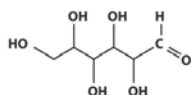
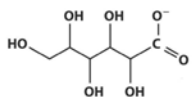


- 1 Metabolism is powered by oxidation of glucose. What is the oxidation number of the rightmost carbon atom in glucose, RCHO?



- A +1  
B +2  
C +3
- 2 Glucose can be oxidized to gluconate. What is the oxidation number of the rightmost carbon atom in gluconate, RCOO-?



- A +1  
B +2  
C +3
- 3 Write the balancee half reaction for reduction of gluconate, RCOO-(aq), to glucose, RCHO(aq).
- A ..  
B ..
- 4 At pH = 7, reduction of gluconate to glucose,  $\text{RCOO}^-(\text{aq}) + 3 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightleftharpoons \text{RCHO}(\text{aq}) + \text{H}_2\text{O}(\text{l})$ , has standard voltage  $E_0' = -0.44 \text{ V}$ . The standard voltage at pH = 0 is ...
- A lower (more negative)  
B the same  
C higher (more positive)

- 5 At pH = 7, reduction of gluconate to glucose,  $\text{RCOO}^-(\text{aq}) + 3 \text{H}^+(\text{aq}) + 2 \text{e}^- \rightleftharpoons \text{RCHO}(\text{aq}) + \text{H}_2\text{O}(\text{l})$ , has standard voltage  $E_o' = -0.44 \text{ V}$ . Which relation between  $E_o'$  and  $E_o$ , the standard voltage at pH = 0, is correct?
- A  $E_o = E_o' - 0.03 \log(1/(10^{-7})^3) = E_o' - 0.63 = +1.07$ ,  
so  $E_o = -0.44 - 0.63 = -1.07$
  - B  $E_o' = E_o - 0.03 \log(1/(10^{-7})^3) = E_o - 0.63 = -0.44$ , so  $E_o = E_o' + 0.63 = +0.19$
  - C  $E_o' = E_o$
- 6 The standard reduction potential of  $\text{Cu}^{2+}$  citrate,  $\text{Cu}(\text{cit})^-(\text{aq})$ , to  $\text{Cu}^+(\text{aq})$  is  $-0.04 \text{ V}$ . Is  $\text{Cu}(\text{cit})^-(\text{aq})$  able to oxidize glucose at pH = 0.
- A yes
  - B no
- 7 The equilibrium constant for precipitation of  $\text{Cu}^+$  in basic solution as  $\text{Cu}_2\text{O}(\text{s})$ ,  $2 \text{Cu}^+(\text{aq}) + 2 \text{OH}^-(\text{aq}) \rightleftharpoons \text{Cu}_2\text{O}(\text{s}) + \text{H}_2\text{O}(\text{l})$ , is  $K = 4 \times 10^{12}$ . Compared to pH = 7, at pH = 14 reduction of  $\text{Cu}^{2+}$  citrate,  $\text{Cu}(\text{cit})^-(\text{aq})$ , to  $\text{Cu}^+(\text{aq})$  would ...
- A be less spontaneous
  - B have the same spontaneity
  - C be more spontaneous