AP Chemistry Practice Ladder

Choose one answer per question. Circle A, B, C, or D.

1. In an idealized photoelectron spectrum, two peaks have equal heights. Peak X is at a lower binding energy than peak Y. What do the peaks indicate?

A. The subshells have equal numbers of electrons. It takes less energy to remove an electron from X.
B. The subshells have equal numbers of electrons. It takes more energy to remove an electron from X.
C. The subshell for X has fewer electrons. It takes equal energy to remove an electron from either.
D. The subshell for X has more electrons. It takes equal energy to remove an electron from either.

2. A linear molecule model has a central atom with two identical polar bonds pointing in opposite directions. What is the net molecular dipole?

A. Equal to the magnitude of one bond dipole
B. Twice the magnitude of one bond dipole
C. Zero, because the two bond dipoles cancel
D. Half the magnitude of one bond dipole

3. Two comparable model liquids are at the same temperature. The molecules in liquid A attract one another more strongly than those in liquid B. Which liquid has the lower equilibrium vapor pressure?

A. Liquid B
B. Liquid A
C. Their equilibrium vapor pressures are equal.
D. Both equilibrium vapor pressures are zero.

4. In a fictional particle model, a single metal ion changes from a charge of 2+ to 4+. Which change accounts for that increase?

A. Reduction by gaining four electrons
B. Reduction by gaining two electrons
C. Oxidation by losing four electrons
D. Oxidation by losing two electrons

5. A closed model system interconverts C and D. At equilibrium, the concentration of D is three times that of C. How do the forward and reverse reaction rates compare?

A. The forward rate is three times the reverse rate.
B. They are equal.
C. The reverse rate is three times the forward rate.
D. Both rates must be zero.

6. A model ideal-gas mixture contains 1.50 mol of A, 3.00 mol of B, and 0.50 mol of C at a total pressure of 120.0 kPa. What is the partial pressure of A?

A. 36.0 kPa
B. 60.0 kPa
C. 72.0 kPa
D. 18.0 kPa

7. A simulated graph of absorbance versus concentration is linear through the origin. Its absorbance is 0.16 at 0.020 mmol/L. What concentration gives an absorbance of 0.56?

A. 0.112 mmol/L
B. 0.0057 mmol/L
C. 0.040 mmol/L
D. 0.070 mmol/L

8. A fictional rate table lists triples in the order [A], [B], initial rate, with consistent units: (2, 1, 3), (4, 1, 12), and (2, 3, 3). Which rate law fits?

A. Rate = k[A]
B. Rate = k[A][B]
C. Rate = k[A]^2
D. Rate = k[B]^2

9. In a fictional buffer model, the weak acid has pKa 6.40 and the conjugate-base concentration is 0.10 times the acid concentration. Assuming Henderson–Hasselbalch applies, what is the pH?

A. 5.40
B. 6.30
C. 6.50
D. 7.40

10. In a calorimetry model, 40.0 g of surroundings with specific heat 4.00 J/(g·K) warm by 3.00 K. The surroundings exchange heat only with the reaction. What is the heat change for the reaction?

A. +120 J
B. +480 J
C. −160 J
D. −480 J

11. For two fictional equations, 2 X → 2 Z has ΔH = −44 kJ, and Y → Z has ΔH = +17 kJ. The values refer to the equations as written. What is ΔH for X → Y?

A. −5 kJ
B. +39 kJ
C. −39 kJ
D. −61 kJ

12. For a fictional equilibrium 2 X(aq) ⇌ Y(aq), K = 0.80. A snapshot shows [X] = 0.50 M and [Y] = 0.30 M. Using the concentration-based expression, what are Q and the net direction?

A. Q = 1.20, with net change toward Y.
B. Q = 1.20, with net change toward X.
C. Q = 0.60, with net change toward Y.
D. Q = 0.80, with no net change.

13. A fictional reaction has ΔH° = +36.0 kJ/mol and ΔS° = +90.0 J/(mol·K), assumed constant from 350 to 450 K. Which direction is favored by the sign of ΔG° at each temperature?

A. Forward at 350 K, reverse at 450 K
B. Forward at both temperatures
C. Reverse at both temperatures
D. Reverse at 350 K, forward at 450 K

14. A fictional galvanic cell has standard reduction potentials of +0.42 V for half-reaction M (one electron) and −0.31 V for N (two electrons). Which half-reaction occurs as reduction, and what is the standard cell potential?

A. Reduction follows M, and the cell potential is +0.73 V.
B. Reduction follows N, and the cell potential is +0.73 V.
C. Reduction follows M, and the cell potential is +1.15 V.
D. Reduction follows M, and the cell potential is +0.11 V.

15. A fictional compound sample contains 3.60 g of A and 4.00 g of B. Their atomic molar masses are 24.0 and 40.0 g/mol, respectively. The compound has a molar mass of 304.0 g/mol. What is its molecular formula?

A. A_4B_6
B. A_3B_2
C. A_6B_4
D. A_9B_6