

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:

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

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:

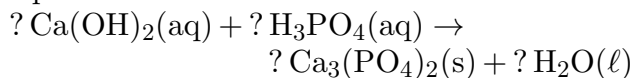
10^{20} H atoms is much less than 1 mole of H atoms. 100g of water is 5.56 moles of water which would have 11.12 moles of H atoms. 5 g of an unknown substance even if it was pure hydrogen could only be 5 moles of H atoms.

20 g of hydrogen gas is 10 moles of H₂ 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 H₂O when the equation



is balanced using the smallest possible integers?

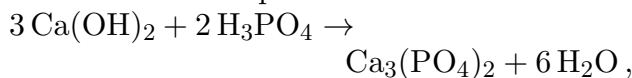
1. 2
2. 6 **correct**
3. 3
4. 8
5. 4

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

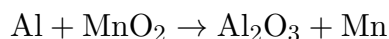


and the coefficient of H₂O is 6.

Mlib 08 0075

006 10.0 points

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



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

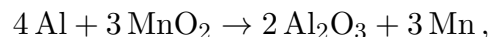
1. ten
2. fifteen
3. twelve **correct**
4. seven

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



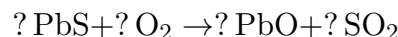
and has 4 Al, 3 Mn and 6 O atoms on each side.

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

Balance Equation 105

007 10.0 points

When the equation

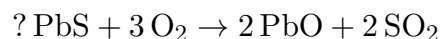


is balanced, the coefficients are

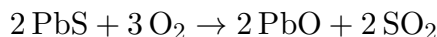
1. 2; 6; 4; 4
2. 2; 2; 1; 2
3. 1; 2; 1; 1
4. 4; 12; 4; 4
5. 2; 3; 2; 2 **correct**

Explanation:

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



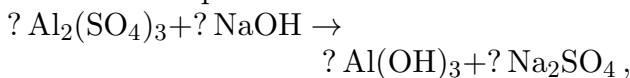
Now there are 2 each of Pb and S on the right, so the balanced equation is



Balance Equation 126

008 10.0 points

Balance the equation

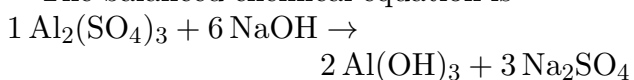


using the smallest possible integers. What is the sum of the coefficients in the balanced equation?

- ten
- eight
- fourteen
- twelve **correct**
- six

Explanation:

The balanced chemical equation is



which gives 2 Al, 3 SO₄, 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?

- All have the same number of atoms
- 3.05 moles of argon
- 3.05 moles of water
- 3.05 moles of CH₄ **correct**
- 3.05 moles of helium

Explanation:

For 3.05 moles of water:

$$\begin{aligned} ? \text{ atoms} &= 3.05 \text{ mol H}_2\text{O} \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \\ &\times \frac{3 \text{ atoms}}{1 \text{ molecule}} \\ &= 5.51 \times 10^{24} \text{ atoms} \end{aligned}$$

For 3.05 moles of CH₄:

$$\begin{aligned} ? \text{ atoms} &= 3.05 \text{ mol CH}_4 \times \frac{6.02 \times 10^{23} \text{ molec}}{1 \text{ mol}} \\ &\times \frac{5 \text{ atoms}}{1 \text{ molecule}} \\ &= 9.18 \times 10^{24} \text{ atoms} \end{aligned}$$

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.)

- 160.0 g
- 175.0 g **correct**
- 150.0 g
- 200.0 g
- 35.0 g

Explanation:

$$\begin{aligned} m_{\text{Cu, ini}} &= 100.0 \text{ g} & m_{\text{O}_2} &= 25.0 \text{ g} \\ m_{\text{Cu, fin}} &= 140.0 \text{ g} \end{aligned}$$

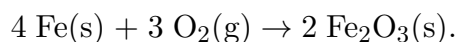
If 100 g copper and 25 g oxygen react completely with each other, there must be 125 g of product formed (law of conservation of mass). This product is CuO.

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:

$$\begin{aligned}\frac{100 \text{ g Cu}}{125 \text{ g CuO}} &= \frac{140 \text{ g Cu}}{x} \\ x &= \frac{(140 \text{ g Cu})(125 \text{ g CuO})}{100 \text{ g Cu}} \\ &= 175 \text{ g CuO}\end{aligned}$$

Mlib 01 5009
011 10.0 points

Consider the reaction



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:

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

The balanced equation for the reaction tells us that 4 mol Fe reacts with 3 mol O₂ to produce 2 mol Fe₂O₃. We have two possible starting points. We know 12.5 g Fe₂O₃ was produced and that 8.74 g Fe was present at the start of the reaction.

Choosing the 12.5 g of Fe₂O₃ to start with, first we convert to moles using the molar mass:

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

Now we use the mole ratio from the balanced equation to find moles O₂ needed to produce 0.0783 mol Fe₂O₃.

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

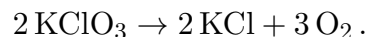
We convert from moles to grams:

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

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:



What mass of oxygen (O₂) would be produced upon thermal decomposition of 25 g of potassium chlorate (KClO₃ 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:

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

The balanced equation for the reaction indicates that 3 mol O₂ are produced for every 2 mol KClO₃ reacted. First we calculate the moles KClO₃ present:

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

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 $KClO_3$:

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

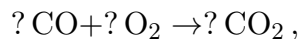
We convert from moles to grams O_2 :

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

Msci 03 0307

013 10.0 points

In the reaction



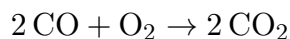
how much oxygen is required to convert 21 g of CO into CO_2 ?

1. 42 g
2. 12 g **correct**
3. 24 g
4. 6 g
5. 48 g
6. 21 g

Explanation:

$$m_{CO} = 21 \text{ g}$$

The balanced equation for the reaction is



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:

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

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

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

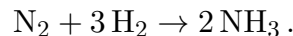
We convert from moles to grams O_2 :

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

Brodbelt 013 012

014 10.0 points

Consider the reaction



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:

$$m_{N_2} = 74.2 \text{ g}$$

$$n_{H_2} = 14.0 \text{ mol}$$

First you must determine the limiting reactant:

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

According to balanced equation, we need

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

We have

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

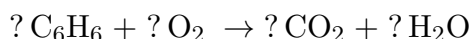
Therefore, H₂ is an excess and N₂ is limiting.

$$\begin{aligned} ? \text{ molec NH}_3 &= 2.65 \text{ mol N}_2 \times \frac{2 \text{ mol NH}_3}{1 \text{ mol N}_2} \\ &\times \frac{6.022 \times 10^{23} \text{ NH}_3 \text{ molec}}{1 \text{ mol NH}_3 \text{ molec}} \\ &= 3.19 \times 10^{24} \text{ molec NH}_3 \end{aligned}$$

Limit mccord01x hmwk

015 10.0 points

For the reaction



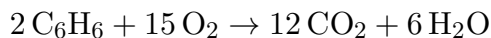
25.1 grams of C₆H₆ are allowed to react with 84.82 grams of O₂. How much CO₂ will be produced by this reaction?

Correct answer: 84.85 grams.

Explanation:

$$m_{\text{C}_6\text{H}_6} = 25.1 \text{ g} \qquad m_{\text{O}_2} = 84.82 \text{ g}$$

The balanced equation for the reaction is



FW of C₆H₆ is 78.1118 g/mol, giving 0.3213 mol C₆H₆.

FW of O₂ is 31.9988 g/mol, giving 2.651 mol O₂.

FW of CO₂ is 44.0095 g/mol

$$\begin{aligned} 0.3213 \text{ mol C}_6\text{H}_6 \times \frac{15 \text{ mol O}_2}{2 \text{ mol C}_6\text{H}_6} \\ = 2.41 \text{ mol O}_2 \end{aligned}$$

which is less than what is actually present.

Therefore the limiting reactant must be C₆H₆.

$$\begin{aligned} 0.3213 \text{ mol C}_6\text{H}_6 \times \frac{12 \text{ mol CO}_2}{2 \text{ mol C}_6\text{H}_6} \\ \times \frac{44.0095 \text{ g CO}_2}{1 \text{ mol CO}_2} = 84.85 \text{ g CO}_2 \end{aligned}$$