

- An aqueous solution of calcium bromide has a concentration of 0.441 molal. The percent by mass of calcium bromide in the solution is:
 - 5.00%
 - 8.10%
 - 10.10%
 - 12.15%
 - 16.20%

- The melting point of ethanol $\text{CH}_3\text{CH}_2\text{OH}$ is $-117.300\text{ }^\circ\text{C}$ at 1 atmosphere ($K_f(\text{ethanol}) = -1.99\text{ }^\circ\text{C/m}$). In a laboratory experiment, students synthesized a new compound and found that when 10.60 grams of the compound were dissolved in 241.0 grams of ethanol, the solution began to melt at $-117.778\text{ }^\circ\text{C}$. The compound was also found to be nonvolatile and a non-electrolyte. What is the molecular weight they determined for this compound?
 - 78 g/mol
 - 91 g/mol
 - 183 g/mol
 - 266 g/mol
 - 312 g/mol

- For the decomposition of ammonia on a platinum surface at $856\text{ }^\circ\text{C}$

$$2\text{ NH}_3 \longrightarrow \text{N}_2 + 3\text{ H}_2$$
 the average rate of disappearance of NH_3 over the time period from $t = 0\text{ s}$ to $t = 4746\text{ s}$ is found to be $1.50\text{e-}6\text{ M s}^{-1}$. The average rate of formation of H_2 over the same time period is:
 - $1.00\cdot 10^{-6}\text{ M s}^{-1}$
 - $1.50\cdot 10^{-6}\text{ M s}^{-1}$
 - $2.25\cdot 10^{-6}\text{ M s}^{-1}$
 - $4.50\cdot 10^{-6}\text{ M s}^{-1}$
 - $1.50\cdot 10^{-5}\text{ M s}^{-1}$

- The gas phase decomposition of nitrogen dioxide at $383\text{ }^\circ\text{C}$

$$2\text{ NO}_2 \longrightarrow 2\text{ NO} + \text{O}_2$$
 is second order in NO_2 with a rate constant of $0.540\text{ M}^{-1}\text{s}^{-1}$. If the initial concentration of NO_2 is $8.76\cdot 10^{-2}\text{ M}$, the concentration of NO_2 will be $2.19\cdot 10^{-2}\text{ M}$ after how many seconds?
 - 15.4 s
 - 31.7 s
 - 63.4 s
 - 126.8 s
 - 160.2 s

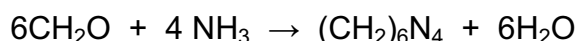
5. What is the mol fraction Na_2SO_4 in a solution which is 11.5% by weight Na_2SO_4 (molar mass $\text{Na}_2\text{SO}_4 = 142.06 \text{ g/mol}$ and $\text{H}_2\text{O} = 18.016 \text{ g/mol}$)?
- 0.0810
 - 0.0914
 - 0.0745
 - 0.0173
 - 0.0162
6. If the mol fraction NaCl in a solution is 0.0175, what is the weight percent NaCl (molar mass $\text{NaCl} = 58.44 \text{ g/mol}$ and $\text{H}_2\text{O} = 18.016 \text{ g/mol}$)?
- 5.46%
 - 5.77%
 - 10.2%
 - 11.5%
 - 17.7%
7. What is the mol fraction NaNO_3 in a solution which is 2.15 m?
- 0.0180
 - 0.0268
 - 0.0373
 - 0.09387
 - 0.0785
8. A 1.34 M NiCl_2 (molar mass = 129.6 g/mol) solution has a density of 1.12 g/cm^3 . What is the weight percent NiCl_2 of the solution?
- 1.73%
 - 8.64%
 - 15.5%
 - 25.4%
 - 29.8%
9. A volumetric flask is necessary for the preparation of which one of the following concentration measurements?
- molality
 - X
 - mass %
 - molarity
 - ppm

10. Which of the following solutions would have the lowest vapor pressure?
- 1 m glucose ($C_6H_{12}O_6$)
 - 1 m $MgCl_2$
 - 1 m $NaNO_3$
 - 1 m $NaBr$
 - pure H_2O
11. In general, as the temperature increases, the rate of a chemical reaction
- increases due to an increased activation energy.
 - increases only for an endothermic reaction.
 - increases due to a greater number of effective collisions.
 - increases because bonds are weakened.
 - is not changed.
12. If the activation energy for the forward reaction of a given process is +110 kJ and the activation energy for the reverse reaction of the same process is +60.0 kJ, then the energy change for the overall process is
- 50 kJ
 - +50 kJ
 - 170 kJ
 - +170 kJ
 - 60 kJ
13. In basic solution, $(CH_3)_3CCl$ reacts according to the equation
- $$(CH_3)_3CCl + OH^- \rightarrow (CH_3)_3COH + Cl^-$$
- The accepted mechanism for the reaction is
- $$(CH_3)_3CCl \rightarrow (CH_3)_3C^+ + Cl^- \text{ (slow)}$$
- $$(CH_3)_3C^+ + OH^- \rightarrow (CH_3)_3COH \text{ (fast)}$$
- What is the rate law expression for the reaction?
- rate = $k[(CH_3)_3C^+][OH^-]$
 - rate = $k[(CH_3)_3C^+][OH^-]$,
 - rate = $k[Cl^-]$
 - rate = $k[(CH_3)_3CCl]$
 - rate = $k[(CH_3)_3CCl][OH^-]$
14. The reaction $X \rightarrow Y$ follows first-order kinetics with $k = 0.83/\text{min}$. If the initial concentration of X is 3.6 M, what is the concentration of X after 15 minutes?
- 0.046 M
 - 0.230 M
 - 1.1×10^{-1} M
 - 1.84×10^{-3} M
 - 1.4×10^{-5} M

15. For a reaction, the rate law is $\text{rate} = k[\text{A}]^1[\text{B}]^0[\text{C}]^1$. What are the units for k where the time unit is seconds (s)?

- a. (mol/L•s)
- b. L/mol•s
- c. L²/mol²•s
- d. mol²/L²•s
- e. mol³/L³•s

16. For the reaction



the rate is expressed as $1/6(\Delta[\text{H}_2\text{O}]/\Delta t)$. An equivalent would be

- a. $-\Delta[(\text{CH}_2)_6\text{N}_4]/\Delta t$
- b. $6(\Delta[\text{CH}_2\text{O}]/\Delta t)$
- c. $-6(\Delta[\text{CH}_2\text{O}]/\Delta t)$
- d. $-1/4(\Delta[\text{NH}_3]/\Delta t)$
- e. $-1/6(\Delta[\text{H}_2\text{O}]/\Delta t)$

17. Given the initial rate data for the reaction $\text{A} + \text{B} \rightarrow \text{C}$, determine the rate expression for the reaction.

<u>[A], M</u>	<u>[B], M</u>	<u>$\Delta[\text{C}]/\Delta t$ initial M/s</u>
0.10	0.20	5.00
0.20	0.20	10.0
0.10	0.15	2.81

- a. $\Delta[\text{C}]/\Delta t = 1250[\text{A}][\text{B}]^2$
- b. $\Delta[\text{C}]/\Delta t = 250[\text{A}][\text{B}]$
- c. $\Delta[\text{C}]/\Delta t = 250[\text{A}]^2$
- d. $\Delta[\text{C}]/\Delta t = 50.0[\text{A}]$
- e. $\Delta[\text{C}]/\Delta t = 5.0[\text{A}][\text{B}]$

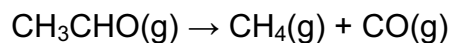
18. After five half-life periods for a first-order reaction, what is the molarity of a reagent initially at 0.366 M?

- a. 1.14×10^{-2}
- b. 3.12×10^{-2}
- c. 6.57×10^{-3}
- d. 3.12×10^3
- e. 7.32×10^{-2}

19. Which of the following reactions will have the greatest rate at 298 K?
Assume that the frequency factor A is the same for all reactions.

- a. $\Delta E = +10 \text{ kJ/mol}$ $E_a = 25 \text{ kJ/mol}$
- b. $\Delta E = -10 \text{ kJ/mol}$ $E_a = 25 \text{ kJ/mol}$
- c. $\Delta E = -10 \text{ kJ/mol}$ $E_a = 15 \text{ kJ/mol}$
- d. $\Delta E = -10 \text{ kJ/mol}$ $E_a = 50 \text{ kJ/mol}$
- e. $\Delta E = -10 \text{ kJ/mol}$ $E_a = 15 \text{ kJ/mol}$

20. The reaction



proceeds via the rate expression $\Delta[\text{CO}]/\Delta t = [\text{CH}_3\text{CHO}]^{3/2}$. What is the overall order of the reaction?

- a. zero-order
- b. first-order
- c. second-order
- d. third-order
- e. three-halves-order