

**JEE Main April 2024**  
**Question Paper With Text Solution**  
**04 April | Shift-2**

**PHYSICS**



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

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31. An electric bulb rated 50 W- 200 V is connected across a 100 V supply. The power dissipation of the bulb is :

- (1) 50 W                      (2) 12.5 W                      (3) 100 W                      (4) 25 W

Question ID : 68019113835

Ans. Official Answer NTA (2)

Sol.

32. Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Number of photons increases with increase in frequency of light.

Reason R : Maximum kinetic energy of emitted electrons increases with the frequency of incident radiation.

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

- (1) A is correct but R is not correct.  
(2) Both A and R are correct and R is NOT the correct explanation of A.  
(3) Both A and R are correct and R is the correct explanation of A.  
(4) A is not correct but R is correct.

Question ID : 68019113840

Ans. Official Answer NTA (4)

Sol.

33. The magnetic moment of a bar magnet is  $0.5 \text{ am}^2$ . It is suspended in a uniform magnetic field of  $8 \times 10^{-2} \text{ T}$ . The work done in rotating it from its most stable to most unstable position is :

- (1)  $4 \times 10^{-2} \text{ J}$   
(2)  $16 \times 10^{-2} \text{ J}$   
(3) Zero  
(4)  $8 \times 10^{-2} \text{ J}$

Question ID : 68019113836

Ans. Official Answer NTA (4)

Sol.

34. A charge  $q$  is placed at the center of one of the surface of a cube. The flux linked with the cube is :

- (1)  $\frac{q}{2 \epsilon_0}$                       (2)  $\frac{q}{8 \epsilon_0}$                       (3)  $\frac{q}{4 \epsilon_0}$                       (4) Zero



Question ID : 68019113834

Ans. Official Answer NTA(1)

Sol.

35. According to Bohr's theory, the moment of momentum of an electron revolving in 4<sup>th</sup> orbit of hydrogen atom is :

(1)  $2\frac{h}{\pi}$

(2)  $8\frac{h}{\pi}$

(3)  $\frac{h}{\pi}$

(4)  $\frac{h}{2\pi}$

Question ID : 68019113841

Ans. Official Answer NTA(1)

Sol.

36. Applying the principle of homogeneity of dimensions, determine which one is correct, where T is time period, G is gravitational constant, M is mass, r is radius of orbit.

(1)  $T^2 = 4\pi^2 r^3$

(2)  $T^2 = \frac{4\pi^2 r^3}{GM}$

(3)  $T^2 = \frac{4\pi^2 r^2}{GM}$

(4)  $T^2 = \frac{4\pi^2 r}{GM^2}$

Question ID : 68019113825

Ans. Official Answer NTA(2)

Sol.

37. A sample of gas at temperature T is adiabatically expanded to double its volume. Adiabatic constant for the gas is  $\gamma = 3/2$ . The work done by the gas in the process is :

 $(\mu = 1 \text{ mole})$ 

(1)  $RT[\sqrt{2} - 2]$

(2)  $RT[2\sqrt{2} - 1]$

(3)  $RT[1 - 2\sqrt{2}]$

(4)  $RT[2 - \sqrt{2}]$

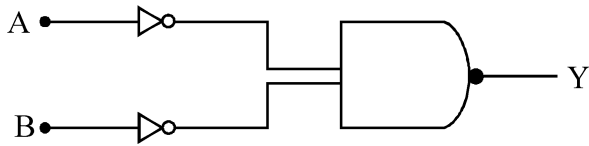


Question ID : 68019113832

Ans. Official Answer NTA (4)

Sol.

38. Identify the logic gate given in the circuit :



(1) NAND - gate

(2) AND gate

(3) NOR gate

(4) OR - gate

Question ID : 68019113842

Ans. Official Answer NTA (4)

Sol.

39. A 90 kg body placed at  $2R$  distance from surface of earth experiences gravitational pull of :(R = Radius of earth,  $g = 10 \text{ m s}^{-2}$ )

(1) 300 N

(2) 225 N

(3) 100 N

(4) 120 N

Question ID : 68019113828

Ans. Official Answer NTA (3)

Sol.

40. Correct formula for height of a satellite from earth's surface is :

(1)  $\left(\frac{T^2 R^2 g}{4\pi}\right)^{1/2} - R$

(2)  $\left(\frac{T^2 R^2 g}{4\pi}\right)^{1/3} + R$



$$(3) \left( \frac{T^2 R^2}{4\pi^2 g} \right)^{1/3} - R$$

$$(4) \left( \frac{T^2 R^2 g}{4\pi^2} \right)^{1/3} - R$$

Question ID : 68019113830

Ans. Official Answer NTA (4)

Sol.

41. Arrange the following in the ascending order of wavelength :

- A. Gamma rays ( $\lambda_1$ )
- B. x - rays ( $\lambda_2$ )
- C. Infrared waves ( $\lambda_3$ )
- D. Microwaves ( $\lambda_4$ )

Choose the most appropriate answer from the options given below

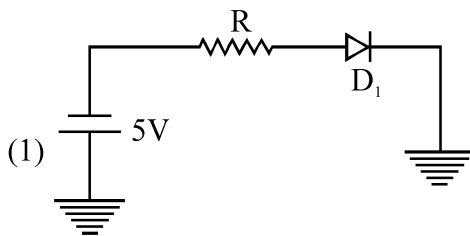
- (1)  $\lambda_4 < \lambda_3 < \lambda_2 < \lambda_1$
- (2)  $\lambda_1 < \lambda_2 < \lambda_3 < \lambda_4$
- (3)  $\lambda_2 < \lambda_1 < \lambda_4 < \lambda_3$
- (4)  $\lambda_4 < \lambda_3 < \lambda_1 < \lambda_2$

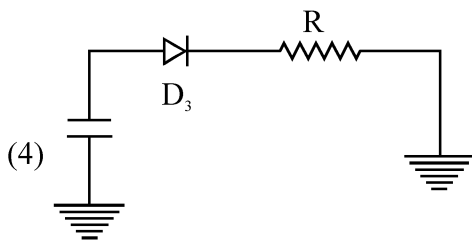
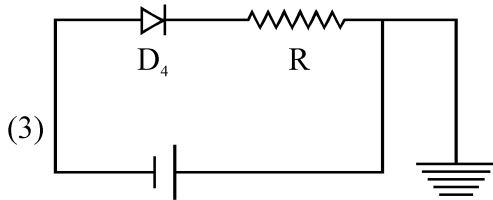
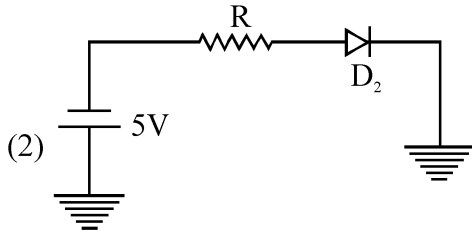
Question ID : 68019113838

Ans. Official Answer NTA (2)

Sol.

42. Which of the diode circuit shows correct biasing used for the measurement of dynamic resistance of p-n junction diode :





Question ID : 68019113824

Ans. Official Answer NTA (2)

Sol.

43. Match List I with List II

List I

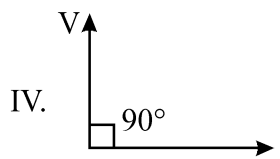
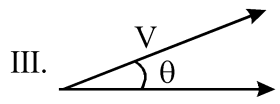
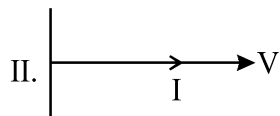
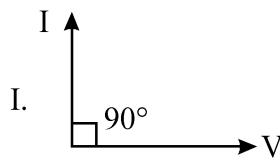
A. Purely capacitive circuit

B. Purely inductive circuit

C. LCR series at resonance

D. LCR series circuit

List II





Choose the correct answer from the options given below :

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

Question ID : 68019113837

Ans. Official Answer NTA(2)

Sol.

44. The translational degrees of freedom ( $f_t$ ) and rotational degrees of freedom ( $f_r$ ) of  $\text{CH}_4$  molecule are :

- (1)  $f_t = 3$  and  $f_r = 3$
- (2)  $f_t = 2$  and  $f_r = 3$
- (3)  $f_t = 3$  and  $f_r = 2$
- (4)  $f_t = 2$  and  $f_r = 2$

Question ID : 68019113833

Ans. Official Answer NTA(1)

Sol.

45. The width of one of the two slits in a Young's double slit experiment is 4 times that of the other slit. The ratio of the maximum of the minimum intensity in the interference pattern is :

- (1) 16 : 1
- (2) 1 : 1
- (3) 9 : 1
- (4) 4 : 1

Question ID : 68019113839

Ans. Official Answer NTA(3)

Sol.

46. A 2 kg brick begins to slide over a surface which is inclined at an angle of  $45^\circ$  with respect to horizontal axis.

The co-efficient of static friction between their surfaces is :

- (1) 1
- (2) 1.7



(3)  $\frac{1}{\sqrt{3}}$

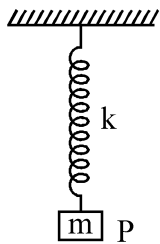
(4) 0.5

Question ID : 68019113827

Ans. Official Answer NTA(1)

Sol.

47. In simple harmonic motion, the total mechanical energy of given system is E. If mass of oscillating particle P is doubled then the new energy of the system for same amplitude is :



(1)  $\frac{E}{\sqrt{2}}$

(2) E

(3) 2E

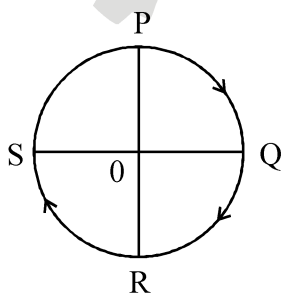
(4)  $E\sqrt{2}$

Question ID : 68019113843

Ans. Official Answer NTA(2)

Sol.

48. A cyclist starts from the point P of a circular ground of radius 2 km and travels along its circumference to the point S. The displacement of a cyclist is :



(1)  $\sqrt{8}$  km

(2) 4 km

(3) 6 km

(4) 8 km

Question ID : 68019113826

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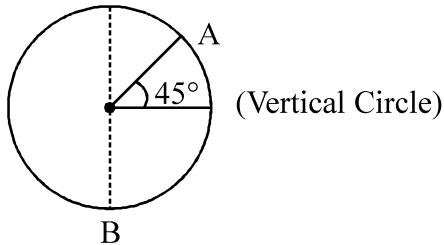




Ans. Official Answer NTA (1)

Sol.

49. A body of  $m$  kg slides from rest along the curve of vertical circle from point A to B in friction less path. The velocity of the body at B is :



(given,  $R = 14$  m,  $g = 10$  m/s<sup>2</sup> and  $\sqrt{2} = 1.4$ )

- (1) 19.8 m/s
- (2) 10.6 m/s
- (3) 21.9 m/s
- (4) 16.7 m/s

Question ID : 68019113829

Ans. Official Answer NTA (3)

Sol.

50. Given below are two statements :

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

Statement II : The rise of a liquid in a capillary tube does not depend on the inner radius of the tube.

In the light of the above statements, choose the correct answer from the options given below :

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

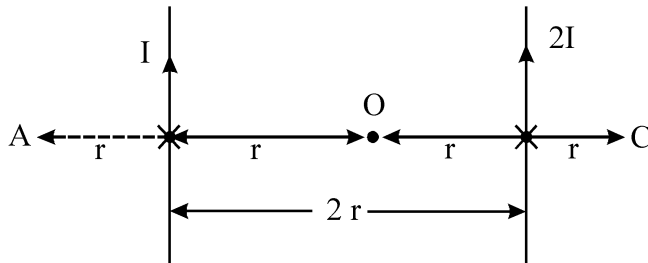
Question ID : 68019113831

Ans. Official Answer NTA (3)



Sol.

51. Two parallel long current carrying wire separated by a distance  $2r$  are shown in the figure. The ratio of magnetic field at A to the magnetic field produce at C is  $\frac{x}{7}$ . The value of x is \_\_\_\_\_.



Question ID : 68019113847

Ans. Official Answer NTA (5)

Sol.

52. Two wires A and B are made up of the same material and have the same mass. Wire A has radius of 2.0 mm and wire B has radius of 4.0 mm. The resistance of wire B is  $2\Omega$ . The resistance of wire A is \_\_\_\_\_  $\Omega$ .

Question ID: 68019113848

Ans. Official Answer NTA (32)

Sol.

53. A light ray is incident on a glass slab of thickness  $4\sqrt{3}$  cm and refractive index  $\sqrt{2}$ . The angle of incidence is equal to the critical angle for the glass slab with air. The lateral displacement of ray after passing through glass slab is \_\_\_\_\_ cm.

(Given  $\sin 15^\circ = 0.25$ )

Question ID : 68019113845

Ans. Official Answer NTA (2)

Sol.

54. A bus moving along a straight highway with speed of 72 km/h is brought to halt within 4s after applying the brakes. The distance travelled by the bus during this time (Assume the retardation is uniform) is \_\_\_\_\_ m.

Question ID : 68019113852

Ans. Official Answer NTA (40)

Sol.



55. The displacement of a particle executing SHM is given by  $x = 10 \sin \left( \omega t + \frac{\pi}{3} \right)$  m. The time period of motion is 3.14 s. The velocity of the particle at  $t = 0$  is \_\_\_\_\_

Question ID : 68019113849

Ans. Official Answer NTA (10)

Sol.

56. A parallel plate capacitor of capacitance 12.5 pF is charged by a battery connected between its plates to potential difference of 12.0 V. The battery is now disconnected and a dielectric slab ( $\epsilon_r = 6$ ) is inserted between the plates. The change in its potential energy after inserting the dielectric slab is \_\_\_\_\_  $\times 10^{-12}$  J.

Question ID : 68019113853

Ans. Official Answer NTA (750)

Sol.

57. Mercury is filled in a tube radius 2 cm up to height of 30 cm. The force exerted by mercury on the bottom of the tube is \_\_\_\_\_ N.

(Given, atmospheric pressure =  $10^5$  Nm<sup>-2</sup>, density of mercury =  $1.36 \times 10^4$  kg m<sup>-3</sup>,  $g = 10$  m s<sup>-2</sup>,  $\pi = \frac{22}{7}$ )

Question ID : 68019113850

Ans. Official Answer NTA (177)

Sol.

58. In a system two particles of masses  $m_1 = 3$  kg and  $m_2 = 2$  kg are placed at certain distance from each other. The particle of mass  $m_1$  is moved towards the center of mass of the system through a distance 2 cm. In order to keep the center of mass of the system at the original position, the particle of mass  $m_2$  should move towards the center of mass by the distance \_\_\_\_\_ cm.

Question ID : 68019113851

Ans. Official Answer NTA (3)

Sol.

59. The disintegration energy  $Q$  for the nuclear fission of  $^{235}\text{U} \rightarrow ^{140}\text{Ce} + ^{94}\text{Zr} + n$  is \_\_\_\_\_ MeV.

Given atomic masses of  $^{235}\text{U} : 235.0439\text{u}$ ;  $^{140}\text{Ce} : 139.9054\text{u}$ ,

$^{94}\text{Zr} : 93.9063\text{u}$ ;  $n : 1.0086\text{u}$ ,

value of  $c^2 = 931\text{MeV/u}$ .

Question ID : 68019113844

Ans. Official Answer NTA (208)



Sol.

60. A rod of length 60 cm rotates with a uniform angular velocity  $20 \text{ rad s}^{-1}$  about its perpendicular bisector, in a uniform magnetic field  $0.5 \text{ T}$ . The direction of magnetic field is parallel to the axis of rotation. The difference between the two ends of the rod is \_\_\_\_\_ V.

Question ID : 68019113846

Ans. Official Answer NTA(0)

Sol.

