Oxidation Numbers

Video Workbook with Dr. B

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Oxidation Numbers follow a set of rules.

The key is to know the rules and practice.

Read this guide, watch the videos to the right, and then do the 40 practice problems below. Each problem has an answer and video solution.

Oxidation Numbers

More Practice with Oxidation Numbers

You must be able to find the oxidation numbers for substances quickly and accurately to do half reactions and balance redox rxns.

General Rules for Finding Oxidation Numbers

- Free elements have an oxidation number of zero (e.g. Na, Fe, H_2, O_2, S_8).
- In an ion all oxidation numbers must add up to the charge on the ion.
- In a neutral compound all oxidation numbers must add up to zero.
- Group 1 = +1
- Group 2 = +2
- Hydrogen with Non-Metals = +1
- Hydrogen with Metals (or Boron) = -1
- Fluorine = -1
- Oxygen = -2 (except with H_2O_2 or with Fluorine)
- Group 17(7A) = -1 (except Cl, Br, & I when bonded to O or F)

Occasionally you'll need this rule: The more electronegative element in a binary compound is assigned the number equal to the charge it would have if it were an ion. The CN^- ion is an example.

Where did the rules come from?

For *Oxidation Numbers* (often called *States*) the rules rely on the concept of electronegativity.

In general, the more electronegative element will gain electrons.

For example, Fluorine (F) is the most electronegative element on the Periodic Table. It always has an oxidation number of -1. Fluorine will get one electron from other atoms when bonding (to complete its octet).

40 Practice Problems and Video Explanations

To learn fastest:

- Use the rules at first *but* transition to memory.
- Do the problem, check your answer. If you are wrong figure out why and try again.
- If you are getting the right answers, do problems lower in the list. They are harder.

Answers on the next page.

Na	O_2	NH_3	H_2O	CH_4
NaCl	OH^-	$FeSO_4$	CO_2	S_8
HCl	HNO_3	OF_2	NO_3^-	Fe_2O_3
$C_2O_4^{2-}$	NO	H_2SO_4	CO_3^{2-}	$FeCl_3$
Na_2O_2	HCO_3-	SO_4^{2-}	N_2O_5	$CuSO_4$
H_2O_2	H_4SiO_4	NH_4^+	P_4O_{10}	$Cr_2(SO_4)_3$
MnO_4^-	CH_3COOH	$Cr_2O_7^{2-}$	$Fe(CN)_6^{4-}$	PbO_2
CrO_4^{2-}	$K_4Fe(CN)_6$	$S_2O_3^{2-}$	CN^-	Fe_3O_4

Answers with Video Solutions Below

Na Ans: 0 https://youtu.be/uRz_nCQdFN8	O_2 Ans: 0 on both O atoms. https://youtu.be/XC8eMxUDz2Y	NH_3 Ans: N = -3, H = +1 https://youtu.be/c8VkRgYnU4s	H_2O Ans: H = +1, O = -2 https://youtu.be/gkKNYB28d-s	CH_4 Ans: C = -4, H = +1 https://youtu.be/GIgRa5Cxfn4
$NaCl$ Ans: Na = +1, Cl = -1 https://youtu.be/3YHC5Kbt_sA	OH^- Ans: O = -2, H = +1 https://youtu.be/1h8bYTXea_0	$FeSO_4$ Ans: Fe = +2, S = +6, O = -2 https://youtu.be/PTPsYJxDy9c	CO_2 Ans: C = +4, O = -2 https://youtu.be/e9PrTHA0W80	S_8 Ans: S = 0 https://youtu.be/Ig_3WjCu6s4
HCl Ans: H = +1, Cl = -1 https://youtu.be/iXytCWWcBUI	HNO_3 Ans: H = +1, N = +5, O = -2 https://youtu.be/xZeBDUwzyvc	OF_2 Ans: F = -1 O = -1 https://youtu.be/MtX425dVoEQ	NO_3^- Ans: N = +5, O = -2 https://youtu.be/1dFNrNdtSrM	Fe_2O_3 Ans: Fe = +3, O = -2 https://youtu.be/7ql5_vT3ZM8
$C_2O_4^{2-}$ Ans: C = +3, O = -2 https://youtu.be/afCOk1QwFuQ	NO Ans: N = +2, O = -2 https://youtu.be/Ks67knKgjvA	H_2SO_4 Ans: H = +1, S = +6 , O = -2 https://youtu.be/M7Y2idm395Q	CO_3^{2-} Ans: C = +4 O = -2 https://youtu.be/k2UVKdLrfAA	$FeCl_3$ Ans: Fe = +3, Cl = -1 https://youtu.be/7ZSP_kQCKOo
Na_2O_2 Ans: Na = +1, O = -1 https://youtu.be/JNHpNjFOdlY	HCO_3- Ans: H = +1, C = 4. O = -2 https://youtu.be/NfWp8SmCDKU	SO_4^{2-} Ans: S = + 6, O = -2 https://youtu.be/WR5uwhA6Nmc	N_2O_5 Ans: N = +5, O = -2 https://youtu.be/ZHpAwL4b-wk	$CuSO_4$ Ans: Cu = +2, S = +6 O = -2 https://youtu.be/3GJ3nvYdAZg
H_2O_2 Ans: H = +1, O = -1 https://youtu.be/FBqzhMpx66c	H_4SiO_4 Ans: H = +1, Si = +4, O = -2 https://youtu.be/xpXi-wJmsKE	NH_4^+ Ans: N = -3, H = +1 https://youtu.be/HdkiaV2Y_Pw	P_4O_{10} Ans: P = +5, O = -2 https://youtu.be/DjqMIBCqWhc	$Cr_2(SO_4)_3$ Ans: Cr = +3, S = +6, O = -2 https://youtu.be/wHvg4kzaVoU
MnO_4^- Ans: Mn = +7, O = -2 https://youtu.be/rdMyNcQSVK4	CH_3COOH See video. https://youtu.be/48nneIWCt3s	$Cr_2O_7^{2-}$ Ans: Cr = +6, O = -2 https://youtu.be/CLBPOl_q3k0	$Fe(CN)_6^{4-}$ Ans: Fe = +2, C = +2, N = -3 https://youtu.be/rICXJ0FJC54	PbO_2 Ans: P = +4, O = -2 https://youtu.be/4MbpkEAw3UA
CrO_4^{2-} Ans: Cr = +6, O = -2 https://youtu.be/ie-ItY0kcqY	$K_4Fe(CN)_6$ K = +1, Fe = +2, C = +2, N = -3 https://youtu.be/2Ib5fw7HKTg	$S_2O_3^{2-}$ Ans: S = +2, O = -2 (see video) https://youtu.be/qsh8P1TPRTY	CN^- Ans: C = +2, N = -3 (see video) https://youtu.be/_6A1wguFTFQ	Fe_3O_4 Fe = +8/3, O = -2 (see video) https://youtu.be/bicJaOdrMuA

Redox Guides

Introduction to Redox
Finding Oxidation Numbers (this guide)
Writing Half Reactions
Key Terms: Oxidized, Reduced, Oxidizing Agent, Reducing Agent
Balancing Half Reactions
Matching Electrons, Combining Half Reactions
Balancing Redox in Basic Medium
Practice, Practice, Practice

Report errors and suggestions to DrB@breslyn.org

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