Topic covered:
- Mole Concept (Session - 1) - JEE

**Daily Practice Problems**

1. Calculate the number of FeSO$_4$.7H$_2$O formula units in 0.5 millimoles of pure FeSO$_4$.7H$_2$O.
   a. 0.5 $N_A$  
   b. 0.0005 $N_A$  
   c. 0.005 $N_A$  
   d. 5000 $N_A$

2. Find the number of millimoles of CH$_4$ in a sample containing $1.2044 \times 10^{21}$ CH$_4$ molecules.
   a. 2  
   b. 0.002  
   c. 20  
   d. 0.02

3. Find the total number of oxygen atoms in $6 \times 10^6$ formula units of the complex [Co(H$_2$O)$_6$]Cl$_2$.
   a. $42 \times 10^6$  
   b. $6 \times 10^6$  
   c. $3.6 \times 10^7$  
   d. $1.8 \times 10^7$

4. If we have a CuSO$_4$.5H$_2$O sample and it contains a total of 1116 oxygen atoms, find the number of formula units of CuSO$_4$.5H$_2$O present in the sample.
   a. 124  
   b. 9 $N_A$  
   c. 0.124 $N_A$  
   d. 279

5. Find the number of oxygen atoms in 10 millimoles of [Fe(H$_2$O)$_5$NO]SO$_4$.
   a. 0.01 $N_A$  
   b. 0.1 $N_A$  
   c. $N_A$  
   d. 10 $N_A$

6. Find the number of moles of MgSO$_4$.7H$_2$O in a pure sample that contains 0.0022 moles of oxygen atoms.
   a. 2 moles  
   b. 0.2 moles  
   c. 0.002 moles  
   d. 0.2 millimoles

7. Find the total number of moles of electrons in $6.023 \times 10^{23}$ NO$_3^-$ ions.
   a. 32  
   b. 31  
   c. 28  
   d. 30

8. Find the total number of electrons present in 20 millimoles of K$_2$SO$_4$.
   a. $2.03 \times 10^{24}$  
   b. $6.02 \times 10^{23}$  
   c. $1.04 \times 10^{24}$  
   d. $1.20 \times 10^{23}$
9. If we have a pure NaNO₃ sample that contains a total of 8.4 kilomoles of electrons, find the number of moles of NaNO₃ present in the sample.
   a. 200 moles
   b. 2 moles
   c. 0.2 moles
   d. 400 moles

10. If we have a pure CaCO₃ sample that contains a total of $1.5055 \times 10^{22}$ electrons, then the number of millimoles of CaCO₃ present in the sample is:
   a. 0.2
   b. 0.3
   c. 0.03
   d. 0.5
## Answer Key

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1. (b)
   1 millimole = 10^{-3} moles
   1 mole of pure FeSO\(_4\).7H\(_2\)O contains \(N_A\) number of formula units of FeSO\(_4\).7H\(_2\)O
   The number of formula units in 0.5 millimoles of pure FeSO\(_4\).7H\(_2\)O will be:
   = 0.5 \times 10^{-3} \times N_A
   = 0.0005 N_A

2. (a)
   1 mole CH\(_4\) contains \(6.022 \times 10^{23}\) molecules of CH\(_4\)
   So, the number of moles that have \(1.2044 \times 10^{21}\) molecules of CH\(_4\):
   = \frac{1.2044 \times 10^{21}}{6.022 \times 10^{23}}
   = 0.002
   = 2 millimoles

3. (c)
   Number of O-atoms present in one formula unit of [Co(H\(_2\)O)\(_6\)]Cl\(_2\) = 6
   Number of O-atoms present in \(6 \times 10^6\) formula units of [Co(H\(_2\)O)\(_6\)]Cl\(_2\) are,
   = 6 \times 6 \times 10^6
   = 3.6 \times 10^7\) atoms

4. (a)
   One formula unit of CuSO\(_4\).5H\(_2\)O has 9 O-atoms.
   So, \(1116\) O-atoms will be present in:
   = \frac{1116}{9}\) formula units of CuSO\(_4\).5H\(_2\)O
   = 124 formula unit of CuSO\(_4\).5H\(_2\)O

5. (b)
   Number of O-atoms in one formula unit of [Fe(H\(_2\)O)\(_5\)NO]SO\(_4\) = 10
   Therefore, number of O-atoms in one mole of [Fe(H\(_2\)O)\(_5\)NO]SO\(_4\) = 10 \(N_A\)
   So, number of O-atoms in 10 millimoles of [Fe(H\(_2\)O)\(_5\)NO]SO\(_4\)
   = 10 \times 10^{-3} \times 10 \(N_A\)
   = 0.1 \(N_A\)
6. (d)
11 O-atoms are present in one formula unit of MgSO$_4$.7H$_2$O
So, 11 moles of O-atoms are present in 1 mole of MgSO$_4$.7H$_2$O
The number of moles of MgSO$_4$.7H$_2$O that would have 0.0022 moles of O-atoms:
   \[ \frac{0.0022}{11} = 0.0002 \]
   = 0.2 millimoles

7. (a)
Total number of electrons in one NO$_3^-$ ion = 7 + (8×3) + 1 = 32
So, the number of electrons in 6.023 × 10$^{23}$ NO$_3^-$ ions:
   \[ = 6.023 \times 10^{23} \times 32 \]
   = 32 moles

8. (c)
Total number of electrons in one formula unit of K$_2$SO$_4$ = 19 × 2 + 16 + 8 × 4 = 86
So, total number of electrons present in one mole of K$_2$SO$_4$ = 86 × 6.022 × 10$^{23}$
Hence, total number of electrons in 20 millimoles K$_2$SO$_4$:
   \[ = 20 \times 10^{-3} \times 86 \times 6.022 \times 10^{23} \]
   = 1.04 × 10$^{24}$

9. (a)
Total number of electrons present in 1 formula unit of NaNO$_3$ = 11 + 7 + 24 = 42
So, total number of electrons present in one mole of NaNO$_3$ = 42 × 6.022 × 10$^{23}$
The moles of NaNO$_3$ that would have 8.4 kilomoles of electrons will moles of CaCO$_3$ moles of CaCO$_3$ be:
   \[ = \frac{8.4 \times 10^8 \times 6.022 \times 10^{23}}{42 \times 6.022 \times 10^{23}} \]
   = 200 moles

10. (d)
Total number of electrons present in 1 formula unit of CaCO$_3$ = 20 + 6 + 8 × 3 = 50
So, 50 × 6.022 × 10$^{23}$ electrons are present in 1 mol of CaCO$_3$
Hence, the number of moles of CaCO$_3$ that would have 1.5055 × 10$^{22}$ electrons will be:
   \[ = \frac{1.5055 \times 10^{22}}{50 \times 6.022 \times 10^{23}} \]
   = 0.0005
   = 0.5 millimoles