JEE Main 31 January 2024 Shift 1 Answer Key

Physics

Q.1: If the stopping potential is 8 V for incident light with wavelength λ and it is 2 V for a wavelength of 3λ, then find the threshold wavelength.
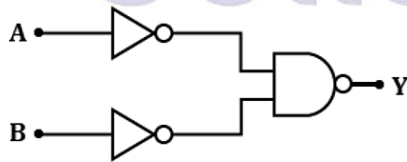A.1: 9λ

Q.2: If two charges Q and 3Q are kept in a line separated by a distance R, the electric field is zero at a distance x from origin O. Find the value of x
A.2: A2 - (√3 - 1)R/2

Q.3: The mass defect in a nuclear reaction is 0.4 u. If the Q value of the reaction is x/10 MeV, then find x. (Take 1 u = 930.5 MeV/c2)
A.3: 3722

Q.4: What is the logic gate equivalent to the given logic circuit?

A.4: OR

Q.5: A pulley is placed on top of a triangular surface such that it forms 53° and 37° with the horizontal. The pulley carries two blocks of masses M and m on the 53° incline and 37° incline respectively. If M = 10 kg has an acceleration of 2 m/s^2 in the direction of the 53° incline plane, then find the mass m.

A.5: 7.5 kg

Q.6: If the percentage error in measuring the length and diameter of a wire is 0.1% each, then find the percentage error of the resistance of the wire.

A.6: 0.3%

Q.7: Four identical particles of mass m each are placed at 4 corners of a square. The gravitational force exerted on one of the masses by other masses is $[(2\sqrt{2}+1)/32]\ Gm^2/l^2$. Find the length of the side of the square.

A.7: 4l

Q.8: A ball dropped from height H rebounds up to height h after colliding with a horizontal surface. If the coefficient of restitution for collision is e = 1/2, then find H/h.

A.8: 4

Q.9: For a 1-D motion, relation between position x and time t is $t = \alpha x^2 + \beta x$. Find the relation between velocity v and acceleration a.

A.9: $a = 2v^3$

Q.10: Two resistances having the coefficient of variation of resistivity α_1 and α_2 have equal resistance. Find the equivalent temperature coefficient of resistivity in series and parallel combinations.

A.10: $\frac{a_1+a_2}{2}, \frac{a_1+a_2}{2}$

Q.11: The fundamental frequency of a closed organ pipe is equal to the frequency of the first overtone of an open organ pipe of length 60 cm. What is the length of the closed organ pipe?

A.11: 15 cm

Q.12: Force F depends on distance x and time t as $F = ax^2 + bt^{1/2}$. What final b^2/a dimension?

A.12: ML^3T^{-3}

Q.13: Two charges q and 3q are placed at a distance r from each other. Find the distance from q where the electric field is zero.

A.13: $r/\sqrt{3} + 1$

Q.14: The refractive index of a thin prism of an apex angle A is cot (A/2). Find the minimum angle of deviation.

A.14: $180° - 2A$

Q.15: In a single electron atom/ion, the first member of the Lyman series is 1, then find the wavelength of the second member of their series.

A.15: $\frac{27}{32}\lambda$

Q.16: In YDSE, the intensity at two sources is in the ratio of 1:9. If the source is incoherent then the intensity at the central point is I_1, and if the sources are coherent (and phase differs by 60°) then the intensity at the central point is I_2 then I_1/I_2 is?

A.16: 10/13

Q.17: Calculate the average energy density of an electromagnetic wave whose electric field is oscillating with amplitude 50 V/m and frequency 5 x 10^{10} Hz.

A.17: $1.1 \times 10^{-8} J/m^3$

Q.18: A uniform disk of mass 50 kg is rolling without slipping with a speed of 0.4 m/s. Find the minimum energy required to bring the disk to rest (in J).

A.18: 6 J

Q.19: At any instant, the magnetic field inside a coil is 3000 T and it changes to 2000 T in the next 2 seconds. If the average induced emf through the coil is 22 V, then find the number of turns in the coil. (Area of turn is 2×10^{-3} m^2)

A.19: 22

Q.20: A parallel plate capacitor with plates separated by 5 mm then it draws a current of I_0 from the AC source. Now a dielectric of thickness 2 mm is inserted between plates then current draws increase by 25%. Find dielectric constant.

A.20: 2