

1	Exam	Exam Set	Roll No	Name	Total Marks	Grade	Rank	Corre
2	26 ELECTROSTATICS		12723	SHUBHAYAN KUILA	56.0		1	15
3	26 ELECTROSTATICS		12717	TATHAGATO PAL	55.0		2	15
4	26 ELECTROSTATICS		12925	ANURAG PATRA	44.0		3	12
5	26 ELECTROSTATICS		00000		41.0		4	11
6	26 ELECTROSTATICS		12724	MAYUKH SARDAR	41.0		4	11
7	26 ELECTROSTATICS		12104	PRERONA MUKHERJEE	40.0		6	10
8	26 ELECTROSTATICS		12907	ARIJIT MONDAL	38.0		7	10
9	26 ELECTROSTATICS		12609	RAJDEEP DEBNATH	37.0		8	10
10	26 ELECTROSTATICS		12903	SABUJ MONDAL	35.0		9	9
11	26 ELECTROSTATICS		12131	ANANYA GHOSH	34.0		10	9
12	26 ELECTROSTATICS		12904	ANKAN KARMAKAR	32.0		11	8
13	26 ELECTROSTATICS		12917	ARPITA KHASKEL	32.0		11	9
14	26 ELECTROSTATICS		12911	RACHAITA NATH	29.0		13	9
15	26 ELECTROSTATICS		12725	ARAV ARYAN	28.0		14	8
16	26 ELECTROSTATICS		12901	ANWESHA ROY	28.0		14	8
17	26 ELECTROSTATICS		12915	MOYUKH MAHAPATRA	27.0		16	7
18	26 ELECTROSTATICS		12912	SOUMIK CHAKRABORTY	26.0		17	7
19	26 ELECTROSTATICS		12619	TRISHA SAMADDAR	25.0		18	8
20	26 ELECTROSTATICS		12704	ARKAKYOTI DASH	25.0		18	7
21	26 ELECTROSTATICS		12922	DEBOJIT BANIK	25.0		18	7
22	26 ELECTROSTATICS		12636	SOHAM SEN	19.0		21	6
23	26 ELECTROSTATICS		12908	TANUSKA BISWAS	19.0		21	5
24	26 ELECTROSTATICS		12924	TIYASHA SAHA	15.0		23	5
25	26 ELECTROSTATICS		12921	ANISHA MALLICK	12.0		24	4
26	26 ELECTROSTATICS		12902	SAMPURNA DAS	9.0		25	3
27	26 ELECTROSTATICS		12729	SOHINI SARKAR	6.0		26	3
28	26 ELECTROSTATICS		12914	BISWARUPA KARMAKAR	6.0		26	4
29	26 ELECTROSTATICS		12708	NAMRATA BAIDYA	4.0		28	2
30	26 ELECTROSTATICS		12727	SRIJITA DAS	-1.0		29	2
31	26 ELECTROSTATICS		12804	MRINMAY MONDAL	-5.0		30	0
32	26 ELECTROSTATICS		12703	ADRITO BERA	-7.0		31	2

Result

Written Test

Tathagato - 24

Shubhayan - 24

Namrota - 17.5

Adrito - 8.5

Aarav - 15.5

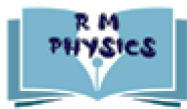
Om - 20

Mayukh - 21.5

Arkojyoti - 19

Srjita - 6

Sohini - 16



R.M. PHYSICS TUTORIALS

NEET, JEE MAIN & WBJEE

FULL PAPER

FM : 180

DURATION : 1 hr

1. What are the dimensions of A/B in the relation $F = A\sqrt{x} + Bt^2$, where F is the force, x is the distance and t is time?

- (a) ML^2T^{-2} (b) $L^{-1/2}T^2$
(c) $L^{-1/2}T^{-1}$ (d) LT^{-2}

2. The speed of a swimmer in still water is 16 m/s. The speed of river water is 8 m/s and is flowing due east. If he is standing on the south bank and wishes to cross the river along the shortest path. The angle at which he should make his strokes w.r.t. north is given by

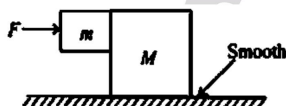
- (a) 60° west (b) 45° west
(c) 30° west (d) 0°

3. The equation of trajectory of projectile is given by $y = x/\sqrt{3} - gx^2/20$, where x and y are in metre. The maximum range of the projectile is

- (a) $8/3$ m (b) $4/3$ m
(c) $3/4$ m (d) $3/8$ m

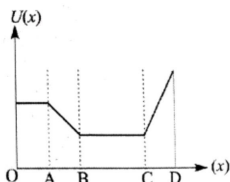
4. The two blocks, $m = 10$ kg and $M = 50$ kg are free to move as shown. The coefficient of static friction between the blocks is 0.5 and there is no friction between M and the ground. A minimum horizontal force F is applied to hold m against M that is equal to

- (a) 100 N (b) 50 N
(c) 240 N (d) 180 N



5. The figure gives the potential energy function $U(x)$ for a system in which a particle is in one-dimensional motion. In which region the magnitude of the force on the particle is greatest:

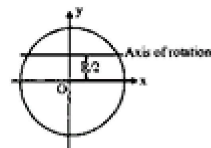
- (a) OA (b) AB
(c) BC (d) CD



6. The instantaneous angular position of a point on a rotating wheel is given by the equation $\theta(t) = 2t^3 - 6t^2$. The torque on the wheel becomes zero at

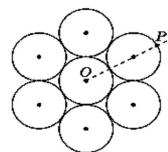
- (a) $t = 1$ s (b) $t = 0.5$ s
(c) $t = 0.25$ s (d) $t = 2$ s

7. M.I of a circular loop of radius R about the axis in figure is



- (a) MR^2 (b) $(3/4)MR^2$
(c) $MR^2/2$ (d) $2MR^2$

8. Seven identical circular planar discs, each of mass M and radius R are welded symmetrically as shown. The moment of inertia of the arrangement about the axis normal to the plane and passing through the point P is:



- (a) $19/2 MR^2$ (b) $55/2 MR^2$
(c) $73/2 MR^2$ (d) $181/2 MR^2$

9. Two satellites A and B having masses in the ratio 4: 3 are revolving in circular orbits of radii $3r$ and $4r$ respectively around the earth. The ratio of total mechanical energy of A to B is:

- (a) 9 : 16 (b) 16 : 9
(c) 1 : 1 (d) 4 : 3

10. Select the incorrect statements from the following.

- I. The orbital velocity of a satellite increases with the radius of the orbit
II. Escape velocity of a particle from the surface of the earth depends on the speed with which it is fired
III. The time period of a satellite does not depend on the radius of the orbit
IV. The orbital velocity is inversely proportional to the square root of the radius of the orbit.

- (a) I and II (b) I and IV
(c) I, II and IV (d) I, II and III

11. If average depth of an ocean is 4000 m and the bulk modulus of water is 2×10^9 Nm^{-2} , then fractional compression $\Delta V/V$ of water at the bottom of ocean is $\alpha \times 10^{-2}$. The value of α is:

(Given, $g = 10$ ms^{-2} , $\rho = 1000$ $kg m^{-3}$)

- (a) 1 (b) 2
(c) 3 (d) 4

12. An air bubble of negligible weight having radius r rises steadily through a solution of density σ at speed v . The coefficient of viscosity of the solution is given by:

- (a) $\eta = 4r\sigma g / 9v$
 (b) $\eta = 4r^2\sigma g / 9v$
 (c) $\eta = 2\pi r^2\sigma g / 9v$
 (d) $\eta = 2r^2\sigma g / 3\pi v$

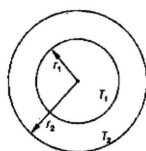
13. A liquid is filled upto a height of 20 cm in a cylindrical vessel. The speed of liquid coming out of a small hole at the bottom of the vessel is ($g = 10 \text{ ms}^{-2}$)

- (a) 1.2 ms^{-1} (b) 1 ms^{-1}
 (c) 2 ms^{-1} (d) 3.2 ms^{-1}

14. A body cools in a surrounding of constant temperature 30°C . Its heat capacity is $2 \text{ J/kg } ^\circ\text{C}$. Initial temperature of the body is 40°C . Assume Newton's law of cooling is valid. The body cools to 38°C in 10 minutes. In further 10 minutes it will cool from 38°C to

- (a) 36°C (b) 36.4°C
 (c) 37°C (d) 37.5°C

15. The figure shows a system of two concentric spheres of radii r_1 and r_2 are kept at temperatures T_1 and T_2 respectively. The radial rate of flow of heat in a substance between the two concentric spheres is proportional to

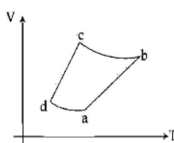


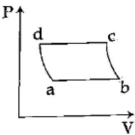
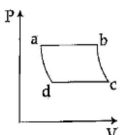
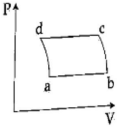
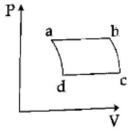
- (a) $\ln(r_2/r_1)$
 (b) $(r_2 - r_1) / (r_1 r_2)$
 (c) $(r_2 - r_1)$
 (d) $(r_1 r_2) / (r_2 - r_1)$

16. The pressure inside a tyre is 4 times that of atmosphere. If the tyre bursts suddenly at temperature 300 K , what will be the new temperature?

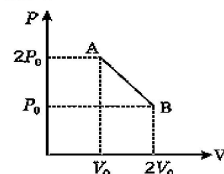
- (a) $300 (4)^{7/2}$ (b) $300 (4)^{2/7}$
 (c) $300 (2)^{7/2}$ (d) $300 (4)^{-2/7}$

17. An ideal gas goes through a reversible cycle $a \rightarrow b \rightarrow c \rightarrow d$ has the V - T diagram shown below. Process $d \rightarrow a$ and $b \rightarrow c$ are adiabatic. The corresponding P - V diagram for the process is



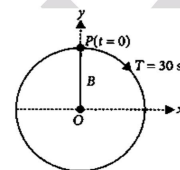
- (a) 
 (b) 
 (c) 
 (d) 

18. 'n' moles of an ideal gas undergoes a process $A \rightarrow B$ as shown in the figure. The maximum temperature of the gas during the process will be :



- (a) $9P_0V_0 / 2nR$ (b) $9P_0V_0 / nR$
 (c) $9P_0V_0 / 4nR$
 (d) $3P_0V_0 / 2nR$

19. Figure shows the circular motion of a particle. The radius of the circle, the period, sense of revolution and the initial position are indicated on the figure. The simple harmonic motion of the x -projection of the radius vector of the rotating particle P is



- (a) $x(t) = B \sin(2\pi t/30)$
 (b) $x(t) = B \cos(\pi t/15)$
 (c) $x(t) = B \sin(\pi t/15 + \pi/2)$
 (d) $x(t) = B \cos(\pi t/15 + \pi/2)$

20. Two simple harmonic motions are represented by the equations $y_1 = 0.1 \sin(100\pi t + \pi/3)$ and $y_2 = 0.1 \cos \pi t$. The phase difference of the velocity of particle 1 with respect to the velocity of particle 2 is

- (a) $\pi/3$ (b) $-\pi/6$
 (c) $\pi/6$ (d) $-\pi/3$

21. Two factories are sounding their sirens at 800 Hz . A man goes from one factory to other at a speed of 2 m/s . The velocity of sound is 320 m/s . The number of beats heard by the person in one second will be:

- (a) 2 (b) 4
 (c) 8 (d) 10

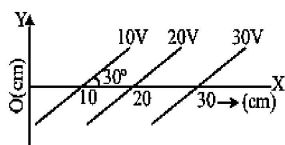
22. If the length of a stretched string is shortened by 40% and the tension increased by 44% then the ratio of the final and initial fundamental frequencies is

- (a) $3 : 4$ (b) $4 : 3$
 (c) $1 : 3$ (d) $2 : 1$

23. An organ pipe P_1 closed at one end vibrating in its first overtone and another pipe P_2 open at both ends vibrating in third overtone are in resonance with a given tuning fork. The ratio of the length of P_1 to that of P_2 is

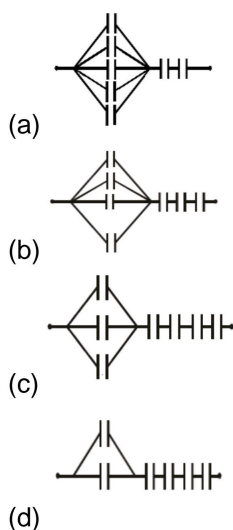
- (a) $8/3$ (b) $3/8$
 (c) $1/2$ (d) $1/3$

24. Equipotential surfaces are shown in figure. Then the electric field strength will be



- (a) 100 Vm^{-1} along X-axis
 (b) 100 Vm^{-1} along Y-axis
 (c) 200 Vm^{-1} at an angle 120° with X-axis
 (d) 50 Vm^{-1} at an angle 120° with X-axis

25. Seven capacitors each of capacitance $2\mu\text{F}$ are to be connected in a configuration to obtain an effective capacitance of $(10/11) \mu\text{F}$. Which of the combination(s) shown in figure will achieve the desired result?



26. Consider the following statements regarding series grouping of capacitors and select the correct statements.

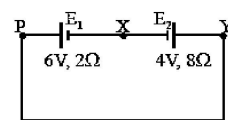
- I. Charge on each capacitor remains same and equals to the main charge supplied by the battery.
 II. Potential difference and energy distributes in the reverse ratio of capacitance.
 III. Effective capacitance is even less than the least of the individual capacitances.
 IV. Potential on each capacitor remains same and equals to the potential supplied by battery.

- (a) I and II
 (b) III and IV
 (c) II and IV only
 (d) I, II and III

27. There exists a uniform electric field $E = 4 \times 10^5 \text{ Vm}^{-1}$ directed along negative x-axis such that electric potential at origin is zero. A charge of $-200 \mu\text{C}$ is placed at origin, and a charge of $+200 \mu\text{C}$ is placed at $(3\text{m}, 0)$. The electrostatic potential energy of the system is

- (a) 120 J
 (b) -120 J
 (c) -240 J
 (d) zero

28. A cell E_1 of emf 6 V and internal resistance 2Ω is connected with another cell E_2 of emf 4 V and internal resistance 8Ω (as shown in the figure). The potential difference across points X and Y is:



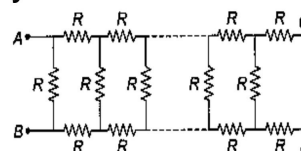
- (a) 10.0 V
 (b) 3.6 V
 (c) 5.6 V
 (d) 2.0 V

29. **Assertion** : For a conductor resistivity increases with increase in temperature.

Reason : Since $\rho = m/ne^2\tau$, when temperature increases the random motion of free electrons increases and vibration of ions increases which decreases τ .

- (a) If both Assertion and Reason are correct and the Reason is a correct explanation of the Assertion.
 (b) If both Assertion and Reason are correct but Reason is not a correct explanation of the Assertion.
 (c) If the Assertion is correct but Reason is incorrect.
 (d) If the Assertion is incorrect and Reason is correct.

30. In Fig. find the value of resistor to be connected between C and D, so that the resistance of the entire circuit between A and B does not change with the number of elementary sets.



- (a) R
 (b) $R(\sqrt{3} - 1)$
 (c) $3R$
 (d) $R(\sqrt{3} + 1)$

31. The distance moved by the screw of a screw gauge is 2 mm in four rotations and there are 50 divisions on its cap. When nothing is put between its jaws, 20th division of circular scale coincides with reference line, and zero of linear scale is hidden from circular scale when two jaws touch each other or zero of circular scale is lying above the reference line. When plate is placed between the jaws, main scale reads 2 divisions and circular scale reads 20 divisions. Thickness of plate is

- (a) 1.1 mm
 (b) 1.2 mm
 (c) 1.4 mm
 (d) 1.5 mm

32. The length of a simple pendulum is about 100 cm known to have an accuracy of 1 mm . Its period of oscillation is 2 s determined by measuring the time for 100 oscillations using a clock of 0.1 s resolution. What is the accuracy in the determined value of g ?

- (a) 0.2% (b) 0.5%
(c) 0.1% (d) 2%

33. Forty electric bulbs are connected in series across a 220 V supply. After one bulb is fused the remaining 39 are connected again in series across the same supply. The illumination will be

- (a) more with 40 bulbs than with 39
(b) more with 39 bulbs than with 40
(c) equal in both the cases
(d) in the ratio $40^2 : 39^2$

34. A thin circular wire carrying a current I has a magnetic moment M . The shape of the wire is changed to a square and it carries the same current. It will have a magnetic moment

- (a) M (b) $(4/\pi^2)M$
(c) $(4/\pi)M$ (d) $(\pi/4)M$

35. A long solenoid carrying a current produces a magnetic field B along its axis. If the current is double and the number of turns per cm is halved, the new value of the magnetic field is

- (a) $4B$ (b) $B/2$
(c) B (d) $2B$

36. A helium nucleus makes a full rotation in a circle of radius 0.8 meter in 2 sec. The value of the magnetic field induction B in tesla at the centre of circle will be

- (a) $2 \times 10^{-19} \mu_0$ (b) $10^{-19}/\mu_0$
(c) $10^{-19} \mu_0$
(d) $2 \times 10^{-20}/\mu_0$

37. A magnetizing field of $2 \times 10^3 \text{ Am}^{-1}$ produces a magnetic flux density of $8\pi \text{ T}$ in an iron rod. The relative permeability of the rod will be

- (a) 10^2 (b) 1
(c) 10^4 (d) 10^3

38. Consider the following statements and identify incorrect statement(s).

- I. Diamagnetism is temperature independent.
II. Paramagnetism is explained by domain theory.
III. Above curie temperature a ferromagnetic material becomes paramagnetic.
IV. Magnetic susceptibility is small and negative for diamagnetic substance.

- (a) I only (b) II only
(c) I, II and III (d) II and IV

39. Two coils have a mutual inductance 0.005H. The current changes in first coil according to equation $I = I_0 \sin \omega t$ where $I_0 = 10\text{A}$ and $\omega = 100\pi$ radian/sec. The max. value of e.m.f. in second coil is

- (a) 2π (b) 5π
(c) π (d) 4π

40. A transformer has an efficiency of 80%. It works at 4 kW and 100 V. If secondary voltage is 240 V, the current in primary coil is

- (a) 0.4 A (b) 4 A
(c) 10 A (d) 40 A

41. In an electrical circuit R , L , C and an a.c. voltage source are all connected in series. When L is removed from the circuit, the phase difference between the voltage the current in the circuit is $\pi/3$. If instead, C is removed from the circuit, the phase difference is again $\pi/3$. The power factor of the circuit is

- (a) $\frac{1}{2}$ (b) $1/\sqrt{2}$
(c) 1 (d) $\sqrt{3}/2$

42. The angle of prism is 60° and angle of deviation is 30° . In the position of minimum deviation, the values of angle of incidence and angle of emergence are:

- (a) $i = 45^\circ$; $e = 50^\circ$
(b) $i = 30^\circ$; $e = 45^\circ$
(c) $i = 45^\circ$; $e = 45^\circ$
(d) $i = 30^\circ$; $e = 30^\circ$

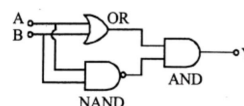
43. A plano-convex lens is made of material of refractive index 1.6. The radius of curvature of the curved surface is 60 cm. The focal length of the lens is

- (a) 50 cm (b) 100 cm
(c) 200 cm (d) 400 cm

44. A beam of unpolarised light of intensity I_0 is passed through a similar polaroid A and then through another polaroid B. Then a third polaroid C is kept in between A and B so that its axis makes an angle of 45° relative to that of A. The intensity of the emergent light is

- (a) I_0 (b) $I_0/2$
(c) $I_0/4$ (d) $I_0/8$

45. The following configuration of gate is equivalent to



- (a) NAND gate (b) XOR gate
(c) OR gate (d) NOR gate