This print-out should have 15 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering.

Mlib 00 2531
001 10.0 points

The measurement 3.2×10^{-3} g could also be written as

1. 3.2 pg.

2. 3.2 mg. **correct**

3. 3.2 kg.

4. None of these

5. 3.2 g.

Explanation:
mg refers to 10^{-3}.

ACAMP FE 0007
002 10.0 points

The mole concept is important in chemistry because

1. it establishes a standard for reaction stoichiometry.

2. atoms and molecules are very small and the mole concept allows us to count atoms and molecules by weighing macroscopic amounts of material. **correct**

3. it provides a universally accepted standard for mass.

4. it allows us to distinguish between elements and compounds.

5. it explains the properties of gases.

Explanation:
The mole concept is important in chemistry because we know that if we weight 63.55 g of pure copper, then we have about a mole of copper atoms.

Mlib 01 0529
003 10.0 points

How many atoms of hydrogen are contained in 1 mole of methane (CH_4)?

1. 6.02×10^{23} atoms

2. The correct answer is not given.

3. 3.01×10^{24} atoms

4. 2.41×10^{24} atoms **correct**

5. 4 atoms

Explanation:
$n = 1$ mol

Each methane molecule contains 4 hydrogen atoms. There are Avogadro's number of methane molecules in one mole of methane molecules:

$$\begin{aligned} n_{\rm H} &= 1 \text{ mol CH}_4 \\ &\quad \times \frac{6.02 \times 10^{23} \text{ molec CH}_4}{1 \text{ mol CH}_4} \\ &\quad \times \frac{4 \text{ H atoms}}{1 \text{ molec CH}_4} \\ &= 2.41 \times 10^{24} \text{ H atoms} \end{aligned}$$

Counting Hs
004 10.0 points

Which has the greatest number of hydrogen atoms?

1. 5 g of an unknown compound

2. 10^{20} hydrogen atoms

3. 100g of a substance that is 2% H by mass

4. 100 g of water

5. 20 g of hydrogen gas **correct**

Explanation:
10^{20} H atoms is much less than 1 mole of H atoms. 100g of water is 5.56 moles of water which would have 11.12 moles of H atoms. 5 g of an unknown substance even if it was pure hydrogen could only be 5 moles of H atoms.

20 g of hydrogen gas is 10 moles of H_2 which is 20 moles of H atoms. 100g of a substance that is 2% by mass hydrogen has 2 g of Hydrogen which is 2 moles. 20 moles of H atoms is the greatest number of atoms.

Mlib 01 3075
005 10.0 points

What is the coefficient for H_2O when the equation

$$? \, Ca(OH)_2(aq) + ? \, H_3PO_4(aq) \rightarrow ? \, Ca_3(PO_4)_2(s) + ? \, H_2O(\ell)$$

is balanced using the smallest possible integers?

1. 2

2. 6 **correct**

3. 3

4. 8

5. 4

Explanation:

A balanced equation has the same number of each kind of atom on each side of the equation. We find the number of each kind of atom using equation coefficients and composition stoichiometry. For example, we find there are 12 H atoms on the product side:

$$? \, \text{H atoms} = 6 \text{ H}_2\text{O} \times \frac{2\,\text{H}}{\text{H}_2\text{O}} = 12 \text{ H}$$

The balanced equation is

$$3\,Ca(OH)_2 + 2\,H_3PO_4 \rightarrow Ca_3(PO_4)_2 + 6\,H_2O\,,$$

and the coefficient of H_2O is 6.

Mlib 08 0075
006 10.0 points

When aluminum metal is heated with manganese oxide, the following reaction occurs.

$$Al + MnO_2 \rightarrow Al_2O_3 + Mn$$

Balance this equation and indicate the sum of the coefficients for all the species.

1. ten

2. fifteen

3. twelve **correct**

4. seven

Explanation:

A balanced equation has the same number of each kind of atom on both sides of the equation. We find the number of each kind of atom using equation coefficients and composition stoichiometry. For example, we find there are 6 O atoms on the reactant side:

$$? \text{ O atoms} = 3 \text{ MnO}_2 \times \frac{2 \text{ O}}{1 \text{ MnO}_2} = 6 \text{ O}$$

The balanced equation is

$$4\,Al + 3\,MnO_2 \rightarrow 2\,Al_2O_3 + 3\,Mn\,,$$

and has 4 Al, 3 Mn and 6 O atoms on each side.

$$? \text{ sum coefficients} = 4 + 3 + 2 + 3 = 12$$

Balance Equation 105
007 10.0 points

When the equation

$$? \, PbS + ? \, O_2 \rightarrow ? \, PbO + ? \, SO_2$$

is balanced, the coefficients are

1. 2; 6; 4; 4

2. 2; 2; 1; 2

3. 1; 2; 1; 1

4. 4; 12; 4; 4

5. 2; 3; 2; 2 **correct**

Explanation:

There are 2 oxygens on the left and 3 on the right, so at least six oxygens are needed:

$$? \, PbS + 3\,O_2 \rightarrow 2\,PbO + 2\,SO_2$$

Now there are 2 each of Pb and S on the right, so the balanced equation is

$$2\,PbS + 3\,O_2 \rightarrow 2\,PbO + 2\,SO_2$$

Balance Equation 126
008 10.0 points

Balance the equation
$?\,Al_2(SO_4)_3 + ?\,NaOH \rightarrow$
$?\,Al(OH)_3 + ?\,Na_2SO_4$,
using the smallest possible integers. What is the sum of the coefficients in the balanced equation?

1. ten

2. eight

3. fourteen

4. twelve **correct**

5. six

Explanation:
The balanced chemical equation is
$1\,Al_2(SO_4)_3 + 6\,NaOH \rightarrow$
$2\,Al(OH)_3 + 3\,Na_2SO_4$
which gives 2 Al, 3 SO_4, 6 Na, and 6 OH^- on both sides of the equation. The sum of coefficients is $1 + 6 + 2 + 3 = 12$.

Brodbelt 20044
009 10.0 points

Which one has the greatest number of atoms?

1. All have the same number of atoms

2. 3.05 moles of argon

3. 3.05 moles of water

4. 3.05 moles of CH_4 **correct**

5. 3.05 moles of helium

Explanation:
For 3.05 moles of water:

$$\begin{aligned} ?\,\text{atoms} &= 3.05\,\text{mol}\,H_2O \times \frac{6.02 \times 10^{23}\,\text{molec}}{1\,\text{mol}} \\ &\quad \times \frac{3\,\text{atoms}}{1\,\text{molecule}} \\ &= 5.51 \times 10^{24}\ \text{atoms} \end{aligned}$$

For 3.05 moles of CH_4:

$$\begin{aligned} ?\,\text{atoms} &= 3.05\,\text{mol}\,CH_4 \times \frac{6.02 \times 10^{23}\,\text{molec}}{1\,\text{mol}} \\ &\quad \times \frac{5\,\text{atoms}}{1\,\text{molecule}} \\ &= 9.18 \times 10^{24}\ \text{atoms} \end{aligned}$$

For 3.05 moles of helium:

$$\begin{aligned} ?\ \text{atoms} &= 3.05\ \text{mol He} \times \frac{6.02 \times 10^{23}\ \text{atoms}}{1\ \text{mol}} \\ &= 1.84 \times 10^{24}\ \text{atoms} \end{aligned}$$

For 3.5 moles of argon:

$$\begin{aligned} ?\ \text{atoms} &= 3.05\ \text{mol Ar} \times \frac{6.02 \times 10^{23}\ \text{atoms}}{1\ \text{mol}} \\ &= 1.84 \times 10^{24}\ \text{atoms} \end{aligned}$$

Mlib 01 5027
010 10.0 points

If 100.0 grams of copper (Cu) completely reacts with 25.0 grams of oxygen, how much copper(II) oxide (CuO) will form from 140.0 grams of copper and excess oxygen? (*Note*: CuO is the only product of this reaction.)

1. 160.0 g

2. 175.0 g **correct**

3. 150.0 g

4. 200.0 g

5. 35.0 g

Explanation:
$m_{Cu,\,ini} = 100.0$ g $\qquad m_{O_2} = 25.0$ g
$m_{Cu,\,fin} = 140.0$ g

If 100 g copper and 25 g oxygen react completely with each other, there must be 125 g of product formed (law of conservation of mass). This product is CuO.

Now we have a ratio: for every 100 g of Cu reacted, 125 g of CuO will be produced (assuming there is enough oxygen). We use this ratio to find the mass of CuO that could be formed from 140 g of Cu and excess oxygen. We set our known ratio (100 g Cu : 125 g CuO) equal to our experimental ratio (140 g Cu : x g CuO) and solve for the unknown:

$$\frac{100 \text{ g Cu}}{125 \text{ g CuO}} = \frac{140 \text{ g Cu}}{x}$$
$$x = \frac{(140 \text{ g Cu})\,(125 \text{ g CuO})}{100 \text{ g Cu}} = 175 \text{ g CuO}$$

Mlib 01 5009
011 10.0 points

Consider the reaction

$4\,\text{Fe(s)} + 3\,\text{O}_2\text{(g)} \rightarrow 2\,\text{Fe}_2\text{O}_3\text{(s)}$.

If 12.5 g of iron(III) oxide (rust) are produced from 8.74 g of iron, how much oxygen gas is needed for this reaction?

1. 8.74 g

2. 21.2 g

3. 3.74 g **correct**

4. 12.5 g

5. 7.5 g

Explanation:
$m_{\text{iron}} = 8.74$ g $m_{\text{oxide}} = 12.5$ g

The balanced equation for the reaction tells us that 4 mol Fe reacts with 3 mol O_2 to produce 2 mol Fe_2O_3. We have two possible starting points. We know 12.5 g Fe_2O_3 was produced and that 8.74 g Fe was present at the start of the reaction.

Choosing the 12.5 g of Fe_2O_3 to start with, first we convert to moles using the molar mass:

$$? \text{ mol Fe}_2\text{O}_3 = 12.5 \text{ g Fe}_2\text{O}_3 \times \frac{1 \text{ mol Fe}_2\text{O}_3}{159.7 \text{ g Fe}_2\text{O}_3} = 0.0783 \text{ mol Fe}_2\text{O}_3$$

Now we use the mole ratio from the balanced equation to find moles O_2 needed to produce 0.0783 mol Fe_2O_3.

$$? \text{ mol O}_2 = 0.0783 \text{ mol Fe}_2\text{O}_3 \times \frac{3 \text{ mol O}_2}{2 \text{ mol Fe}_2\text{O}_3} = 0.117 \text{ mol O}_2$$

We convert from moles to grams:

$$? \text{ g O}_2 = 0.117 \text{ mol O}_2 \times \frac{32 \text{ g O}_2}{1 \text{ mol O}_2} = 3.744 \text{ g O}_2$$

Starting with 8.74 g Fe and following the same steps results in the same numerical answer.

Msci 02 1236
012 10.0 points

Upon heating, potassium chlorate produces potassium chloride and oxygen:

$$2\,\text{KClO}_3 \rightarrow 2\,\text{KCl} + 3\,\text{O}_2\,.$$

What mass of oxygen (O_2) would be produced upon thermal decomposition of 25 g of potassium chlorate ($KClO_3$ with MW 122.5 g/mol)?

1. 6.5 g

2. 9.8 g **correct**

3. 4.4 g

4. 4.9 g

5. 3.3 g

Explanation:
$m_{\text{KClO}_3} = 25.0$ g $MW_{\text{KClO}_3} = 122.5$ g/mol

The balanced equation for the reaction indicates that 3 mol O_2 are produced for every 2 mol $KClO_3$ reacted. First we calculate the moles $KClO_3$ present:

$$? \text{ mol KClO}_3 = 25 \text{ g KClO}_3 \times \frac{1 \text{ mol KClO}_3}{122.55 \text{ g KClO}_3} = 0.204 \text{ mol KClO}_3$$

Now we use the mole-to-mole ratio from the balanced equation to find the moles O_2 that could be produced from this amount of $KClO_3$:

$$? \text{ mol } O_2 = 0.204 \text{ mol } KClO_3 \times \frac{3 \text{ mol } O_2}{2 \text{ mol } KClO_3} = 0.306 \text{ mol } O_2$$

We convert from moles to grams O_2:

$$? \text{ g } O_2 = 0.306 \text{ mol } O_2 \times \frac{32 \text{ g } O_2}{1 \text{ mol } O_2} = 9.8 \text{ g } O_2$$

Msci 03 0307
013 10.0 points

In the reaction

$$? \, CO + ? \, O_2 \to ? \, CO_2 \,,$$

how much oxygen is required to convert 21 g of CO into CO_2?

1. 42 g

2. 12 g **correct**

3. 24 g

4. 6 g

5. 48 g

6. 21 g

Explanation:
$m_{CO} = 21$ g

The balanced equation for the reaction is

$$2\,CO + O_2 \to 2\,CO_2$$

The coefficients in this equation indicate that 2 mol CO are needed for each mol O_2 reacted. First we calculate the moles of CO present:

$$? \text{ mol CO} = 21 \text{ g CO} \times \frac{1 \text{ mol CO}}{28 \text{ g CO}} = 0.75 \text{ mol CO}$$

Using the mole ratio from the balanced equation, we find the moles O_2 needed to completely react with 0.75 mol CO:

$$? \text{ mol } O_2 = 0.75 \text{ mol CO} \times \frac{1 \text{ mol } O_2}{2 \text{ mol CO}} = 0.375 \text{ mol } O_2$$

We convert from moles to grams O_2:

$$? \text{ g } O_2 = 0.375 \text{ mol } O_2 \times \frac{32 \text{ g } O_2}{1 \text{ mol } O_2} = 12 \text{ g } O_2$$

Brodbelt 013 012
014 10.0 points

Consider the reaction

$$N_2 + 3\,H_2 \to 2\,NH_3 \,.$$

How much NH_3 can be produced from the reaction of 74.2 g of N_2 and 14.0 moles of H_2?

1. 1.26×10^{25} molecules

2. 3.19×10^{24} molecules **correct**

3. 1.69×10^{25} molecules

4. 1.59×10^{24} molecules

5. 5.62×10^{24} molecules

Explanation:
$m_{N_2} = 74.2$ g $\quad n_{H_2} = 14.0$ mol

First you must determine the limiting reactant:

$$? \text{ mol } N_2 = 74.2 \text{ g } N_2 \times \frac{1 \text{ mol } N_2}{28 \text{ g } N_2} = 2.65 \text{ mol } N_2$$

According to balanced equation, we need

$$\frac{3 \text{ mol } H_2}{1 \text{ mol } N_2} \,.$$

We have

$$\frac{14.0 \text{ mol } H_2}{2.65 \text{ mol } N_2} = \frac{5.28 \text{ mol } H_2}{1 \text{ mol } N_2}$$

Therefore, H_2 is an excess and N_2 is limiting.

$$? \text{ molec } NH_3 = 2.65 \text{ mol } N_2 \times \frac{2 \text{ mol } NH_3}{1 \text{ mol } N_2} \times \frac{6.022 \times 10^{23} \text{ } NH_3 \text{ molec}}{1 \text{ mol } NH_3 \text{ molec}} = 3.19 \times 10^{24} \text{ molec } NH_3$$

Limit mccord01x hmwk
015 10.0 points

For the reaction

$$? \, C_6H_6 + ? \, O_2 \rightarrow ? \, CO_2 + ? \, H_2O$$

25.1 grams of C_6H_6 are allowed to react with 84.82 grams of O_2. How much CO_2 will be produced by this reaction?

Correct answer: 84.85 grams.

Explanation:

$m_{C_6H_6} = 25.1$ g $\qquad m_{O_2} = 84.82$ g

The balanced equation for the reaction is

$$2 \, C_6H_6 + 15 \, O_2 \rightarrow 12 \, CO_2 + 6 \, H_2O$$

FW of C_6H_6 is 78.1118 g/mol, giving 0.3213 mol C_6H_6.
FW of O_2 is 31.9988 g/mol, giving 2.651 mol O_2.
FW of CO_2 is 44.0095 g/mol

$$0.3213 \text{ mol } C_6H_6 \times \frac{15 \text{ mol } O_2}{2 \text{ mol } C_6H_6} = 2.41 \text{ mol } O_2$$

which is less than what is actually present. Therefore the limiting reactant must be C_6H_6.

$$0.3213 \text{ mol } C_6H_6 \times \frac{12 \text{ mol } CO_2}{2 \text{ mol } C_6H_6} \times \frac{44.0095 \text{ g } CO_2}{1 \text{ mol } CO_2} = 84.85 \text{ g } CO_2$$