SATISH SCIENCE ACADEMY

DHANORI PUNE-411015

PHYSICS

MHT - CET - Physics

Time Allowed: 1 hour **Maximum Marks: 50**

1. If the radius of curvature of the path of two particles of same masses are in the ratio 1 : 2, then in order to have constant centripetal force, their velocity, should be in the ratio of **[1]**

   a) 1 : 4 b) 4 : 1

   c) $\sqrt{2}$: 1 d) 1 : $\sqrt{2}$

2. The path followed by projectile is called _____. **[1]**

   a) projection b) trajectory

   c) ellipse d) parabola

3. A steel bar AB of mass 10 kg and length 1 m is kept horizontal by supporting it at the two ends. Two weights of 4 kg and 6 kg are suspended from points of the bar at distances 30 cm and 80 cm respectively from the end A. The reaction at the end A is **[1]**

   a) 97.8 N b) 78.2 N

   c) 107.8 N d) 88.2 N

4. Particle of masses m, 2m, 3m, ..., nm grams are placed on the same line at distance l, 2l, 3l, ..., nl cm from a fixed point. The distance of centre of mass of the particles from the fixed point in centimetres is **[1]**

   a) $\frac{l}{n+1}$ b) $\frac{(2n+1)l}{3}$

   c) $\frac{2l}{n(n^2+1)}$ d) $\frac{n(n^2+1)l}{2}$

5. A spherical planet far out in space has a mass M_0 and diameter D_0. A particle of mass m falling freely near the surface of this planet will experience an acceleration due to gravity which is equal to **[1]**

   a) $\frac{4mGM_0}{D_0^2}$ b) $\frac{GM_0}{D_0^2}$

   c) $\frac{GmM_0}{D_0^2}$ d) $\frac{4GM_0}{D_0^2}$

6. A satellite of mass m moves around the Earth in a circular orbit with speed v. The potential energy of the satellite is **[1]**

   a) $\frac{3}{2}$ mv^2 b) mv^2

   c) -mv^2 d) $-\frac{3}{2}$ mv^2

7. Two iron bars of same length with unequal radii are heated for the same rise in temperature. Then linear expansion will be **[1]**

   a) more in thick rod. b) more in thin rod.

   c) same for both rods. d) twice in thin rod.

8. For any given scale X, the ice point is 40° and the steam point is 120°. For another scale Y, the ice point and steam point are -30° and 130° respectively. If X reads 50°, then Y would read **[1]**

a) -10°
b) -8°
c) -5°
d) -12°

9. A source of sound when moves towards a stationary observer, then frequency of the sound heard by listener is more than actual frequency because the **[1]**

a) apparent wavelength of sound increases.
b) velocity of sound increases.
c) velocity and apparent wavelength of sound increases.
d) apparent wavelength of sound decreases.

10. When both source and listener approach each other with a velocity equal to half the velocity of sound, the change in frequency of the sound as detected by the listener is **[1]**

a) 150%
b) 200%
c) 300%
d) 100%

11. Magnifying power of a telescope in normal adjustment when final image of a star is formed at infinity is 9. The tube length of the telescope is 60 cm, then focal length of objective is **[1]**

a) 36 cm
b) 54 cm
c) 6 cm
d) 9 cm

12. A small angled prism of refractive index 1.6 gives a deviation of 3.6°. The angle of prism is _____. **[1]**

a) 8°
b) 5°
c) 7°
d) 6°

13. A charge q_1 exerts some force on a second charge q_2. If third charge q_3 is brought near charge q_1, the force of q_1 exerted on q_2 **[1]**

a) increases.
b) increases if q_3 is of the same sign as q_1 and decreases if q_3 is of opposite sign.
c) decreases.
d) remains unchanged.

14. Pick out the statement which is incorrect. **[1]**

a) Field lines never intersect.
b) The electric field lines forms closed loop.
c) A negative test charge experiences a force opposite to the direction of the field.
d) The tangent drawn to a line of force represents the direction of electric field.

15. To a germanium sample, traces of gallium are added as an impurity. The resultant sample would behave like **[1]**

a) an insulator
b) a p-type semiconductor
c) an n-type semiconductor
d) a conductor

16. Calculate the angular momentum of the earth due to rotation about its own axis. Assume that the earth is a sphere of mass 6×10^{24} kg and radius 6400 km. **[1]**

a) 71.45×10^{31} kg m^2 s^{-1}
b) 7.145×10^{33} kg m^2 s^{-1}

c) 71.45×10^{30} kg m^2 s^{-1}

d) 714.5×10^{32} kg m^2 s^{-1}

17. If the moment of inertia of a body is 2.5 kg m^2, then the torque required to produce an angular acceleration of 18 rad/s^2 in the body is **[1]**

a) 45 Nm

b) 47 Nm

c) 55 Nm

d) 50 Nm

18. When the bob of a conical pendulum is moving in a horizontal circle at constant speed, which quantity is fixed? **[1]**

a) Centripetal force

b) Acceleration

c) Kinetic energy

d) Velocity

19. Angular velocity of hour arm of a clock, in rad/s, is **[1]**

a) $\frac{\pi}{30}$

b) $\frac{\pi}{43200}$

c) $\frac{\pi}{1800}$

d) $\frac{\pi}{21600}$

20. A coin is placed on a horizontal platform which undergoes vertical simple harmonic motion of angular frequency ω. The amplitude of oscillation is gradually increased. The coin will leave contact with the platform for the first time **[1]**

a) for an amplitude of $\frac{g}{\omega^2}$.

b) at the highest position of the platform.

c) for an amplitude of $\frac{g^2}{\omega^2}$.

d) at the mean position of the platform.

21. In a simple pendulum, the period of oscillation T is related to length of the pendulum l as **[1]**

a) $\frac{l^2}{\mathrm{T}} = \text{constant}$

b) $\frac{l}{\mathrm{T}^2} = \text{constant}$

c) $\frac{l}{T} = \text{constant}$

d) $\frac{l^2}{\mathrm{T}^2} = \text{constant}$

22. Two simple harmonic motions are represented by the equations $y_1 = 0.1 \sin\left(100\pi + \frac{\pi}{3}\right)$ and $y_2 = 0.1 \cos \pi$ t. **[1]**
The phase difference of the velocity of particle 1 with respect to the velocity of particle 2 is

a) $\frac{\pi}{3}$

b) $\frac{\pi}{6}$

c) $\frac{-\pi}{3}$

d) $\frac{-\pi}{6}$

23. A current of $\frac{25}{\pi}$ Hz frequency is passing through an A.C. circuit having series combination of R = 100 Ω and L = 2 H, the phase difference between voltage and current is _____. **[1]**

a) 30°

b) 60°

c) 45°

d) 90°

24. Consider a liquid at rest in a container which opens into atmosphere. At any point A at a depth h below the surface of the liquid, **[1]**

i. the gauge pressure at point A is ρgh.

ii. the gauge pressure at point A is $P_a + \rho$gh.

iii. The total pressure at point A is ρgh.

iv. The total pressure at point A is $P_a + \rho$gh.

The correct alternative is

a) (ii) and (iv)

b) (iii) and (iv)

c) (i) and (iv)

d) (i) and (iii)

25. An incompressible fluid flows steadily through a cylindrical pipe which has radius 2R at a point A and radius R at B. If the velocity at point A is v, its velocity at point B will be **[1]**

a) 2v

b) 4v

c) v

d) $\frac{v}{2}$

26. A source of sound placed at the open end of a resonance column sends an acoustic wave of pressure amplitude p_0 inside the tube. If the atmospheric pressure is p_A, then the ratio of maximum and minimum pressures at the closed end of the tube will be **[1]**

a) $\frac{\left(p_A+\frac{1}{2}p_0\right)}{\left(p_A-\frac{1}{2}p_0\right)}$

b) $\frac{\left(p_A+2p_0\right)}{\left(p_A-2p_0\right)}$

c) $\frac{p_A}{p_0}$

d) $\frac{\left(p_A+p_0\right)}{\left(p_A-p_0\right)}$

27. In open organ pipe, if fundamental frequency is n, then the other frequencies are **[1]**

a) n, n^2, n^3, ...

b) n, 2n, 4n, 8n

c) n, 3n, 5n

d) n, 2n, 3n, 4n

28. Which of the following surfaces will radiate maximum heat? **[1]**

a) Bright (white)

b) Bright (black)

c) Black (rough)

d) White (rough)

29. Which of the following formulae is wrong? **[1]**

a) $C_p = \frac{\gamma R}{\gamma-1}$

b) $C_v = \frac{R}{\gamma-1}$

c) $\frac{C_p}{C_v} = \gamma$

d) $C_p - C_v = 2R$

30. The temperatures of two bodies A and B are 727 ^oC and 127 ^oC. The ratio of rates of emission of radiations will be **[1]**

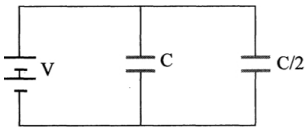
a) $\frac{100}{16}$

b) $\frac{1000}{400}$

c) $\frac{727}{127}$

d) $\frac{625}{16}$

31. Two condensers, one of capacity C and the other of capacity $\frac{C}{2}$, are connected to a V-volt battery as shown **[1]**



The work done in charging fully both the condensers is

a) $\frac{1}{4}CV^2$

b) $\frac{1}{2}CV^2$

c) $2CV^2$

d) $\frac{3}{4}CV^2$

32. Two insulated spheres of radii R_1 and R_2 having charges Q_1 and Q_2 respectively are connected to each other. **[1]**

There is

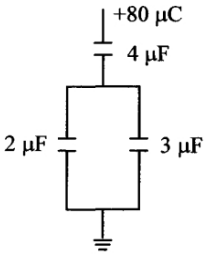
a) a decrease in the energy of the system unless $Q_1R_2 = Q_2R_1$.

b) no change in the energy of the system.

c) an increase in the energy of the system.

d) always a decrease in the energy of the system.

33. In the given circuit, a charge of +80 μC is given to upper plate of a 4 μF capacitor. At steady state the charge on the upper plate of the 3 μF capacitor is **[1]**



a) 80 μC

b) 0 μC

c) 48 μC

d) 60 μC

34. The smallest angular or linear separation between the two point objects at which they appear to be just resolved is known as **[1]**

a) resolving power of optical instrument.

b) Airy's disc.

c) numerical aperture.

d) limit of resolution of an optical instrument.

35. Longitudinal waves do not exhibit _____. **[1]**

a) polarisation

b) diffraction

c) reflection

d) refraction

36. Two coherent sources of intensities I_1 and I_2 produce an interference pattern. The maximum intensity in the interference pattern will be **[1]**

a) $I_1 + I_2$

b) $I_1^2 + I_2^2$

c) $\left(\sqrt{I_1} + \sqrt{I_2}\right)^2$

d) $(I_1 + I_2)^2$

37. In an ammeter, 10% of the main current is passing through galvanometer, if the galvanometer is shunted with a 10 Ω resistance. What is the resistance of the galvanometer? **[1]**

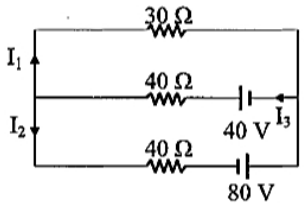
a) 50 Ω

b) 90 Ω

c) 100 Ω

d) 20 Ω

38. In the given circuit, the current I_1 is **[1]**



a) 0.4 A

b) - 0.8 A

c) 0.8 A

d) - 0.4 A

39. If a velocity has both perpendicular and parallel components while moving through a magnetic field, what is the path followed by a charged particle? **[1]**

a) Elliptical

b) Linear

c) Helical

d) Circular

40. A particle of mass 'm' and charge 'q' is incident on XZ plane with velocity 'v' in a direction making angle 'θ' with a uniform magnetic field applied along X-axis. The nature of motion performed by the particle is **[1]**

a) helical

b) parabola

c) straight line

d) circular

41. The phenomenon in which magnetic field is produced in the space near a conductor carrying current is called _____. **[1]**

a) thermionic effect

b) magnetic effect of electric current

c) heating effect

d) photoelectric effect

42. A substance is placed in a non uniform magnetic field. It experiences weak force towards the strong field. The substance is _____ type. **[1]**

a) Triomagnetic

b) Diamagnetic

c) Ferromagnetic

d) Paramagnetic

43. The armature coil of an a.c. generator has 1000 turns, each of area 2 m^2. It was rotating in a uniform magnetic field of B = 0.2 T at an angular speed of 60 rad/s. It was found that in a certain position of the coil, the current in the circuit became zero. What was the flux in the coil? **[1]**

a) 200 Wb

b) 250 Wb

c) 400 Wb

d) 300 Wb

44. In a coil, rate of change of area is 5 m^2/milli second and current becomes 1 ampere from 2 ampere in 2×10^{-3} s. If magnitude of field is 1 tesla, then self inductance of the coil is **[1]**

a) 5 H

b) 2 H

c) 20 H

d) 10 H

45. A surface receives light of wavelength λ_1 = 450 nm, causing the ejection of photo-electrons for which the stopping potential is Vs_1 = 0.2 V. If the radiations of wavelength λ_2 = 120 nm are now incident on the surface, the threshold frequency for the surface is **[1]**

a) 8.5×10^{14} Hz

b) 6.2×10^{14} Hz

c) 4.3×10^{13} Hz

d) 2.4×10^{13} Hz

46. The minimum kinetic energy of a ground state hydrogen atom required to have head-on collision with another ground state hydrogen atom but at rest to produce a photon is given by **[1]**

a) 2.04 eV

b) -9.1 eV

c) 20.4 eV

d) 4.20 eV

47. An electron of stationary hydrogen atom jumps from 4^{th} energy level to ground level. The velocity that the photon acquired as a result of electron transition will be (h = Planck's constant, R = Rydberg's constant, m = mass of photon) **[1]**

a) $\frac{13hR}{16\ m}$

b) $\frac{11hR}{16\ m}$

c) $\frac{9Rh}{16\ m}$

d) $\frac{15hR}{16\ m}$

48. A nucleus of mass 20 u emits a γ photon of energy 6 MeV. If the emission assume to occur when nucleus is free and rest, then the nucleus will have kinetic energy nearest to (take 1 u = 1.6×10^{-27} kg) **[1]**

a) 0.1 keV

b) 1 ke V

c) 100 ke V

d) 10 keV

49. Truth table given below represents **[1]**

A	B	Y
0	0	1
0	1	0
1	0	0
1	1	0

a) NAND gate

b) OR gate

c) AND gate

d) NOR gate

50. A litre of dry air at S.T.P. expands adiabatically to a volume of 3 litres. If γ = 1.40, the work done by air is ($3^{1.4}$ = 4.6555) [Take air to be an ideal gas] **[1]**

a) 90.5 J

b) 100.8 J

c) 48 J

d) 60.7 J