

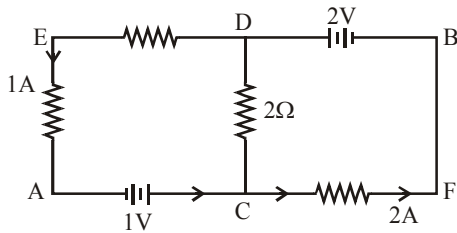
FINAL JEE-MAIN EXAMINATION – SEPTEMBER, 2020

(Held On Saturday 05th SEPTEMBER, 2020) TIME : 3 PM to 6 PM

PHYSICS

TEST PAPER WITH ANSWER

1. In the circuit, given in the figure currents in different branches and value of one resistor are shown. Then potential at point B with respect to the point A is :



- (1) +1V (2) - 1V (3) - 2V (4) +2V

Official Ans. by NTA (1)

2. A parallel plate capacitor has plate of length 'l', width 'w' and separation of plates is 'd'. It is connected to a battery of emf V. A dielectric slab of the same thickness 'd' and of dielectric constant $k = 4$ is being inserted between the plates of the capacitor. At what length of the slab inside plates, will be energy stored in the capacitor be two times the initial energy stored?

- (1) $l/4$ (2) $l/2$ (3) $l/3$ (4) $2l/3$

Official Ans. by NTA (3)

3. Ten charges are placed on the circumference of a circle of radius R with constant angular separation between successive charges. Alternate charges 1, 3, 5, 7, 9 have charge (+q) each, while 2, 4, 6, 8, 10 have charge (-q) each. The potential V and the electric field E at the centre of the circle are respectively:

(Take $V = 0$ at infinity)

(1) $V = \frac{10q}{4\pi\epsilon_0 R}; E = \frac{10q}{4\pi\epsilon_0 R^2}$

(2) $V = 0, E = \frac{10q}{4\pi\epsilon_0 R^2}$

(3) $V = 0, E = 0$

(4) $V = \frac{10q}{4\pi\epsilon_0 R}; E = 0$

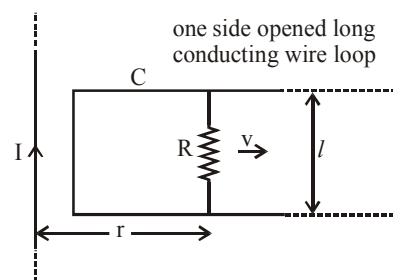
Official Ans. by NTA (3)

4. An iron rod of volume 10^{-3} m^3 and relative permeability 1000 is placed as core in a solenoid with 10 turns/cm. If a current of 0.5 A is passed through the solenoid, then the magnetic moment of the rod will be :

- (1) $0.5 \times 10^2 \text{ Am}^2$ (2) $50 \times 10^2 \text{ Am}^2$
(3) $500 \times 10^2 \text{ Am}^2$ (4) $5 \times 10^2 \text{ Am}^2$

Official Ans. by NTA (4)

5. An infinitely long straight wire carrying current I, one side opened rectangular loop and a conductor C with a sliding connector are located in the same plane, as shown in the figure. The connector has length l and resistance R. It slides to the right with a velocity v. The resistance of the conductor and the self inductance of the loop are negligible. The induced current in the loop, as a function of separation r, between the connector and the straight wire is :



(1) $\frac{\mu_0}{\pi} \frac{Ivl}{Rr}$ (2) $\frac{\mu_0}{2\pi} \frac{Ivl}{Rr}$

(3) $\frac{2\mu_0}{\pi} \frac{Ivl}{Rr}$ (4) $\frac{\mu_0}{4\pi} \frac{Ivl}{Rr}$

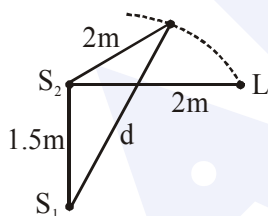
Official Ans. by NTA (2)

6. The acceleration due to gravity on the earth's surface at the poles is g and angular velocity of the earth about the axis passing through the pole is ω . An object is weighed at the equator and at a height h above the poles by using a spring balance. If the weights are found to be same, then h is : ($h \ll R$, where R is the radius of the earth)

- (1) $\frac{R^2\omega^2}{8g}$ (2) $\frac{R^2\omega^2}{4g}$ (3) $\frac{R^2\omega^2}{g}$ (4) $\frac{R^2\omega^2}{2g}$

Official Ans. by NTA (4)

7. Two coherent sources of sound, S_1 and S_2 , produce sound waves of the same wavelength, $\lambda = 1$ m, in phase. S_1 and S_2 are placed 1.5 m apart (see fig.) A listener, located at L , directly in front of S_2 finds that the intensity is at a minimum when he is 2m away from S_2 . The listener moves away from S_1 , keeping his distance from S_2 fixed. The adjacent maximum of intensity is observed when the listener is at a distance d from S_1 . Then, d is :



- (1) 12m (2) 3m (3) 5m (4) 2m

Official Ans. by NTA (2)

8. A driver in a car, approaching a vertical wall notices that the frequency of his car horn, has changed from 440 Hz to 480 Hz, when it gets reflected from the wall. If the speed of sound in air is 345 m/s, then the speed of the car is

- (1) 36 km/hr (2) 24 km/hr
(3) 18 km/hr (4) 54 km/hr

Official Ans. by NTA (4)

9. In an adiabatic process, the density of a diatomic gas becomes 32 times its initial value. The final pressure of the gas is found to be n times the initial pressure. The value of n is:

- (1) 326 (2) $\frac{1}{32}$ (3) 32 (4) 128

Official Ans. by NTA (4)

10. A radioactive nucleus decays by two different processes. The half life for the first process is 10s and that for the second is 100s. the effective half life of the nucleus is close to:

- (1) 9 sec (2) 55 sec
(3) 6 sec (4) 12 sec

Official Ans. by NTA (1)

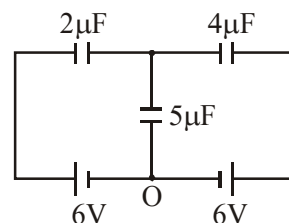
11. A ring is hung on a nail. It can oscillate, without slipping or sliding (i) in its plane with a time period T_1 and, (ii) back and forth in a direction perpendicular to its plane, with a period T_2 . the

ratio $\frac{T_1}{T_2}$ will be :

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

Official Ans. by NTA (1)

12. In the circuit shown, charge on the $5 \mu\text{F}$ capacitor is :



- (1) $5.45 \mu\text{C}$ (2) $16.36 \mu\text{C}$
(3) $10.90 \mu\text{C}$ (4) $18.00 \mu\text{C}$

Official Ans. by NTA (2)

13. In an experiment to verify Stokes law, a small spherical ball of radius r and density ρ falls under gravity through a distance h in air before entering a tank of water. If the terminal velocity of the ball inside water is same as its velocity just before entering the water surface, then the value of h is proportional to :

(ignore viscosity of air)

- (1) r (2) r^4 (3) r^3 (4) r^2

Official Ans. by NTA (2)

14. Two different wires having lengths L_1 and L_2 , and respective temperature coefficient of linear expansion α_1 and α_2 , are joined end-to-end. Then the effective temperature coefficient of linear expansion is :

(1) $4 \frac{\alpha_1 \alpha_2}{\alpha_1 + \alpha_2} \frac{L_2 L_1}{(L_2 + L_1)^2}$ (2) $2\sqrt{\alpha_1 \alpha_2}$

(3) $\frac{\alpha_1 + \alpha_2}{2}$ (4) $\frac{\alpha_1 L_1 + \alpha_2 L_2}{L_1 + L_2}$

Official Ans. by NTA (4)

15. The quantities $x = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$, $y = \frac{E}{B}$ and

$z = \frac{1}{CR}$ are defined where C-capacitance,

R-Resistance, l -length, E-Electric field, B-magnetic field and ϵ_0 , μ_0 , -free space permittivity and permeability respectively. Then :

- (1) Only x and y have the same dimension
 (2) x , y and z have the same dimension
 (3) Only x and z have the same dimension
 (4) Only y and z have the same dimension

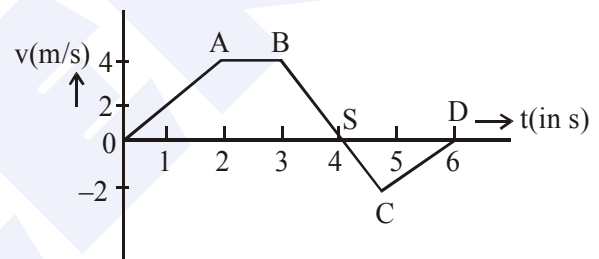
Official Ans. by NTA (2)

16. A galvanometer is used in laboratory for detecting the null point in electrical experiments. If, on passing a current of 6mA it produces a deflection of 2° , its figure of merit is close to :

- (1) 3×10^{-3} A/div.
 (2) 333° A/div.
 (3) 6×10^{-3} A/div.
 (4) 666° A/div.

Official Ans. by NTA (1)

17. The velocity (v) and time (t) graph of a body in a straight line motion is shown in the figure. The point S is at 4.333 seconds. The total distance covered by the body in 6s is :



- (1) 12m (2) $\frac{49}{4}$ m
 (3) 11 m (4) $\frac{37}{3}$ m

Official Ans. by NTA (4)

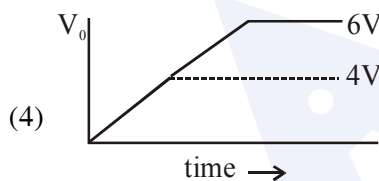
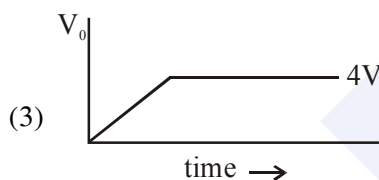
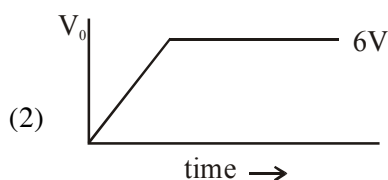
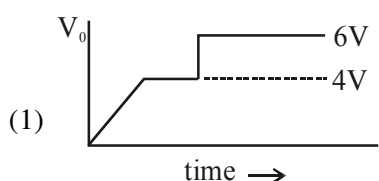
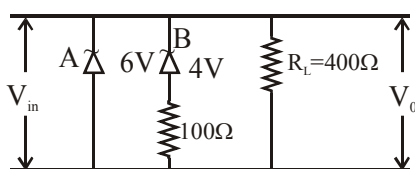
18. A spaceship in space sweeps stationary interplanetary dust. As a result, its mass increases at a rate $\frac{dM(t)}{dt} = bv^2(t)$, where $v(t)$ is its instantaneous velocity. The instantaneous acceleration of the satellite is:

- (1) $-\frac{2bv^3}{M(t)}$ (2) $-\frac{bv^3}{2M(t)}$
 (3) $-bv^3(t)$ (4) $-\frac{bv^3}{M(t)}$

Official Ans. by NTA (4)

19. Two Zener diodes (A and B) having breakdown voltages of 6V and 4V respectively, are connected as shown in the circuit below. The output voltage V_0 variation with input voltage linearly increasing with time, is given by :

($V_{input} = 0V$ at $t = 0$) (figures are qualitative)



Official Ans. by NTA (4)

Official Ans. by ALLEN (2)

20. The correct match between the entries in column I and column II are :

I	II
Radiation	Wavelength
(a) Microwave	(i) 100m
(b) Gamma rays	(ii) 10^{-15} m
(c) A.M. radio waves	(iii) 10^{-10} m
(d) X-rays	(iv) 10^{-3} m

(1) (a)-(ii), (b)-(i), (c)-(iv), (d)-(iii)

(2) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)

(3) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)

(4) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)

Official Ans. by NTA (4)

21. The surface of a metal is illuminated alternately with photons of energies $E_1 = 4eV$ and $E_2 = 2.5 eV$ respectively. The ratio of maximum speeds of the photoelectrons emitted in the two cases is 2. The work function of the metal in (eV) is _____.

Official Ans. by NTA (2.00)

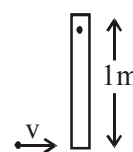
22. Nitrogen gas is at $300^\circ C$ temperature. The temperature (in K) at which the rms speed of a H_2 molecule would be equal to the rms speed of a nitrogen molecule, is _____.

(Molar mass of N_2 gas 28 g)

Official Ans. by NTA (41.00)

Official Ans. by ALLEN (40.93)

23. A thin rod of mass 0.9 kg and length 1m is suspended, at rest, from one end so that it can freely oscillate in the vertical plane. A particle of mass 0.1 kg moving in a straight line with velocity 80 m/s hits the rod at its bottom most point and sticks to it (see figure). The angular speed (in rad/s) of the rod immediately after the collision will be _____.



Official Ans. by NTA (20.00)

24. A body of mass 2kg is driven by an engine delivering a constant power 1J/s. The body starts from rest and moves in a straight line. After 9 seconds, the body has moved a distance (in m) _____.

Official Ans. by NTA (18.00)

25. A prism of angle $A = 1^\circ$ has a refractive index $\mu = 1.5$. A good estimate for the minimum angle of deviation (in degrees) is close to $N/10$. Value of N is _____.

Official Ans. by NTA (5.00)