The Mole and Molarity

Name KEY

1. How many moles are present in 70.4g of H_2O?

$70.4g \div 18.0g/mol = 3.91\ mol$

2. How many moles are present in 3.545×10^{-6}g of $FeCl_3$?

$\frac{3.545 \times 10^{-6} g\ FeCl_3}{1} \times \frac{1\ mol}{162.3g} = 2.184 \times 10^{-8}\ mol$

3. How many moles do you have if you have 7.39×10^{49} molecules of Au_2O_3?

$\frac{7.39 \times 10^{49}\ molecules}{1} \times \frac{1\ mol}{6.02 \times 10^{23}\ molecules} = 1.23 \times 10^{26}\ mols$

4. If you have 7.40 moles of CH_4, how many molecules do you have?

$\frac{7.40\ mol}{1} \times \frac{6.02 \times 10^{23}\ molecules}{1\ mol} = 4.45 \times 10^{24}\ molecules$

5. If you have 7.40 moles of CH_4, how many atoms of Hydrogen do you have?

$\frac{7.40\ mol}{1} \times \frac{6.02 \times 10^{23}\ molecules}{1\ mol} \times \frac{4\ H}{1\ CH_4} = 1.78 \times 10^{25}\ atoms\ H$

6. How many molecules do you have in 39.4g of $KMnO_4$?

$\frac{39.4g}{1} \times \frac{1\ mol}{158.0g} \times \frac{6.02 \times 10^{23}\ molecules}{1\ mol} = 1.50 \times 10^{23}\ molecules$

7. What mass would 3.56×10^{30} atoms of Au have?

$\frac{3.65 \times 10^{30}\ atoms}{1} \times \frac{1\ mol}{6.02 \times 10^{23}\ atoms} \times \frac{197.0\ g}{1\ mol} = 1.19 \times 10^{9}\ g$

8. What would be the mass of 3 atoms of Uranium?

$\frac{3\ atoms}{1} \times \frac{1\ mol}{6.02 \times 10^{23}\ atoms} \times \frac{238.0\ g}{1\ mol} = 1.19 \times 10^{-21}\ g$

9. What volume would 2.3 moles of N_2 gass occupy at STP?

$2.3\ mol \times \frac{22.4L}{mol} = 51.5 = 52L$

10. What volume would 30 moles of CH_4 occupy at STP?

$30\ mol \times \frac{22.4L}{mol} = 672 = 7 \times 10^{2}L$

11. What volume would 39.4g of O_2 gas occupy at STP?

$\frac{39.4g}{1} \times \frac{1\ mol}{32.0g} \times \frac{22.4\ L}{1\ mol} = 27.6L$

12. How many moles of Cl_2 gas would occupy a volume of 32.8L at STP?

$\frac{32.8L}{1} \times \frac{1\ mol}{22.4\ L} = 1.46\ mol$

13. What volume would 6.02×10^{23} molecules of F_2 gas occupy at STP?

$\frac{6.02\times10^{23}\ \text{molecules}}{1} \times \frac{1\ \text{mol}}{6.02\times10^{23}\ \text{molecules}} \times \frac{22.4\ \text{L}}{1\ \text{mol}}$

$= 22.4\ \text{L}$

14. What volume would 600,000 molecules of N_2 occupy at STP?

$\frac{600{,}000\ \text{molecules}}{1} \times \frac{1\ \text{mols}}{6.02\times10^{23}\ \text{molecules}} \times \frac{22.4\ \text{L}}{1\ \text{mol}}$

$= 2.23\times10^{-17}\ \text{L}$

15. If a container held 45L of O_2 gas at STP, what mass would be present?

$\frac{45\ \text{L}}{1} \times \frac{1\ \text{mol}}{22.4\ \text{L}} \times \frac{32.0\ \text{g}}{1\ \text{mol}} = 64\ \text{g}$

16. If a container held 90L of CH_4 gas at STP how many molecules would this be?

$\frac{90\ \text{L}}{1} \times \frac{1\ \text{mol}}{22.4\ \text{L}} \times \frac{6.02\times10^{23}\ \text{molecules}}{1\ \text{mol}} = 2.42\times10^{24}\ \text{molecules}$

17. If 3.3 moles of NaCl were dissolved into 2L of water, what would the resulting concentration be?

$C = \frac{n}{V} = \frac{3.3}{2} = 1.65 = 2\text{M}$

18. If 3.70×10^{-2} moles of NaOH were dissolved into 20.4L, what would the concentration be?

$C = \frac{n}{V} = \frac{3.70\times10^{-2}}{20.4} = 1.81\times10^{-3}\text{M}$

19. If 9g of KOH was dissolved into 200ml of water what would the concentration be?

$\frac{9\text{g}}{1} \times \frac{1\ \text{mol}}{56.1\text{g}} = 0.16\ \text{mol}$

$C = \frac{n}{V} = \frac{0.16}{0.200} = 0.8\text{M}$

20. If 30g of NaOH was dissolved into a bathtub containing 50L of water, what would the concentration be?

$\frac{30\text{g}}{1} \times \frac{1\ \text{mol}}{40.0\text{g}} = 0.75\text{mol}$

$C = \frac{n}{V} = \frac{0.75}{50} = 1.5\times10^{-2} = 2\times10^{-2}\text{M}$

21. What would the concentration be if 3.74×10^{25} molecules of KCl was dissolved into 500 L of water?

$\frac{3.74\times10^{25}\ \text{molecules}}{1} \times \frac{1\ \text{mol}}{6.02\times10^{23}\ \text{molecules}} = 62.1\text{mol}$

$C = \frac{n}{V} = \frac{62.1}{500} = 0.124 = 0.1\text{M}$

22. If you had 5L of 6M HCl, how many moles of HCl would there be in total?

$n = CV$

$= 6\text{M} \times 5\text{L}$

$= 30\ \text{mol}$

23. What mass of NaOH solid would you need to make 1L of 1M solution?

$n = CV = 1 \times 1 = 1\ \text{mol}$

$1\ \text{mol} \times 40.0\ \text{g/mol} = 40\text{g}$

24. If you had 25 L of 5M H_2SO_4, how many molecules of H2SO4 would you have?

$n = CV = 5\text{M} \times 25\text{L} = \frac{125\ \text{mol}}{1} \times \frac{6.02\times10^{23}\ \text{molecules}}{1\ \text{mol}}$

$= 7.5\times10^{25}$

$= 8\times10^{25}\ \text{molecules}$

25. If you dissolved 23g of $KMnO_4$ into 1.6L of water, what would the concentration be?

$\frac{23\text{g}}{1} \times \frac{1\ \text{mol}}{158.0\text{g}} = 0.15\text{mol}$ $\quad C = \frac{n}{V} = \frac{0.15}{1.6} = 9.1\times10^{-2}\ \text{M}$