BYJU'S Home Learning Program

Topic covered:

- **Mole Concept (Session - 1) - JEE**

Worksheet

1. Calculate the number of NO_2 molecules in 4 moles of a pure sample of NO_2 molecules.
   a. 6.022×10^{23}
   b. 24.088×10^{23}
   c. 2.408×10^{23}
   d. 12.044×10^{23}

2. Calculate the number of formula units of Na_2SO_4 in 4/9 millimoles of a pure sample of Na_2SO_4.
   a. 24.088×10^{23}
   b. 2.41×10^{20}
   c. 2.68×10^{20}
   d. 2.68×10^{23}

3. Calculate the number of formula units of $CuSO_4.5H_2O$ present in 10^{-13} moles of pure $CuSO_4.5H_2O$.
   a. 6.022×10^{10}
   b. 6.022×10^{13}
   c. 6.022×10^{12}
   d. 6.022×10^{9}

4. Find the number of moles of NO_2 molecules in a sample containing 3.011×10^{23} molecules of NO_2.
   a. 0.05 moles
   b. 0.5 moles
   c. 2 moles
   d. 0.25 moles

5. Find the number of moles of HNO_3 molecules in a sample containing 10^6 molecules of HNO_3.
   a. 2.66×10^{-18} moles
   b. 2.66×10^{-20} moles
   c. 1.66×10^{-20} moles
   d. 1.66×10^{-18} moles

6. Find the number of millimoles of KOH in a sample containing 30 KOH molecules.
   a. 4.98×10^{-23}
   b. 0.498×10^{-23}
   c. 4.98×10^{23}
   d. 4.98×10^{-20}

7. Find the total number of oxygen atoms in 200 formula units of Na_2SO_4.
   a. 800
   b. 600
   c. 1200
   d. 1600

8. Find the total number of oxygen atoms in 3×10^3 formula units of $[Ni(H_2O)_6]Cl_2$.
   a. 6×10^3
   b. 18×10^3
   c. 24×10^3
   d. 0.6×10^3

9. If we have a pure CH_3OH sample and it contains a total of 6000 hydrogen atoms, then find the number of CH_3OH molecules present in the sample.
   a. 1200
   b. 1000
   c. 1500
   d. 800

10. We have a pure H_2SO_4 sample and it contains a total of 1120 hydrogen atoms. Find the number of H_2SO_4 molecules present in the sample.
   a. 560
   b. 2240
   c. 1120
   d. 1000

11. If we have a $FeSO_4.7H_2O$ sample and it contains a total of 2233 oxygen atoms, then find the number of formula units of $FeSO_4.7H_2O$ present in the sample.
   a. 210
   b. 203
   c. 103
   d. 233

12. Find the number of O-atoms in 2/3 moles of NO_2.
   a. 4.014×10^{23}
   b. 4.014×10^{20}
   c. 8.029×10^{23}
   d. 8.029×10^{20}

13. How many C-atoms are present in 2.6 micromoles of $C_6H_{12}O_6$?
   a. 3.13×10^{16}
   b. 6.26×10^{16}
   c. 1.56×10^{16}
   d. 9.39×10^{16}

14. How many O-atoms are present in 3/8 millimoles of $[Co(H_2O)_4Cl_2]Cl$?
   a. 9.033×10^{24}
   b. 2.26×10^{24}
   c. 9.033×10^{20}
   d. 2.26×10^{20}

15. Find the number of moles of N_2O_5 in a pure sample that contains 1 nanomole of O-atoms.
   a. 2×10^{-10} moles
   b. 0.2×10^{-10} moles
   c. 4×10^{-10} moles
   d. 0.4×10^{-10} moles

16. Find the number of moles of $CuSO_4.5H_2O$ in a pure sample that contains 0.045 moles of O-atoms.
   a. 0.5 moles
   b. 0.005 moles
   c. 50 moles
   d. 5 moles

17. Find the number of moles of $BaCl_2.2H_2O$ in a pure sample that contains 3/8 kilomoles of oxygen atoms.

18. Find the total number of moles of electrons present in 24.088×10^{23} SO_2 molecules.
   a. 132 moles
   b. 128 moles
   c. 232 moles
   d. 328 moles

19. Find the total number of moles of electrons present in 6.022×10^{18} H_3PO_4 molecules.
    a. 0.5 moles
    b. 0.05 moles
    c. 0.005 moles
    d. 0.0005 moles

20. Find the total number of moles of electrons present in 12.044×10^{14} PO_4^{3-} ions.

21. If we have a pure Na_2SO_4 sample that contains a total of 7 billion electrons, then find the number of moles of Na_2SO_4 present in the sample.
    a. 1.66×10^{-16} moles
    b. 1.66×10^{-14} moles
    c. 3.66×10^{-16} moles
    d. 3.66×10^{-14} mole

22. If we have a pure $Ca(NO3)_2$ sample that contains a total of 1.64 kilomoles of electrons then find the number of moles of $Ca(NO3)_2$ present in the sample.
    a. 10 moles
    b. 20 moles
    c. 30 moles
    d. 40 moles

23. If we have a pure $MgCO_3$ sample that contains a total of 1.26 millimoles of electrons, find the number of moles of $MgCO_3$ present in the sample.

24. Find the total number of electrons present in 40 millimoles of $BaSO_4$. (atomic number of Ba=56)
    a. 2.89×10^{24}
    b. 3.89×10^{24}
    c. 2.51×10^{24}
    d. 3.51×10^{24}

25. If we have a pure Na_2CO_3 sample that contains a total of 7.8286×10^{24} electrons, then find the number of moles of Na_2CO_3 present in the sample.
    a. 0.5 moles
    b. 0.3 moles
    c. 0.7 moles
    d. 0.25 moles

Answer Key

Question Number	1	2	3	4	5
Answer Key	(b)	(c)	(a)	(b)	(d)

Question Number	6	7	8	9	10
Answer Key	(d)	(a)	(b)	(c)	(a)

Question Number	11	12	13	14	15
Answer Key	(b)	(c)	(d)	(c)	(a)

Question Number	16	17	18	19	20
Answer Key	(b)	187.50 mol	(b)	(d)	10^{-7} mol

Question Number	21	22	23	24	25
Answer Key	(a)	(b)	3×10^{-5} mol	(c)	(d)

Solutions

1. (b)
   We know,
   1 mole of $NO_2 = 6.022 \times 10^{23}$ NO_2 molecules
   So, 4 moles of $NO_2 = 6.022 \times 10^{23} \times 4$ molecules$= 24.088 \times 10^{23}$ NO_2 molecules

2. (c)
   We know,
   1 mole of $Na_2SO_4 = 6.022 \times 10^{23}$ formula units of Na_2SO_4
   So, 1 millimole of $Na_2SO_4 = 6.022 \times 10^{20}$ formula units of Na_2SO_4
   Therefore 4/9 millimoles of Na_2SO_4
   $= 6.022 \times 10^{20} \times \frac{4}{9}$ formula units$= 2.68 \times 10^{20}$ formula units of Na_2SO_4

3. (a)
   We know,
   1 mole of $CuSO_4.5H_2O = 6.022 \times 10^{23}$ formula units of $CuSO_4.5H_2O$
   So, 10^{-13} moles of pure $CuSO_4.5H_2O$
   $= 6.022 \times 10^{23} \times 10^{-13}$ formula units $= 6.022 \times 10^{10}$ formula units of $CuSO_4.5H_2O$

4. (b)
   We know,
   6.022×10^{23} molecules of $NO_2 = 1$ mole of NO_2
   So, 3.011×10^{23} molecules of NO_2
   $= \frac{3.011\times10^{23}}{6.022\times10^{23}}$ moles $= 0.5$ moles of NO_2

5. (d)
   We know,
   6.022×10^{23} molecules of $HNO_3 = 1$ mole of HNO_3
   So, 10^6 molecules of $HNO_3 = \frac{10^6}{6.022\times10^{23}}$ moles $= 1.66 \times 10^{-18}$ moles of HNO_3

6. (d)
   We know,
   6.022×10^{23} molecules of KOH$= 1$ mole of KOH
   So, 30 molecules of KOH $= \frac{30}{6.022\times10^{23}}$ mole of KOH
   $= (\frac{30}{6.022\times10^{23}}) \times 10^3$ millimoles of KOH$= 4.98 \times 10^{-20}$ millimoles of KOH

7. (a)
Number of O-atoms in one formula unit of $Na_2SO_4 = 4$
So, number of O-atoms in 200 formula unit of $Na_2SO_4 = 200 \times 4 = 800$

8. (b)
Number of O-atoms in one formula unit of $[Ni(H_2O)_6]Cl_2 = 6$
So, number of O-atoms in 3×10^3 formula units of $[Ni(H_2O)_6]Cl_2 = 6 \times 3 \times 10^3$
$= 18 \times 10^3$

9. (c)
From the molecular formula of CH_3OH,
1 mole CH_3OH contains 4 moles of H atoms
So, we can say that 4 moles of H-atoms are present in 1 mole of CH_3OH.
Again, 6.022×10^{23} H-atoms = 1 mole of H-atoms
Therefore, 6000 H-atoms $= \frac{6000}{6.022\times10^{23}}$ moles of H-atoms
Hence number of CH_3OH molecules present in the sample
$= \frac{6000}{6.022\times10^{23}} \times \frac{1}{4} \times 6.022 \times 10^{23} = 1500$

10. (a)
From the molecular formula of H_2SO_4,
1 mole of H_2SO_4 contains 2 moles of H atoms
So, 2 moles of H-atoms are present in 1 mole of H_2SO_4
Again, 6.022×10^{23} H-atoms = 1 mole of H-atoms
Therefore, 1120 H-atoms $= \frac{1120}{6.022\times10^{23}}$ moles of H-atoms
Hence, number of H_2SO_4 molecules present in the sample
$= \frac{1120}{6.022\times10^{23}} \times \frac{1}{2} \times 6.022 \times 10^{23} = 560$

11. (b)
From the molecular formula of $FeSO_4.7H_2O$,
1 mole of $FeSO_4.7H_2O$ contains 11 moles of O-atoms
So, 11 moles of O-atoms are present in 1 mole of $FeSO_4.7H_2O$
Again, 6.022×10^{23} O-atoms = 1 mole of O-atoms
Therefore, 2233 O-atoms $= \frac{2233}{6.022\times10^{23}}$ moles of O-atoms
Hence, number of formula units of $FeSO_4.7H_2O$ present in the sample:
$= \frac{2233}{6.022\times10^{23}} \times \frac{1}{11} \times 6.022 \times 10^{23} = 203$

12. (c)

From the molecular formula of NO_2,

1 mole of NO_2 molecules contains 2 moles of O-atoms

So, 2/3 moles of NO_2 molecules contain 4/3 moles of O atoms

Again, 1 mole of O-atoms = 6.022×10^{23} O-atoms

Therefore, 4/3 moles of O-atoms = $\frac{4}{3} \times 6.022 \times 10^{23}$

$= 8.029 \times 10^{23}$ O-atoms

13. (d)

From the formula of $C_6H_{12}O_6$,

1 mole of $C_6H_{12}O_6$ molecules contains 6 moles of C atoms.

So, 2.6 micromoles of $C_6H_{12}O_6$ molecules contain $2.6 \times 6 = 15.6$ micromoles of C-atoms

Again, 1 mole of C-atoms = 6.022×10^{23} C-atoms

Therefore, 15.6 micromoles of C-atoms = $15.6 \times 10^{-6} \times 6.022 \times 10^{23}$ C-atoms

$= 9.39 \times 10^{16}$ C-atoms

14. (c)

From the formula of [Co(H2O)4Cl2]Cl,

1 mole of [Co(H2O)4Cl2]Cl formula unit contains 4 moles of O-atoms

So, 3/8 millimoles of $[Co(H_2O)_4Cl_2]Cl$ contain $\frac{3}{8} \times 4 = \frac{3}{2}$ millimoles of O-atom

Again, 1 mole of O-atoms = 6.022×10^{23} O-atoms

Therefore, $\frac{3}{2}$ millimoles of O-atoms = $\frac{3}{2} \times 10^{-3} \times 6.022 \times 10^{23}$ O-atoms

$= 9.033 \times 10^{20}$ O-atoms

15. (a)

From the molecular formula of N_2O_5,

5 moles of O-atoms are contained in 1 mole of N_2O_5

So, 1 nanomole of O-atoms will be contained in

$= \frac{1}{5} \times 10^{-9}$ moles of N_2O_5

$= 2 \times 10^{-10}$ moles of N_2O_5

16. (b)

From the molecular formula unit of $CuSO_4.5H_2O$,

9 moles of O-atoms are contained in 1 mole of $CuSO_4.5H_2O$

So, 0.045 moles of O-atoms will be contained in

$= \frac{1}{9} \times 0.045$ moles $= 0.005$ moles of $CuSO_4.5H_2O$

17. (187.50 mol)

From the molecular formula unit of $BaCl_2.2H_2O$,

2 moles of O-atoms are contained in 1 mole of $BaCl_2.2H_2O$

So, 3/8 kilomoles of O-atoms will be contained in

$= \frac{1}{2} \times \frac{3}{8} \times 1000$ moles of $BaCl_2.2H_2O$

$= 187.50$ moles of $BaCl_2.2H_2O$

18. (b)

24.088×10^{23} SO_2 molecules $= \frac{24.088\times10^{23}}{6.022\times10^{23}}$ moles $= 4$ moles of SO_2

The number of electrons in one molecule of $SO_2 = 16 + 8 \times 2 = 32$ eletrons

So, the number of moles of electrons in one mole of $SO_2 = 32$ moles

Therefore, total number of moles of electrons in 4 moles of $SO_2 = 128$ moles

19. (d)

6.022×10^{18} H_3PO_4 molecules $= \frac{6.022\times10^{18}}{6.022\times10^{23}}$ moles $= 10^{-5}$ moles H_3PO_4

The number of electrons in one molecule of $H_3PO_4 = 3 + 15 + 8 \times 4 = 50$ electrons

So, the number of moles of electrons in one mole of $H_3PO_4 = 50$ moles

Therefore, the total number of moles of electrons in 10^{-5} moles of H_3PO_4 would be:

$= 50 \times 10^{-5}$ moles $= 0.0005$ moles

20. (10^{-7} mol)

We know,

12.044×10^{14} PO_4^{3-}ions $= \frac{12.044\times10^{14}}{6.022\times10^{23}}$ moles $= 2 \times 10^{-9}$ moles PO_4^{3-}ions

The number of electrons in one PO_4^{3-}ion $= 15 + 8 \times 4 + 3 = 50$ electrons

So, the number of moles of electrons in one mole of PO_4^{3-} ion $= 50$ moles

Therefore, the total number of moles of electrons in 2×10^{-9} moles of PO_4^{3-}ions:

$= 50 \times 2 \times 10^{-9}$ moles $= 10^{-7}$ moles

21. (a)

One molecule of Na_2SO_4 contains $= (11 \times 2 + 16 + 8 \times 4) = 70$ electrons

So, number of electrons in 1 mole of $Na_2SO_4 = 70 \times 6.022 \times 10^{23}$

Therefore 7×10^9 electrons will be contained in

$= \frac{7 \times 10^9}{70 \times 6.022 \times 10^{23}}$ moles of Na_2SO_4

$= 1.66 \times 10^{-16}$ moles of Na_2SO_4

22. (b)

One molecule of $Ca(NO_3)_2$ contains $= (20 + 2 \times 7 + 6 \times 8) = 82$ electrons

So, number of electrons in 1 mole of $Ca(NO_3)_2 = 82 \times 6.022 \times 10^{23}$

Therefore 1.64 kilomoles of electrons will be contained in

$= \frac{1.64 \times 1000 \times 6.02210^{23}}{82 \times 6.022 \times 10^{23}}$ moles of $Ca(NO_3)_2$

$= 20$ moles of $Ca(NO_3)_2$

23. (3×10^{-5} mol)

One molecule of $MgCO_3$ contains $= (12 + 6 + 8 \times 3) = 42$ electrons

So, number of electrons in 1 mole of $MgCO_3 = 42 \times 6.022 \times 10^{23}$

Therefore, 1.26 millimoles of electrons will contained in

$= \frac{1.26 \times 10^{-3} \times 6.02210^{23}}{42 \times 6.022 \times 10^{23}}$ moles $= 3 \times 10^{-5}$ moles of $MgCO_3$

24. (c)

The total number of electrons present in one molecule of $BaSO_4 = 56 + 16 + 32 = 104$

Therefore, total number of electrons present in one mole of $BaSO_4 = 104 \times 6.022 \times 10^{23}$

Hence, total number of electrons present in 40 millimoles of $BaSO_4$

$= 104 \times 6.022 \times 10^{23} \times 40 \times 10^{-3} = 2.51 \times 10^{24}$

25. (d)

Total number of electrons present in one molecule of $Na_2CO_3 = 11 \times 2 + 6 + 3 \times 8 = 52$

So, $52 \times 6.022 \times 10^{23}$ electrons are present in 1 mole of Na_2CO_3

Therefore, 7.8286×10^{24} electrons will be present in

$= \frac{7.8286 \times 10^{24}}{52 \times 6.022 \times 10^{23}}$ moles of Na_2CO_3

$= 0.25$ moles of Na_2CO_3