

Limiting Reagent Chemistry Questions with Solutions

Q1. We can calculate the limiting reagent in a reaction by many factors, but which of the factors cannot help to determine the limiting reactant:

- a) Number of moles
- b) Mass given
- c) Volume given
- d) Pressure given

Correct Answer: (d) Pressure given

Q2. Silicon nitride (Si_3N_4) is made by combining Si and nitrogen gas (N_2) at a high temperature. How much (in g) Si is needed to react with an excess of nitrogen gas to prepare 125 g of silicon nitride if the percent yield of the reaction is 95.0%?

- a) 89 g
- b) 79.1
- c) 75 g
- d) 90.8 g

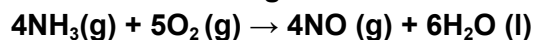
Correct Answer: (b) 79.1 g

Q3. What is a limiting reactant?

- a) The reactant that is used up first and prevents more product from being made.
- b) The reactant that makes the product.
- c) The reactant that is used up last and prevents more product from being made
- d) The substance that is in excess that doesn't get used up as a reactant.

Correct Answer: (a) The reactant that is used up first and prevents more product from being made.

Q4. In the following reaction:



When 1 mole ammonia and 1 mole of O_2 are mixed, then the number of moles of NO formed will be:

- a) 0.8
- b) 0.7
- c) 0.6
- d) 0.5

Correct Answer: (a) 0.8 mole

Q5. 10 g of marble(calcium carbonate) was added to 15 g of dilute hydrochloric acid, product formed is calcium chloride, water and carbon dioxide. Which of the following is true?

- a) Hydrochloric acid is the limiting reactant
- b) Hydrochloric acid is the excess reactant
- c) Calcium carbonate is the excess reactant
- d) None of the above

Correct Answer: (b) Hydrochloric acid is the excess reactant

Q6. What is a Limiting reagent?

Answer. A limiting reagent is a reactant that occurs in lower concentrations in a reaction. When it is consumed, the reaction will stop, regardless of the amount of reactant present in the reaction. It restricts the amount of product produced. In other words, it determines the magnitude of the reaction.

Q7. NO₂ is formed when 0.740 g of O₃ reacts with 0.670 g of NO. What is the limiting reagent?

Answer. $O_3 + NO \rightarrow O_2 + NO_2$

1 mole of O₃ reacts with 1 mole of NO.

0.74 g O₃ = $0.74 / 48 = 0.0154$ mol O₃

0.67 g NO = $0.67 / 30 = 0.0223$ mol NO

O₃ is the limiting reagent and NO is in excess.

Q8. How do you determine which product is the limiting one?

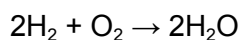
Answer. Compare the calculated amount of a reactant to the actual amount available to determine which reactant is the limiting one. If more is needed than what is available, it is the limiting reactant.

Q9. If 4.95 g of ethylene (C₂H₄) are combusted with 3.25 g of oxygen. What is the limiting reagent?

Answer. The limiting reagent would be O₂.

Q10. Calculate the limiting reagent in $2H_2 + O_2 \rightarrow 2H_2O$

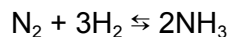
Answer. Given 1 mol of hydrogen and 1 mol of oxygen in the reaction:



The limiting reactant would be hydrogen because the reaction uses up hydrogen twice as fast as oxygen.

Q11. 50.0 kg of N₂ (g) and 10.0 kg of H₂ (g) are mixed to produce NH₃ (g). Identify the limiting reagent in the production of NH₃ in this situation.

Answer.



1 mol N₂ (g) requires 3 mol H₂ (g), for the reaction.

Hence, for 17.86×10^2 mol of N₂, the moles of H₂ (g) required would be $17.86 \times 10^2 \text{ mol N}_2 \times (3 \text{ mol H}_2 \text{ (g)}) / (1 \text{ mol N}_2 \text{ (g)})$

$$= 5.36 \times 10^3 \text{ mol H}_2$$

But we have only 4.96×10^3 mol H₂. Hence, dihydrogen is the limiting reagent

Q12. What is the greatest amount of MgO (i moles) that can be made with 7.8 moles of Mg and 4.7 moles of O₂? Which is the limiting reagent?

Answer. $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

For 7.8 moles of Mg = $(1 \text{ moles of O}_2 / 2 \text{ moles of Mg}) \times 7.8 \text{ mole Mg} = 3.9 \text{ moles of O}_2$

For 4.7 moles of O₂ = $(2 \text{ moles of Mg} / 1 \text{ mole of O}_2) \times 4.7 \text{ moles O}_2 = 9.4 \text{ moles Mg}$.

Therefore, Mg is the limiting reagent.

Q13. Calculate the amount of C formed in the reaction $2\text{A} + 4\text{B} \rightarrow 3\text{C} + 4\text{D}$ when 5 moles of A react with 6 moles of B.

Answer. The balanced reaction is $2\text{A} + 4\text{B} \rightarrow 3\text{C} + 4\text{D}$

Moles given is 5 moles of A and 6 moles of B

Ratio of moles given and stoichiometry coefficients:

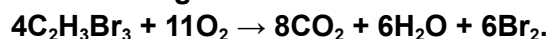
$$\text{For A: } 5/2 = 2.5$$

$$\text{For B: } 6/4 = 1.5$$

Since 1.5 is less than 2.5, B is the limiting reagent because it will be used first.

Therefore, the moles produced of C = $\frac{3}{4} = 4.5 \text{ mol}$.

Q14 What would be the limiting reagent if 75 grams of C₂H₃Br₃ reacted with 50.0 grams of O₂ in the following reaction:



Answer. Conversion to moles

$$75 \text{ g} \times (1 \text{ mole} / 266.72 \text{ g}) = 0.28 \text{ mole C}_2\text{H}_3\text{Br}_3$$

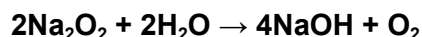
$$50 \text{ g} \times (1 \text{ mole} / 32 \text{ g}) = 1.56 \text{ mol O}_2$$

To calculate how much C₂H₃Br₃ would be required if all the O₂ is used up:

$$1.56 \text{ mol O}_2 \times (4 \text{ mol C}_2\text{H}_3\text{Br}_3 / 11 \text{ mol O}_2) = 0.567 \text{ mol C}_2\text{H}_3\text{Br}_3$$

This shows that 0.567 mol C₂H₃Br₃ is needed to react with all of the oxygen. C₂H₃Br₃ is the limiting reagent because there is only 0.28 mol of it present.

Q15. What would be the limiting reagent if 80.0 grams of Na_2O_2 reacted with 30.0 grams of H_2O in the reaction?



Answer. $80 \text{ g Na}_2\text{O}_2 \times (1 \text{ mol Na}_2\text{O}_2 / 77.98 \text{ g Na}_2\text{O}_2) \times (4 \text{ moles NaOH} / 2 \text{ moles Na}_2\text{O}_2) = 2.06 \text{ moles NaOH}$

$30 \text{ g H}_2\text{O} \times (1 \text{ mol H}_2\text{O} / 18 \text{ g H}_2\text{O}) \times (4 \text{ moles NaOH} / 2 \text{ moles Na}_2\text{O}_2) = 3.33 \text{ moles NaOH}$

Since Na_2O produces less NaOH than H_2O , it is the limiting reagent.

Practise Questions on Limiting Reagent

Q1. The reactant which is not consumed completely in the reaction is ____.

Answer. Excess reactant.

Q2. In a reaction: $\text{A} + \text{B}_2 \rightarrow \text{AB}_2$

Identify the limiting reagent, if any, in the following reaction mixtures.

- (i) 300 atoms of A + 200 molecules of B
- (ii) 2 mol A + 3 mol B
- (iii) 100 atoms of A + 100 molecules of B
- (iv) 5 mol A + 2.5 mol B
- (v) 2.5 mol A + 5 mol B

Answer. The extent of a reaction is determined by a limiting reagent. During a reaction, the reactant is the first to be consumed, causing the reaction to stop and limiting the amount of products formed.

(i) In the given reaction, one atom of A reacts with one molecule of B. As a result, 200 molecules of B will react with 200 atoms of A, leaving 100 atoms of A unreacted. As a result, B is the limiting reagent.

(ii) The reaction states that 1 mole of A reacts with 1 mole of B. As a result, two moles of A will react with only two moles of B. As a result, only one mole of A will be consumed. As a result, A is the limiting reagent.

(iii) In the given reaction, 1 atom of A reacts with 1 molecule of B. As a result, all 100 A atoms will combine with all 100 B molecules. As a result, where no limiting reagent is present, the mixture is stoichiometric.

(iv) 1 mole of atom A and 1 mole of molecule B combine. As a result, 2.5 mole B will combine with only 2.5 mole A. As a result, 2.5 mole of A will remain unchanged. As a result, B is the limiting reagent.

(v) The reaction states that 1 mole of atom A combines with 1 mole of molecule B. As a result, 2.5 mole of A will combine with only 2.5 mole of B, leaving the remaining 2.5 mole of B. Hence, A is the limiting reagent.

Q3. The reactant which is entirely consumed in the reaction is known as the limiting reagent. In the reaction $2A + 4B \rightarrow 3C + 4D$, if 5 moles of A react with 6 moles of B then, which is the limiting reagent?

- a) A
- b) B
- c) C
- d) D

Correct Answer: (b) B

Explanation: The balanced reaction is $2A + 4B \rightarrow 3C + 4D$

Ratio of moles given and stoichiometry coefficients:

For A: $5/2 = 2.5$

For B: $6/4 = 1.5$

Since 1.5 is less than 2.5, B is the limiting reagent because it will be used first.

Q4. If you have an actual yield of 29.3 grams of product and the theoretical yield is 35.0 grams, what is your percent yield?

Answer. The reaction's actual yield is 29.3 grams, while the theoretical yield is 35.0 grams. When we calculate the percent yield, we get the following value.

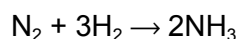
% yield = (actual yield / theoretical yield) $\times$ 100

% yield = $(29.3 \text{ g} / 35 \text{ g}) \times 100$

% yield = 83.7 %

Q5. 6 g of H_2 reacts with 14 g of N_2 to form NH_3 until the reaction consumes the limiting reagent completely. The amount of another reactant remaining in g is:

Answer. The balanced equation for the reaction is-



28 g of N_2 is reacting with 6g of H_2 to give 34 g of NH_3

Given- 14 g of N_2 and 6g of H_2

The actually consumed quantity is 14 g of N_2 and 3g of H_2

So, nitrogen is the limiting reagent, therefore, the excess reagent left is 3g.