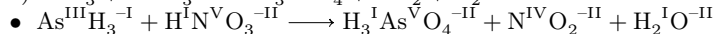
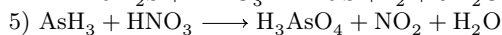
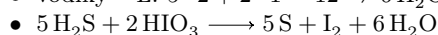
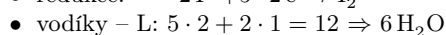
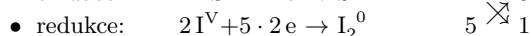
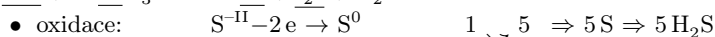
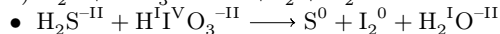
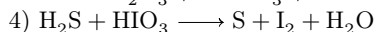
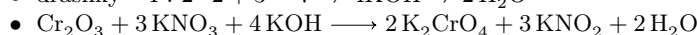
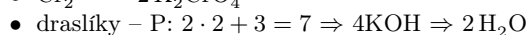
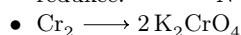
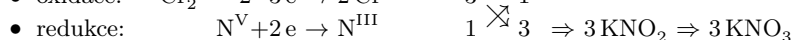
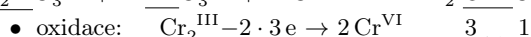
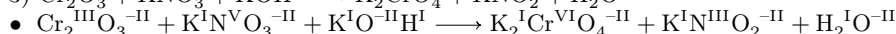
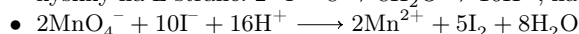
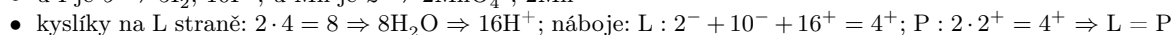
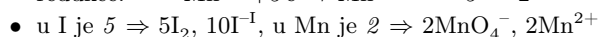
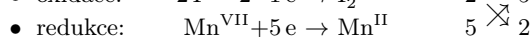
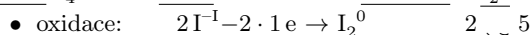
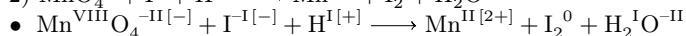
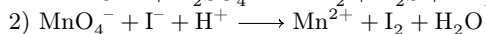
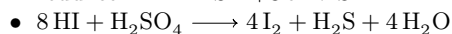
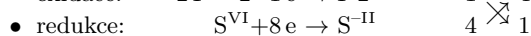
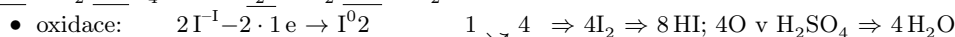
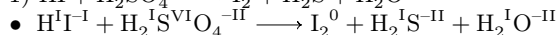
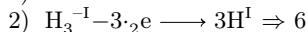
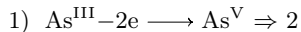


# 1/18 B Procvičování vyčíslování rovnic

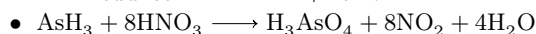
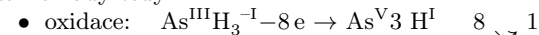
## Vyčíslování dalších redox rovnic s řešením



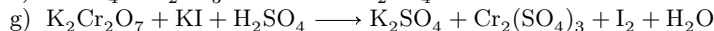
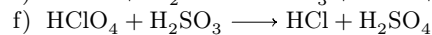
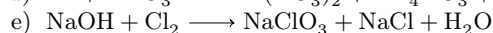
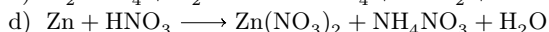
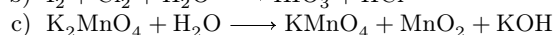
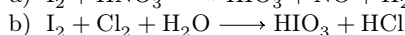
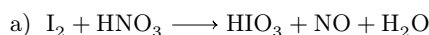
• oxidace



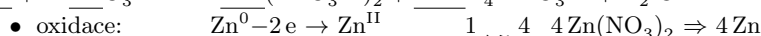
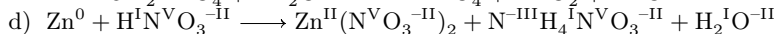
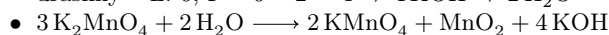
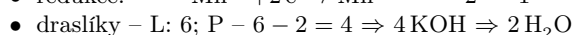
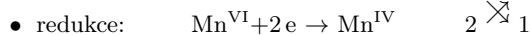
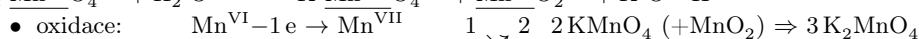
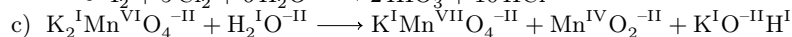
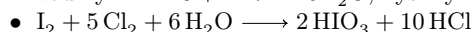
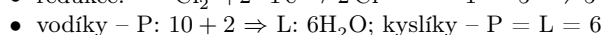
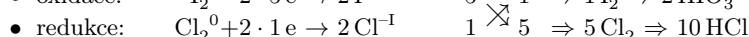
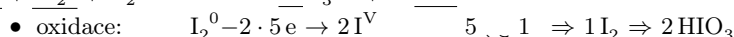
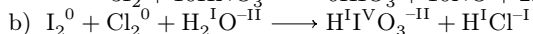
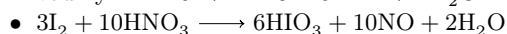
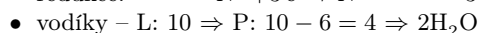
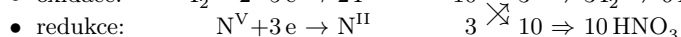
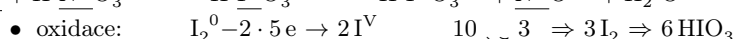
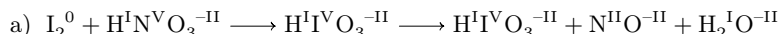
• dohromady tedy



## Vyčíslete rovnice následujících oxidačně redukčních reakcí



## Postupy



- redukce:  $N^V + 8e \rightarrow N^{-III} \quad 4 \quad 1$
- dusíky – P:  $4 \cdot 2 + 1 + 1 = 10 \Rightarrow 10 \text{HNO}_3$ ; vodíky – P:  $10 - 4 = 6 \Rightarrow 3 \text{H}_2\text{O}$
- $4 \text{Zn} + 10 \text{HNO}_3 \rightarrow 4 \text{Zn}(\text{NO}_3)_2 + \text{NH}_4\text{NO}_3 + 3 \text{H}_2\text{O}$
- e)  $\text{Na}^{\text{I}}\text{O}^{-\text{II}}\text{H}^{\text{I}} + \text{Cl}_2^0 \rightarrow \text{Na}^{\text{I}}\text{Cl}^{\text{V}}\text{O}_3^{-\text{II}} + \text{Na}^{\text{I}}\text{Cl}^{\text{I}} + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $\text{Cl}_2^0 - 2 \cdot 5e \rightarrow 2 \text{Cl}^{\text{V}} \quad 5 \quad 1$
  - redukce:  $\text{Cl}_2^0 + 2 \cdot 1e \rightarrow 2 \text{Cl}^{\text{I}} \quad 1 \quad 5$   $\times$   $5 \quad 5 \text{NaCl} + (\text{NaClO}_3 \Rightarrow 6 \text{NaOH})$
  - chlory – P:  $6 \Rightarrow \text{L}: 3 \text{Cl}_2$ ; vodíky – L:  $6 \Rightarrow \text{P}: 3 \text{H}_2\text{O}$
  - $6 \text{NaOH} + 3 \text{Cl}_2 \rightarrow \text{NaClO}_3 + 5 \text{NaCl} + 3 \text{H}_2\text{O}$
- f)  $\text{H}^{\text{I}}\text{Cl}^{\text{VII}}\text{O}_4^{-\text{II}} + \text{H}_2^{\text{I}}\text{S}^{\text{IV}}\text{O}_3^{-\text{II}} \rightarrow \text{H}^{\text{I}}\text{Cl}^{\text{I}} + \text{H}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}}$ 
  - oxidace:  $\text{S}^{\text{IV}} - 2e \rightarrow \text{S}^{\text{VI}} \quad 1 \quad 4$   $4 \text{H}_2\text{SO}_4 \Rightarrow 4 \text{H}_2\text{SO}_3$
  - redukce:  $\text{Cl}^{\text{VII}} + 8e \rightarrow \text{Cl}^{\text{I}} \quad 4 \quad 1$   $\times$   $4 \quad 1$
  - $\text{HClO}_4 + 4 \text{H}_2\text{SO}_3 \rightarrow \text{HCl} + 4 \text{H}_2\text{SO}_4$
- g)  $\text{K}_2^{\text{I}}\text{Cr}_2^{\text{VI}}\text{O}_7^{-\text{II}} + \text{K}^{\text{I}}\text{I}^{-\text{I}} + \text{H}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} \rightarrow \text{K}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} + \text{Cr}_2^{\text{III}}(\text{S}^{\text{VI}}\text{O}_4^{-\text{II}})_3 + \text{I}_2^0 + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $2\text{I}^{-\text{I}} - 2 \cdot 1e \rightarrow \text{I}_2^0 \quad 1 \quad 3$   $3 \text{I}_2 \Rightarrow 6 \text{KI}$
  - redukce:  $\text{Cr}_2^{\text{VI}} + 6e \rightarrow \text{Cr}_2^{\text{III}} \quad 3 \quad 1$   $\times$   $3 \quad 1$
  - draslíky – L:  $2 + 6 = 8 \Rightarrow 4 \text{K}_2\text{SO}_4$ ; síry – P:  $4 + 3 = 7 \Rightarrow 7 \text{H}_2\text{SO}_4 \Rightarrow 7 \text{H}_2\text{O}$
  - $\text{K}_2\text{Cr}_2\text{O}_7 + 6 \text{KI} + 7 \text{H}_2\text{SO}_4 \rightarrow 4 \text{K}_2\text{SO}_4 + \text{Cr}_2(\text{SO}_4)_3 + 3 \text{I}_2 + 7 \text{H}_2\text{O}$

### Další redox rovnice pro procvičování jejich vyčíslování

- a)  $\text{Cr}_2\text{O}_7^{2-} + \text{Cl}^- + \text{H}^+ \rightarrow \text{Cr}^{3+} + \text{Cl}_2 + \text{H}_2\text{O}$
- b)  $\text{CrO}_4^{2-} + \text{I}^- + \text{H}^+ \rightarrow \text{Cr}^{3+} + \text{I}_2 + \text{H}_2\text{O}$
- c)  $\text{CuS} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 + \text{NO}_2 + \text{H}_2\text{O}$
- d)  $\text{HIO}_3 + \text{FeSO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{I}_2 + \text{Fe}_2(\text{SO}_4)_3 + \text{H}_2\text{O}$
- e)  $\text{H}_2\text{O}_2 + \text{I}^- + \text{H}^+ \rightarrow \text{H}_2\text{O} + \text{I}_2$
- f)  $\text{Cu}_2\text{O} + \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{NO}_2 + \text{H}_2\text{O}$
- g)  $\text{H}_2\text{O}_2 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{O}_2 + \text{MnSO}_4 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$

### Postupy

- a)  $\text{Cr}_2^{\text{VI}}\text{O}_7^{-\text{II}[2-]} + \text{Cl}^{-\text{I}[-]} + \text{H}^{\text{I}[+]} \rightarrow \text{Cr}^{\text{III}[3+]} + \text{Cl}_2^0 + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $2\text{Cl}^{-\text{I}} - 2 \cdot 1e \rightarrow \text{Cl}_2^0 \quad 1 \quad 3$   $3 \text{Cl}_2 \Rightarrow 6 \text{Cl}^{-\text{I}}$
  - redukce:  $\text{Cr}_2^{\text{VI}} + 2 \cdot 3e \rightarrow 2 \text{Cr}^{\text{III}} \quad 3 \quad 1$   $\times$   $1 \quad 7 \text{O} \Rightarrow 7 \text{H}_2\text{O} \Rightarrow 14 \text{H}^+$
  - náboje – L:  $2^- + 10^- + 16^+ = 4^+$ ; P:  $2 \cdot 2^+ = 4^+ \Rightarrow \text{L} = \text{P}$
  - $\text{Cr}_2\text{O}_7^{2-} + 6 \text{Cl}^- + 14 \text{H}^+ \rightarrow 2 \text{Cr}^{3+} + 3 \text{Cl}_2 + 3 \text{H}_2\text{O}$
- b)  $\text{Cr}^{\text{VI}}\text{O}_4^{-\text{II}[2-]} + \text{I}^{-\text{I}[-]} + \text{H}^{\text{I}[+]} \rightarrow \text{Cr}^{\text{III}[3+]} + \text{I}_2^0 + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $2\text{I}^{-\text{I}} - 2 \cdot 1e \rightarrow \text{I}_2^0 \quad 2 \quad 3$   $3 \text{I}_2 \Rightarrow 6 \text{I}^-$
  - redukce:  $\text{Cr}^{\text{VI}} + 3e \rightarrow \text{Cr}^{\text{III}} \quad 3 \quad 1$   $\times$   $2 \quad 2 \text{Cr}^{3+} \Rightarrow 2 \text{CrO}_4^{2-}$
  - 8 kyslíků  $\Rightarrow 8 \text{H}_2\text{O} \Rightarrow 16 \text{H}^+$
  - náboje – L:  $2 \cdot 2^- + 6^- + 16^+ = 6^+$ ; P:  $2 \cdot 3^+ = 6^+ \Rightarrow \text{L} = \text{P}$
  - $2 \text{CrO}_4^{2-} + 6 \text{I}^- + 16 \text{H}^+ \rightarrow 2 \text{Cr}^{3+} + 3 \text{I}_2 + 8 \text{H}_2\text{O}$
- c)  $\text{Cu}^{\text{II}}\text{S}^{-\text{II}} + \text{H}^{\text{I}}\text{N}^{\text{V}}\text{O}_3^{-\text{II}} \rightarrow \text{Cu}^{\text{II}}(\text{N}^{\text{V}}\text{O}_3^{-\text{II}})_2 + \text{H}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} + \text{N}^{\text{IV}}\text{O}_2^{-\text{II}} + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $\text{S}^{-\text{II}} - 8e \rightarrow \text{S}^{\text{VI}} \quad 8 \quad 1$
  - redukce:  $\text{N}^{\text{V}} + 1e \rightarrow \text{N}^{\text{IV}} \quad 1 \quad 8$   $8 \text{NO}_2 (+ (\text{NO}_3)_2 \Rightarrow 10 \text{N} \Rightarrow 10 \text{HNO}_3)$
  - $\text{CuS} + 10 \text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{SO}_4 + 8 \text{NO}_2 + 4 \text{H}_2\text{O}$
- d)  $\text{H}^{\text{I}}\text{I}^{\text{V}}\text{O}_3^{-\text{II}} + \text{Fe}^{\text{II}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} + \text{H}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} \rightarrow \text{I}_2^0 + \text{Fe}_2^{\text{III}}(\text{S}^{\text{VI}}\text{O}_4^{-\text{II}})_3 + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $2\text{Fe}^{\text{II}} - 2 \cdot 1e \rightarrow \text{Fe}_2^{\text{III}} \quad 1 \quad 5$   $5 \text{Fe}_2(\text{SO}_4)_3 \Rightarrow 10 \text{FeSO}_4$
  - redukce:  $2\text{I}^{\text{V}} + 2 \cdot 5e \rightarrow \text{I}_2^0 \quad 5 \quad 1$   $\times$   $1 \quad 1$   $\text{I}_2 \Rightarrow 2 \text{HIO}_3$
  - síry – P:  $5 \cdot 3 = 15$ ; L:  $15 - 10 = 5 \Rightarrow 5 \text{H}_2\text{SO}_4$ ; vodíky – L:  $12 \Rightarrow 6 \text{H}_2\text{O}$
  - $2 \text{HIO}_3 + 10 \text{FeSO}_4 + 5 \text{H}_2\text{SO}_4 \rightarrow \text{I}_2 + 5 \text{Fe}_2(\text{SO}_4)_3 + 6 \text{H}_2\text{O}$
- e)  $\text{H}_2^{\text{I}}\text{O}_2^{-\text{I}} + \text{I}^{-\text{I}[-]} + \text{H}^{\text{I}[+]} \rightarrow \text{H}_2^{\text{I}}\text{O}^{-\text{II}} + \text{I}_2^0$ 
  - oxidace:  $2\text{I}^{-\text{I}} - 2 \cdot 1e \rightarrow \text{I}_2^0 \quad 1 \quad 1$   $\times$   $1 \quad 1$   $\text{I}_2 \Rightarrow 2 \text{I}^-$
  - redukce:  $\text{O}_2^{-\text{I}} + 1 \cdot 2e \rightarrow 2 \text{O}^{-\text{II}} \quad 1 \quad 1$   $\times$   $1 \quad 1$   $\text{O}_2 \Rightarrow 2 \text{H}_2\text{O}$
  - náboje – L:  $2^- + 2^+ = 0$ ; P:  $0 \Rightarrow \text{L} = \text{P}$
  - $\text{H}_2\text{O}_2 + 2 \text{I}^- + \text{H}^+ \rightarrow 2 \text{H}_2\text{O} + \text{I}_2$
- f)  $\text{Cu}_2^{\text{I}}\text{O}^{-\text{II}} + \text{H}^{\text{I}}\text{N}^{\text{V}}\text{O}_3^{-\text{II}} \rightarrow \text{Cu}^{\text{II}}(\text{N}^{\text{V}}\text{O}_3^{-\text{II}})_2 + \text{N}^{\text{IV}}\text{O}_2^{-\text{II}} + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $\text{Cu}_2^{\text{I}} - 2 \cdot 1e \rightarrow 2 \text{Cu}^{\text{II}} \quad 2 \quad 1$
  - redukce:  $\text{N}^{\text{V}} + 1e \rightarrow \text{N}^{\text{IV}} \quad 1 \quad 2$   $\times$   $2 \quad 2 \text{NO}_2$
  - $\text{Cu}_2\text{O} \Rightarrow 2 \text{Cu}(\text{NO}_3)_2$ ; dusíky – P:  $2 \cdot 2 + 2 = 6 \Rightarrow \text{L}: 6 \text{HNO}_3 \Rightarrow \text{P}: 3 \text{H}_2\text{O}$
  - $\text{Cu}_2\text{O} + 6 \text{HNO}_3 \rightarrow 2 \text{Cu}(\text{NO}_3)_2 + 2 \text{NO}_2 + 3 \text{H}_2\text{O}$
- g)  $\text{H}_2^{\text{I}}\text{O}_2^{-\text{I}} + \text{K}^{\text{I}}\text{Mn}^{\text{VII}}\text{O}_4^{-\text{II}} + \text{H}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} \rightarrow \text{O}_2^0 + \text{Mn}^{\text{VII}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} + \text{K}_2^{\text{I}}\text{S}^{\text{VI}}\text{O}_4^{-\text{II}} + \text{H}_2^{\text{I}}\text{O}^{-\text{II}}$ 
  - oxidace:  $2\text{I}^{-\text{I}} - 2 \cdot 1e \rightarrow \text{I}_2^0 \quad 2 \quad 5$   $5 \text{O}_2 \Rightarrow 5 \text{H}_2\text{O}$
  - redukce:  $\text{Mn}^{\text{VII}} + 5e \rightarrow \text{Mn}^{\text{II}} \quad 5 \quad 2$   $\times$   $2 \quad 2 \text{MnSO}_4 \Rightarrow 2 \text{KMnO}_4$
  - síry – P:  $2 + 1 = 3 \Rightarrow \text{L}: 3 \text{H}_2\text{SO}_4$ ; vodíky – L:  $5 \cdot 2 + 3 \cdot 2 = 16 \Rightarrow \text{P}: 8 \text{H}_2\text{O}$
  - $5 \text{H}_2\text{O}_2 + 2 \text{KMnO}_4 + 3 \text{H}_2\text{SO}_4 \rightarrow 5 \text{O}_2 + 2 \text{MnSO}_4 + \text{K}_2\text{SO}_4 + 8 \text{H}_2\text{O}$