

24. In a vessel, the gas is at a pressure P. If the mass of all the molecules is halved and their speed is doubled, then the resultant pressure will be

(A) P (B) 4P (C) P/2 (D) 2P

25. The composition of two simple harmonic motions of equal periods at right angles to each other and with a phase difference of π, results in the displacement of the particle along a

(A) straight line (B) circle (C) parabola (D) ellipse

26. The time period of a body executing SHM is 4 sec. After how much time interval from time t = 0, its displacement will be half of its amplitude ?

(A) $\frac{1}{4}$sec (B) $\frac{1}{2}$sec (C) $\frac{1}{6}$sec (D) $\frac{1}{3}$sec

27. The frequency of a tuning fork is 256 Hz. It will not resonate with a fork of frequency

(A) 738 Hz (B) 256 Hz (C) 768 Hz (D) 512 Hz

28. A tube closed at one end containing air produces fundamental note of frequency 512 Hz. If the tube is open at both the ends, the fundamental frequency will be

(A) 1024 Hz (B) 256 Hz (C) 1280 Hz (D) 768 Hz

29. A particle is performing simple harmonic motion along x-axis with amplitude 4 cm and time pariod 1.2 sec. The minimum time taken by the particle to move from x = + 2 to x = + 4 cm and back again is given by

(A) 0.4 s (B) 0.3 s (C) 0.2 s (D) 0.6 s

30. A body of mass M is situated in a potential field $U(x) = U_0 (1 - \cos kx)$, where U_0 and k are constants. The time period of small oscillation will be

(A) $2\pi k\sqrt{MU_0}$ (B) $\frac{2\pi}{k}\sqrt{\frac{M}{U_0}}$ (C) $2\pi k\sqrt{\frac{U_0}{M}}$ (D) $\frac{2\pi}{k}\sqrt{\frac{U_0}{M}}$

31. Find the distance between two successive nodes if equation of a stationary wave is

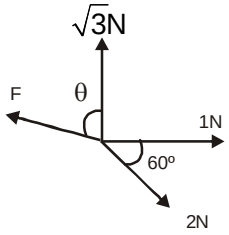
$$y = 10 \sin \frac{\pi x}{4} \cos 20\ \pi t$$

(A) 4 (B) 2 (C) 1 (D) 8

32. A uniform rope having linear density λ hangs vertically from the ceiling and its lower end is free. A disturbance produced at the free end has a speed V_0 at point P mid way on the rope. Then, the time taken by the disturbance pulse to reach the ceiling is

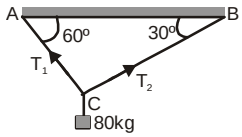
(A) $\frac{4v_0}{g}$ (B) $\frac{2\sqrt{2}\ V_0}{g}$ (C) $\frac{2\sqrt{2}\ V_0^2}{\pi g}$ (D) $\frac{2\sqrt{2}\ V_0}{\lambda g}$

33. Four concurrent coplanar forces in Newton are acting at a point as shown in figure and keep it in equilibrium. Then value of F and θ are



(A) 1 N, 60° (B) 2 N, 60° (C) $\sqrt{2}$ N, 90° (D) 2 N, 90°

34. A mass 80 kg is supported by two light inextensible cables as shown in figure. Then the ratio of tensions T_1 and T_2 is

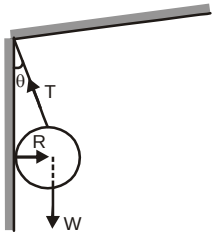


(A) 1:2 (B) 1:1 (C) $\sqrt{3}:1$ (D) $1:\sqrt{3}$

35. If $\vec{A}_1$ and $\vec{A}_2$ are two non-collinear unit vectors and if $|\vec{A}_1 + \vec{A}_2| = \sqrt{3}$, then the value of $(\vec{A}_1 - \vec{A}_2).(2\vec{A}_1 + \vec{A}_2)$ is

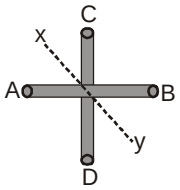
(A) 1 (B) 1/2 (C) 3/2 (D) 2

36. A sphere of weight W is hanging against a wall as shown in fig. Which of the relation is incorrect ?



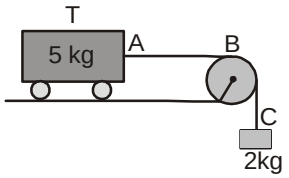
(A) $\vec{T} + \vec{W} + \vec{R} = 0$ (B) T sinθ = R (C) T = W/cos θ (D) W – R =T/cosθ

37. AB and CD are two identical rods each of length l and mass m joined to form a corss. The moment of inertia of these two rods about a bisector (XY) of angle between the rods, fig. is



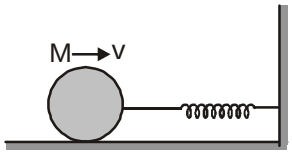
(A) $\frac{ml^2}{12}$ (B) $\frac{ml^2}{3}$ (C) $\frac{2ml^2}{3}$ (D) $\frac{ml^2}{6}$

38. A trolley T of mass 5 kg on a smooth horizontal surface is pulled by a load of 2 kg through a uniform rope ABC of length 2m and mass 1 kg. as shown in figure. As the load falls from BC = 0 m to BC = 2m, its acceleration, in m/s^2 changes from



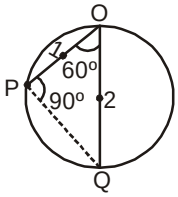
(A) $\frac{20}{6}$ to $\frac{30}{6}$ (B) $\frac{20}{8}$ to $\frac{30}{8}$ (C) $\frac{20}{6}$ to $\frac{30}{8}$ (D) none of the above

39. A solid sphere rolls without slipping and presses a spring of spring constant k as shown in figure. Then the maximum compression in the spring will be



(A) $v\sqrt{\frac{5M}{2K}}$ (B) $v\sqrt{\frac{2M}{5K}}$ (C) $v\sqrt{\frac{5M}{7K}}$ (D) $v\sqrt{\frac{7M}{5K}}$

40. Two particles 1 and 2 are allowed to descend on frictionless chord OP and diameter OQ respectively as shown in figure. The ratio of the speeds of the particles 1 and 2 respectively when they reach on the circumference is



(A) 1 (B) $\frac{1}{2}$ (C) $\frac{1}{4}$ (D) $2\frac{1}{\sqrt{2}}$

Assertion & Reason

Questions with Assertion A and Reason R

(A) Both A and R are true and R is correct explanation of A.

(B) Both A and R are true but R is not correct explanation of A.

(C) A is true, R is false.

(D) Both A and R are false.

41. **Assertion** : Soldiers are asked to break steps while crossing the bridge.

Reason : The frequency of thick marching may be equal to the natural frequency of bridge and may lead to resonance which can break the bridge.

42. **Assertion** : A cyclist leans inwards while taking a turn, while a man sitting in a car leans outwards on a curve.

Reason : Centripetal acceleration is acting towards the centre of the curve in motion along a curved path.

43. **Assertion** : It is difficult to move a cycle along the road with its brakes on.

Reason : Sliding friction is greater than rolling friction.

44. **Assertion** : If polar ice melts, days will be longer.

Reason : Moment of inertia increases and thus angular velocity decreases.

45. **Assertion** : The comets do not obey Kepler's laws of planetary motion.

Reason : The comets do not have elliptical orbits.

46. **Assertion** : A needle placed carefully on the surface of water may float, whereas a ball of the same material will always sink.

Reason : The buoyant force on an object depends both on the material and shape of the object.

47. **Assertion** : A hollow metallic closed container blackend and maintained at a uniform temperature can act as a source of black body radiation.

Reason : All metals act as black bodies.

48. **Assertion** : At room temperature water does not sublimate from ice to steam.

Reason : The critical point of water is much above the room temperarture.

49. **Assertion** : The ratio C_P/C_V for a diatomic gas is more than that for a monotomic gas.

Reason : The molecules of a monotomic gas have more degree of freedom than those of a diatomic gas.

50. **Assertion** : On a rainy day, it is difficult to drive a car or bus at high speed.

Reason : The value of coefficient of friction is lowered on wetting the surface.

51. **Assertion** : Centripetal force does no work.

Reason : Force and displacement are perpendicular to each other.

52. **Assertion** : If ice cap of the pole melts, the duration of a day will get shorten.

Reason : Ice will flow towards the equator and decrease the moment of inertia of the earth. This increases the frequency of rotation of the earth.

53. **Assertion** : Water kept in an open vessel will quickly evaporate on the surface of the moon.

Reason : The temperature at the surface of the moon is much higher than the boiling point of water.

54. **Assertion** : Lead is more elastic than rubber.

Reason : If the same load is attached to lead and rubber wires of the same cross-sectional area, the strain of lead is very much less than that of rubber.

55. **Assertion** : The shape of an automobile is so designed that its front resembles the streamline pattern of the fluid through which it moves.

Reason : The shape of front of an automobile if in shape of a bullet helps to creat an upward thrust which reduces friction offered by road.

56. **Assertion** : The ratio C_p/C_v is more for helium gas than for hydrogen gas.

Reason : C_p is lower for higher atomicity.

57. **Assertion** : It is not possible for a system, unaided by an external agency to transfer heat from a body at a lower temperature to another at a higher temperature.

Reason : It is not possible to violate the second law of thermodynamics.

58. **Assertion** : For a constant mass sample of an ideal gas, at constant temperature, the product of the pressure and volume is a constant.

Reason : The mean square velocity of the molecules is inversely proportional to square root molar mass.

59. **Assertion** : Resonance is a special case of forced vibration in which the natural frequency of vibration of the body is the same as the impressed frequency and the amplitude of force vibration, is maximum.

Reason : The amplitude of forced virbations of a body increases with an increase in the frequency of the externally impressed periodic force.

60. **Assertion** : When two vibrating tuning forks having frequencies 256 Hz and 512 Hz are held near each other, beats cannot be heared.

Reason : The principle of superposition is valid only if the frequencies of the oscillators are nearly equal.

ANSWERS KEY

[PHYSICS]

1.	(D)	2.	(C)	3.	(B)	4.	(D)	5.	(A)	6.	(B)	7.	(C)
8.	(A)	9.	(D)	10.	(D)	11.	(D)	12.	(A)	13.	(A)	14.	(A)
15.	(A)	16.	(C)	17.	(B)	18.	(D)	19.	(C)	20.	(C)	21.	(C)
22.	(A)	23.	(B)	24.	(D)	25.	(A)	26.	(D)	27.	(A)	28.	(A)
29.	(A)	30.	(B)	31.	(A)	32.	(B)	33.	(D)	34.	(C)	35.	(B)
36.	(D)	37.	(A)	38.	(B)	39.	(D)	40.	(B)	41.	(A)	42.	(B)
43.	(A)	44.	(A)	45.	(D)	46.	(C)	47.	(C)	48.	(C)	49.	(D)
50.	(A)	51.	(A)	52.	(D)	53.	(C)	54.	(A)	55.	(C)	56.	(C)
57.	(A)	58.	(B)	59.	(C)	60.	(C)						