

SATISH INTERNATIONAL SCHOOL

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PHYSICS

JEE main - Physics

Maximum Marks: 100

[4]

Time Allowed: 1 hour General Instructions:

- All questions are compulsory.
- There are 25 questions where the first 20 questions are MCQs and the next 5 are numerical.
- You will get 4 marks for each correct response and 1 mark will be deducted for an incorrect answer.

PHYSICS (Section-A)

b) [ML²T⁻²]

d) [MLT⁻²]

- 1. The dimensional formula of Young's modulus is:
 - a) $[ML^{-1}T^{-2}]$
 - c) [MLT-3]
- 2. A particle starts out at t = 0 s from point x_0 = 20 m with an initial velocity v_0 = 15 m/s and a constant retardation [4]

5 m/s². Then its associated velocity-time and position-time graphs respectively would be



3. Two particles are projected from the ground simultaneously with speeds 20 m/s and $\frac{20}{\sqrt{3}}$ m/s at angles 30° and [4] 60° with the horizontal in the same direction. The maximum distance between them till both of them strike the ground is approximately: (g = 10 m/s²)

a) 10.4 m	b) 30.2 m
c) 16.4 m	d) 23.09 m

4. A particle is moving in a vertical circle. The tensions in the string when passing through two positions at angles [4] 30° and 60° from vertical (lowest position) are T₁ and T₂ respectively then:

a) tension in the string always remains the b) $T_1 = T_2$

same

c) $T_2 > T_1$	d) $T_1 > T_2$

5. For a body moving in a circular path, the work done by the centripetal force is:

a) Zero	b) Nagative
c) Positive	d) Constant

6. Find the torque about the origin when a force of $3\hat{j}$ N acts on a particle whose position vector is $2\hat{k}$ m. [4]

a) 6 \hat{k} N m	b) - \hat{i} N m
c) $\hat{6j}$ N m	d) $\hat{6i}$ N m

7. A liquid is kept in a cylindrical vessel, which is rotated along its axis (vertical) as shown in figure. The liquid [4] rises at the sides. If the radius of the vessel is 5 cm and speed of rotation is 120 rpm, the difference in the levels h of the liquid at the centre and sides is:



a) 1 cm

- c) 3 cm
- 8. When a metal rod is heated it expands because:
 - a) the size of its atoms increases b) atmospheric air rushes into it
 - c) the distance among its atoms increases d) the actual cause is still unknown
- 9. When a gas enclosed in a closed vessel was heated so as to increase its temperature by 5°C, its pressure was seen [4] to have increase by 1%. The initial temperature of the gas was nearly:

b) 4 cm

d) 2 cm

a) 105°C	b) 500°C
c) 273°C	d) 227°C

- 10. A pendulum of length l = 1 m is released from $\theta_0 = 60^\circ$. The rate of change of speed of the bob at $\theta = 30^\circ$ is: (g [4] = 10 m/s²)
 - a) 5 m/s^2 b) 10 m/s^2 c) $5\sqrt{3} \text{ m/s}^2$ d) 2.5 m/s^2

A capacitor of capacity C₁ is charged upto potential V volt and then connected in parallel to an uncharged [4]
 capacitor of capacity C₂. The final potential difference across each capacitor will be:

a)
$$\frac{C_1 V}{C_1 + C_2}$$

b) $\left(1 - \frac{C_2}{C_1}\right) V$
c) $\left(1 + \frac{C_2}{C_1}\right) V$
d) $\frac{C_2 V}{C_1 + C_2}$

12. The magnetic field due to a straight conductor of uniform cross-section of radius a and carrying a steady current [4] is represented by

[4]

[4]



14. A solenoid of length 1 metre has self-inductance L henry, if the number of turns are doubled, it's self-inductance: [4]

b) becomes 4 L henry

d) becomes 3L henry

c) becomes $\frac{L}{\sqrt{2}}$ henry

15. The armature of DC motor has 20 Ω resistance. It draws a current of 2.5 ampere when run by 220 volt DC [4] supply. The value of back emf induced in it will be:

a) 180 V

16.

The energy contained in a small volume through which an electromagnetic wave is passing oscillates with: [4]

b) 190 V

d) 150 V

- a) zero frequency b) the frequency of the wave
- c) double of the frequency of wave d) half of the frequency of the wave
- 17. One milliwatt of light of wavelength 4560 $\stackrel{o}{A}$ is incident on a caesium surface of work function 1.9 eV. Given that [4] quantum efficiency of photoelectric emission is 0.5 %, Planck constant h = 6.62×10^{-34} J-sec, velocity of light C = 3×10^8 m/s, the photoelectric current liberated is:
 - a) 1.856×10^{-4} amp b) 1.856×10^{-7} amp c) 1.856×10^{-6} amp d) 1.856×10^{-5} amp
- 18. The frequency of the first line of the Balmer series in a hydrogen atom is v_0 Hz. The frequency v of the line [4] emitted by a singly ionised He-atom is:
 - a) $4v_0 Hz$ b) $(\frac{v_0}{4}) Hz$ c) $(\frac{v_0}{2}) Hz$ d) $2v_0 Hz$

19. An unstable heavy nucleus at rest breaks into two nuclei which move away with velocities in the ratio of 8:27. [4]

[4]

The ratio of the radii of the nuclei (assumed to be spherical) is:

a) 8 : 27 b) 2 : 3

20. The correct symbol for Zener diode is:



PHYSICS (Section-B)

- 21. Two unit negative charges are placed on a straight line. A positive charge 'q' is placed exactly at the mid-point [4] between these unit charges. If the system of three charges is in equilibrium the value of q (in C) is:
- 22. Acceleration due to gravity on moon is $\frac{1}{6}$ th of the acceleration due to gravity on earth. If the ratio of densities of **[4]** earth (ρ_e) and moon (ρ_m) is $\left(\frac{\rho_e}{\rho_m}\right) = \frac{5}{3}$, then radius of moon R_m is kR_e . What will be the value of k?
- 23. A particle of mass 0.1 kg is attached to one end of a mass-less spring of force constant 10 Nm⁻¹, lying on a frictionless horizontal plane. The other end of the spring is fixed. The particle starts moving horizontally from its equilibrium position at time t = 0 with an initial velocity u_0 . When the speed of the particle is 0.5 u_0 , it collides elastically with a rigid wall. The time at which the particle passes through the equilibrium position for the second time is _______s. (Take $\pi = 3.14$)
- 24. Switch S is closed for long-time in the given figure. Find the current through the inductor just after switch S is **[4]** opened.



25. Starting at temperature 300 K, one mole of an ideal diatomic gas ($\gamma = 1.4$) is first compressed adiabatically from **[4]** volume V₁ to V₂ = $\frac{V_1}{16}$. It is then allowed to expand isobarically to volume 2V₂. If all the processes are quasistatic then the final temperature of the gas (in ^oK) is (to the nearest integer) _____.

[4]