# Appendix C HALF-CELL POTENTIALS

| | | $E^\circ_{1/2}$ in V |
|---|---|---|
| 1. | $O_3(g) + 2\,H^+(aq) + 2\,e^- \rightleftharpoons O_2(g) + H_2O(l)$ | 2.08 |
| 2. | $Co^{3+}(aq) + e^- \rightleftharpoons Co^{2+}(aq)$ | 1.92 |
| 3. | $Au^+(aq) + e^- \rightleftharpoons Au(s)$ | 1.69 |
| 4. | $MnO_4^-(aq) + 8\,H^+(aq) + 5\,e^- \rightleftharpoons Mn^{2+}(aq) + 4\,H_2O(l)$ | 1.51 |
| 5. | $HClO(aq) + H^+(aq) + 2\,e^- \rightleftharpoons Cl^-(aq) + H_2O(l)$ | 1.48 |
| 6. | $ClO_3^-(aq) + 6\,H^+(aq) + 6\,e^- \rightleftharpoons Cl^-(aq) + 3\,H_2O(l)$ | 1.45 |
| 7. | $Au^{3+}(aq) + 2\,e^- \rightleftharpoons Au^+(aq)$ | 1.40 |
| 8. | $Cl_2(g) + 2\,e^- \rightleftharpoons 2\,Cl^-(aq)$ | 1.36 |
| 9. | $HCrO_4^-(aq) + 7\,H^+(aq) + 3\,e^- \rightleftharpoons Cr^{3+}(aq) + 4\,H_2O(l)$ | 1.35 |
| 10. | $2\,HNO_2(aq) + 4\,H^+(aq) + 4\,e^- \rightleftharpoons N_2O(g) + 3\,H_2O(l)$ | 1.30 |
| 11. | $O_2(g) + 4\,H^+(aq) + 4\,e^- \rightleftharpoons 2\,H_2O(l)$ | 1.23 |
| 12. | $MnO_2(s) + 4\,H^+(aq) + 2\,e^- \rightleftharpoons Mn^{2+}(aq) + 2\,H_2O(l)$ | 1.22 |
| 13. | $SeO_4^{2-}(aq) + 4\,H^+(aq) + 2\,e^- \rightleftharpoons H_2SeO_3(aq) + H_2O(l)$ | 1.15 |
| 14. | $IO_3^-(aq) + 6\,H^+(aq) + 6\,e^- \rightleftharpoons I^-(aq) + 3\,H_2O(l)$ | 1.08 |
| 15. | $Br_2(l) + 2\,e^- \rightleftharpoons 2\,Br^-(aq)$ | 1.07 |
| 16. | $NO_3^-(aq) + 4\,H^+(aq) + 3\,e^- \rightleftharpoons NO(g) + 2\,H_2O(l)$ | 0.96 |
| 17. | $Ag^+(aq) + e^- \rightleftharpoons Ag(s)$ | 0.80 |
| 18. | $Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq)$ | 0.77 |
| 19. | $O_2(g) + 2\,H^+(aq) + 2\,e^- \rightleftharpoons H_2O_2(aq)$ | 0.70 |
| 20. | $ClO_3^-(aq) + 3\,H_2O(l) + 6\,e^- \rightleftharpoons Cl^-(aq) + 6\,OH^-(aq)$ | 0.62 |
| 21. | $MnO_4^-(aq) + 2\,H_2O(l) + 3\,e^- \rightleftharpoons MnO_2(s) + 4\,OH^-(aq)$ | 0.60 |
| 22. | $I_2(s) + 2\,e^- \rightleftharpoons 2\,I^-(aq)$ | 0.54 |
| 23. | $Cu^+(aq) + e^- \rightleftharpoons Cu(s)$ | 0.52 |
| 24. | $O_2(g) + 2\,H_2O(l) + 4\,e^- \rightleftharpoons 4\,OH^-(aq)$ | 0.40 |
| 25. | $Cu^{2+}(aq) + 2\,e^- \rightleftharpoons Cu(s)$ | 0.34 |
| 26. | $ClO_3^-(aq) + H_2O(l) + 2\,e^- \rightleftharpoons ClO_2^-(aq) + 2\,OH^-(aq)$ | 0.33 |
| 27. | $AgCl(s) + e^- \rightleftharpoons Ag(s) + Cl^-(aq)$ | 0.22 |
| 28. | $Cu^{2+}(aq) + e^- \rightleftharpoons Cu^+(aq)$ | 0.15 |
| 29. | $Sn^{4+}(aq) + 2\,e^- \rightleftharpoons Sn^{2+}(aq)$ | 0.15 |
| 30. | $2\,H^+(aq) + 2\,e^- \rightleftharpoons H_2(g)$ | 0.00 |
| 31. | $Fe^{3+}(aq) + 3\,e^- \rightleftharpoons Fe(s)$ | −0.04 |
| 32. | $SnO_2(s) + 4\,H^+(aq) + 2\,e^- \rightleftharpoons Sn^{2+}(aq) + 2\,H_2O(l)$ | −0.09 |
| 33. | $Sn^{2+}(aq) + 2\,e^- \rightleftharpoons Sn(s)$ | −0.14 |
| 34. | $Ni^{2+}(aq) + 2\,e^- \rightleftharpoons Ni(s)$ | −0.26 |
| 35. | $Cr^{3+}(aq) + e^- \rightleftharpoons Cr^{2+}(aq)$ | −0.41 |
| 36. | $Fe^{2+}(aq) + 2\,e^- \rightleftharpoons Fe(s)$ | −0.45 |
| 37. | $NO_2^-(aq) + H_2O(l) + e^- \rightleftharpoons NO(g) + 2\,OH^-(aq)$ | −0.46 |
| 38. | $H_3PO_3(aq) + 2\,H^+(aq) + 2\,e^- \rightleftharpoons H_3PO_2(aq) + H_2O(l)$ | −0.50 |
| 39. | $2\,SO_3^{2-}(aq) + 3\,H_2O(l) + 4\,e^- \rightleftharpoons S_2O_3^{2-}(aq) + 6\,OH^-(aq)$ | −0.57 |
| 40. | $Cr^{3+}(aq) + 3\,e^- \rightleftharpoons Cr(s)$ | −0.74 |
| 41. | $Zn^{2+}(aq) + 2\,e^- \rightleftharpoons Zn(s)$ | −0.76 |
| 42. | $SO_4^{2-}(aq) + H_2O(l) + 2\,e^- \rightleftharpoons SO_3^{2-}(aq) + 2\,OH^-(aq)$ | −0.93 |
| 43. | $Al^{3+}(aq) + 3\,e^- \rightleftharpoons Al(s)$ | −1.66 |
| 44. | $Al(OH)_4^-(aq) + 3\,e^- \rightleftharpoons Al(s) + 4\,OH^-(aq)$ | −2.33 |
| 45. | $Mg^{2+}(aq) + 2\,e^- \rightleftharpoons Mg(s)$ | −2.37 |

**Chem 202** **FINAL EXAM** **April 23, 2016**

| Dr. Hoyt MWF 9:00 | | | Dr. Kuta TTh 11:00 | | | Dr. Noble TTh 2:30 | | | Dr. Franco online | Dr. Kuta TTh 5:30 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 01 | Th | 8:00 | 07 | W | 8:00 | 15 | M | 9:00 | 50 | 75 | Th | 4:30 |
| 02 | T | 12:00 | 08 | F | 1:00 | 16 | M | 10:00 | | 76 | Th | 7:00 |
| 03 | T | 1:00 | 09 | T | 9:00 | 17 | T | 11:00 | | 77 | T | 7:00 |
| 04 | Th | 10:00 | 10 | W | 9:00 | 18 | W | 8:00 | | | | |
| 05 | Th | 1:00 | 11 | Th | 9:00 | 19 | W | 12:00 | | | | |
| 06 | M | 8:00 | 21 | F | 12:00 | | | | | | | |

This exam will be graded by the SCANTRON Form provided. Be certain that you fill it in correctly. On the front side in the spaces as shown below, enter your name (print and sign), your instructor's name, and the number for your recitation section (from the above list).

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NAME ____ print your name and sign your name _____

SUBJECT _____ your instructor's name _____ TEST NO. _ section number _

DATE _____ PERIOD _____

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On the back side of the Form in the colored portion where it says "NAME", print your last name. BE CERTAIN TO ENTER THE CORRECT INFORMATION.

This exam has 35 questions. Part 1 has 15 questions worth four points each and covers newer material; this Part must be answered on the FRONT side of the SCANTRON Form in spaces 1-15. Part 2 has 20 questions worth two points each and covers older material; this Part must be answered on the BACK side of the SCANTRON Form in spaces 26-45. Because of this arrangement, THERE ARE NO QUESTIONS NUMBERED 16-25. Skip 16-25 on the SCANTRON Form.

Be certain no stray marks are on the Form. Be certain you fill in all spaces properly. Be certain you cleanly erase any changes. You must use a pencil.

For every question there is only one correct answer. Be certain you have all questions 1-15 and 26-45.

None of the exam pages will be collected. You may tear pages off. TURN IN ONLY THE SCANTRON CARD. Give the card to your (or another) TA in the room. Have your picture ID ready.

The key for the exam will be posted shortly afterwards at *noblereaction.org/gc/202misc.htm*. If you record your answers, you will be able to grade your exam.

**Chem 202** **FINAL EXAM** **Spring 2016**

INFORMATION, SCRAP AND COVER PAGE

This information may or may not be needed.

NOTE: Due to the various ways of solving some problems, answers can differ by ±1 in the final significant digit. Be aware of this.

Constants, Conversions

$\text{mol} = 6.022 \times 10^{23}$

$R = 0.08206\ \text{L} \cdot \text{atm/(mol} \cdot \text{K)} = 8.314\ \text{J/(mol} \cdot \text{K)}$

$T(\text{K}) = T(^\circ\text{C}) + 273$

Heat

$q = \Delta T \times \text{mass} \times c$

Specific heat capacity, in J/(g • °C): $H_2O(s)$ 2.09 $H_2O(l)$ 4.18 $H_2O(g)$ 1.84

Phase changes for $H_2O$, in kJ or kJ/mol: $\Delta H^\circ_{\text{fus}} = 6.02$ $\Delta H^\circ_{\text{vap}} = 40.65$

Thermodynamic Parameters

| | $\Delta H^\circ_f$ kJ/mol | $S^\circ$ J/K•mol | $\Delta G^\circ_f$ kJ/mol | | $\Delta H^\circ_f$ kJ/mol | $S^\circ$ J/K•mol | $\Delta G^\circ_f$ kJ/mol |
|---|---|---|---|---|---|---|---|
| $CH_4(g)$ | −74.87 | 186.25 | −50.77 | $H_2O(l)$ | −285.83 | 69.95 | −237.14 |
| $C_2H_6(g)$ | −84.68 | 229.60 | −32.82 | | | | |
| $C_3H_8(g)$ | −104.70 | 270.31 | −24.31 | $Ag(s)$ | 0 | 42.55 | 0 |
| $CO_2(g)$ | −393.52 | 213.80 | −394.39 | $Ag^+(aq)$ | 105.58 | 72.68 | 77.11 |
| $HCO_3^-(aq)$ | −691.99 | 91.2 | −586.77 | $AgCl(s)$ | −127.07 | 96.2 | −109.79 |
| $CO_3^{2-}(aq)$ | −677.14 | −56.9 | −527.81 | $Ag_2CO_3(s)$ | −505.8 | 167.4 | −436.8 |

Free Energy

$$\Delta G = \Delta G^\circ + RT \ln Q$$

$$\Delta G^\circ = -RT \ln K$$

Quadratic Equation

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$K_a$ Values

| | | | |
|---|---|---|---|
| $H_2C_2O_4$ | $5.4 \times 10^{-2}$ | $5.4 \times 10^{-5}$ | |
| $H_3PO_4$ | $7.1 \times 10^{-3}$ | $6.3 \times 10^{-8}$ | $4.5 \times 10^{-13}$ |

$K_b$ Value

$(C_2H_5)_2NH$ $8.6 \times 10^{-4}$

Electrochemical

$$\Delta G^\circ = -nFE^\circ$$

$$F = 96{,}485\ \text{C/mol}$$

$$E = E^\circ - \frac{0.0257\ \text{V}}{n} \ln Q$$

$$E^\circ = \frac{0.0257\ \text{V}}{n} \ln K$$

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This includes your exam papers, your scrap work, and your Scantron card.

## Part 1. Newer Material

1. Which $K_{sp}$ expression is correct for aluminum carbonate?

(A) $\dfrac{2\,[Al^{3+}] + 3\,[CO_3^{2-}]}{[Al_2(CO_3)_3]}$ (B) $\dfrac{[Al^{3+}]^2 + [CO_3^{2-}]^3}{[Al_2(CO_3)_3]}$ (C) $\dfrac{[Al^{3+}]^2\,[CO_3^{2-}]^3}{[Al_2(CO_3)_3]}$

(D) $3\,[Al^{3+}] + 2\,[CO_3^{2-}]$ (E) $[Al^{3+}]^2\,[CO_3^{2-}]^3$

2. $K_{sp}$ for lead(II) chloride is $1.7 \times 10^{-5}$. Which of the relationships below will give the correct value, $x$, for the (simple) solubility of lead(II) chloride?

(A) $1.7 \times 10^{-5} = x$ (B) $1.7 \times 10^{-5} = x^2$ (C) $1.7 \times 10^{-5} = 2x^2$

(D) $1.7 \times 10^{-5} = 4x^3$ (E) $1.7 \times 10^{-5} = 9x^3$

3. The $K_{sp}$ of silver oxalate is $5.4 \times 10^{-12}$. In which of the following solutions would silver oxalate have the highest solubility?

(A) 0.1 M silver nitrate (B) 0.1 M sodium oxalate (C) 0.1 m sodium acetate

(D) 0.1 M nitric acid (E) 0.1 M potassium hydroxide

4. Consider the following (unbalanced) equation in basic solution.

$$Mg(s) + NiO_2(s) \rightarrow Mg(OH)_2(s) + Ni(OH)_2(s)$$

After balancing this equation to smallest whole number coefficients, what is the coefficient for $H_2O$?

(A) 0 (B) 1 (C) 2 (D) 3 (E) 4

5. Calculate the value of $E°$ (in V) for the following reaction.

$$3\,Au^{+}(aq) + 2\,Al^{3+}(aq) \rightarrow 3\,Au^{3+}(aq) + 2\,Al(s)$$

(A) –1.41 (B) –1.88 (C) –2.20 (D) –2.67 (E) –3.06

6. Consider the following notation for a galvanic (voltaic) cell.

$$Pt(s)\,|\,ClO_3^-(aq),\ ClO_2^-(aq),\ OH^-(aq)\,||\,H^+(aq)\,|\,O_2(g)\,|\,Pt(s)$$

Using the numbers for the half-cell reactions in the far left column on Appendix C, which two half-reactions make up this whole reaction? (rev = reverse of the indicated half-reaction.)

(A) #11 and rev #26 (B) #24 and rev #26 (C) #6 and rev #11
(D) #11 and rev #20 (E) #6 and rev #19

7. Find $\Delta G°$ (in kJ) for the following cell reaction.

$$2\,Br_2(l) + 4\,OH^-(aq) \rightarrow 4\,Br^-(aq) + O_2(g) + 2\,H_2O(l)$$

(A) −440 (B) −260 (C) −210 (D) −130 (E) −65

8. Consider the following cell notation.

$$Pt(s)\,|\,NO(g)\,|\,NO_3^-(aq),\ H^+(aq)\,||\,ClO_3^-(aq),\ Cl^-(aq),\ H^+(aq)\,|\,Pt(s)$$

Which of the following statements is FALSE?

(A) NO(*g*) is oxidized.
(B) For the whole reaction, six electrons are transferred between the anode and the cathode.
(C) $ClO_3^-(aq)$ is the reducing agent.
(D) This is a galvanic (voltaic) cell.
(E) The standard potential is 0.49 V.

9. Using the half-cell potentials for the $Sn^{2+}/Sn$ and $Sn^{4+}/Sn^{2+}$ couples, derive the half-cell potential (in V) for the $Sn^{4+}/Sn$ couple.

(A) 0.005 (B) 0.06 (C) 0.10 (D) 0.14 (E) 0.18

10. Using half-cell potentials, determine the equilibrium constant, *K*, at 25 °C for the following reaction.

$$Cu(s) + I_2(s) \rightleftharpoons Cu^{2+}(aq) + 2\,I^-(aq)$$

(A) $9.8 \times 10^3$ (B) $1.5 \times 10^4$ (C) $8.1 \times 10^5$ (D) $5.7 \times 10^6$ (E) $3.3 \times 10^7$

11. Consider the following (balanced) equation for a galvanic (voltaic) cell.

$$4\,H^+(aq) + O_2(g) + 4\,Br^-(aq) \rightarrow 2\,Br_2(l) + 2\,H_2O(l)$$

Calculate $E$ (in V) under the following conditions:

$P(O_2) = 1.0$ atm  $[Br^-] = 0.10$ M  pH = 1.00

(A) 0.04  (B) 0.06  (C) 0.09  (D) 0.11  (E) 0.14

12. Which of the following statements is FALSE?

(A) In every balanced equation for a reduction half-reaction, the electrons are on the left.
(B) In every balanced equation for an oxidation half-reaction, the oxidant is on the left.
(C) At standard conditions, $I_2(s)$ is a better oxidizing agent than $AgCl(s)$.
(D) In a galvanic (voltaic) cell, $E$ starts positive and becomes less positive as the cell operates.
(E) In an electrolytic cell, electrons enter the cathode half-cell.

13. Consider using the following reduction half-reaction in a cell.

$$Cu^+(aq) + e^- \rightarrow Cu(s)$$

Which of the following oxidation half-reactions will give a nonspontaneous overall reaction at standard conditions?

(A) $Ag(s) + Cl^-(aq) \rightarrow AgCl(s) + e^-$
(B) $Fe(s) \rightarrow Fe^{3+}(aq) + 3\,e^-$
(C) $Cr^{2+}(aq) \rightarrow Cr^{3+}(aq) + e^-$
(D) $Sn^{2+}(aq) \rightarrow Sn^{4+}(aq) + 2\,e^-$
(E) $2\,Cl^-(aq) \rightarrow Cl_2(g) + 2\,e^-$

14. $^{35}S$ decays by beta negative emission. What nuclide is the decay product?

(A) $^{31}_{14}Si$  (B) $^{34}_{15}P$  (C) $^{35}_{15}P$  (D) $^{34}_{16}S$  (E) $^{35}_{17}Cl$

15. What is the product of electron capture by $^{103}Pd$?

(A) $^{99}Tc$  (B) $^{102}Ru$  (C) $^{103}Rh$  (D) $^{107}Ag$  (E) $^{108}Cd$

**16-25: LEAVE THESE SPACES BLANK ON THE SCANTRON CARD. GO TO NUMBER 26 ON THE BACKSIDE OF THE CARD.**

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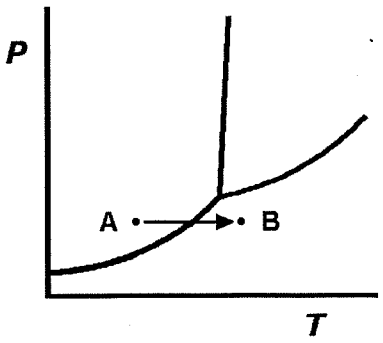
## Part 2. Older Material

26. Consider the phase diagram at right. Which phase change occurs on going from point A to point B?




(A) fusion
(B) vaporization
(C) condensation
(D) sublimation
(E) deposition

27. How much total (heat) energy (in kJ) is required to convert 52.0 g ice at –10.0 °C to liquid at 80.0 °C?

(A) 23.6 (B) 35.9 (C) 40.8 (D) 56.2 (E) 61.1

28. Which of the following statements is TRUE?

(A) $CI_4$ has a lower boiling point than $CCl_4$.
(B) $C_5H_{12}$ has a lower boiling point than $C_6H_{14}$.
(C) $CH_4$ can hydrogen bond with water.
(D) $CH_3–O–CH_3$ can hydrogen bond with another $CH_3–O–CH_3$.
(E) Te has less polarizability than S.

29. How many of the following can form hydrogen bonds with water?

$Na^+$ $CH_3COOH$ $C_2H_6$ $CH_3NH_2$ HF

(A) 1 (B) 2 (C) 3 (D) 4 (E) 5

30. Which of the following compounds has the strongest dispersion?

(A) $SiH_4$ (B) $AsBr_3$ (C) $CH_4$ (D) $SO_2$ (E) $HCF_3$

31. Which statement below is FALSE for the process of dissolving carbon dioxide into water?

(A) $CO_2$ acts as an acid in water.
(B) $CO_2$ is more soluble in cold water than in warm water.
(C) The process of dissolving $CO_2$ in water has a negative $\Delta S$.
(D) When $CO_2$ dissolves in water, the pH decreases.
(E) The process of dissolving $CO_2$ in water is endothermic.

32. A solution contains 1.5 g of naphthalene, $C_{10}H_8$, in 50. g of cyclohexane, $C_6H_{12}$. What is the molality of naphthalene in the solution?

(A) 0.16 (B) 0.23 (C) 0.37 (D) 0.40 (E) 0.51

33. The properties of solutions can differ from the properties of pure solvents. Consider a solution containing 2.2 g of urea ($CH_4N_2O$, molar mass = 60.06 g) in 100. g water. Which of the following statements is TRUE for this solution?

(A) The boiling point of the solution is higher than 100 °C.
(B) The freezing point of the solution is 1.5 °C.
(C) The vapor pressure of the solution is higher than the vapor pressure of pure water.
(D) The density of the solution will be the same as that of pure water.
(E) The osmotic pressure of the solution will have a negative value.

34. Of the relationships below,

$\Delta G = 0$ $\Delta G = \Delta G°$ $\Delta H° = 0$ $Q = K$

$Q = 1$ $K = 1$ $\text{rate}_{\text{forward}} = \text{rate}_{\text{reverse}}$

how many are always TRUE for a system at equilibrium?

(A) 1 (B) 2 (C) 3 (D) 5 (E) all 7

35. Calculate $\Delta G°$ at 298 K for the combustion of methane. (One of the products is $H_2O(l)$.)

(A) –817.90 (B) –1075.97 (C) –1466.21 (D) –1862.71 (E) –2105.34

36. Which of the following statements is FALSE?

(A) The number of reactants in an elementary step determines the molecularity of the step.
(B) A simple (one-step) mechanism cannot involve intermediates.
(C) The rate law, $k[A][B]^2$, is third order overall.
(D) After two half-lives, a reaction is 75% complete.
(E) A larger activation energy gives a larger $k$.

37. The following is an elementary step with $k = 9.6 \times 10^7$ (L mol$^{-1}$ s$^{-1}$) at 298 K.

$$OH + NH_3 \rightarrow H_2O + NH_2$$

What is the rate of the reaction (in mol/L/s) when [OH] = $2.8 \times 10^{-8}$ mol/L and [$NH_3$] = 0.062 mol/L?

(A) 0.0032 (B) 0.080 (C) 0.17 (D) 0.36 (E) 0.58

38. Consider the following equilibria and $K$ values.

$NH_3(g) \rightleftharpoons NH_3(aq)$ $K = 59.7$
$Br_2(l) \rightleftharpoons Br_2(aq)$ $K = 0.205$
$Br_2(l) + 2\,NH_3(g) \rightleftharpoons N_2H_4(aq) + 2\,H^+(aq) + 2\,Br^-(aq)$ $K = 1.80 \times 10^8$

What is $K$ for the following?

$$Br_2(aq) + 2\,NH_3(aq) \rightleftharpoons N_2H_4(aq) + 2\,H^+(aq) + 2\,Br^-(aq)$$

(A) $3.83 \times 10^3$ (B) $9.32 \times 10^4$ (C) $2.46 \times 10^5$ (D) $5.07 \times 10^6$ (E) $4.81 \times 10^7$

39. Consider the following equilibrium at 298 K, for which $\Delta G° = -24.31$ kJ.

$$3\,C(graph) + 4\,H_2(g) \rightleftharpoons C_3H_8(g)$$

At equilibrium, the system contains 8.6 g C and 0.068 atm $H_2$. What is the pressure (in atm) of $C_3H_8$?

(A) 0.0017 (B) 0.080 (C) 0.39 (D) 6.2 (E) 11

40. Consider the following system. Compared to standard conditions,

$$2\,Zn(s) + 2\,HClO(aq) \rightleftharpoons Zn^{2+}(aq) + 2\,Cl^{-}(aq) + H_2O(l) + ZnO(s)$$

which change below will give a greater driving force to the right?

(A) Add more Zn(*s*). (B) Add more ZnO(*s*). (C) Decrease [HClO].

(D) Increase $[Zn^{2+}]$. (E) Add more water to dilute the entire solution.

41. 0.599 g of nitric acid is dissolved in water to make 250. mL of solution. What is the pH?

(A) 1.29 (B) 1.42 (C) 1.60 (D) 1.89 (E) 2.03

42. Which of the following statements is TRUE?

(A) As a solution becomes more acidic, its pH increases.
(B) As $[OH^-]$ increases, pH decreases.
(C) pOH > 7 means that the solution is basic.
(D) In an acidic solution, $[H^+] > [OH^-]$.
(E) In an acidic solution, pH > pOH.

43. Which of the following statements regarding $H_2PO_4^-$ is FALSE?

(A) It is amphoteric.
(B) Its conjugate base is $HPO_4^{2-}$.
(C) It is a better acid than it is a base.
(D) It is the product of the second dissociation step of phosphoric acid.
(E) It is the conjugate base of phosphoric acid.

44. A solution is made using 0.00354 mol diethylamine, $(C_2H_5)_2NH$, in 300. mL total volume. What is the pH?

(A) 11.45 (B) 11.51 (C) 11.73 (D) 12.07 (E) 12.21

45. What is the concentration (in M) of $C_2O_4^{2-}$ ion in 0.150 M oxalic acid solution?

(A) $1.5 \times 10^{-5}$ (B) $2.9 \times 10^{-5}$ (C) $5.4 \times 10^{-5}$ (D) $1.3 \times 10^{-4}$ (E) $9.8 \times 10^{-4}$