CBSE Board Short Numerical

Question 1: If the ionization energy for a hydrogen atom is 13.6 eV. What is the energy of the level with quantum number n=4?

a) -1.51eV
b) -.85eV
c) -1 eV
d) None of these

Solution:
The energy of the quantum state for H is

$$E_n = \frac{-13.6}{n^2} eV$$

For n=4,

$$E_4 = -\frac{13.6}{4^2} = -.85eV$$

Question 2: To give a magnified image of a cavity a dentist holds a small mirror with a focal length of 12mm a distance 9 mm from a tooth. What will be the linear magnification obtained?
a) 4
b) 2
c) 3
d) None of these

Solution

We have

$$\frac{1}{9} + \frac{1}{x} = \frac{1}{12}$$

$$x = -36mm$$

So magnification =|x/9|=4

Question 3: A coil has inductance 2 H and resistance .5 ohm. If the coil is suddenly connected across a 15V battery. Find the time required for the current to rise to .63 of its final value
a) 4 s
b) 3 s
c) 1 s

d) none of these

Solution:
The time required is the time constant of the circuit
Time constant =L/R=4 s

Question 4 : A electron and proton are free in electric field. Which one will have greater acceleration?
a) electron
b) Proton

Solution

Now we know that acceleration in electric field is given by

a=qE/m

Both the particles have same charge but different mass
Electron is lighter than proton.
So from above equation,electron will be faster

Question 5: A $9X10^{-10}$ F capacitor is charged by a 100 V battery. How much electrostatic energy is stored in the capacitor?
a) $4.5X10^{-5}$ J

b) $5X10^{-6}$ J

c) $4X10^{-6}$ J

d) $4.5X10^{-6}$ J

Solution:
Electrostatic energy is given by

$$U = \frac{1}{2}CV^2$$

Substituting all the values
$U=4.5X10^{-6}$ J

Question 6:
Three resistances 16, 12 and 20 Ohm are connected in parallel. What resistance must be connected in series with this combination to give a total resistance of 30 Ohm?

a) 14 ohm
b) 13.1 ohm
c)19.89 ohm
d) 25.89 ohm

Solution:
The resistance of the parallel combination (12,16 and 20) is given by

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}$$

$$R=5.11\Omega$$

Now

$$R_x+R=30$$

$$R_x=25.98\Omega$$

Question 7:An alternating voltage E=200sin(300t) is applied across a series of combination of R=10ohm and L=800mH.
Calculate the power factor of the circuit
a).512
b) .421
c) .5
d) .0416

Solution:
Given
E_0 =200V
ω=300 rad/se
R=10 ohm
L=800mH=.8H

Now impedence of the circuit is given by

$$Z=\sqrt{R^2+(\omega L)^2}=240.2\Omega \text{ X}$$

Power factor is given by

$$\cos\phi=\frac{R}{Z}=.0416$$

Question 8: Sun an Moon emit maximum radiation at 5000 Å and $15X10^4$ Å
The temperature of the Moon is 200K ,what is the temperature of Sun
a) 6000K
b) 5000k
c)5476 K
d) 7000K

Solution:

By wien's displacement law,we have

$\lambda_m T = cons\tan t$

So

$(\lambda_m T)_{sun} = (\lambda_m T)_{moon}$

Or

$T_{sun} = 6000K$

Question 9: What is the dimensional formula for induced EMF

a) $ML^2T^{-3}A^{-1}$

b) $ML^3T^{-3}A^{-1}$

c) $ML^2T^{-3}A^{-2}$

d) None of these

Solution (a)

Question 10. The current is the primary coil of the circuit is reduced from 10 A to 0 uniformly in 1 ms. Calculate the emf induced in the secondary coil of the Coefficent of Mutual inductance is 3 H

a) 10000V

b) 12000V

c) 45000V

d) 30,000V

Solution:

$e = -M\frac{di}{dt}$

Here M=3H

$\frac{di}{dt} = \frac{10}{10^{-3}} = 10{,}000$

So e=30000V