JEE Main April 2024

Question Paper With Text Solution

08 April | Shift-1

PHYSICS

31. Two planets A and B having masses m_1 and m_2 move around the sun in circular orbits of r_1 and r_2 radii respectively. If angular momentum of A is L and that of B is 3L, the ratio of time period $\left(\dfrac{T_A}{T_B}\right)$ is:

    (1) $\left(\dfrac{r_1}{r_2}\right)^3$ (2) $\dfrac{1}{27}\left(\dfrac{m_2}{m_1}\right)^3$ (3) $27\left(\dfrac{m_1}{m_2}\right)^3$ (4) $\left(\dfrac{r_2}{r_1}\right)^{\frac{3}{2}}$

Question ID: 68019114371

Ans.   Official Answer NTA (2)

Sol.

32. Young's modulus is determined by the equation given by $Y = 49000\,\dfrac{m}{l}\,\dfrac{dyne}{cm^2}$ where M is the mass and l is the extension of wire used in the experiment. Now error in Young modules(Y) is estimated by taking data from M--l plot in graph paper. The smallest scale divisions are 5 g and 0.02 cm along load axis and extension axis respectively. If the value of M and l are 500 g and 2 cm respectively then percentage error of Y is :

    (1) 0.5%   (2) 0.02%   (3) 0.2%   (4) 2%

Question ID: 68019114381

Ans.   Official Answer NTA (4)

Sol.

33. Paramagnetic substances:

    A. align themselves along the directions of external magnetic field.

    B. attract strongly towards external magnetic field.

    C. has susceptibility little more than zero.

    D. move from a region of strong magnetic field to weak magnetic field.

    Choose the most appropriate answer from the options given below:

    (1) A, B, C Only

    (2) B, D Only

    (3) A, C Only

    (4) A, B, C, D

Question ID: 68019114374

Ans.   Official Answer NTA (3)

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Sol.

34. Two charged conduting spheres of radii a and b are connected to each other by a conducting wire. The ratio of charges of the two spheres respectively is:

(1) $\dfrac{a}{b}$ (2) ab   (3) $\dfrac{b}{a}$ (4) $\sqrt{ab}$

Question ID: 68019114378

Ans. Official Answer NTA (1)

Sol.

35. Average force exerted on a non-reflecting surface at normal incidence is 2.4×10^{-4}N. If 360 W/cm^2 is the light energy flux during span of 1 hour 30 minutes, Then the area of the surface is:

(1) 0.2 m^2

(2) 20 m^2

(3) 0.1 m^2

(4) 0.02 m^2

Question ID: 68019114375

Ans. Official Answer NTA (4)

Sol.

36. Critical angle of incidence for a pair of optical media is 45°. The refractive indices of first and second media are in the ratio:
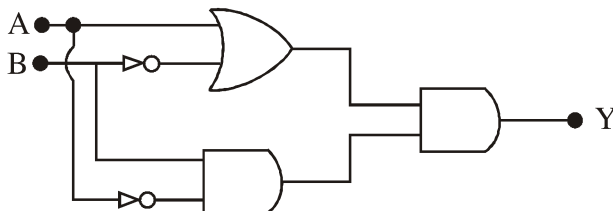
(1) $1:2$ (2) $1:\sqrt{2}$ (3) $2:1$ (4) $\sqrt{2}:1$

Question ID: 68019114376

Ans. Official Answer NTA (4)

Sol.

37. The output Y of following circuit for given inputs is:

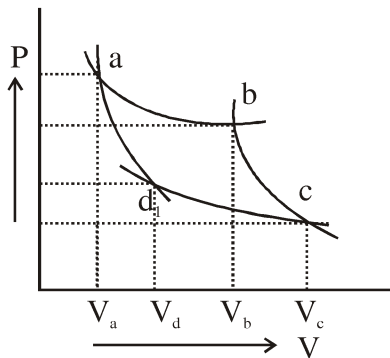(1) $\Lambda.B(\Lambda+B)$ (2) $A \cdot B$ (3) $\overline{A} \cdot B$ (4) 0

Question ID: 68019114380

Ans.   Official Answer NTA (4)

Sol.

38.   Two different adiabatic paths for the same gas intersect two isothermal curves as shown in P-V diagram. The relation between the ratio $\dfrac{V_a}{V_d}$ and the ratio $\dfrac{V_b}{V_c}$ is:

(1) $\dfrac{V_a}{V_d} = \left(\dfrac{V_b}{V_c}\right)^{-1}$ (2) $\dfrac{V_a}{V_d} \neq \dfrac{V_b}{V_c}$ (3) $\dfrac{V_a}{V_d} = \dfrac{V_b}{V_c}$ (4) $\dfrac{V_a}{V_d} = \left(\dfrac{V_b}{V_c}\right)^{2}$

Question ID: 68019114370

Ans.   Official Answer NTA (3)

Sol.

39.   Correct Bernoulli's equation is (symbols have their usual meaning):

(1) $P + \rho gh + \dfrac{1}{2}\rho v^2 = \text{constant}$

(2) $P + \dfrac{1}{2}\rho gh + \dfrac{1}{2}\rho v^2 = \text{constant}$

(3) $P + \rho gh + \rho v^2 = \text{constant}$

(4) $P + mgh + \dfrac{1}{2}mv^2 = \text{constant}$

Question ID: 68019114369

Ans.   Official Answer NTA (1)

Sol.

40. The diameter of a sphere is measured using a vernier caliper whose 9 divisions of main scale are equal to 10 divisions of vernier scale. The shortest division on the main scale is equal to 1mm. The main scale reading is 2 cm and second division of vernier scale coincides with a division on main scale. If mass of the sphere is 8.635 g, the density of the sphere is:

(1) 1.7 g/cm³   (2) 2.2 g/cm³   (3) 2.5 g/cm³   (4) 2.0 g/cm³

Question ID: 68019114382

Ans.   Official Answer NTA (4)

Sol.

41. A mixture of one mole of monoatomic gas and one mole of a diatomic gas (rigid) are kept at room temperature (27°C). The ratio of specific heat of gases at constant volume respectively is:

(1) $\dfrac{7}{5}$ (2) $\dfrac{3}{5}$ (3) $\dfrac{5}{3}$ (4) $\dfrac{3}{2}$

Question ID: 68019114372

Ans.   Official Answer NTA (2)

Sol.

42. A player caught a cricket ball of mass 150 g moving at a speed of 20 m/s. If the catching process is completed in 0.1 s, the magnitude of force exerted by the ball on the hand of the player is:

(1) 3N   (2) 30 N   (3) 150 N   (4) 300 N

Question ID: 68019114367

Ans.   Official Answer NTA (2)

Sol.

43. A LCR circuit is at resonance for a capacitor C, inductance L and resistance R. Now the value of resistance is halved keeping all other parameters same. The current amplitude at resonance will be now:

(1) double   (2) halved   (3) Zero   (4) same

Question ID: 68019114383

Ans.   Official Answer NTA (1)

Sol.

44. A stationary particle breaks into two parts of masses m_A and m_B which move with velocities v_A and v_B respectively. The ratio of their kinetic energies $(K_B : K_A)$ is:

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(1) 1 : 1   (2) $v_B : v_A$ (3) $m_B : m_A$ (4) $m_B v_B : m_A v_A$

Question ID: 68019114366

Ans.   Official Answer NTA (2)

Sol.

45.   A clock has 75 cm, 60 cm long second hand and minute hand respectively. In 30 minutes duration the tip of second hand will travel x distance more than the tip of minute hand. The value of x in meter is nearly (Take $\pi = 3.14$) :

(1) 220.0   (2) 118.9   (3) 139.4   (4) 140.5

Question ID: 68019114365

Ans.   Official Answer NTA (3)
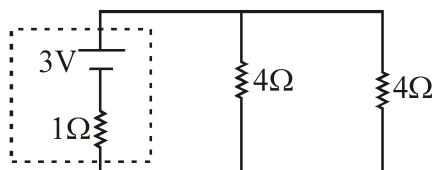
Sol.

46.   In an expression $a \times 10^b$:

(1) a is order of magnitude for $b \le 5$

(2) b is order of magnitude for $5 < a \le 10$

(3) b is order of magnitude for $a \le 5$

(4) b is order of magnitude for $a \ge 5$

Question ID: 68019114364

Ans.   Official Answer NTA (3)

Sol.

47.   In the given circuit, the terminal potential difference of the cell is:

(1) 1.5 V   (2) 2V   (3) 4V   (4) 3V

Question ID: 68019114373

Ans.   Official Answer NTA (2)

Sol.

48. Binding energy of a certain nucleus is 18×10^8 J. How much is the difference between total mass of all the nucleons and nuclear mass of the given nucleus:

(1) $2\mu g$ (2) $10\mu g$ (3) $20\mu g$ (4) $0.2\mu g$

Question ID: 68019114379

Ans. Official Answer NTA (3)

Sol.

49. A proton and an electron are associated with same de-Broglie wavelength. The ratio of their kinetic energies is: (Assume h = 6.63×10^{-34} J s, $m_e = 9.0 \times 10^{-31}$ kg and $m_p = 1836$ times m_e)

(1) $1 : \dfrac{1}{\sqrt{1836}}$ (2) $1 : 1836$ (3) $1 : \dfrac{1}{1836}$ (4) $1 : \sqrt{1836}$

Question ID: 68019114377

Ans. Official Answer NTA (2)

Sol.

50. Three bodies A, B and C have equal kinetic energies and their masses are 400g, 1.2 kg and 1.6 kg respetively. The ratio of their linear momenta is:

(1) $\sqrt{3} : \sqrt{2} : 1$ (2) $1 : \sqrt{3} : 2$ (3) $\sqrt{2} : \sqrt{3} : 1$ (4) $1 : \sqrt{3} : \sqrt{2}$

Question ID: 68019114368

Ans. Official Answer NTA (2)

Sol.

51. An electric field, $\vec{E}\, \dfrac{2\hat{i} + 6\hat{j} + 8\hat{k}}{\sqrt{6}}$ passes through the surface of 4 m² area having unit vector $\hat{n} = \left(\dfrac{2\hat{i} + \hat{j} + \hat{k}}{\sqrt{6}} \right)$. The electric flux for that surface is _____ Vm.

Question ID: 68019114388

Ans. Official Answer NTA (12)

Sol.

52. A parallel beam of monochromatic light of wavelength 600 nm passes through single slit of 0.4 mm width. Angular divergence corresponding to second order minima would be _____ $\times 10^{-3}$ rad.
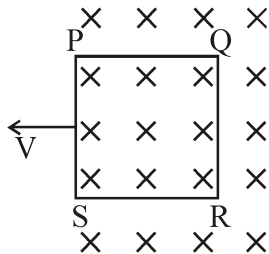
Question ID: 68019114392

Ans. Official Answer NTA (6)

Sol.

53. A square loop PQRS having 10 turns, area 3.6×10^{-3} m^2 and resistance 100Ω is "slowly and uniformly being pulled out of a uniform magnetic field of magnitude B = 0.5 T as shown. Work done in pulling the loop out of the field in 1.0 s is _____ $\times 10^{-6}$)J.

Question ID: 68019114393

Ans.   Official Answer NTA (3)

Sol.

54. A liquid column of height 0.04 cm balances excess pressure of a soap bubble of certain radius. If density of liquid is 8×10^3 kg m^{-3} and surface tension of soap solution is 0.28 Nm^{-1}, then diameter of the soap bubble is _____ cm.(if g = 10 ms^{-2})

Question ID: 68019114386

Ans.   Official Answer NTA (7)

Sol.

55. A closed and an open organ pipe have same lengths. If the ratio of frequencies of their seventh overtones is $\left(\dfrac{a-1}{a} \right)$ then the value of a is _____.

Question ID: 68019114387

Ans.   Official Answer NTA (16)

Sol.

56. An electron with kinetic energy 5 eV enters a region of uniform magnetic field of $3\mu T$ perpendicular to its direction. An electric field E is applied perpendicular to the "direction of velocity and magnetic field. The value of E, so that electron moves along the same path, is _____NC^{-1}

(Given, mass of electron = 9×10^{-31} kg, electric charge = 1.6×10^{-19}C)

Question ID: 68019114390

Ans.   Official Answer NTA (4)

Sol.

57.   A uniform thin metal plate of mass 10kg with dimensions is shown. The ratio of x and y coordinates of center of mass of plate in $\dfrac{n}{9}$. The value of n is _____.
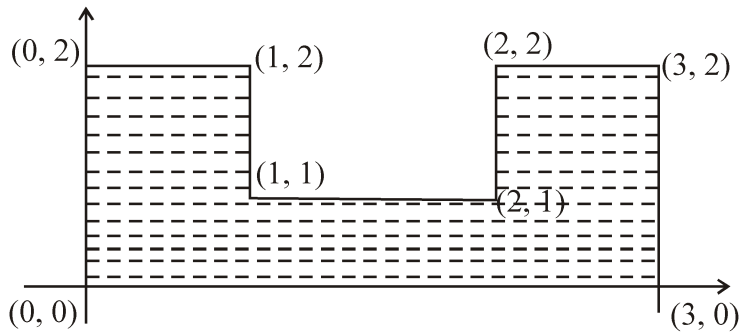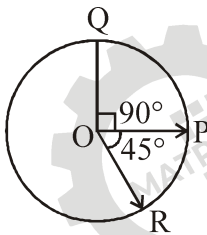

Question ID: 68019114385

Ans.   Official Answer NTA (15)

Sol.

58.   Three vectors $\overrightarrow{OP}, \overrightarrow{OQ}$ and $\overrightarrow{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____.

Question ID:68019114384

Ans.   Official Answer NTA (3)

Sol.

59.   Resistance of a wire at 0°C, 100°C and t°C is found to be $10\Omega, 10.2\Omega$ and $10.95\,\Omega$ respectively. The temperature t in Kelvin scale is_____ .

Question ID: 68019114389

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Ans.   Official Answer NTA (748)

Sol.

60.   In an alpha particle scattering experiment distance of closest approach for the α particle is 4.5×10^{-14} m. If target nucleus has atomic number 80, then maximum velocity of α -particle is _____ $\times 10^5$ m/s approximately.

   $(\dfrac{1}{4\pi \in_0} = 9 \times 10^9$ SI unit, mass of α particle $= 6.72 \times 10^{-27}$ kg$)$

Question ID: 68019114391

Ans.   Official Answer NTA (156)

Sol.