

FINAL JEE-MAIN EXAMINATION – JANUARY, 2023
(Held On Tuesday 31st January, 2023)
TIME : 3 : 00 PM to 6 : 00 PM
PHYSICS
TEST PAPER WITH ANSWER
SECTION-A

1. The H amount of thermal energy is developed by a resistor in 10 s when a current of 4A is passed through it. If the current is increased to 16A, the thermal energy developed by the resistor in 10 s will be:

- (1) H (2) 16H
 (3) $\frac{H}{4}$ (4) 4H

Official Ans. by NTA (2)
Ans. (2)

2. A body is moving with constant speed, in a circle of radius 10 m. The body completes one revolution in 4 s. At the end of 3rd second, the displacement of body (in m) from its starting point is:

- (1) 30 (2) 15π
 (3) 5π (4) $10\sqrt{2}$

Official Ans. by NTA (4)
Ans. (4)

3. A microscope is focused on an object at the bottom of a bucket. If liquid with refractive index $\frac{5}{3}$ is poured inside the bucket, then microscope have to be raised by 30 cm to focus the object again. The height of the liquid in the bucket is :

- (1) 75 cm (2) 50 cm
 (3) 18 cm (4) 12 cm

Official Ans. by NTA (1)
Ans. (1)

4. A stone of mass 1 kg is tied to end of a massless string of length 1 m. If the breaking tension of the string is 400 N, then maximum linear velocity, the stone can have without breaking the string, while rotating in horizontal plane, is:

- (1) 20 ms^{-1} (2) 40 ms^{-1}
 (3) 400 ms^{-1} (4) 10 ms^{-1}

Official Ans. by NTA (1)
Ans. (1)

5. For a solid rod, the Young's modulus of elasticity is $3.2 \times 10^{11} \text{ Nm}^{-2}$ and density is $8 \times 10^3 \text{ kg m}^{-3}$. The velocity of longitudinal wave in the rod will be.

- (1) $145.75 \times 10^3 \text{ ms}^{-1}$
 (2) $3.65 \times 10^3 \text{ ms}^{-1}$
 (3) $18.96 \times 10^3 \text{ ms}^{-1}$
 (4) $6.32 \times 10^3 \text{ ms}^{-1}$

Official Ans. by NTA (4)
Ans. (4)

6. A long conducting wire having a current I flowing through it, is bent into a circular coil of N turns. Then it is bent into a circular coil of n turns. The magnetic field is calculated at the centre of coils in both the cases. The ratio of the magnetic field in first case to that of second case is:

- (1) N : n (2) $n^2 : N^2$
 (3) $N^2 : n^2$ (4) n : N

Official Ans. by NTA (3)
Ans. (3)

7. Heat energy of 735 J is given to a diatomic gas allowing the gas to expand at constant pressure. Each gas molecule rotates around an internal axis but do not oscillate. The increase in the internal energy of the gas will be:

- (1) 525 J (2) 441 J
 (3) 572 J (4) 735 J

Official Ans. by NTA (1)
Ans. (1)

8. Given below are two statements

Statement I: For transmitting a signal, size of antenna (l) should be comparable to wavelength of signal (at least $l = \frac{\lambda}{4}$ in dimension).

Statement II: In amplitude modulation, amplitude of carrier wave remains constant (unchanged).

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

23. A water heater of power 2000 W is used to heat water. The specific heat capacity of water is $4200 \text{ J kg}^{-1} \text{ K}^{-1}$. The efficiency of heater is 70%. Time required to heat 2 kg of water from 10°C to 60°C is _____ s.

(Assume that the specific heat capacity of water remains constant over the temperature range of the water).

Official Ans. by NTA (300)

Ans. (300)

24. A ball is dropped from a height of 20 m. If the coefficient of restitution for the collision between ball and floor is 0.5, after hitting the floor, the ball rebounds to a height of _____ m.

Official Ans. by NTA (5)

Ans. (5)

25. Two discs of same mass and different radii are made of different materials such that their thicknesses are 1 cm and 0.5 cm respectively. The densities of materials are in the ratio 3:5. The moment of inertia of these discs respectively about their diameters will be in the ratio of $\frac{x}{6}$. The value of x is _____.

Official Ans. by NTA (5)

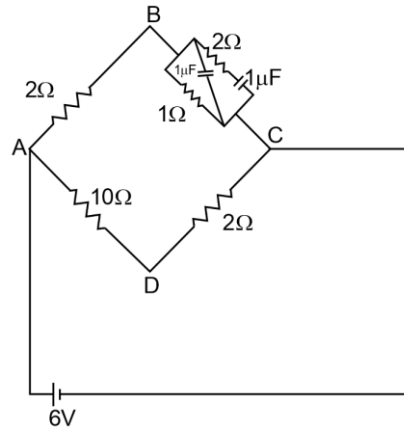
Ans. (5)

26. If the binding energy of ground state electron in a hydrogen atom is 13.6 eV, then, the energy required to remove the electron from the second excited state of Li^{2+} will be: $x \times 10^{-1}$ eV. The value of x is _____.

Official Ans. by NTA (136)

Ans. (136)

27. For the given circuit, in the steady state, $|V_B - V_D| =$ _____ V.



Official Ans. by NTA (1)

Ans. (1)

28. Two parallel plate capacitors C_1 and C_2 each having capacitance of $10 \mu\text{F}$ are individually charged by a 100 V D.C. source. Capacitor C_1 is kept connected to the source and a dielectric slab is inserted between its plates. Capacitor C_2 is disconnected from the source and then a dielectric slab is inserted in it. Afterwards the capacitor C_1 is also disconnected from the source and the two capacitors are finally connected in parallel combination. The common potential of the combination will be _____ V. (Assuming Dielectric constant = 10)

Official Ans. by NTA (55)

Ans. (55)

29. The displacement equations of two interfering waves are given by

$$y_1 = 10 \sin \left(\omega t + \frac{\pi}{3} \right) \text{ cm,}$$

$$y_2 = 5 \left[\sin(\omega t) + \sqrt{3} \cos \omega t \right] \text{ cm respectively. The amplitude of the resultant wave is _____ cm.}$$

Official Ans. by NTA (20)

Ans. (20)

30. Two bodies are projected from ground with same speeds 40 ms^{-1} at two different angles with respect to horizontal. The bodies were found to have same range. If one of the body was projected at an angle of 60° , with horizontal then sum of the maximum heights, attained by the two projectiles, is _____ m. (Given $g = 10 \text{ ms}^{-2}$)

Official Ans. by NTA (80)

Ans. (80)