

AP Unit Exam Chps 12-17 Practice Test

1. The following reaction is initiated and the concentrations are measured after ten minutes:

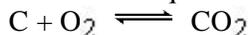


$$[A] = 1.78 M \quad [B] = 2.21 M \quad [AB_3] = 1.19 M$$

Is the reaction in equilibrium?

- No, because $Q > K$.
- No, and the $[AB_3]$ must increase to establish equilibrium.
- Yes.
- No, because $Q < K$.
- There is no way to tell.

2. What is the equilibrium constant for the following reaction?



a. $\frac{[CO_2]}{[C][O_2]}$

c. $\frac{[CO_2]^2}{[C]^2[O_2]^2}$

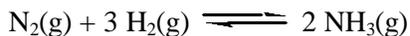
b. $\frac{[C]^2[O_2]^2}{[CO_2]^2}$

d. $\frac{[C][O_2]}{[CO_2]}$

3. Which statement is **incorrect**?

- A process that absorbs energy from its surroundings is called exothermic.
 - Kinetic energy is the energy of motion.
 - Potential energy is the energy that a system possesses by virtue of its position or composition.
 - The Law of Conservation of Energy is another statement of the First Law of Thermodynamics.
 - Energy is the capacity to do work or to transfer heat.
4. Which of the following interactions are the strongest?
- hydrogen bonding force
 - dispersion force
 - London force
 - ion-ion interactions
 - permanent dipole force
5. Calculate the amount of heat (in joules) required to convert 92.5 g of water at 25.0°C to steam at 108.0°C. (Sp. heat of $H_2O(l) = 4.18 J/g \cdot ^\circ C$, Sp. heat of $H_2O(g) = 2.03 J/g \cdot ^\circ C$, heat of vap. of $H_2O(l) = 2.260 kJ/g$)
- $2.26 \times 10^5 J$
 - $3.05 \times 10^4 J$
 - $2.40 \times 10^5 J$
 - $2.20 \times 10^4 J$
 - $6.43 \times 10^5 J$

6. Consider the formation of ammonia from nitrogen and hydrogen:



A reaction is initiated with 0.50 M of both N₂ and H₂ and no NH₃. At equilibrium, the concentration of NH₃ was 0.25 M. What is the value of K_c?

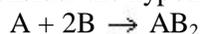
- 85
- 0.012
- 16
- 1.0
- 5.3

7. Calculate ΔG^0 at 298 K for the reaction below.

	Fe ₂ O ₃ (s)	+	13CO(g)	→	2Fe(CO) ₅ (g)	+	3CO ₂ (g)
ΔH_f^0 (kJ/mol)	-824.2		-110.5		-733.8		-393.5
S^0 (J/mol•K)	87.4		197.6		445.2		213.6

- +63.6 kJ
- 193.3 kJ
- 243.1 kJ
- +26.8 kJ
- 52.2 kJ

8. Consider the hypothetical reaction shown below.



Assume that the following proposed mechanism is consistent with the rate data.

B	+	B	→	B ₂	slow
B ₂	+	A	→	AB + B	fast
B	+	AB	→	AB ₂	fast
A	+	2B	→	AB ₂	overall

Which one of the following statements must be true? The reaction is _____.

- second order in A and second order overall
- first order in A, second order in B, and third order overall
- second order in B and second order overall
- second order in B, zero order in A, and third order overall
- first order in A and first order overall

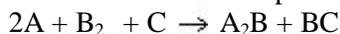
9. Physical properties that depend on the _____ but not the _____ of solute particles in a given amount of solvent are called colligative properties.

- number, polarity
- kind, number
- number, kind
- polarity, number
- polarity, concentration

10. Calculate the molality of a solution that contains 25 g of H₂SO₄ dissolved in 80. g of H₂O.

- 7.0 m
- 2.2 m
- 6.3 m
- 3.2 m

- e. 1.6 m
11. Which aqueous solution would have the lowest vapor pressure at 25°C?
- 1 M glucose, C₆H₁₂O₆
 - 1 M NaCl
 - 1 M sucrose, C₁₂H₁₀O₁₁
 - 1 M Na₃PO₄
 - 1 M MgCl₂
12. What is the rate law for the following reaction?
A + 2B → C + D
- rate = k[A][B]
 - rate = k[A]²[B]
 - rate = k[A][B]²
 - rate = k[A]²[B]²
13. Calculate the amount of heat required to convert 10.0 grams of ice at -20.°C to steam at 120.°C. (Sp. heat of H₂O(s) = 2.09 J/g•°C, Sp. heat of H₂O(l) = 4.18 J/g•°C, Sp heat of H₂O(g) = 2.03 J/g•°C; heat of fus. of H₂O(s) = 333 J/g, heat of vap. of H₂O(l) = 2260 J/g)
- 26.3 kJ
 - 30.9 kJ
 - 46.4 kJ
 - 41.2 kJ
 - 18.6 kJ
14. At the same _____, the molecules of all samples of ideal gases have the same average kinetic energies.
- mass
 - density
 - pressure
 - volume
 - temperature
15. Determine the rate-law expression for the reaction below.



Trial	Initial [A]	Initial [B ₂]	Initial [C]	Initial Rate of Formation of BC
1	0.20 M	0.20 M	0.20 M	2.4 × 10 ⁻⁶ M•min ⁻¹
2	0.40 M	0.30 M	0.20 M	9.6 × 10 ⁻⁶ M•min ⁻¹
3	0.20 M	0.30 M	0.20 M	2.4 × 10 ⁻⁶ M•min ⁻¹
4	0.20 M	0.40 M	0.40 M	4.8 × 10 ⁻⁶ M•min ⁻¹

- rate = k[A]²[B₂][C]
 - rate = k[A][C]²
 - rate = k[B₂]²[C]²
 - rate = k[A][B₂][C]
 - rate = k[A]²[C]
16. Evaluate the specific rate constant for the reaction at the temperature for which the data were obtained. The rate-law expression is rate = k[A][B]².

Experiment	A + B → C		
	Initial [A]	Initial [B]	Initial Rate of Formation of C
1	0.10 M	0.10 M	4.0 × 10 ⁻⁴ M/min

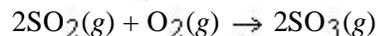
2	0.20 M	0.20 M	$3.2 \times 10^{-3} M/\text{min}$
3	0.10 M	0.20 M	$1.6 \times 10^{-3} M/\text{min}$

- $4.0 \times 10^{-1} M^2 \cdot \text{min}^{-1}$
- $7.0 \times 10^{-3} M^2 \cdot \text{min}^{-1}$
- $3.6 \times 10^{-2} M^2 \cdot \text{min}^{-1}$
- $6.2 \times 10^{-1} M^2 \cdot \text{min}^{-1}$
- $1.2 \times 10^{-2} M^2 \cdot \text{min}^{-1}$

17. How much heat is absorbed in the complete reaction of 3.00 grams of SiO_2 with excess carbon in the reaction below? ΔH^0 for the reaction is +624.6 kJ.

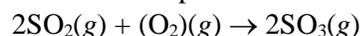


- 366 kJ
 - 5.06 kJ
 - 1.33×10^4 kJ
 - 31.2 kJ
 - 1.13×10^5 kJ
18. Calculate ΔH for the reaction of sulfur dioxide with oxygen.



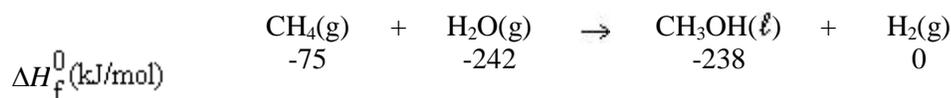
$$(\Delta H_{\text{f}}^0 \text{SO}_2(\text{g}) = -296.8 \text{ kJ/mol}; \Delta H_{\text{f}}^0 \text{SO}_3(\text{g}) = -395.7 \text{ kJ/mol})$$

- 197.8 kJ
 - 98.9 kJ
 - Not enough information is given.
 - 197.8 kJ
19. What is the expression for the equilibrium constant for the reaction described by the following equation?

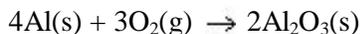


- $\frac{[2\text{SO}_2]^2[\text{O}_2]}{[2\text{SO}_3]^2}$
- $\frac{[\text{SO}_3]^2}{[\text{SO}_2]^2[\text{O}_2]}$
- $\frac{[2\text{SO}_2][\text{O}_2]}{[2\text{SO}_3]}$
- $\frac{[2\text{SO}_3]}{[2\text{SO}_2][\text{O}_2]}$

20. Given the standard heats of formation for the following compounds, calculate ΔH_{298}^0 for the following reaction.

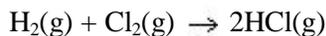


- 405 kJ
 - +79 kJ
 - +594 kcal
 - 79 kJ
 - 594 kcal
21. Calculate the amount of heat released in the complete combustion of 8.17 grams of Al to form $\text{Al}_2\text{O}_3(\text{s})$ at 25°C and 1 atm. ΔH_{f}^0 for $\text{Al}_2\text{O}_3(\text{s}) = 1676 \text{ kJ/mol}$

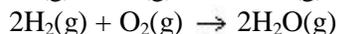


- a. 127 kJ
 - b. 101 kJ
 - c. 203 kJ
 - d. 254 kJ
 - e. 237 kJ
22. Calculate the freezing point of a solution that contains 8.0 g of sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) in 100. g of H_2O . K_f for $\text{H}_2\text{O} = 1.86^\circ\text{C}/m$.
- a. 0.04°C
 - b. -0.39°C
 - c. -0.044°C
 - d. -0.44°C
 - e. -0.22°C
23. A dentist has a 5.00 L cylinder of "laughing gas", N_2O , at 20.0 atm and 25°C . What mass of gas is contained in it?
- a. 4.09 g
 - b. 8.31 g
 - c. 696 g
 - d. 180 g
 - e. 1660 g

24. From the following data at 25°C ,

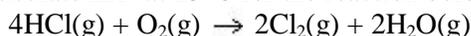


$$\Delta H^0 = -185 \text{ kJ}$$



$$\Delta H^0 = -483.7 \text{ kJ}$$

Calculate ΔH^0 at 25°C for the reaction below.



- a. -86.8 kJ
 - b. -299 kJ
 - c. +299 kJ
 - d. +114 kJ
 - e. -114 kJ
25. Reaction rates increase with increasing temperature because ____.
- a. the energy of the transition state is lowered
 - b. larger molecules collide more frequently
 - c. the activation energy is decreased
 - d. the activation energy increases
 - e. a greater fraction of molecules possess the activation energy when they collide
26. What is the molecular weight of a gas if 0.104 gram of the gas occupies 48.7 mL at STP?
- a. 40.0 g/mol
 - b. 28.2 g/mol
 - c. 47.8 g/mol
 - d. 5.06 g/mol
 - e. 34.5 g/mol
27. Which of the changes listed below would shift the following reaction to the right?
- $$4\text{HCl(g)} + \text{O}_2\text{(g)} \rightleftharpoons 2\text{Cl}_2\text{(g)} + 2\text{H}_2\text{O(g)}$$
- a. decrease of pressure
 - c. removal of O_2

