

JEE Main April 2024
Question Paper With Text Solution
05 April | Shift-1

PHYSICS



JEE Main & Advanced | XI-XII Foundation | VI-X Pre-Foundation

Office : Piprali Road, Sikar (Raj.) | Ph. 01572-241911
Website : www.matrixedu.in ; Email : smd@matrixacademy.co.in



31. A wooden block of mass 5 kg rests on a soft horizontal floor, When an iron cylinder of mass 25 kg is placed on the top of the block, the floor yields and the block and the cylinder together go down with an acceleration of 0.1 ms^{-2} . The action force of the system on the floor is equal to:

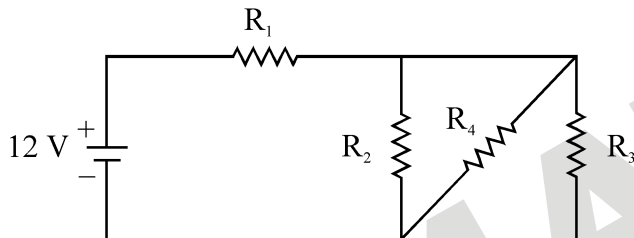
- (1) 294 N (2) 297 N (3) 291 N (4) 196 N

Question ID: 87827055640

Ans. Official Answer NTA (3)

Sol.

32. In the given figure $R_1 = 10\Omega$, $R_2 = 8\Omega$, $R_3 = 4\Omega$ and $R_4 = 8\Omega$. Battery is ideal with emf 12V. Equivalent resistance of the circuit and current supplied by battery are respectively:



- (1) 12Ω and 11.4A (2) 10.5Ω and 1A (3) 12Ω and 1A (4) 10.5Ω and 1.14A

Question ID: 87827055649

Ans. Official Answer NTA (3)

Sol.

33. In a co-axial straight cable, the central conductor and the outer conductor carry equal currents in opposite directions. The magnetic field is zero :

- (1) outside the cable
(2) in between the two conductors
(3) inside the outer conductor
(4) inside the inner conductor

Question ID: 87827055650

Ans. Official Answer NTA (1)

Sol.



34. Time periods of oscillation of the same simple pendulum measured using four different measuring clocks were recorded as 4.62 s, 4.632 s, 4.6 s and 4.64 s. The arithmetic mean of these readings in correct significant figure is:

- (1) 5 s (2) 4.62 s (3) 4.6 s (4) 4.623 s

Question ID: 87827055657

Ans. Official Answer NTA (3)

Sol.

35. An alternating voltage of amplitude 40 V and frequency 4 kHz is applied directly across the capacitor of $12\mu\text{F}$. The maximum displacement current between the plates of the capacitor is nearly:

- (1) 12A (2) 8 A (3) 10 A (4) 13A

Question ID: 87827055652

Ans. Official Answer NTA (1)

Sol.

36. The angle between vector \vec{Q} and the resultant of $(2\vec{Q} + 2\vec{P})$ and $(2\vec{Q} - 2\vec{P})$ is:

- (1) $\tan^{-1}(P/Q)$ (2) 0° (3) $\tan^{-1}(2Q/P)$ (4) $\tan^{-1}\frac{(2\vec{Q} - 2\vec{P})}{2\vec{Q} + 2\vec{P}}$

Question ID: 87827055639

Ans. Official Answer NTA (2)

Sol.

37. An electron rotates in a circle around a nucleus having positive charge Ze . Correct relation between total energy (E) of electron to its potential energy (U) is:

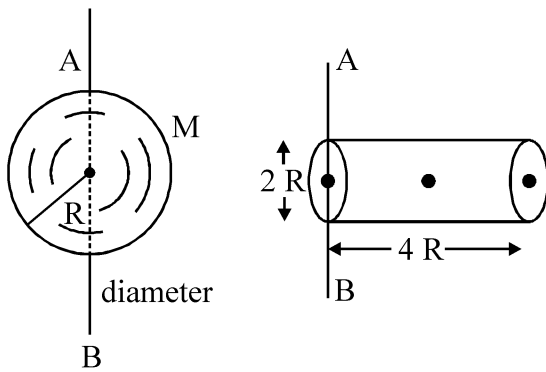
- (a) $2E=3U$ (2) $2E=U$ (3) $2E=2U$ (4) $E=U$

Question ID: 87827055655

Ans. Official Answer NTA (2)

Sol.

38. Ratio of radius of gyration of a hollow sphere to that of a solid cylinder of equal mass, for moment of Inertia about their diameter axis AB as shown in figure is $\sqrt{\frac{8}{x}}$, We The value of x is:



(1) 67

(2) 34

(3) 17

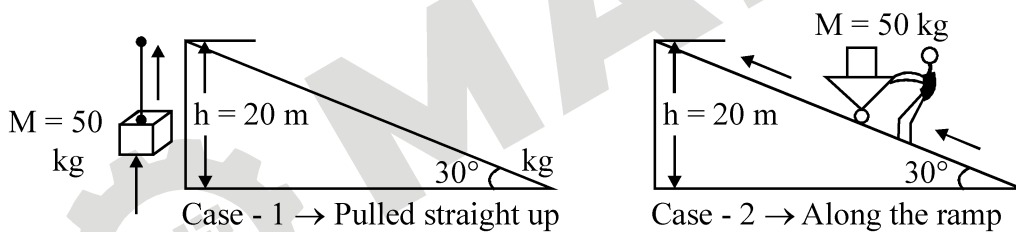
(4) 51

Question ID: 87827055642

Ans. Official Answer NTA(1)

Sol.

39. A body of mass 50 kg is lifted to a height of 20 m from the ground in the two different ways as shown in the figures. The ratio of work done against the gravity in both the respective cases, will be :



(1) 1 : 1

(2) $\sqrt{3} : 2$

(3) 1 : 2

(4) 2 : 1

Question ID: 87827055641

Ans. Official Answer NTA(1)

Sol.

40. If the collision frequency of hydrogen molecules in a closed chamber at 27°C is Z , then the collision frequency of the same system at 127°C is :

(1) $\frac{2}{\sqrt{3}}Z$ (2) $\frac{\sqrt{3}}{2}Z$ (3) $\frac{3}{4}Z$ (4) $\frac{4}{3}Z$

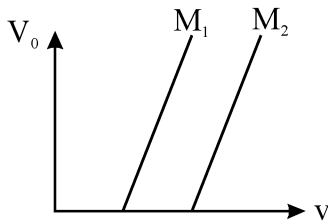
Question ID: 87827055646

Ans. Official Answer NTA(1)

Sol.



41. Given below are two statements:



Statement I: Figure shows the variation of stopping potential with frequency (ν) for the two photosensitive materials M_1 and M_2 . The slope gives value of $\frac{h}{e}$, where h is Planck's constant, e is the charge of electron.

Statement II: M_2 will emit photoelectrons of greater kinetic energy for the incident radiation having same frequency.

In the light of the above statements, choose the **most appropriate** answer from the options given below.

- (1) Both Statement I and Statement II are correct
- (2) Both Statement I and Statement II are incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Statement I is correct and Statement II is incorrect

Question ID: 87827055654

Ans. Official Answer NTA (4)

Sol.

42. If G be the gravitational constant and u be the energy density then which of the following quantity have the dimensions as that of the \sqrt{uG} :

- (1) pressure gradient per unit mass
- (2) Force per unit mass
- (3) Energy per unit mass
- (4) Gravitational potential

Question ID: 87827055638

Ans. Official Answer NTA (2)

Sol.



43. Light emerges out of a convex lens when a source of light kept at its focus. The shape of wavefront of the light is :

- (1) cylindrical
- (2) both spherical and cylindrical
- (3) plane
- (4) spherical

Question ID: 87827055653

Ans. Official Answer NTA (3)

Sol.

44. Match List I with List II :

List I

List II

(A) Kinetic energy of planet

(I) $\frac{-GMm}{a}$

(B) Gravitation Potential energy of sun-planet system

(II) $\frac{GMm}{2a}$

(C) Total mechanical energy of planet

(III) $\frac{Gm}{r}$

(D) Escape energy at the surface of planet for unit mass object

(IV) $\frac{-GMm}{2a}$

(Where a = radius of planet orbit, r = radius of planet, M = mass of Sun, m = mass of planet)

Choose the correct answer from the options given below :

- (1) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
- (2) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
- (3) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)
- (4) (A)-(III), (B)-(IV), (C)-(I), (C)-(II)

Question ID: 87827055643

Ans. Official Answer NTA (2)

Sol.



45. Given below are two statements :

Statement I: When a capillary tube is dipped into a liquid, the liquid neither rises nor falls in the capillary. The contact angle may be 0° .

Statement II: The contact angle between a solid and a liquid is a property of the material of the solid and liquid as well.

In the light of the above statement, choose the correct answer from the options given below.

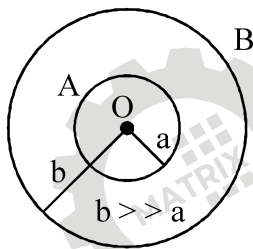
- (1) Both Statement I and Statement II are true
- (2) Statement I is true and Statement II is false
- (3) Both Statement I and Statement II are false
- (4) Statement I is false but Statement II is true

Question ID: 87827055644

Ans. Official Answer NTA (4)

Sol.

46. Two conducting circular loops A and B are placed in the same plane with their centres coinciding as shown in figure. The mutual inductance between them is :



- (1) $\frac{\mu_0 \pi a^2}{2b}$
- (2) $\frac{\mu_0}{2\pi} \cdot \frac{b^2}{a}$
- (3) $\frac{\mu_0}{2\pi} \cdot \frac{a^2}{b}$
- (4) $\frac{\mu_0 \pi b^2}{2a}$

Question ID: 87827055651

Ans. Official Answer NTA (1)

Sol.

47. A simple pendulum doing small oscillations at a place R height above earth surface has time period of $T_1 = 4s$. T_2 would be its time period if it is brought to a point which is at a height $2R$ from earth surface. Choose the correct relation [R = radius of earth] :

- (1) $2T_1 = T_2$
- (2) $3T_1 = 2T_2$
- (3) $2T_1 = 3T_2$
- (4) $T_1 = T_2$

Question ID: 87827055647



Ans. Official Answer NTA (2)

Sol.

48. In hydrogen like system the ratio of coulombian force and gravitational force between an electron and a proton is in the order of :

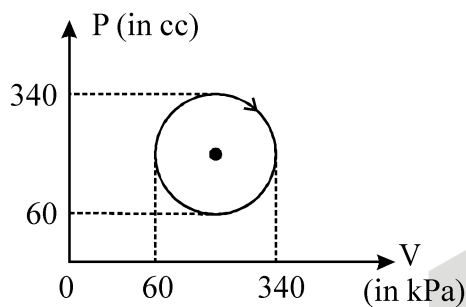
- (1) 10^{19} (2) 10^{39} (3) 10^{36} (4) 10^{29}

Question ID: 87827055648

Ans. Official Answer NTA (2)

Sol.

49. The heat absorbed by a system in going through the given cyclic process is:



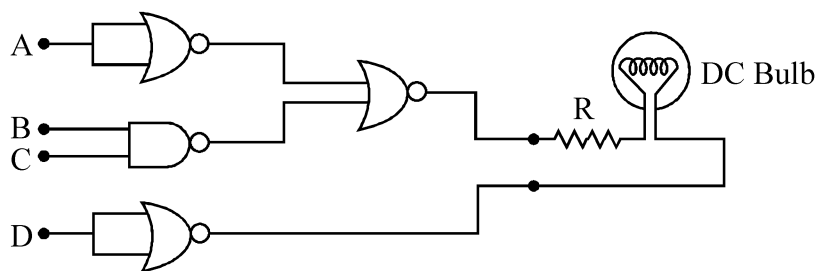
- (1) 61.6 J (2) 431.2 J (3) 616 J (4) 19.6 J

Question ID: 87827055645

Ans. Official Answer NTA (1)

Sol.

50. Following gates section is connected in a complete suitable circuit.



For which of the following combination, bulb will glow (ON):

- (1) A = 0, B = 1, C = 1, D = 1 (2) A = 1, B = 0, C = 0, D = 0
 (3) A = 1, B = 1, C = 1, D = 0 (4) A = 0, B = 0, C = 0, D = 1

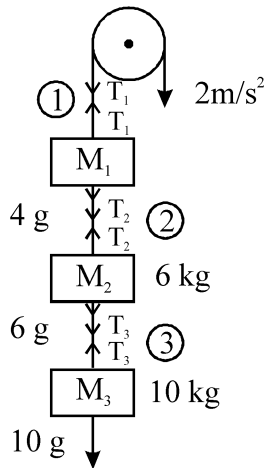


Question ID: 87827055656

Ans. Official Answer NTA (2)

Sol.

51. Three blocks M_1 , M_2 , M_3 having masses 4 kg, 6 kg and 10 kg respectively are hanging from a smooth pulley using rope 1, 2 and 3 as shown in figure. The tension in string 1 (T_1) when they are moving upward with acceleration of 2ms^{-2} is _____ N (if $g=10\text{ m/s}^2$)



Question ID: 87827055659

Ans. Official Answer NTA (240)

Sol.

52. The density and breaking stress of a wire are $6 \times 10^4\text{ kg/m}^3$ and $1.2 \times 10^8\text{ N/m}^2$ respectively. The wire is suspended from a rigid support on a planet where acceleration due to gravity is $\frac{1^{\text{rd}}}{3}$ of the value on the surface of earth. The maximum length of the wire with breaking is _____ m (take, $g=10\text{ m/s}^2$).

Question ID: 87827055660

Ans. Official Answer NTA (600)

Sol.

53. Three capacitors of capacitances $25\mu\text{F}$, $30\mu\text{F}$ and $45\mu\text{F}$ are connected in parallel to a supply of 100 V. Energy stored in the above combination is E. When these capacitors are connected in series to the same supply, the stored energy is $\frac{9}{x}$ E. The value of x is _____.

Question ID: 87827055661

MATRIX JEE ACADEMY

Office : Piprali Road, Sikar (Raj.) | Ph. 01572-241911

Website : www.matrixedu.in ; Email : smd@matrixacademy.co.in



Ans. Official Answer NTA (86)

Sol.

54. If three helium nuclei combine to form a carbon nucleus then the energy released in this reaction is $_____ \times 10^{-2}$ MeV. (Given $1 \text{ u} = 931 \text{ MeV}/c^2$, atomic mass of helium = 4.002603 u)

Question ID: 87827055666

Ans. Official Answer NTA (727)

Sol.

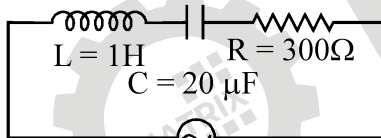
55. A body moves on a frictionless plane starting from rest. If S_n is distance moved between $t = n-1$ and $t = n$ and S_{n-1} is distance moved between $t = n-2$ and $t = n-1$, then the ratio $\frac{S_{n-1}}{S_n}$ is $\left(1 - \frac{2}{x}\right)$ for $n = 10$. The value of x is.

Question ID: 87827055658

Ans. Official Answer NTA (19)

Sol.

56. An ac source is connected in given series LCR circuit. The rms potential difference across the capacitor of $20 \mu\text{F}$ is $_____ \text{ V}$.



Question ID: 87827055664

Ans. Official Answer NTA (50)

Sol.

57. In Young's double slit experiment, carried out with light of wavelength 5000 \AA , the distance between the slits is 0.3 mm and the screen is at 200 cm from the slits. The central maximum is at $x = 0 \text{ cm}$. The value of x for third maxima is $_____ \text{ mm}$.

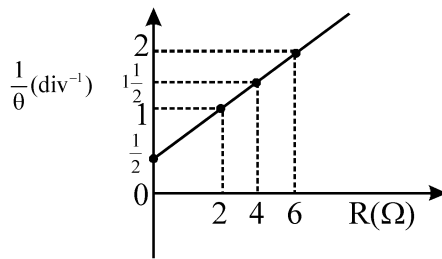


Question ID: 87827055665

Ans. Official Answer NTA (10)

Sol.

58. In the experiment to determine the galvanometer resistance by half-deflection method, the plot of $\frac{1}{\theta}$ vs the resistance (R) of the resistance box is shown in the figure, The figure of merit of the galvanometer is $\underline{\hspace{2cm}}$ $\times 10^{-1}$ A/division. [The source has emf 2V]



Question ID: 87827055667

Ans. Official Answer NTA (5)

Sol.

59. A 2A current carrying straight metal wire of resistance 1Ω , resistivity $2 \times 10^{-6} \Omega\text{m}$, area of cross-section 10 mm^2 and mass 500 g is suspended horizontally in mid air by applying a uniform magnetic field \vec{B} . The magnitude of B is $\underline{\hspace{2cm}}$ $\times 10^{-1}$ T (given, $g = 10 \text{ m/s}^2$).

Question ID: 87827055663

Ans. Official Answer NTA (5)

Sol.

60. The electric field between the two parallel plates of a capacitor of $1.5\mu\text{F}$ capacitance drops to one third of its initial value in $6.6\mu\text{s}$ when the plates are connected by a thin wire.

The resistance of this wire is $\underline{\hspace{2cm}}$ Ω (Given, $\log 3 = 1.1$)

Question ID: 87827055662

Ans. Official Answer NTA (4)

Sol.