Which of the following salts has the highest molar solubility in water?

Select one:

a. $PbS\ (K_{sp} = 2.5 \times 10^{-27})$

b. $BaCrO_4\ (K_{sp} = 1.2 \times 10^{-10})$

c. $AgCl\ (K_{sp} = 1.8 \times 10^{-10})$

The answer is E

d. $BaSO_4\ (K_{sp} = 1.1 \times 10^{-10})$

e. $SrCO_3\ (K_{sp} = 9.3 \times 10^{-10})$

The standard enthalpy of vaporization $CFCl_3$ is 25.21 kJ/mol at its normal boiling point of 17°C. What is the change of entropy for 1 mol of liquid $CFCl_3$ when it vaporizes at its normal boiling point?

Select one:

a.
86.9 J/K

b.
-72.4 J/K

c.
90.7 J/K

d.
82.1 J/K

e.
77.1 J/K

(2) $\Delta H^{\circ}_{vap} = 25.21\ KJ/mol$

normal b.p → P = 1atm , T = 17°C

$$\Delta S = \frac{-\Delta H}{T(K)} = \frac{-(-25.21\ KJ/mol)}{(17+273)\ K} = +0.0869\ \frac{KJ}{mol \cdot K}$$

$$= +86.9\ \frac{J}{mol \cdot K}$$ (a)

In the following reaction, $2HSO_3^- + O_2 \rightarrow 2SO_4^{2-} + 2H^+$, the rate of the reaction was reported as 6×10^{-14} $mol \cdot L^{-1} \cdot s^{-1}$. The rate of consumption of O_2 equals.

Select one:

a.

6×10^{-14} $mol \cdot L^{-1} \cdot s^{-1}$

b.

-6×10^{-14} $mol \cdot L^{-1} \cdot s^{-1}$

c.

12×10^{-14} $mol \cdot L^{-1} \cdot s^{-1}$

d.

-12×10^{-14} $mol \cdot L^{-1} \cdot s^{-1}$

e.

3×10^{-14} $mol \cdot L^{-1} \cdot s^{-1}$

③ $2HSO_3^- + O_2 \rightarrow 2SO_4^{-2} + 2H^+$

$$\frac{-\Delta[O_2]}{\Delta t} = 6 \times 10^{-14} \longrightarrow \frac{\Delta[O_2]}{\Delta t} = -6 \times 10^{-14}$$ (b)

What is the pH of a saturated solution of $Zn(OH)_2$? For $Zn(OH)_2$, $K_{sp} = 2.1 \times 10^{-18}$.

Select one:

a.

9.21

b.

8.87

c.

8.21

d.

9.54

e.

10.2

(4) $Zn(OH)_2 \rightleftharpoons Zn^{+2} + 2OH^-$ $\quad K_{sp} = 2.1 \times 10^{-18}$

$\qquad\qquad\qquad\quad x \qquad\quad 2x$

$K_{sp} = 2.1 \times 10^{-18} = (x)(2x)^2 = 4x^3 \rightarrow x = \sqrt[3]{\frac{2.1 \times 10^{-18}}{4}}$

$x = 8.07 \times 10^{-7}$

$[OH^-] = 2x = 1.6 \times 10^{-6}$

$pOH = -\log(1.6 \times 10^{-6}) = 5.796$

$pH = 14 - 5.796 = 8.204$ (c)

Assuming ΔH and ΔS are constant with respect to temperature, under what conditions will a chemical reaction be spontaneous at all temperatures ?

Select one:

a.
$\Delta H = 0$, and ΔS is negative.

b.
ΔH is negative, and ΔS is positive.

c.
ΔH is positive, and ΔS is negative.

d.
Cannot be predicted

e.
$\Delta S = 0$, and ΔH is positive.

The answer is B

If 291 g of a compound is added to 1.02 kg of water to increase the boiling point by 5.77 °C, what is the molar mass of the added compound? (Assume a van 't Hoff factor of 1.). K_b for water is 0.512 °C/m.

Select one:

a.
21.8 g/mol

b.
30.6 g/mol

c.
25.3 g/mol

48.5 g/mol

e.
38.6 g/mol

⑥ m = 291 g compound $\xrightarrow{\text{add to}}$ 1.02 kg water , $\Delta T_b = 5.77^\circ C$

M.mass (compound) = ??

van't Hoff Factor = 1 , K_b (water) = 0.512 °c/m .

الحل $\rightarrow$ $\Delta T_b = K_b m \rightarrow m = \frac{\Delta T_b}{K_b} = \frac{5.77}{0.512} = 11.27\ m$

$m = \frac{\#\ mol\ of\ solute}{mass\ of\ solvent(Kg)} \rightarrow \#\ mol\ of\ solute = 11.27 \times 1.02$

$= 11.495\ mol$

$11.495 = \frac{mass}{M.mass} \rightarrow M.mass = 25.3\ g/mol$ ©

Selenium tetrafluoride, SeF_4, is a colorless liquid. It has a vapor pressure of 757 mmHg at 378 K and 522 mmHg at 368 K. What is the heat of vaporization of selenium tetrafluoride?

Select one:

- a. 4.31 J/mol
- b. 14.2 kJ/mol
- c. 18.0 kJ/mol
- d. 87.1 kJ/mol

43.0 kJ/mol

(7) V.P (Sefu) = 757 mmHg → T = 378 K

= 522 mmHg → T = 368 K

$\Delta H_{vap} = ?1$

الحل ←

$$\ln \frac{P_1}{P_2} = \frac{\Delta H_{vap}}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$\ln \frac{757}{522} = \frac{\Delta H_{vap}}{8.314} \left(\frac{1}{368} - \frac{1}{378} \right)$$

(e)

$\Delta H_{vap} \simeq 42987 \ \frac{J}{mol} \xrightarrow{\times 10^{-3}} \simeq 43.0 \ \frac{KJ}{mol}$

For which of the following will precipitation be expected?

Select one:

a.

$Q_c = K_{sp}$

b.

$Q_c < K_{sp}$

c.

$Q_c > K_{sp}$

$K_{sp} = 1$

The answer is C

e.

$Q_c = 1$

What is ΔG° at 298 K for the following reaction?

$H_2(g) + Br_2(g) \rightarrow 2HBr(g)$; $\Delta H^\circ = 77.0kJ$; $\Delta S^\circ = 21.3\ J/K$ at 298 K

Select one:

- a. -96.15 kJ
- b. −214.4 kJ
- c. 97.45 kJ
- d. 70.65 kJ
- e. -110.2 kJ

⑨ $H_2 + Br_2 \rightarrow 2HBr$ $T = 298\ K$

$\Delta H^\circ = 77.0\ KJ$, $\Delta S^\circ = 21.3\ J/K$, $\Delta G^\circ = ?$

الحل ← $\Delta G = \Delta H - T\Delta S = 77 - 298 * 21.3 \times 10^{-3}$

$= 70.65\ KJ$ (d)

In the following reaction, identify Lewis acid.

$$Fe^{3+}(aq) + 6CN^{-}(aq) \rightleftharpoons Fe(CN)_6^{3-}(aq)$$

Select one:

- a. CN^-
- b. $Fe(CN)^{6-}$
- c. Fe^{3+}
- d. OH^-
- e. H^+

The answer is C

What is the solubility product expression for $Al(OH)_3$?

Select one:

a.

$K_{sp} = 3[Al^{3+}][OH^-]^3$

b.

$K_{sp} = [Al^{3+}][OH^-]^3$

c.

$K_{sp} = [Al^{3+}][OH^-]$

d.

$K_{sp} = [Al^{3+}][3OH^-]^3$

e.

$K_{sp} = [Al^{3+}][3OH^-]$

The answer is B

If 20.0 mL of a 0.10 M weak acid solution (HA) is added to a 20.0 mL of a 0.10 M of its sodium salt (Na+A-), what is the pH of the resulting solution? (Ka = 1.80×10^{-4} for HA)

Select one:

- a. 3.74
- b. 6.74
- c. 4.74
- d. 5.74
- e. 5.05

(12) 20 mL , 0.1M weak acid $\xrightarrow{\text{Add to}}$ 20 mL

0.1M ($\overset{\text{2lo}}{Na^+ A^-}$) , $K_a = 1.8 \times 10^{-4}$ → HA. PH = ?

$$K_a = \frac{[H^+][A^-]}{[HA]} \rightarrow 1.8 \times 10^{-4} = \frac{[H^+]\ 0.1}{0.1}$$

$$PH = -\log(1.8 \times 10^{-4}) = 3.74 \quad (a)$$

The standard free energy of formation of nitric oxide, NO, at 1000. K is 77.7 kJ/mol. Calculate the equilibrium constant for the reaction

$N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ at 1000. K. ($R = 8.31$ J/(K · mol))

Select one:

- a. 3.85×10^{-6}
- b. 8.70×10^{-5}
- c. 1.67×10^{-5}
- d. 1.58×10^{-6}
- e. 5.66×10^{-5}

(13) $\Delta G^\circ = 77.7 \frac{KJ}{mol}$, $T = 1000\ K$

$R = 8.31\ J/K.mol$

الحل ←

$\Delta G^\circ = -RT\ln K$

$77.7 = -8.31 \times 10^{-3} \times 1000 \ln K$

$K = \exp\left(\frac{77.7}{-8.31 \times 10^{-3} \times 1000}\right) = 8.7 \times 10^{-5}$ (b)

Given the following, determine S° at 298 K for one mole of $NO(g)$.

$2NO(g) + O_2(g) \rightarrow 2NO_2(g)$; $\Delta S^\circ = -346.7$ J/K at 298K

Substance	S° (J/(mol · K)) at 298 K
$NO(g)$	?
$O_2(g)$	205.1
$NO_2(g)$	240.0

Select one:

- a. 195.8 J/K
- b. 260.8 J/K
- c. 310.8 J/K
- d. -210.8 J/K
- e. -215.3 J/K

(14) $\Delta S^\circ = \Sigma n S^\circ_P - \Sigma n S^\circ_R$

$-346.7 = 2 \times 240 - (205.1 + 2?)$

$? = 310.8$ J/K ©

The most important intermolecular force that is responsible for allowing hydrogen molecules to be liquefied is

Select one:

- a. London forces (dispersion forces)
- b. dipole-dipole interactions
- c. hydrogen bonding
- d. covalent bonds
- e. ion-dipole forces

The answer is A

The concentration of barium carbonate ($BaCO_3$) in a saturated aqueous solution at 25°C is $6.03 \times 10^{-4} M$. What is the K_{sp} of this sparingly soluble salt?

Select one:

- a. 5.00×10^{-13}
- b. 2.57×10^{-11}
- c. 5.00×10^{-9}
- d. 3.64×10^{-7}
- e. 1.23×10^{-11}

(16) $BaCO_3 \rightleftharpoons Ba^{+2} + CO_3^{-2}$

$6.03 \times 10^{-4} M \quad 6.03 \times 10^{-4} \quad 6.03 \times 10^{-4}$

$K_{sp} = ?$

$K_{sp} = [Ba^{+2}][CO_3^{-2}] = (6.03 \times 10^{-4})^2 = 3.64 \times 10^{-7}$ (d)

The mole fraction of copper (II) nitrate in an aqueous copper (II) nitrate solution is 0.300. What is the molality of the copper (II) nitrate solution? Molar mass of water is 18.0 g/mol.

Select one:

- a. 4.97 m
- b. 238 m
- c. 6.24 m
- d. 8.67 m
- e. 16.7 m

~~mass (H2O)~~ $X_{solute} = 0.3$

$X_{solven(H_2O)} = 1 - 0.3 = 0.7$

$$\text{mass}_{H_2O} = \frac{0.7 \text{ mol } H_2O}{\text{mol solution}} \Big| \frac{18 \text{ g } H_2O}{\text{mol } H_2O} \Big| \frac{1 \text{ Kg}}{10^3 \text{ g}}$$

$$= 0.013 \frac{\text{Kg } H_2O}{\text{mol solution}}$$

$$m \text{ (molality)} = \frac{0.3 \text{ mol solute}}{\text{mol solution}} \Big| \frac{\text{mol solution}}{0.013 \text{ Kg } H_2O}$$

$$= 23.08 \quad (b)$$

* ملاحظة:- الجواب في الخيارات مكتوب خطأ.