

Exam #3

Name Key

(20) 1. Matching (use a letter only once)

$\Delta G^\circ$  for an electrochemical cell is m.

a.  $-RT E^\circ$

The emf  $E$  of an electrochemical cell is j.

b.  $E^\circ - 0.0257V \ln[K^+]$

The equilibrium constant varies versus temperature according to h.

c. the citric cycle

d. fourteen

For the biochemist standard state, pH is g.

e.  $K_2/K_1 = R \ln(T_2/T_1)$

f. zero

$\Delta G_r$  for a chemical reaction is l.

g. decrease

The metabolic pathway from glucose to pyruvate, is called o.

h.  $\ln(K_2/K_1) = (-\Delta H_r^\circ/R)[T_2^{-1} - T_1^{-1}]$

The action potential is the sudden spike in the k potential.

i.  $0.0257V \ln\{[K^+]_{ex}/[K^+]_{in}\}$

For the reaction  $O_2(g) + 4H^+ + 4e^- \rightarrow 2H_2O$ , increasing  $H^+$  will n  $E$ .

j.  $E^\circ - (RT/vF) \ln Q$

At equilibrium and constant  $T$  &  $P$ ,  $\Delta G_r$  equals f.

k. membrane

The membrane potential for  $K^+$  ions is i.

l.  $\Delta G_r^\circ + RT \ln Q$

$$c = 3.00 \times 10^8 \text{ m/s} \quad F = 96,500 \text{ C/mole}$$

m.  $-vFE^\circ$

$$h = 6.626 \times 10^{-34} \text{ J s} \quad R = 298 \text{ K/F} = 0.0257 \text{ V}$$

n. increase

$$R = 8.314 \text{ J/mol-K}$$

o. anaerobic glycolysis

$$R = 1.987 \text{ cal/mol-K}$$

p. unity

$$R = 0.08206 \text{ L-atm/mol-K}$$

q. seven

$$N_A = 6.02 \times 10^{23}$$

r.  $-vF \ln K$

$$1 \text{ atm} = 101.325 \text{ kPa} = 760 \text{ torr}$$

s. carbohydrate

$$k_B = 1.381 \times 10^{-23} \text{ J/K}$$

t.  $RT \ln Q$

(20) 2. Consider the equilibrium constant between  $\beta$ -sheet and  $\alpha$ -helix conformations of a peptide; i.e.  $\beta$ -sheet  $\leftrightarrow$   $\alpha$ -helix.

a. If the equilibrium constant is 1,000 at 25 °C, what is  $\Delta G_r^\circ$  in kJ?

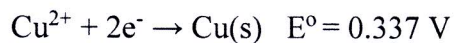
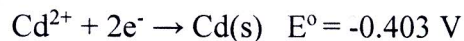
$$\Delta G_r^\circ = -RT \ln K = -8.314 \times 298 \times \ln(1000) \\ = -17,114 \text{ J} = -17.1 \text{ kJ}$$

b. If  $K = 10$  at 100 °C, what is  $\Delta H_r^\circ$  in kJ?

$$\ln \frac{K_2}{K_1} = -\frac{\Delta H_r^\circ}{R} \left[ \frac{1}{T_2} - \frac{1}{T_1} \right] \quad \Delta H_r^\circ = -56,744 \text{ J} \\ = -56.7 \text{ kJ}$$

$$\ln \frac{10}{1000} = \frac{-\Delta H_r^\circ}{8.314} \left[ \frac{1}{373} - \frac{1}{298} \right]$$

(25) 3. Consider the galvanic cell  $\text{Cd(s)} \mid \text{Cd}^{2+} \parallel \text{Cu}^{2+} \mid \text{Cu(s)}$  with the reduction potentials



a. What is the chemical reaction for the cell?



b. What is  $E^\circ$  for the cell?

$$0.740 \text{ V}$$

c. Calculate  $\Delta G_r^\circ$  for the cell reaction?

$$\Delta G_r^\circ = -nFE^\circ = -2 \times 96,500 \times 0.740 = -142,820 \text{ J} \\ = -142.8 \text{ kJ}$$

d. Show how to calculate the equilibrium constant  $K$  for the cell reaction.

$$\Delta G_r^\circ = -nFE^\circ = -RT \ln K$$

$$\ln K = \frac{nFE^\circ}{RT}, \quad K = e^{nFE^\circ/RT}$$

