

FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Saturday 15th April, 2023)

TIME : 9 : 00 AM to 12 : 00 NOON

PHYSICS

TEST PAPER WITH ANSWER

SECTION-A

31. The electric field due to a short electric dipole at a large distance (r) from center of dipole on the equatorial plane varies with distance as :

- (1) r (2) $\frac{1}{r}$
 (3) $\frac{1}{r^3}$ (4) $\frac{1}{r^2}$

Official Ans. by NTA (3)

Ans. (3)

32. In a linear simple harmonic motion (SHM)
 (A) Restoring force is directly proportional to the displacement.
 (B) The acceleration and displacement are opposite in direction.
 (C) The velocity is maximum at mean position.
 (D) The acceleration is minimum at extreme points
 Choose the correct answer from the options given below :

- (1) (A), (B) and (C) only
 (2) (C) and (D) only
 (3) (A), (B) and (D) only
 (4) (A), (C) and (D) only

Official Ans. by NTA (1)

Ans. (1)

33. Two identical particles each of mass 'm' go round a circle of radius a under the action of their mutual gravitational attraction. The angular speed of each particle will be :

- (1) $\sqrt{\frac{Gm}{2a^3}}$ (2) $\sqrt{\frac{Gm}{8a^3}}$
 (3) $\sqrt{\frac{Gm}{4a^3}}$ (4) $\sqrt{\frac{Gm}{a^3}}$

Official Ans. by NTA (3)

Ans. (3)

34. The height of transmitting antenna is 180 m and the height of the receiving antenna is 245 m. The maximum distance between them for satisfactory communication in line of sight will be :

(given $R = 6400$ km)

- (1) 48 km (2) 56 km
 (3) 96 km (4) 104 km

Official Ans. by NTA (4)

Ans. (4)

35. The half-life of a radioactive nucleus is 5 years. The fraction of the original sample that would decay in 15 years is :

- (1) $\frac{1}{8}$ (2) $\frac{1}{4}$
 (3) $\frac{7}{8}$ (4) $\frac{3}{4}$

Official Ans. by NTA (3)

Ans. (3)

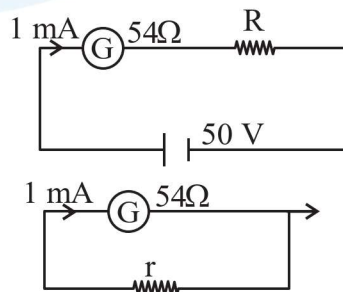
36. The de Broglie wavelength of an electron having kinetic energy E is λ . If the kinetic energy of electron becomes $\frac{E}{4}$, then its de-Broglie wavelength will be :

- (1) $\frac{\lambda}{\sqrt{2}}$ (2) $\frac{\lambda}{2}$
 (3) 2λ (4) $\sqrt{2}\lambda$

Official Ans. by NTA (3)

Ans. (3)

37. For designing a voltmeter of range 50 V and an ammeter of range 10 mA using a galvanometer which has a coil of resistance 54Ω showing a full scale deflection for 1 mA as in figure.



- (A) for voltmeter $R \approx 50 \text{ k}\Omega$
- (B) for ammeter $r \approx 0.2 \Omega$
- (C) for ammeter $r \approx 6 \Omega$
- (D) for voltmeter $R \approx 5 \text{ k}\Omega$
- (E) for voltmeter $R \approx 500 \Omega$

Choose the correct answer from the options given below :

- (1) (C) and (E) (2) (C) and (D)
- (3) (A) and (C) (4) (A) and (B)

Official Ans. by NTA (3)

Ans. (3)

38. (A flask contains Hydrogen and Argon in the ratio 2:1 by mass. The temperature of the mixture is 30°C . The ratio of average kinetic energy per molecule of the two gases (K argon/K hydrogen) is: (Given: Atomic Weight of Ar = 39.9)

- (1) 1 (2) 2
- (3) $\frac{39.9}{2}$ (4) 39.9

Official Ans. by NTA (1)

Ans. (1)

39. Given below are two statements:

Statement I : The equivalent resistance of resistors in a series combination is smaller than least resistance used in the combination.

Statement II : The resistivity of the material is independent of temperature.

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

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

Official Ans. by NTA (2)

Ans. (2)

40. A body is released from a height equal to the radius (R) of the earth. The velocity of the body when it strikes the surface of the earth will be :

(Given g = acceleration due to gravity on the earth.)

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

Official Ans. by NTA (1)

Ans. (1)

41. A 12 V battery connected to a coil of resistance 6Ω through a switch, drives a constant current in the circuit. The switch is opened in 1 ms. The emf induced across the coil is 20 V. The inductance of the coil is :

- (1) 5 mH (2) 12 mH
- (3) 8 mH (4) 10 mH

Official Ans. by NTA (D)

Ans. (D)

42. A wire of length 'L' and radius 'r' is clamped rigidly at one end. When the other end of the wire is pulled by a force f, its length increases by ' ℓ '.

Another wire of same material of length '2L' and radius '2r' is pulled by a force '2f'. Then the increase in its length will be :

- (1) 2ℓ (2) ℓ
- (3) 4ℓ (4) $\ell/2$

Official Ans. by NTA (2)

Ans. (2)

43. The position of a particle related to time is given by $x = (5t^2 - 4t + 5)\text{m}$. The magnitude of velocity of the particle at $t = 2\text{s}$ will be :

- (1) 10 ms^{-1} (2) 14 ms^{-1}
- (3) 16 ms^{-1} (4) 06 ms^{-1}

Official Ans. by NTA (3)

Ans. (3)

44. The position vector of a particle related to time t is given by

$$\vec{r} = (10t\hat{i} + 15t^2\hat{j} + 7t\hat{k})\text{m}$$

The direction of net force experienced by the particle is :

- (1) Positive y-axis (2) Positive x-axis
 (3) Positive z-axis (4) In x-y plane

Official Ans. by NTA (1)

Ans. (1)

45. Match List I with List II of Electromagnetic waves with corresponding wavelength range :

List I	List II
(A) Microwave	(I) 400 nm to 1 nm
(B) Ultraviolet	(II) 1 nm to 10^{-3} nm
(C) X-Ray	(III) 1 mm to 700 nm
(D) Infra-red	(IV) 0.1 m to 1mm

Choose the correct answer from the options given below :

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

Official Ans. by NTA (2)

Ans. (2)

46. A vector in x-y plane makes an angle of 30° with y-axis. The magnitude of y-component of vector is $2\sqrt{3}$. The magnitude of x-component of the vector will be :

- (1) $\frac{1}{\sqrt{3}}$ (2) 6
 (3) $\sqrt{3}$ (4) 2

Official Ans. by NTA (4)

Ans. (4)

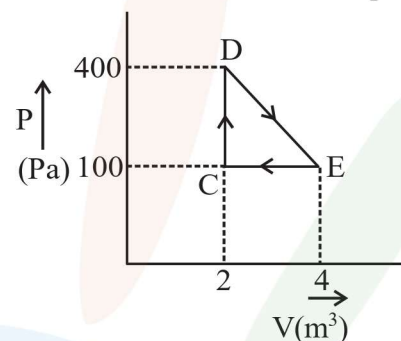
47. The speed of a wave produced in water is given by $v = \lambda^a g^b \rho^c$. Where λ , g and ρ are wavelength of wave, acceleration due to gravity and density of water respectively. The values of a , b and c respectively, are :

- (1) $\frac{1}{2}, \frac{1}{2}, 0$ (2) 1, 1, 0
 (3) 1, -1, 0 (4) $\frac{1}{2}, 0, \frac{1}{2}$

Official Ans. by NTA (1)

Ans. (1)

48. A thermodynamic system is taken through cyclic process. The total work done in the process is :



- (1) 100 J (2) 300 J
 (3) Zero (4) 200 J

Official Ans. by NTA (2)

Ans. (2)

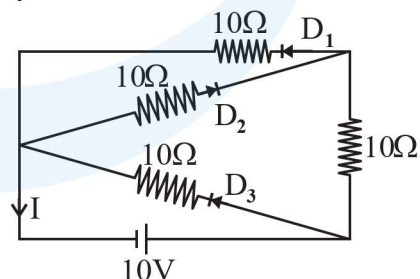
49. A single slit of width a is illuminated by a monochromatic light of wavelength 600 nm. The value of 'a' for which first minimum appears at $\theta = 30^\circ$ on the screen will be :

- (1) $0.6 \mu\text{m}$ (2) $1.2 \mu\text{m}$
 (3) $1.8 \mu\text{m}$ (4) $3 \mu\text{m}$

Official Ans. by NTA (2)

Ans. (2)

50. In the given circuit, the current (I) through the battery will be :



- (1) 1.5 A (2) 1 A
 (3) 2.5 A (4) 2 A

Official Ans. by NTA (1)

Ans. (1)

SECTION-B

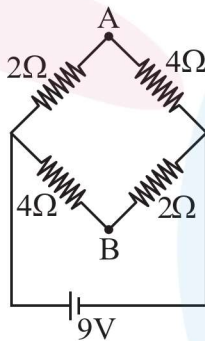
51. A 20 cm long metallic rod is rotated with 210 rpm about an axis normal to the rod passing through its one end. The other end of the rod is in contact with a circular metallic ring. A constant and uniform magnetic field 0.2T parallel to the axis exists everywhere. The emf developed between the centre and the ring is _____ mV.

Take $\pi = \frac{22}{7}$

Official Ans. by NTA (88)

Ans. (88)

52. A network of four resistances is connected to 9V battery, as shown in figure. The magnitude of voltage difference between the points A and B is _____ V.



Official Ans. by NTA (3)

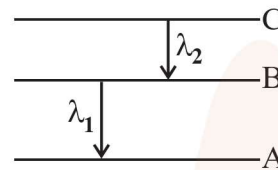
Ans. (3)

53. The fundamental frequency of vibration of a string stretched between two rigid support is 50 Hz. The mass of the string is 18 g and its linear mass density is 20 g/m. The speed of the transverse waves so produced in the string is _____ ms⁻¹.

Official Ans. by NTA (90)

Ans. (90)

54. As per given figure A, B and C are the first, second and third excited energy level of hydrogen atom respectively. If the ratio of the two wavelengths (i.e. $\frac{\lambda_1}{\lambda_2}$) is $\frac{7}{4n}$, then the value of n will be _____.



Official Ans. by NTA (5)

Ans. (5)

55. A solid sphere and a solid cylinder of same mass and radius are rolling on a horizontal surface without slipping. The ratio of their radius of gyration respectively ($k_{sph} : k_{cyl}$) is $2 : \sqrt{x}$, then value of x is _____.

Official Ans. by NTA (5)

Ans. (5)

56. The refractive index of a transparent liquid filled in an equilateral hollow prism is $\sqrt{2}$. The angle of minimum deviation for the liquid will be _____°.

Official Ans. by NTA (30)

Ans. (30)

57. An electron in a hydrogen atom revolves around its nucleus with a speed of 6.76×10^6 ms⁻¹ in an orbit of radius 0.52 Å. The magnetic field produced at the nucleus of the hydrogen atom is _____ T.

Official Ans. by NTA (40)

Ans. (40)

58. There is an air bubble of radius 1.0 mm in a liquid of surface tension 0.075 Nm^{-1} and density 1000 kg m^{-3} at a depth of 10 cm below the free surface. The amount by which the pressure inside the bubble is greater than the atmospheric pressure is _____ Pa ($g = 10 \text{ ms}^{-2}$)

Official Ans. by NTA (1150)

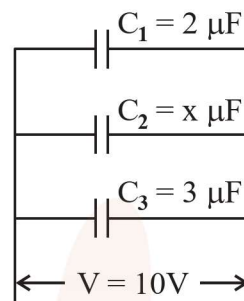
Ans. (1150)

59. A block of mass 10 kg is moving along x-axis under the action of force $F = 5x \text{ N}$. The work done by the force in moving the block from $x = 2\text{m}$ to 4m will be _____ J.

Official Ans. by NTA (30)

Ans. (30)

60. In the given figure the total charge stored in the combination of capacitors is $100 \mu\text{C}$. The value of 'x' is _____ .



Official Ans. by NTA (5)

Ans. (5)