Quiz. 6

1. What is the unit for the following reaction rate expressed in liter per mole per second?

A. rate of a chemical reaction

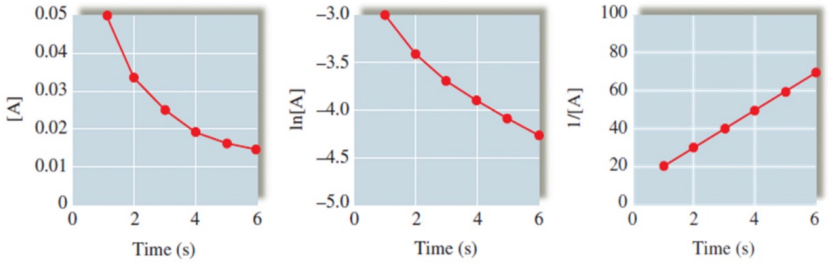
B. rate constant for a zero-order rate law

C. rate constant for a first-order rate law

D. rate constant for a second-order rate law

E. rate constant for a third-order rate law

2. Experimental data for the reaction have been plotted in the following three different ways (with concentration units in mol/L)



What is the order of the reaction with respect to A?

A. zero-order

B. first-order

C. second-order

D. third-order

3. The rate law for the decomposition of phosphine (PH_3) is:

$$Rate = -\frac{\Delta[PH_3]}{\Delta t} = k\,[PH_3]$$

It takes 120. s for 1.00 M PH_3 to decrease to 0.250 M. How much time is required for 2.00 M PH_3 to decrease to a concentration of 0.125 M?

A. 480. s

B. 120. s

C. 1440. s

D. 240. s

4. A study was made of the effect of the hydroxide concentration on the rate of the reaction:

$$I^-(aq) + OCl^-(aq) \longrightarrow IO^-(aq) + Cl^-(aq)$$

The following data were obtained:

$[I^-]_0$ (mol/L)	$[OCl^-]_0$ (mol/L)	$[OH^-]_0$ (mol/L)	Initial Rate (mol/L · s)
0.0013	0.012	0.10	9.4×10^{-3}
0.0026	0.012	0.10	18.7×10^{-3}
0.0013	0.0060	0.10	4.7×10^{-3}
0.0013	0.018	0.10	14.0×10^{-3}
0.0013	0.012	0.050	18.7×10^{-3}
0.0013	0.012	0.20	4.7×10^{-3}
0.0013	0.018	0.20	7.0×10^{-3}

Determine the rate law.

A. k[OH-][OCl-][I-]-1

B. k[OH-][OCl-][I-]

C. k[OH-][OCl-]0.5[I-]

D. k [OCl-]2[I-]

E. k[OH-] [I-]

Quiz 7

1. Consider the reaction of acetic acid in water

$$CH_3CO_2H(aq) + H_2O(l) \rightleftharpoons CH_3CO_2^-(aq) + H_3O^+(aq)$$

where $K_a = 1.8 \times 10^{-5}$.

Which is the stronger acid ?

A. CH3COO-
B. H3O+
C. CH3COOH
D. H2O

2. Use Table 7.2 to order the following from the strongest to the weakest acid.

Table 7.2

Values of K_a for Some Common Monoprotic Acids

Formula	Name	Value of K_a
HSO_4^-	Hydrogen sulfate ion	1.2×10^{-2}
$HClO_2$	Chlorous acid	1.2×10^{-2}
$HC_2H_2ClO_2$	Monochloracetic acid	1.35×10^{-3}
HF	Hydrofluoric acid	7.2×10^{-4}
HNO_2	Nitrous acid	4.0×10^{-4}
$HC_2H_3O_2$	Acetic acid	1.8×10^{-5}
$[Al(H_2O)_6]^{3+}$	Hydrated aluminum(III) ion	1.4×10^{-5}
HOCl	Hypochlorous acid	3.5×10^{-8}
HCN	Hydrocyanic acid	6.2×10^{-10}
NH_4^+	Ammonium ion	5.6×10^{-10}
HOC_6H_5	Phenol	1.6×10^{-10}

A. HCN > NH_4^+ > HOC_6H_5

B. HF > HSO_4^- > HCN

C. HOCl > $[Al(H_2O)_6]^{3+}$ > HOC_6H_5

D. $HClO_2$ > HNO_2 >HF

E. $[Al(H_2O)_6]^{3+}$ > HOC_6H_5 > HOCl

3. Calculate the pH of a 0.010 M solution of iodic acid (HIO_3, $K_a = 0.17$).

A. 2.02

B. 1.38

C. -0.62

D. 0.38

E. 3.38

4. Calculate [S^{2-}] in a 0.10 M H_2S solution. Assume $Ka_1 = 1.0 * 10^{-7}$; $Ka_2 = 1.0 * 10^{-19}$

A. $1.0 * 10^{-19}$

B. $1.38 * 10^{-7}$

C. $2.76 * 10^{-11}$

D. $2.76 * 10^{-10}$

E. $1.0 * 10^{-7}$

Quiz. 8

1. Which one of the symbols is the state function?

A. Heat (q)

B. Work (w)

C. Internal energy (E)

2. A balloon is inflated to its full extent by heating the air inside it. In the final stages of this process, the volume of the balloon changes from 4.00 x 10^6 L to 4.50 x 10^6 L by addition of 1.3 x 10^8 J of energy as heat . Assuming the balloon expands against a constant pressure of 1.0 atm, calculate ΔE for the process.

1 atm = 1 x 10^5 Pa

A. 8 x 10^7 J

B. 4 x 10^7 J

C. 2 x 10^7 J

D. 1 x 10^7 J

3. Which law of thermodynamics is described by the statement: "Energy is neither created nor destroyed"?

A. First law

B. Second law

C. Third law

Quiz. 9

1. Which of the following statements is true?

A. An adiabatic process is defined as a process in which no energy as heat flows into the system.

B. Entropy is independent of temperature.

C. When an ideal gas expands reversibly, and isothermally, $q < 0$, $w < 0$

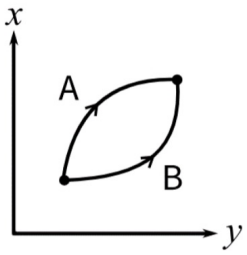
D. An endothermic reaction cannot be spontaneous.

2. Which of the following statements is true?

A. If the temperature of the system increases, heat must have been added to it.

B. For an isothermal process, $q = -w$

C. F (x, y) is a state function defined on state variables (x, y). The change of F going along path A is different from the change of F going along path B.



D. The direction of a reversible process cannot be changed by an infinitesimal (very, very small) modification of a variable.

3. In which of these cases do the surroundings do work on the system?

A. q = -47 kJ, w = +88 kJ

B. q = +82 kJ, w = -47 kJ

C. q = +47 kJ, w = 0

Quiz. 10

1. For each of the following pairs of substances, which of the following sequences represents the correct rank of S° at 25°C and 1 atm?

$C_2H_5OH(l)$ or $C_2H_5OH(g)$
$CO_2(s)$ or $CO_2(g)$
$N_2O(g)$ or $He(g)$

A. $CO_2(s) > CO_2(g)$

B. $N_2O(g) > He(g)$

C. $C_2H_5OH(\ell) > C_2H_5OH(g)$

2. Which of the following is the best reducing agent?

H_2 , Na , Na^+ , F^- , Au

A. F^-

B. Au

C. H_2

D. Na^+

E. Na

3. Base on the following overall reactions. Calculate E° .

Assume that all concentration are 1.0 M and that all partial pressures are 1.0 atm

$Cr^{3+}(aq) + Cl_2(g) \rightarrow Cr_2O_7^{2-}(aq) + Cl^-(aq)$

Half-reaction	$\mathscr{E}°$ (V)
$F_2 + 2e^- \rightarrow 2F^-$	2.87
$Ag^{2+} + e^- \rightarrow Ag^+$	1.99
$Co^{3+} + e^- \rightarrow Co^{2+}$	1.82
$H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$	1.78
$Ce^{4+} + e^- \rightarrow Ce^{3+}$	1.70
$PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$	1.69
$MnO_4^- + 4H^+ + 3e^- \rightarrow MnO_2 + 2H_2O$	1.68
$IO_4^- + 2H^+ + 2e^- \rightarrow IO_3^- + H_2O$	1.60
$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O$	1.51
$Au^{3+} + 3e^- \rightarrow Au$	1.50
$PbO_2 + 4H^+ + 2e^- \rightarrow Pb^{2+} + 2H_2O$	1.46
$Cl_2 + 2e^- \rightarrow 2Cl^-$	1.36
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$	1.33
$O_2 + 4H^+ + 4e^- \rightarrow 2H_2O$	1.23
$MnO_2 + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$	1.21

A. -0.03 V

B. 0.03 V

C. -0.10 V

D. 2.69 V

E. 0.10 V

4. Estimate E° for the half-reaction.

$$2H_2O + 2e^- \longrightarrow H_2 + 2OH^-$$

given the following values of ΔG_f°:

$H_2O(l) = -237$ kJ/mol
$H_2(g) = 0.0$
$OH^-(aq) = -157$ kJ/mol
$e^- = 0.0$

A. -0.829 V

B. 16.58 V

C. -8.30×10^{-4} V

D. 0.414 V

E. -0.414 V