Acid–base back titration calculation

ROYAL SOCIETY OF CHEMISTRY

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rsc.li/3NXxluX

Q: 13 g of hydrogen reacts with 84 g of nitrogen. What is the limiting reagent and what mass of ammonia will be produced?

Step 1: read the question, put information into the table, including writing a balanced equation.

Balanced Equation	N_2 +	$3H_2$ →	$2NH_3$
Ratio	1	3	2
Mass (g)	84	13	
Formula mass (g mol^{-1})			
Moles			
Finding limiting reagent			

Q: 13 g of hydrogen reacts with 84 g of nitrogen. What is the limiting reagent and what mass of ammonia will be produced?

Step 2: calculate formula for the reactants and product.

Balanced Equation	N_2 +	$3H_2$ →	$2NH_3$
Ratio	1	3	2
Mass (g)	84	13	
Formula mass (g mol^{-1})	(14 x 2) = 28	(1 x 2) = 2	(14 + (3 x 1)) = 17
Moles			
Finding limiting reagent			

Q: 13 g of hydrogen reacts with 84 g of nitrogen. What is the limiting reagent and what mass of ammonia will be produced?

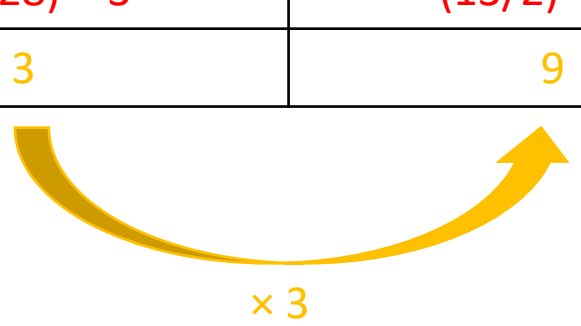
Step 3: calculate moles of the reactants using moles = $\frac{\text{mass}}{\text{formula mass}}$

Balanced Equation	N_2 +	$3H_2$ →	$2NH_3$
Ratio	1	3	2
Mass (g)	84	13	
Formula mass (g mol^{-1})	(14 x 2) = 28	(1 x 2) = 2	(14 + (3 x 1)) = 17
Moles	(84/28) = 3	(13/2) = 6.5	
Finding limiting reagent			

Q: 13 g of hydrogen reacts with 84 g of nitrogen. What is the limiting reagent and what mass of ammonia will be produced?

Step 4: work out the limiting reagent while considering ratios. If I have three moles of N_2 how many moles of H_2 would I need? (3 x 3 = 9 moles of hydrogen needed) Do I have enough? (9 > 6.5 → no)

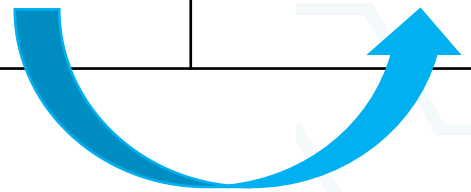
Balanced Equation	N_2 +	$3H_2$ →	$2NH_3$
Ratio	1	3	2
Mass (g)	84	13	
Formula mass (g mol^{-1})	(14 x 2) = 28	(1 x 2) = 2	(14 + (3 x 1)) = 17
Moles	(84/28) = 3	(13/2) = 6.5	
Finding limiting reagent	3	9	



Q: 13 g of hydrogen reacts with 84 g of nitrogen. What is the limiting reagent and what mass of ammonia will be produced?

Step 5: use the ratio of the limiting reagent:product to calculate the moles of product

Balanced Equation	N_2 +	$3H_2$ →	$2NH_3$
Ratio	1	3	2
Mass (g)	84	13	
Formula mass (g mol^{-1})	(14 x 2) = 28	(1 x 2) = 2	(14 + (3 x 1)) = 17
Moles	(84/28) = 3	(13/2) = 6.5	4.33
Finding limiting reagent	3	9	



÷ 3, × 2

Q: 13 g of hydrogen reacts with 84 g of nitrogen. What is the limiting reagent and what mass of ammonia will be produced?

Step 6: use mass = moles x formula mass to calculate mass of product

Balanced Equation	N_2 +	$3H_2$ →	$2NH_3$
Ratio	1	3	2
Mass (g)	84	13	73.7
Formula mass (g mol^{-1})	(14 x 2) = 28	(1 x 2) = 2	(14 + (3 x 1)) = 17
Moles	(84/28) = 3	(13/2) = 6.5	4.33
Finding limiting reagent	3	9