

# 2 Kimyasal Hesaplamalar

## Kısım 3

### Soru 5:

a) Aşağıdaki denklemi denkleştiriniz.

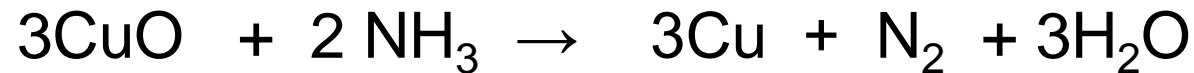
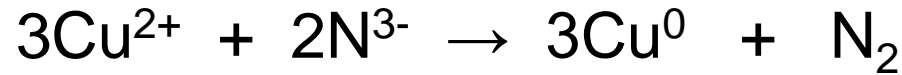
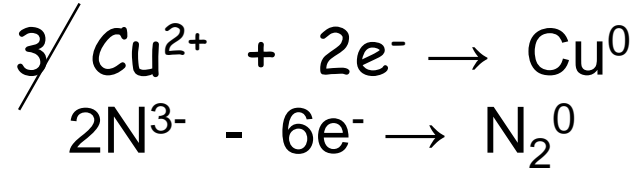
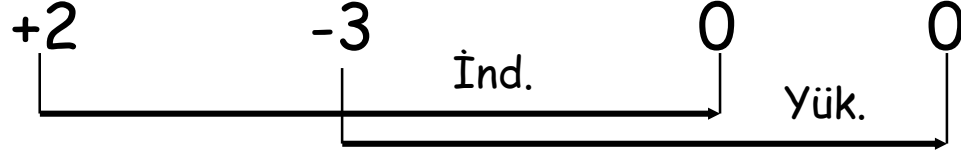


b) 125 g CuO(k) ile 25 g NH<sub>3</sub>(g)'tan kaç g Cu(k) ve kaç g N<sub>2</sub>(g) elde edilir.

(Cu: 63,5 g/mol N:14 g/mol H:1g/mol)

c) Bu deneyde 81,87 g Cu oluşmuş ise reaksiyonun verimi nedir.

**Çözüm:**



b) İlk olarak sınırlayıcı bileşen bulunur.



-----  
X=17,81 g NH<sub>3</sub> elimizde 25 g olduğu için ortamda NH<sub>3</sub> artmıştır.



-----  
X=175,36 g CuO elimizde 125 g olduğu için sınırlayıcı bileşen CuO.



-----  
X=14,675g N<sub>2</sub>



-----  
X=99,84 g Cu

c)

$$\frac{81,87}{99,84} \times 100 = \%82$$

### Soru 6:



Denklemine göre 15,8 g  $\text{KMnO}_4$ ; 67,5 g  $\text{FeCl}_2$  ve 23,36 g saf HCl etkileşiyor. a) Sınırlayıcı bileşeni bulunuz b) Oluşacak KCl kütlesini hesaplayınız. (K: 39, Mn: 55, Fe: 56, Cl: 35,5 g/mol)

### Çözüm

$$\text{KMnO}_4 = 15,8\text{g} / 158\text{ g/mol} = 0,1\text{ mol}$$

$$\text{FeCl}_2 = 67,5\text{ g} / 127\text{ g/mol} = 0,53\text{ mol}$$

$$\text{HCl} = 23,36\text{g} / 36,5\text{ g/mol} = 0,64\text{ mol}$$

$$\text{KCl} = 74,5\text{ g/mol}$$

1 mol $\text{KMnO}_4$	5 mol $\text{FeCl}_2$
0,1 mol	X

---

$$X = 0,5\text{ mol FeCl}_2$$

5 mol $\text{FeCl}_2$	8 mol HCl
0,53 mol	X

$X = 0,85\text{ mol HCl}$  gerekli miktar elimizde 0,64 mol var. O nedenle sınırlayıcı bileşen HCl

8 mol HCl	1 mol KCl
0,64 mol	X

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$$X = 0,08\text{ mol KCl}$$

1 mol HCl	74,5 g KCl
0,08 mol	X

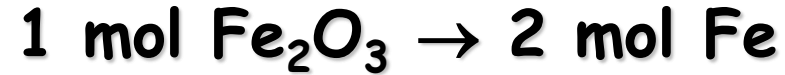
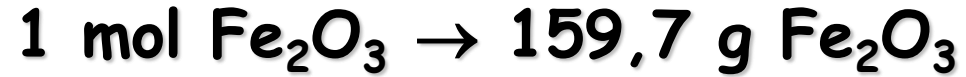
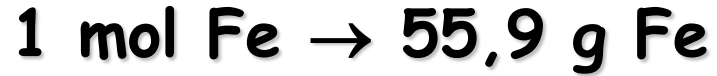
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$$X = 5,96\text{ g KCl}$$

KİMYASAL HESAPLAMALAR

UYGULAMA

**Soru 1:** 10 g  $\text{Fe}_2\text{O}_3$  deki Fe miktarını bulunuz



$$?g\text{Fe} = 10g\text{Fe}_2\text{O}_3 \times \frac{1\text{molFe}_2\text{O}_3}{159,7g\text{Fe}_2\text{O}_3} \times \frac{2\text{molFe}}{1\text{molFe}_2\text{O}_3} \times \frac{55,9g\text{Fe}}{1\text{molFe}}$$

$$?g\text{Fe} = 7,00g\text{Fe}$$

Veya

$$\begin{array}{r} 159,7 \text{ g Fe}_2\text{O}_3 \quad 2 \times 55,9 \text{ g Fe} \\ 10 \text{ g Fe}_2\text{O}_3 \quad X \\ \hline \end{array}$$

$X = 7,00 \text{ g Fe}^{3+}$  vardır

**Soru 2:** Nikotinin 0,6075 g'lık örneği oksijen içinde yakıldığı zaman 1,650 g CO<sub>2</sub>, 0,4725 g H<sub>2</sub>O elde edilmiş ve 0,105 g N<sub>2</sub> geriye kalmıştır. Nikotinin yüzde bileşimi nedir.

**Çözüm**

$$\frac{12 \text{ g C}}{44 \text{ g CO}_2} \cdot 1,650 \text{ g CO}_2 = 0,450 \text{ g C}$$

$$\frac{2 \text{ g H}}{18 \text{ g H}_2\text{O}} \cdot 0,4725 \text{ g H}_2\text{O} = 0,0525 \text{ g H}$$

N yanmadan N<sub>2</sub> olarak çıktığına göre örnekte 0,105 g N<sub>2</sub> vardır. N<sub>2</sub> miktarı bilinmese bile  
 $0,6075 - (0,450 + 0,0525) = 0,105 \text{ g}$  olarak bulunabilir.

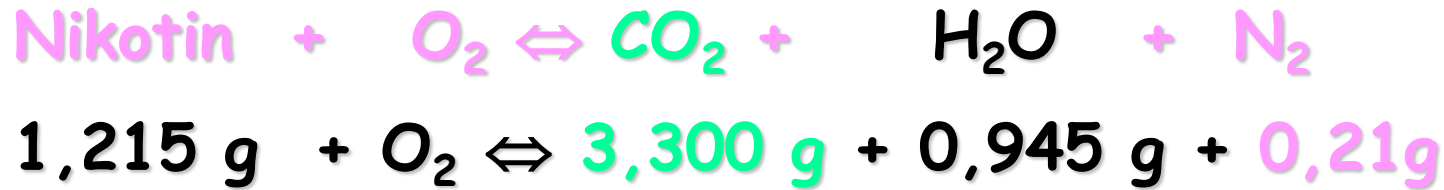
$$\%C \frac{0,450 \text{ g C}}{0,6075 \text{ g nikotin}} \cdot 100 \text{ g Nikotin} = \%74,1 \text{ C}$$

$$\%H \frac{0,0525 \text{ g H}}{0,6075 \text{ g nikotin}} \cdot 100 \text{ g Nikotin} = \%8,6 \text{ H}$$

$$\%N \frac{0,105 \text{ g N}}{0,6075 \text{ g nikotin}} \cdot 100 \text{ g Nikotin} = \%17,3 \text{ N}$$

**Not:** %N toplam %'den de bulunabilir.  
 $\%100 - (\%74,1 - \%8,6) = \%17,3 \text{N}$

**Soru 3:** Nikotin C, H ve N içeren bir bileşiktir. 1,215 g nikotin oksijen ile yakılırsa yanma ürünleri olarak 3,300g CO<sub>2</sub>, 0,945g H<sub>2</sub>O ve 0,21 g N<sub>2</sub> elde ediliyor. Nikotinin % bileşimini bulunuz.



? g C  
? g N  
? g H

1 mol C → 12,0 g C

1 mol H → 1,0 g H

1 mol N → 14,0 g N

1 mol O → 16,0 g O

1 mol CO<sub>2</sub> → 44,0 g CO<sub>2</sub>

1 mol H<sub>2</sub>O → 18,0 g H<sub>2</sub>O



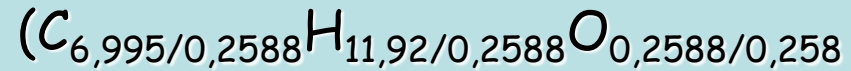
**Soru 4:** Kolesterolün molekül ağırlığı 386 gramdır. Bileşik % 83,94 C, % 11,92 H ve % 4,14 O içermektedir. Kolesterolün en basit ve molekül formülü nedir?

### Çözüm

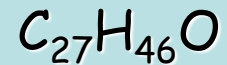
$$n_C: 83,94/12= 6,995 \text{ mol}$$

$$n_H: 11,92/1= 11,92 \text{ mol}$$

$$n_O: 4,14/16= 0,2588 \text{ mol}$$



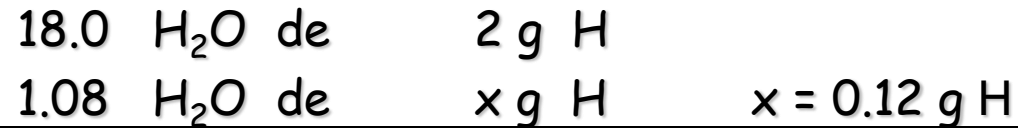
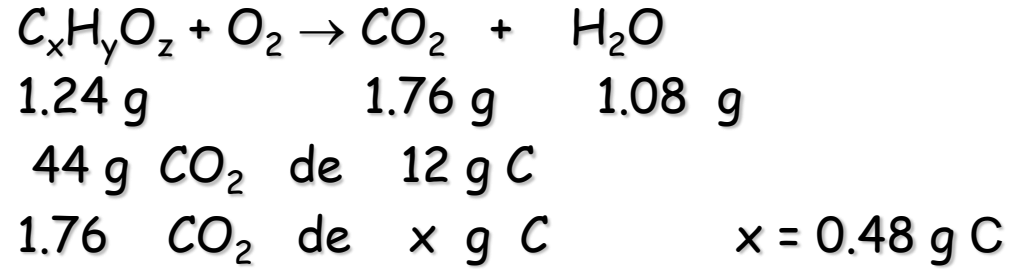
8



## Soru 5:

C, H ve O den oluştuğu bilinen bir organik bileşiğin 1.24 gramı, yeterince oksijen ile yakılıyor. Yakma analizi sonucunda 1.76 g  $CO_2$  ve 1.08 g  $H_2O$  oluştuğuna göre, organik bileşiğin en basit formülü nedir? (C:12; O:16; H:1 g/mol). Molekül kütlesi 62 g/mol ise molekül formülü nedir ?

### Çözüm



$$1.24 - (0.48 + 0.18) = 0.64 \text{ g Oksijen}$$

$$n_C: 0.48/12 = 0.04 \text{ mol}$$

$$n_H: 0.12/1 = 0.12 \text{ mol}$$

$$n_O: 0.64/16 = 0.04 \text{ mol}$$

$$(C_{0.04}H_{0.12}O_{0.04})/0.04: CH_3O \text{ (En basit formül)}$$

$$CH_3O = 12 + 3 + 16 = 31$$

$$62/31 = 2 \text{ Etilen glikol } (C_2H_6O_2) \text{ (Molekül For.)}$$

**Soru 6:** Bir kafein örneğinin yakma analizi sonucu

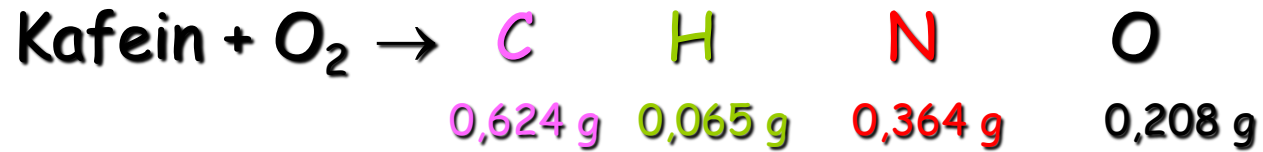
0,624 g C

0,065 g H

0,364 g N

0,208 g O

içerdiği bulunmuştur. Mol kütlesi 194 g/mol ise kafeinin en basit formülü ve molekül formülü nedir?



1 mol C  $\rightarrow$  12,0 g C

1 mol H  $\rightarrow$  1,0 g H

1 mol N  $\rightarrow$  14,0 g N

1 mol O  $\rightarrow$  16,0 g O

**Soru 7:** Yalnız C, H ve O içerdiği bulunan etil alkolün 0,10 g 'lık bir örneği yakılarak

0,1910 g  $\text{CO}_2$   
0,1172 g  $\text{H}_2\text{O}$

elde edilmiştir. Etil alkolün en basit formülü nedir?



1 mol C  $\rightarrow$  12,0 g C

1 mol H  $\rightarrow$  1,0 g H

1 mol O  $\rightarrow$  16,0 g O

1 mol  $\text{CO}_2$   $\rightarrow$  44,0 g  $\text{CO}_2$

1 mol  $\text{H}_2\text{O}$   $\rightarrow$  18,0 g  $\text{H}_2\text{O}$

Soru 8. Aşağıdaki reaksiyonu redoks yöntemi ile denkleştiriniz.



+2

+5

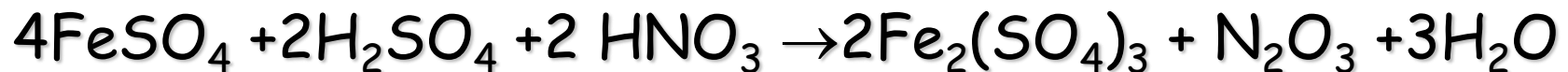
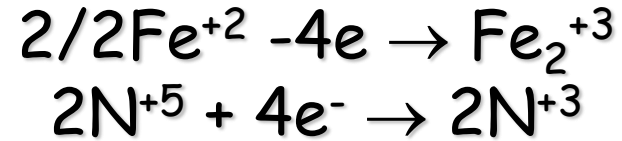
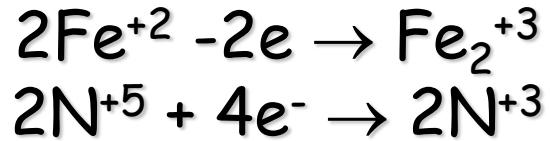
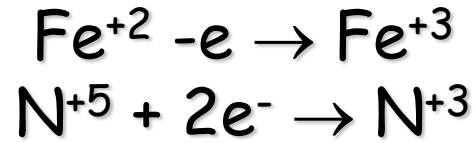
+3

+3

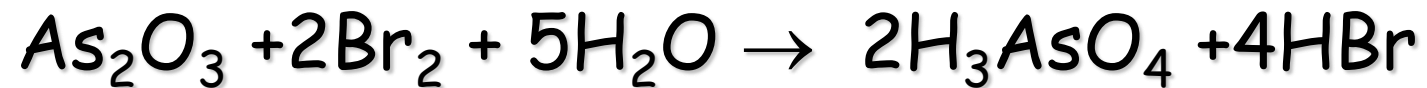
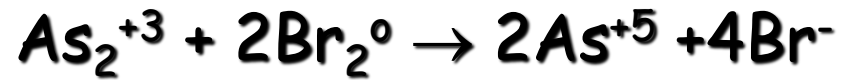
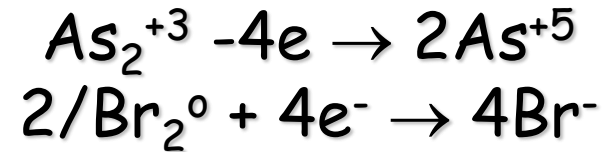
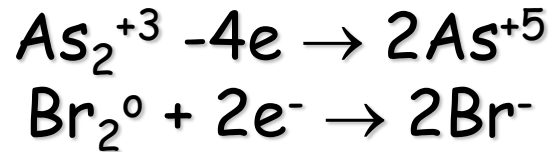
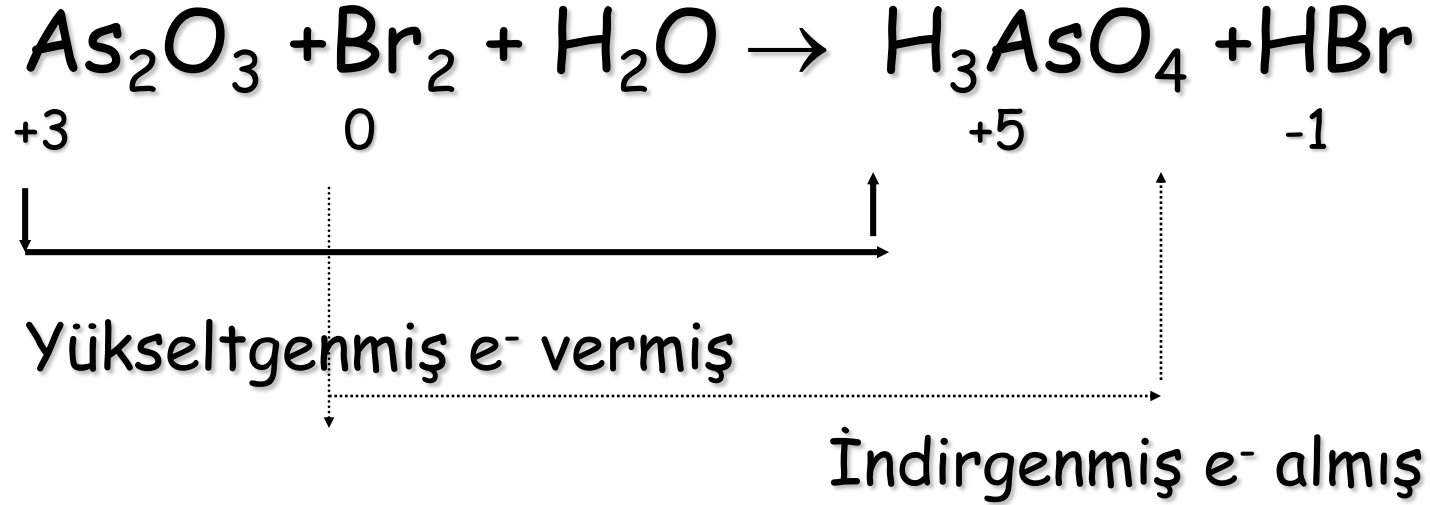


Yükseltgenmiş e<sup>-</sup> vermiş

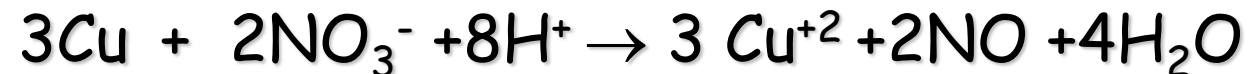
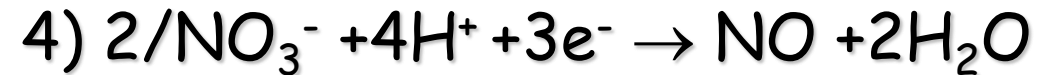
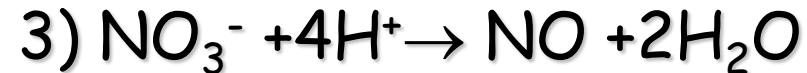
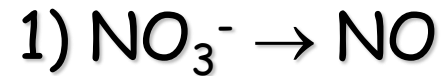
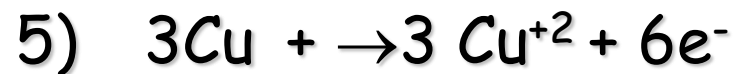
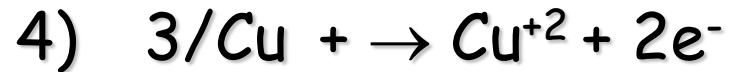
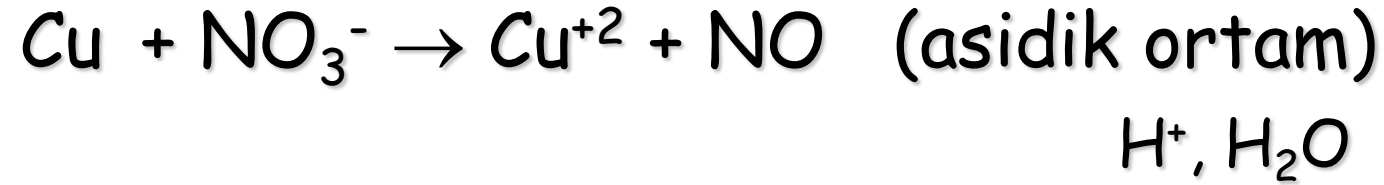
İndirgenmiş e<sup>-</sup> almış



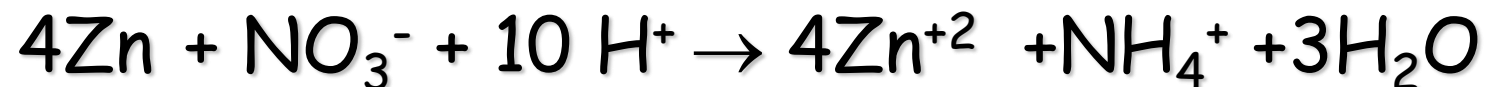
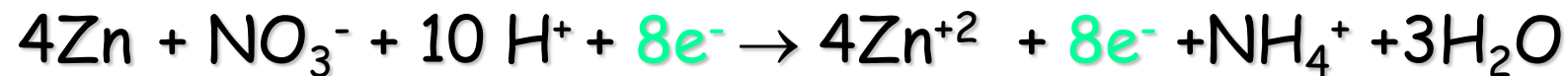
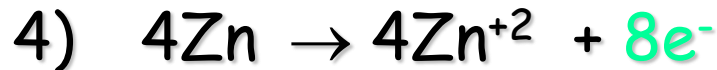
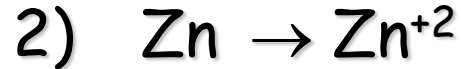
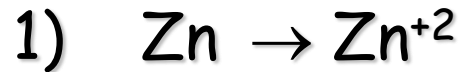
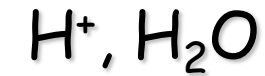
Soru 9.



Soru 10.

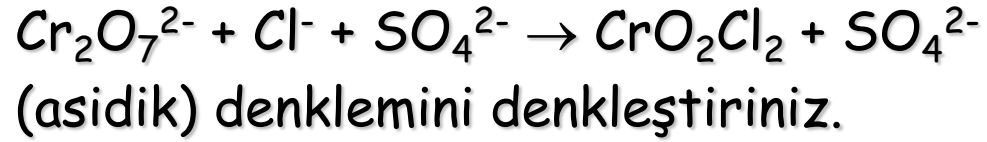


Soru 11.





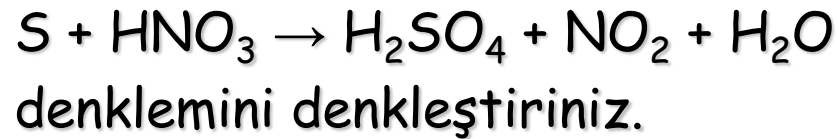
• **SORU 12:**



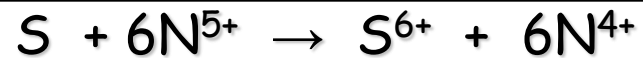
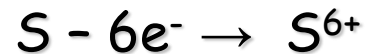
Cevap



**SORU 13:**



Cevap



## Soru 14:

C vitamininin 100 g' ında 40 g C, 4,58 g H ve 54,5 g O bulunduğuna göre en basit ve molekül formülünü hesaplayınız.

C vitamininin molekül kütlesi 176 g/mol'dür.

### Çözüm

$$n_C: 40,9/12= 3,41 \text{ mol}$$

$$n_H: 4,58/1= 4,58 \text{ mol}$$

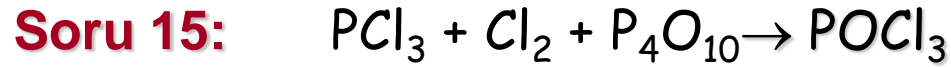
$$n_O: 54,5/16= 3,41 \text{ mol}$$

$(C_{3,41/3,41}H_{4,58/3,41}O_{3,41/3,41}) \cdot CH_{1,34}O$  (sabit sayı çıkması için 3 ile çarpılır.)

$C_3H_4O_3$  (En basit formül)

$$C_3H_4O_3 = 12 \times 3 + 1 \times 4 + 16 \times 3 = 88$$

$$176/88=2 \quad (C_6H_8O_6) \text{ (Molekül For.)}$$



Yukarıdaki reaksiyon denklemine göre; reaktiflerin tamamından birer kg reaksiyona sokuluyor, kaç kg  $\text{POCl}_3$  oluşur?

$\text{PCl}_3$ : 137.5 g/mol;  $\text{Cl}_2$ : 71.0 g/mol;  $\text{P}_4\text{O}_{10}$ : 284.0 g/mol;  $\text{POCl}_3$ : 153.5 g/mol



$$n_{\text{PCl}_3} = 1000 \text{ g} / 137,5 \text{ g/mol} = 7,27 \text{ mol}$$

$$n_{\text{Cl}_2} = 1000 \text{ g} / 71 \text{ g/mol} = 14,09 \text{ mol}$$

$$n_{\text{P}_4\text{O}_{10}} = 1000 \text{ g} / 284 \text{ g/mol} = 3,52 \text{ mol}$$

$$\begin{array}{l} 6 \text{ mol PCl}_3 \quad \text{ile} \quad 1 \text{ mol P}_4\text{O}_{10} \\ 7,27 \text{ mol PCl}_3 \quad \quad \quad X \end{array}$$

-----  
X=1,22 mol  $\text{P}_4\text{O}_{10}$  gerekli 3,52 mol var

$$\begin{array}{l} 6 \text{ mol PCl}_3 \quad \text{ile} \quad 6 \text{ mol Cl}_2 \\ 7,27 \text{ mol PCl}_3 \quad \quad \quad X \end{array}$$

-----  
X=7,27 mol  $\text{Cl}_2$  gerekli, 14,09 mol var

$\text{P}_4\text{O}_{10}$  ve  $\text{Cl}_2$ 'nin mol sayıları fazla olduğu için **sınırlayıcı bileşen  $\text{PCl}_3$ 'dür.**

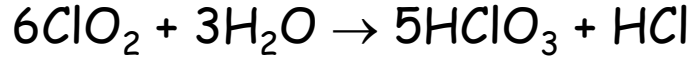
$$\begin{array}{l} 6 \text{ mol PCl}_3 \quad \quad 10 \text{ mol POCl}_3 \\ 7,27 \text{ mol PCl}_3 \quad \quad \quad X \end{array}$$

-----  
X=12,12 mol  $\text{POCl}_3$  oluşur.

$$\begin{array}{l} 1 \text{ mol POCl}_3 \quad \quad 153,5 \text{ g POCl}_3 \\ 12,12 \text{ mol POCl}_3 \quad \quad \quad X \end{array}$$

-----  
X=1860,42 g veya 1,86 kg  $\text{POCl}_3$  oluşur.

## Soru 16:



reaksiyonu % 60 verimle gerçekleşiyor. 4.8 mol  $\text{ClO}_2$  den kaç g  $\text{HClO}_3$  oluşur?

$$\text{HClO}_3 = 84.5 \text{ g/mol}$$

$$\begin{array}{l} 6 \text{ mol } \text{ClO}_2 \quad 5 \text{ mol } \text{HClO}_3 \\ 4.8 \text{ mol } \text{ClO}_2 \quad \quad \times \end{array}$$

---

$$X = 4 \text{ mol } \text{HClO}_3 \text{ oluşur.}$$

$$\begin{array}{l} 1 \text{ mol } \text{HClO}_3 \quad 84,5 \text{ g } \text{HClO}_3 \\ 4 \text{ mol } \text{HClO}_3 \quad \quad \times \end{array}$$

---

$$X = 338 \text{ g } \text{HClO}_3 \text{ oluşur.}$$

$$\%60 = \frac{x}{338} \times 100 = 202.8 \text{ g } \text{HClO}_3$$

**Veya**

$$\begin{array}{l} 6 \text{ mol } \text{ClO}_2 \text{ den} \quad 5 \text{ mol } \text{HClO}_3 \text{ oluşursa} \\ 4.8 \text{ mol } \text{ClO}_2 \text{ den} \quad \quad \quad \times \\ \hline X = 4 \text{ mol oluşur.} \end{array}$$

$$\begin{array}{l} \%100 \quad 4 \text{ mol oluşursa} \\ \%60 \quad \quad \quad \times \\ \hline X = 2.4 \text{ mol oluşur.} \end{array}$$

$$\begin{array}{l} 1 \text{ mol } \text{HClO}_3 \quad 84.5 \text{ g/mol} \\ 2.4 \text{ mol} \quad \quad \quad \times \\ \hline X = 202,8 \text{ g } \text{HClO}_3 \text{ elde edilir} \end{array}$$

**Soru 17:**

12 g Zn ve 6,5 g S'den ne kadar ZnS oluşur. Hangi element sınırlayıcı reaktiftir ve hangi elementten kaç g etkileşmeden kalır.

**Çözüm**

$$\begin{array}{r} 1\text{mol Zn} \quad 65,4 \text{ g} \\ X \quad 12 \text{ g} \\ \hline X=0,183 \text{ mol Zn} \end{array}$$

$$\begin{array}{r} 1\text{mol S} \quad 32,1 \text{ g} \\ X \quad 6,5 \text{ g} \\ \hline X=0,202 \text{ mol S} \end{array}$$

1 mol Zn ile 1 mol S etkileştiğine göre 0,183 mol Zn, 0,183 mol S ile etkileşir ve ortamda bir miktar S etkileşmeden kalır. Yani Zn sınırlayıcı bileşendir.  
1 mol Zn ile 1 mol ZnS oluşur. 0,183 mol Zn ile 0,183 mol ZnS oluşur.

$$\begin{array}{r} 1\text{mol ZnS} \quad 97,5 \text{ g} \\ 0,183\text{mol ZnS} \quad X \\ \hline \end{array}$$

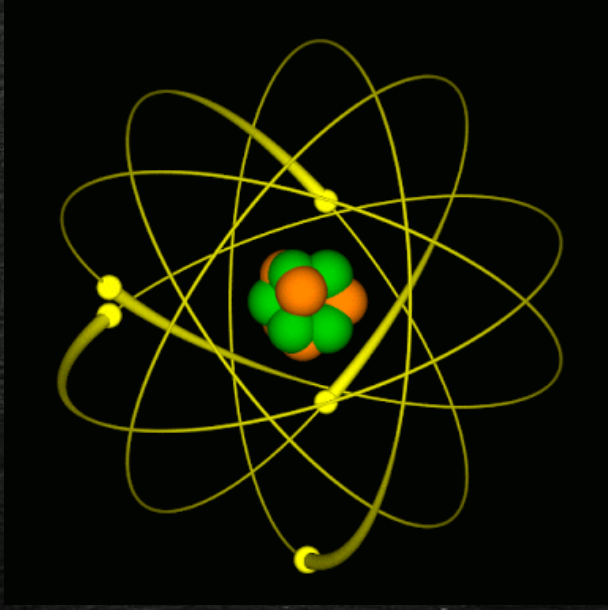
$$X=17,8\text{g ZnS}$$

Etkileşmeden kalan S miktarı ve kütlesi  
 $0,202 - 0,183 = 0,019 \text{ mol S}$

$$\begin{array}{r} 1\text{mol S} \quad 32,1 \text{ g} \\ 0,019\text{mol S} \quad X \\ \hline X=0,61 \text{ g S} \end{array}$$





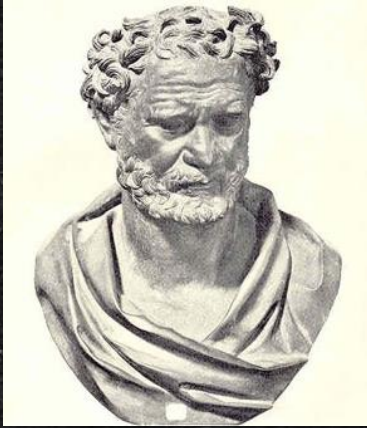


BÖLÜM 3

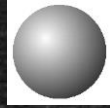
# ATOMUN YAPISI



πάντες ἄνθρωποι τοῦ εἰδέναι ὀρέγονται φύσει



Demokritos  
Μ.Ö. 460 - 370



ἄτομος: bölünmez - en küçük,  
parçalanamaz (zarar verilemez )



## Dalton Atom Kuramı



John Dalton  
1766 - 1844

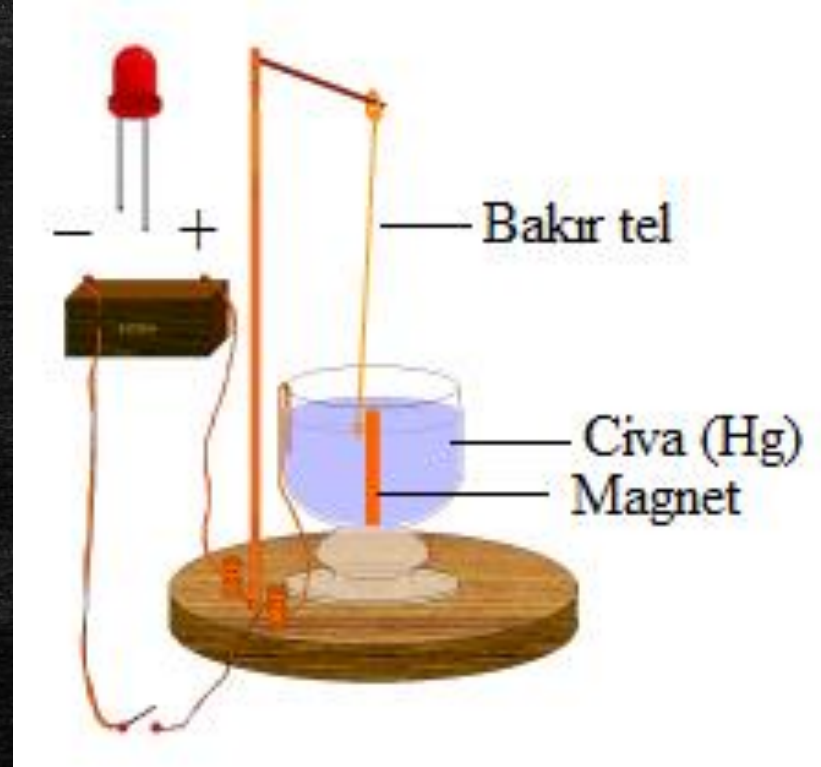
- Her bir element atom adı verilen çok küçük ve bölünemeyen taneciklerden oluşmuştur.
- Elementler kimyasal yönden birbirinin aynı olan atomlar içerirler ve farklı elementlerin atomları da birbirinden farklıdır.
- Atomlar kimyasal tepkimelerde oluşmazlar ve bölünemezler.





Michael Faraday  
1791 - 1867

- Faraday, 1832 yılında yaptığı elektromagnetik indüksiyon deneyi ile, ilk defa negatif yüklü bir cismin varlığını göstermiştir.  
{Bir mıknatis bir sarmal tel bakır içinde hareket ettirilirse, telde bir elektrik akımı akar.}



atom altı cisim

