There are 30 questions for 125 points.
Good Luck!

Possibly Useful Information

\[ 1 \text{ cal} = 4.184 \text{ J} \quad q = \text{mass} \times \text{sp ht} \times \Delta T \quad d = \text{mass/vol} \quad \text{Volume} = l \times h \times w \]
Q.1  The correct chemical name for the compound Ca(NO₃)₂ is...
   a) Calcium dinitrate
   b) Calcium(II)nitrate
   c) Calcium dinitric oxide
   d) Calcium nitrate
   e) Calcium nitoxide

Q.2  How many mols of sodium are needed to form 0.575 mol of sodium sulfide?

   a) 0.575  b) 0.288  c) 0.144  d) 1.15  e) 13.2  
   \[ 0.575 \text{ mol } \text{Na}_2\text{S} \times \frac{2 \text{ mol } \text{Na}}{1 \text{ mol } \text{Na}_2\text{S}} = 1.15 \text{ mol Na} \]

Q.3  Which of the following is an extensive property of matter?
   a) Melting point
   b) Boiling point
   c) Density
   d) Volume
   e) More than one of these

Q.4  The volume of a rectangular solid is given by \( \text{Vol} = \text{length} \times \text{width} \times \text{height} \).

   What is the volume of a solid of \( h = 12.0 \text{ cm} \)

   \( l = 150 \text{ mm} \)

   \( w = 2.0 \text{ m} \)

   a) 360 m³
   b) 180 m³
   c) 90 m³
   d) 0.036 m³
   e) 0.36 m³

Q.5  The prefix nano means
   a) \( 10^9 \)
   b) \( 10^{-9} \)
   c) \( 10^6 \)
   d) \( 10^{-6} \)
   e) None of these
Q.6 Calculate the volume of 8.00 M NaOH solution required to prepare exactly 200 mL of a 0.800 M solution of NaOH.

\[
(8.00 \text{ M}) \times x = (0.800 \text{ M}) \times (200 \text{ mL})
\]

\[
x = \frac{0.800 \text{ M} \times 200 \text{ mL}}{8.00} = 20.0 \text{ mL}
\]

Q.7 How many neutrons are there in a N-15 isotope?

a) 15  b) 8  c) 7  d) -7  e) 22

15 - 7 = 8

Q.8 How many electrons are there in the ion, N^{3-} ?

a) 1  b) 3  c) 7  d) 4  e) 10

7 + 3 = 10

Q.9 Carbon tetrachloride has a density of 1.59 g/mL at 20°C. What volume is occupied by 685 grams of CCl₄?

a) 1080 mL  
b) 2.32 \times 10^{-3} \text{ mL}  
c) 232 mL  
d) 431 mL  
e) 431 L

\[
\frac{685 \text{ g}}{1.59 \text{ g/mL}} = 430.81 \text{ mL}
\]

Q.10 How many atoms are there in exactly 2809 g of silicon?

a) 10 \times \text{Avogadro's number}  
b) 100 \times \text{Avogadro's number}  
c) \text{Avogadro's number}  
d) 1000 \times \text{Avogadro's number}  
e) 0.01 \times \text{Avogadro's number}

\[
\frac{2809 \text{ g of Si}}{28.09 \text{ g/mol}} = 100 \text{ mol of Si}
\]

\[
\therefore \text{# atoms} = 100 \times N_A
\]
Q.11  How many grams of the element silver, Ag, would contain as many silver atoms as there are phosphorus atoms, P, in 6.00 moles of tetraphosphorus, $P_4$?

\[
\text{a)} \quad 186\text{ g} \quad 6.00\text{ mol } P_4 \times \frac{4\text{ mol } P}{1\text{ mol } P_4} = 24.0\text{ mol } P \\
\text{b)} \quad 743\text{ g} \\
\text{c)} \quad 2590\text{ g} \quad 24.0\text{ mol } Ag \times \frac{107.9\text{ g } Ag}{1\text{ mol } Ag} = 2589.6\text{ g } Ag \\
\text{d)} \quad 847\text{ g} \\
\text{e)} \quad 431\text{ g} \\
\]

Q.12  The molecular formula of acetic acid is $C_2H_4O_2$. What is its simplest formula?

\[
\begin{align*}
\text{a)} & \quad \text{CHO} \\
\text{b)} & \quad \text{CH}_2\text{O} \quad \text{C}_2\text{H}_4\text{O}_2 \rightarrow \text{CH}_2\text{O} \\
\text{c)} & \quad \text{C}_2\text{H}_2\text{O}_2 \\
\text{d)} & \quad \text{C}_4\text{H}_8\text{O}_4 \\
\text{e)} & \quad \text{C}_2\text{H}_6O \\
\end{align*}
\]

Q.13  When the following chemical equation is balanced with the smallest integer coefficients, the sum of the coefficients in the balanced equation is:

\[ \text{Cu}_2\text{S} + \text{O}_2 \rightarrow 2\text{Cu} + \text{SO}_2 \]

\[
\begin{align*}
\text{a)} & \quad 2 \\
\text{b)} & \quad 5 \quad \text{c)} \quad 3 \quad \text{d)} \quad 4 \quad \text{e)} \quad 6
\end{align*}
\]

Q.14  Tamoxifen, $C_{26}H_{29}NO$, molar mass = 371.53 g/mol, is a nonsteroidal estrogen antagonist used in the palliative treatment of breast cancer. How many millimoles of tamoxifen are there in 25.0 mg of this drug?

\[
\begin{align*}
\text{a)} & \quad 673\text{ mmol} \\
\text{b)} & \quad 6.73\text{ mmol} \\
\text{c)} & \quad 0.673\text{ mmol} \\
\text{d)} & \quad 0.00673\text{ mmol} \\
\text{e)} & \quad 0.0873\text{ mmol} \\
\end{align*}
\]

\[
\begin{align*}
\frac{25.0\text{ mg}}{1\text{ mg}} \times \frac{\frac{3}{10^{-3}}\text{ mol}}{371.53\text{ g}} = \frac{1\text{ mmol}}{10^{-3}\text{ mol}} \\
= 0.06728 \Rightarrow 0.0673\text{ mmol} \quad \text{Tamoxifen}
\end{align*}
\]

\[
\left[ 26(12.01) + 29(1.008 + 14.01 + 16.00) = 371.53\text{ g/mol} \right]
\]
Q.15  In the correct formula for the ionic compound formed between the calcium ion and the hydroxide ion, the mol ratio of calcium, to oxygen, O, is,

a) 1 to 1
b) 2 to 1
c) 1 to 2
d) 1 to 4
e) 3 to 2

\[ \text{Ca}^{+2} \underline{\text{OH}^-} \]
\[ \text{Ca(OH)}_2 \]
\[ 1:2 \]

Q.16  The formula mass of phosphorous acid, H₃PO₃ (aq) is ...

a) 41.00 amu
b) 122.90 amu
c) 112.00 amu
d) 81.99 amu

e) 89.90 amu

\[ 3(1.008) + 30.97 + 3(16.00) = 81.99 \text{ amu} \]

Q.17  How many mol oxygen, O₂, can be produced by the decomposition of 12.0 mol of reactant in each of the following reactions:

(i) \[ 2\text{KClO}_3 \rightarrow 2\text{KCl} + 3\text{O}_2 \]
\[ 12 \times \frac{3}{2} = 18 \]

(ii) \[ \text{KClO}_4 \rightarrow \text{KCl} + 2\text{O}_2 \]
\[ 12 \times \frac{3}{1} = 24 \]

(iii) \[ 2\text{NaNO}_3 \rightarrow 2\text{NaNO}_2 + \text{O}_2 \]
\[ 12 \times \frac{1}{2} = 6 \]

a) 8, 6, 24, respectively
b) 18, 24, 6, respectively
c) 36, 12, 24, respectively
d) 36, 24, 24, respectively
e) 36, 24, 12, respectively

Q.18  When the following numbers are added, the answer contains ___ significant figures.

\[ 822.68 + 205.86 = 1028.54 \]
\[ 1028.67 = 6 \text{ sig figs} \]

a) 4  b) 5  c) 3  d) 6  e) 7
Q.19 Matter may be classified as a(n) ...

a) Solid, liquid or gas
b) heterogeneous or homogeneous mixture
c) Element
d) Compound
e) All the above are ways of classifying matter

Q.20 Fumaric acid, \( C_4H_4O_4 \), is sometimes used as a substitute for citrus acid in fruit drinks. What is the \% C in fumaric acid?

\[
\begin{align*}
\text{a)} & \quad 33.33 \% \\
\text{b)} & \quad 0.25 \% \\
\text{c)} & \quad 39.80 \% \\
\text{d)} & \quad 40.00 \% \\
\text{e)} & \quad 41.39 \% \\
\end{align*}
\]

\[
\% C = \frac{4 \times (12.01)}{116.072} \times 100 = 41.388 \%
\]

Q.21 How many mols of lead are present in a piece of lead with a volume of 0.600 mL? The density of Pb is 11.34 g/mL.

\[
\begin{align*}
\text{a)} & \quad 6.80 \\
\text{b)} & \quad 0.0328 \\
\text{c)} & \quad 11.0 \\
\text{d)} & \quad 0.547 \\
\text{e)} & \quad 0.0912 \\
\end{align*}
\]

\[
\begin{align*}
\frac{11.34 g}{\text{mL}} \times 0.600 \text{ mL} \times \frac{1 \text{ mol Pb}}{207.2 g \text{ Pb}} = 0.0328 \text{ mol Pb}
\end{align*}
\]

Q.22 A compound is found to have the following \% composition: 38.7\% K, 13.8\% N, 47.5\% O. What is its simplest formula?

\[
\begin{align*}
\text{a)} & \quad \text{KNO}_3 \\
\text{b)} & \quad \text{KNO}_2 \\
\text{c)} & \quad \text{K}_2\text{NO}_2 \\
\text{d)} & \quad \text{K}_2\text{NO}_3 \\
\text{e)} & \quad \text{K}_2\text{N}_2\text{O}_3 \\
\end{align*}
\]

\[
\begin{align*}
\text{K:} & \quad \frac{38.7 \text{ g}}{39.10} = 0.989 \text{ mol K} / 0.985 = 1, \text{ K} \\
\text{N:} & \quad \frac{13.8 \text{ g}}{14.01} = 0.985 \text{ mol N} / 0.985 = 1, \text{ N} \\
\text{O:} & \quad \frac{47.5 \text{ g}}{16.00} = 2.960 \text{ mol O} / 0.985 = 3, \text{ O}
\end{align*}
\]

\[
\begin{align*}
\text{KNO}_3
\end{align*}
\]
Q.23 When the equation:

\[ CS_2 + 3Cl_2 \rightarrow CC_4 + S_2Cl_2 \]

\[ 1 + 3 + 1 + 1 = 6 \]

is balanced with the smallest integer coefficients, the sum of the coefficients is:

a) 5  b) 6  c) 4  d) 3  e) 7

Q.24 The molarity of a solution that contains 14.7 grams of H\(_2\)SO\(_4\) in exactly 200 mL of solution is ...

\[ \frac{2 \times (1.008) + 32.07 + 4(16.00)}{98.086} = 98.09 \text{ g/mol} \]

a) 1.5 M  b) 0.75 M  c) 0.77 M  d) 7.4 M  e) 3.0 M

Q.25 How many kJ of heat are needed to raise the temperature of 125 g of water 50.0 °C?

\[ Q = 125g \times \frac{4.184J}{g \cdot ^\circ C} \times 50^\circ C \]

a) 262 kJ  b) 26.2 kJ  c) 6.25 kJ  d) 62.5 kJ  e) 625 kJ

Q.26 Magnesium metal and molecular oxygen react to form magnesium oxide. If 46.5 g of magnesium and 37.2 g of molecular oxygen are caused to react, which reactant is limiting? [Hint: Write the balanced equation.]

\[ 2 \text{Mg} + O_2 \rightarrow 2 \text{MgO} \]

a) Mg  b) O\(_2\)  c) both  d) none

\[ \text{For Mg:} \left\{ \frac{46.5}{24.31} = 1.91 \text{ mol Mg} \right\} \rightarrow 1.91 \text{ mol MgO} \]

\[ \text{For O}_2 \left\{ \frac{37.2}{32.00} = 1.16 \text{ mol O}_2 \times \frac{2 \text{MgO}}{1 \text{O}_2} = 2.325 \text{ mol MgO} \right\} \]
Q.27  How much chlorine, Cl₂, in grams is required to produce 12.0 g CCl₄ \\
according to the following balanced reaction:

CH₄ + 4 Cl₂ → CCl₄ + 4 HCl

\[
12.01 + 4(35.45) = 153.81 \text{ g/mol}
\]

\[
a) 12.0 \text{ g}  \\
b) 5.52 \text{ g}  \\
c) 22.1 \text{ g}  \\
d) 1.38 \text{ g}  \\
e) 11.0 \text{ g}
\]

\[
\frac{12.0 \text{ g} \text{ CCl}_4}{153.81 \text{ g} \text{Cl}_2} \times \frac{1 \text{ mol} \text{ CCl}_4}{4 \text{ mol} \text{Cl}_2} \times \frac{70.90 \text{ g} \text{Cl}_2}{1 \text{ mol} \text{Cl}_2} = \frac{22.125 \text{ g} \text{Cl}_2}{22.1 \text{ g} \text{Cl}_2}
\]

Q.28  Calculate the % yield if 16.5 grams sodium carbonate is obtained from the 
thermal decomposition of 75.0 g of sodium hydrogen carbonate according to 
the reaction:

2 NaHCO₃ → Na₂CO₃ + H₂O + CO₂

molar masses:
NaHCO₃ = 84.00 g/mol
Na₂CO₃ = 105.99 g/mol
H₂O = 18.01 g/mol
CO₂ = 44.01 g/mol

\[
a) 47.3\%  \\
b) 52.7\%  \\
c) 16.5\%  \\
d) 34.9\%  \\
e) 50.6\%
\]

\[
75.0 \text{ g} \text{NaHCO}_3 \times \frac{1 \text{ mol} \text{NaHCO}_3}{84.00 \text{ g}} \times \frac{1 \text{ mol} \text{Na}_2\text{CO}_3}{2 \text{ mol} \text{NaHCO}_3} \times \frac{105.99 \text{ g} \text{Na}_2\text{CO}_3}{1 \text{ mol} \text{Na}_2\text{CO}_3} = 47.31 \text{ g} \text{Na}_2\text{CO}_3 \text{ Theoretical}
\]

\[
\% \text{ yield} = \frac{16.5}{47.31} \times 100 = 34.87\% = 34.9\%
\]
Q.29  What is the correct $^{A}\text{X}^{z}$ notation for an ion having 35 protons, 36 electrons, and 45 neutrons?

a) \[ ^{45}_{35} \text{Br}^+ \]

b) \[ ^{80}_{35} \text{Br}^- \]

c) \[ ^{80}_{45} \text{Br}^+ \]

d) \[ ^{45}_{35} \text{Br}^- \]

e) \[ ^{45}_{36} \text{Br}^- \]

\[ 35^2 + 45^n = 80 \text{ mass n} \]

\[ 36^2 - 35^+ = -1 \text{ charge on ion} \]

\[ \text{Electrons} \rightarrow \text{protons} \]

Q.30  One centimeter is equal to...

a) 100 m  

b) 1000 m  

c) 10 m  

d) 0.10 m  

e) 0.01 m

\[ 1 \text{ cm} = 10^{-2} \text{ m} = 0.01 \text{ m} \]

End of Test
There are 30 Q for 125 pt.
each question is worth 4.167 pt.