4. The poison gas phosgene, COCl₂, reacts with water in the lungs to form hydrochloric acid and carbon dioxide. How many moles of hydrochloric acid would be formed by 0.835 moles of phosgene?

Equation: \[ \text{COCl}_2 + \text{H}_2\text{O} \rightarrow 2\text{HCl} + \text{CO}_2 \]

| Before | 0.835 mol | xs | → | 0 mol | 0 mol |
| Change | -0.835 mol | -0.835 mol | +1.67 mol | +0.835 mol |
| After  | 0 mol | xs | → | 1.67 mol | 0.835 mol |

1.67 mol HCl formed

5. Iron metal and oxygen combine to form the magnetic oxide of iron, Fe₃O₄. How many moles of iron oxide would be produced from 8.80 moles of pure oxygen? (make your BCA table)

\[ 3\text{Fe} + 2\text{O}_2 \rightarrow \text{Fe}_3\text{O}_4 \]

\[ \frac{3}{2} : \frac{2}{1} = \frac{13.2}{8.8} = 1.49 \]

Before | xs | + | 8.80 mol | → | 0 mol |
Change | -13.2 mol | -8.80 mol | → | +4.4 mol |
After  | xs | 0 mol | → | 4.4 mol |

4.4 mol of Fe₃O₄ produced

6. The recipe for Coca-Cola Classic is a closely guarded secret. Researchers outside the company believe the flavoring mixture, known as “7X”, contains oils of orange, lemon, nutmeg, cinnamon, and coriander. The original mixture also contained caffeine, vanilla, caramel, lime juice, sugar or artificial sweetener, and citric acid.

Over the years, the recipe has changed. For example, the original recipe contained citric acid but this was combined with phosphoric acid to cut production costs. Corn syrup replaced sugar for the same reason.

To produce 1000 cans of Coca-Cola Classic, 40g (0.21 moles) of caffeine are reacted with phosphoric acid and other ingredients. How many moles of phosphoric acid are required? How many moles of carbon dioxide are required?

\[ \text{C}_8\text{H}_10\text{N}_4\text{O}_2 + 4\text{H}_3\text{PO}_4 + 6\text{CO}_2 + \text{other ingredients} \rightarrow \text{C}_6\text{H}_5\text{CO}_2\text{K} + \text{other products} \]

| 0.21 mol | ? | ? |
| C₈H₁₀N₄O₂ | 4 H₃PO₄ | 6 CO₂ + other ingredients | C₆H₅CO₂K + other products |

1 : 4 : 6

\[ \frac{0.21}{0.84} = \frac{1.26}{0.84} \]

1.26 mol of CO₂

0.84 mol of phosphoric acid