

## 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) -0.85eV
- 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  $n=4$ ,

$$E_4 = -\frac{13.6}{4^2} = -0.85eV$$

**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

$$\text{Time constant} = L/R = 4 \text{ s}$$

**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  $9 \times 10^{-10}$  F capacitor is charged by a 100 V battery. How much electrostatic energy is stored in the capacitor?

a)  $4.5 \times 10^{-5}$  J

b)  $5 \times 10^{-6}$  J

c)  $4 \times 10^{-6}$  J

d)  $4.5 \times 10^{-6}$  J

**Solution:**

Electrostatic energy is given by

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

Substituting all the values

$$U = 4.5 \times 10^{-6} \text{ J}$$

**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  $E=200\sin(300t)$  is applied across a series of combination of  $R=10\text{ohm}$  and  $L=800\text{mH}$ .

Calculate the power factor of the circuit

- a).512
- b).421
- c).5
- d).0416

**Solution:**

Given

$$E_0 = 200\text{V}$$

$$\omega = 300 \text{ rad/se}$$

$$R = 10 \text{ ohm}$$

$$L = 800\text{mH} = .8\text{H}$$

Now impedance of the circuit is given by

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

Power factor is given by

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

**Question 8:** Sun and Moon emit maximum radiation at  $5000 \text{ \AA}$  and  $15 \times 10^4 \text{ \AA}$

The temperature of the Moon is  $200\text{K}$ , what is the temperature of Sun

- a) 6000K
- b) 5000k
- c) 5476 K
- d) 7000K

Solution:

By Wien's displacement law, we have

$$\lambda_m T = \text{constant}$$

So

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

Or

$$T_{\text{sun}} = 6000\text{K}$$

**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 in 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 Coefficient of Mutual inductance is 3 H

- a) 10000V
- b) 12000V
- c) 45000V
- d) 30,000V

**Solution:**

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

Here  $M=3\text{H}$

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

So  $e=30000\text{V}$