

Periodic Table of the Elements

1A 1																		2A 2																		3A 13																		4A 14																		5A 15																		6A 16																		7A 17																		8A 18																																																																																																																																																																																																																																																																																																																																																																																									
1 H 1.0079																		4 Be 9.0122																		5 B 10.811																		6 C 12.011																		7 N 14.0067																		8 O 15.9994																		9 F 18.9984																		10 Ne 20.1797																																																																																																																																																																																																																																																																																																																																																																																									
3 Li 6.941																		12 Mg 24.3050																		13 Al 26.9815																		14 Si 28.0855																		15 P 30.9738																		16 S 32.066																		17 Cl 35.4527																		18 Ar 39.948																																																																																																																																																																																																																																																																																																																																																																																									
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19 K 39.0983																		20 Ca 40.078																		21 Sc 44.9559																		22 Ti 47.88																		23 V 50.9415																		24 Cr 51.9961																		25 Mn 54.9380																		26 Fe 55.847																		27 Co 58.9332																		28 Ni 58.69																		29 Cu 63.546																		30 Zn 65.39																		31 Ga 69.723																		32 Ge 72.61																		33 As 74.9216																		34 Se 78.96																		35 Br 79.904																		36 Kr 83.80																																																																																																																																																																																																					
37 Rb 85.4678																		38 Sr 87.62																		39 Y 88.9059																		40 Zr 91.224																		41 Nb 92.9064																		42 Mo 95.94																		43 Tc (98)																		44 Ru 101.07																		45 Rh 102.9055																		46 Pd 106.42																		47 Ag 107.8682																		48 Cd 112.411																		49 In 114.82																		50 Sn 118.710																		51 Sb 121.75																		52 Te 127.60																		53 I 126.9045																		54 Xe 131.29																																																																																																																																																																																																					
55 Cs 132.9054																		56 Ba 137.327																		57 La 138.9055																		72 Hf 178.49																		73 Ta 180.9479																		74 W 183.85																		75 Re 186.207																		76 Os 190.2																		77 Ir 192.22																		78 Pt 195.08																		79 Au 196.9665																		80 Hg 200.59																		81 Tl 204.3833																		82 Pb 207.2																		83 Bi 208.9804																		84 Po (209)																		85 At (210)																		86 Rn (222)																																																																																																																																																																																																					
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58 Ce 140.115																		59 Pr 140.9076																		60 Nd 144.24																		61 Pm (145)																		62 Sm 150.36																		63 Eu 151.965																		64 Gd 157.25																		65 Tb 158.9253																		66 Dy 162.50																		67 Ho 164.9303																		68 Er 167.26																		69 Tm 168.9342																		70 Yb 173.04																		71 Lu 174.967																		90 Th 232.0381																		91 Pa 231.0359																		92 U 238.0289																		93 Np (237)																		94 Pu (244)																		95 Am (243)																		96 Cm (247)																		97 Bk (247)																		98 Cf (251)																		99 Es (252)																		100 Fm (257)																		101 Md (258)																		102 No (259)																		103 Lr (260)																	

This print-out should have 8 questions. Multiple-choice questions may continue on the next column or page – find all choices before answering. The due time is Central time.

Std emf 12 17

20:07, basic, multiple choice, < 1 min, wording-variable.

001

Predict the standard emf of the given cell
 $\text{C}(\text{gr}) \mid \text{Sn}^{4+}(\text{aq}), \text{Sn}^{2+}(\text{aq}) \parallel \text{Pb}^{4+}(\text{aq}), \text{Pb}^{2+} \mid \text{Pt}(\text{s})$

1. +1.52 V **correct**
2. +0.75 V
3. +0.37 V
4. +0.52 V
5. +2.14 V
6. +1.34 V

Explanation:

Identify the cathode (right-side) and anode (left-side) reactions and potentials from the cell diagram.

At the cathode,
 $\text{Pb}^{4+}(\text{aq}) + 2e^- \rightarrow \text{Pb}^{2+}(\text{aq}) \quad E^\circ = +1.67 \text{ V}$

At the anode,
 $\text{Sn}^{2+}(\text{aq}) \rightarrow \text{Sn}^{4+}(\text{aq}) + 2e^- \quad -E^\circ = -0.15 \text{ V}$

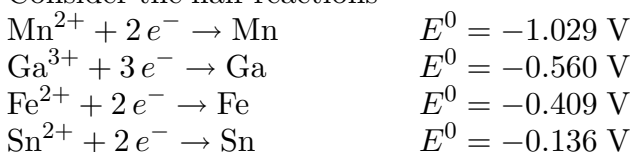
$$\begin{aligned} E_{\text{cell}}^\circ &= E_{\text{cathode}}^\circ - E_{\text{anode}}^\circ \\ &= +1.67 \text{ V} - (+0.15 \text{ V}) \\ &= +1.52 \text{ V} \end{aligned}$$

Msci 21 1220

20:07, general, multiple choice, > 1 min, fixed.

002

Consider the half-reactions



Of the species listed, the strongest oxidizing agent is

1. Sn^{2+} **correct**
2. Mn^{2+}
3. Mn
4. Sn
5. Ga^{3+}

Explanation:

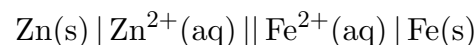
Oxidizing agents get reduced. As E_0 increases, the easier it is for the species to be reduced. Since Sn^{2+} has the biggest E_0 , it is reduced the easiest, making it the strongest oxidizing agent.

ChemPrin3e T12 36

20:09, basic, multiple choice, < 1 min, fixed.

003

Consider the cell



at standard conditions.

Calculate the value of ΔG_r° for the reaction that occurs when current is drawn from this cell.

1. $-62 \text{ kJ} \cdot \text{mol}^{-1}$ **correct**
2. $-230 \text{ kJ} \cdot \text{mol}^{-1}$
3. $+62 \text{ kJ} \cdot \text{mol}^{-1}$
4. $+230 \text{ kJ} \cdot \text{mol}^{-1}$
5. $-31 \text{ kJ} \cdot \text{mol}^{-1}$

Explanation:

Mlib 08 0085

20:12, basic, multiple choice, > 1 min, fixed.

004

A battery has two terminals labeled positive and negative.

As the battery discharges, electrons flow from the ? terminal to the ? terminal through the external circuit and ? reaction occurs at the positive terminal.

1. positive; negative; a reduction
2. positive; negative; an oxidation
3. negative; positive; a reduction **correct**
4. negative; positive; an oxidation
5. positive; negative; an acid/base

Explanation:

In a voltaic cell electrons flow from the negative to the positive terminals. Reduction occurs at the positive terminal.

Mlib 08 0097

20:11, general, multiple choice, > 1 min, fixed.

005

Which of the following batteries could not be recharged?

1. dry cell **correct**
2. lead storage battery
3. nickel-cadmium battery

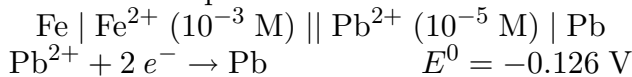
Explanation:

Msci 21 0002

20:08, general, multiple choice, > 1 min, fixed.

006

Calculate the potential for the cell indicated:

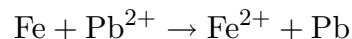


1. 0.255 V **correct**
2. 0.432 V
3. 0.373 V
4. 0.196 V

5. 0.284 V

Explanation:

The overall reaction is



Please notice that since the concentrations are not 1 M, the Nernst equation must be used.

In this cell notation, the anode is located on the left of the salt bridge || and the cathode on the right. So first calculate

$$\begin{aligned} E_{\text{cell}}^0 &= E_{\text{cathode}} - E_{\text{anode}}^0 \\ &= -0.126 \text{ V} - (-0.440) \text{ V} = 0.314 \text{ V} \end{aligned}$$

Using the Nernst Equation

$$\begin{aligned} E_{\text{cell}} &= E_{\text{cell}}^0 - \frac{0.05916}{n} \log Q \\ &= 0.314 \text{ V} - \frac{0.05916}{2} \log \left(\frac{[\text{Fe}^{2+}]}{[\text{Pb}^{2+}]} \right) \\ &= 0.314 \text{ V} - \frac{0.05916}{2} \log \left(\frac{10^{-3}}{10^{-5}} \right) \\ &= 0.25484 \text{ V} \end{aligned}$$

Msci 21 0606

20:05, general, multiple choice, > 1 min, fixed.

007

What weight of Cl₂ gas will be produced by electrolysis of molten NaCl when a current of 4.35 amps flows through it for 15.0 hours? (Cl = 35.457 g/mol)

1. 86.3 g **correct**
2. 19.8 g
3. 0.0250 g
4. 1.44 g
5. 43.2 g

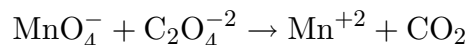
Explanation:

Msci 04 0900

20:01, general, multiple choice, > 1 min, fixed.

008

Using the smallest possible integer coefficients to balance the redox equation



(acidic solution), the coefficient for $\text{C}_2\text{O}_4^{2-}$ is

1. 5. correct

2. 2.

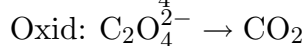
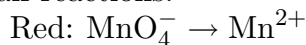
3. 4.

4. 7.

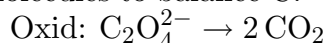
5. The correct coefficient is not given.

Explanation:

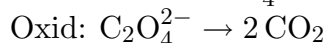
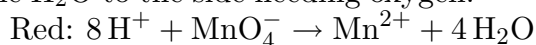
The oxidation number of C changes from +3 to +4, so C is oxidized. The oxidation number of Mn changes from +7 to +2, so Mn is reduced. We set up oxidation and reduction half-reactions:



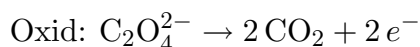
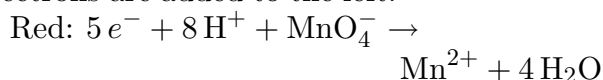
Mn atoms are balanced. We need 2 CO_2 molecules to balance C:



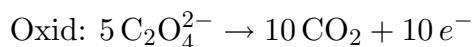
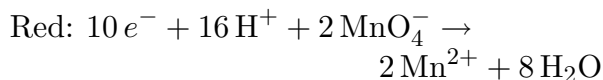
Since this is an acidic solution, we use H_2O and H^+ to balance O and H atoms, adding the H_2O to the side needing oxygen:



We balance the total charge in each half-reaction by adding electrons. In the preceding reduction reaction there is a total charge of +7 on the left and +2 on the right. Five electrons are added to the left:



The number of electrons gained by Mn must equal the number of electrons lost by C. We multiply the reduction reaction by 2 and the oxidation reaction by 5 to balance the electrons:



Adding the half-reactions gives the overall balanced equation:

