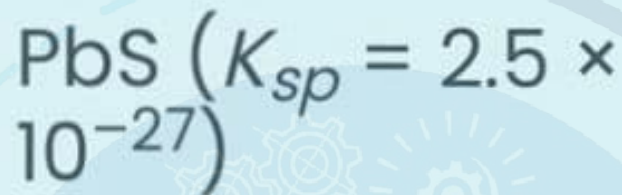


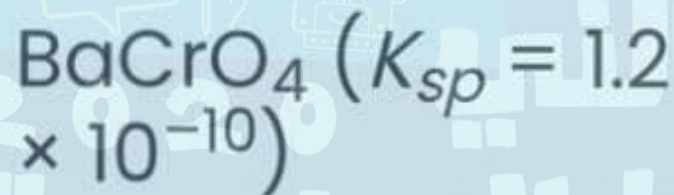
Which of the following salts has the highest molar solubility in water?

Select one:

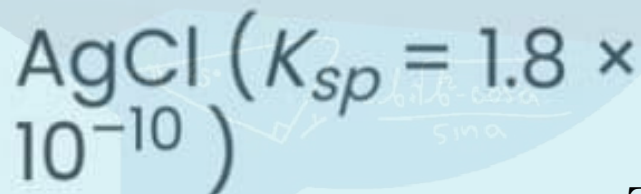
a.



b.

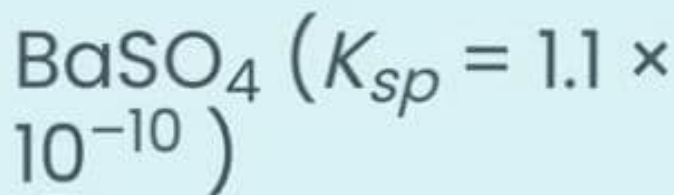


c.

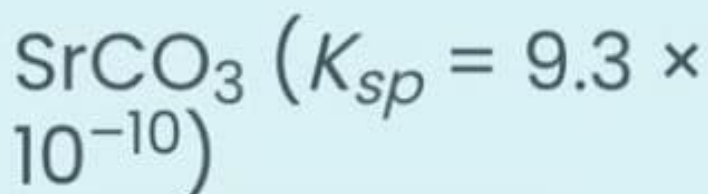


The answer is E

d.



e.



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

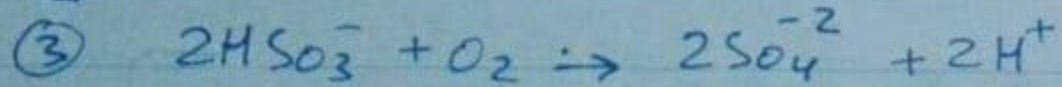
② $\Delta H_{\text{vap}}^{\circ} = 25.21 \text{ kJ/mol}$
normal b.p $\rightarrow P = 1 \text{ atm}$, $T = 17^{\circ}\text{C}$

$$\Delta S = \frac{-\Delta H}{T(\text{K})} = \frac{-(-25.21 \text{ kJ/mol})}{(17 + 273) \text{ K}} = \cancel{\text{[scribble]}}$$
$$= +0.0869 \frac{\text{kJ}}{\text{mol}\cdot\text{K}}$$
$$= +86.9 \frac{\text{J}}{\text{mol}\cdot\text{K}} \quad \textcircled{a}$$

In the following reaction, $2\text{HSO}_3^- + \text{O}_2 \rightarrow 2\text{SO}_4^{2-} + 2\text{H}^+$, the rate of the reaction was reported as $6 \times 10^{-14} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$. The rate of consumption of O_2 equals.

Select one:

- a. $6 \times 10^{-14} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$
- b. $-6 \times 10^{-14} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$
- c. $12 \times 10^{-14} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$
- d. $-12 \times 10^{-14} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$
- e. $3 \times 10^{-14} \text{ mol}\cdot\text{L}^{-1}\cdot\text{s}^{-1}$



$$\frac{-\Delta[\text{O}_2]}{\Delta t} = 6 \times 10^{-14} \rightarrow \frac{\Delta[\text{O}_2]}{\Delta t} = -6 \times 10^{-14} \quad \textcircled{b}$$

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

Select one:

a.

9.21

b.

8.87

c.

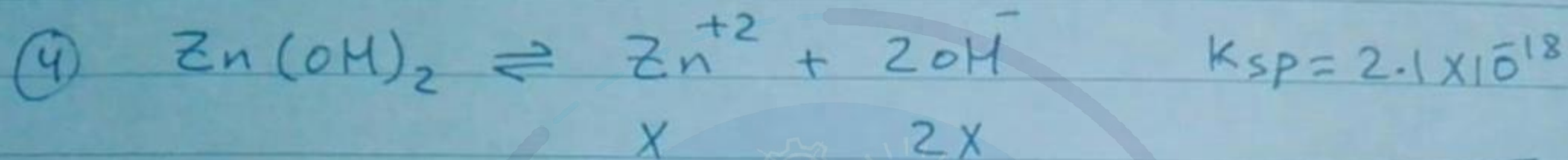
8.21

d.

9.54

e.

10.2



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

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

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

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

$$\text{pH} = 14 - 5.796 = 8.204 \quad \textcircled{C}$$

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 $5.77\text{ }^{\circ}\text{C}$, what is the molar mass of the added compound? (Assume a van 't Hoff factor of 1.). K_b for water is $0.512\text{ }^{\circ}\text{C}/\text{m}$.

Select one:

- a. 21.8 g/mol
- b. 30.6 g/mol
- c. 25.3 g/mol
- d. 48.5 g/mol
- e. 38.6 g/mol

⑥ $m = 291 \text{ g}$ $\xrightarrow[\text{to}]{\text{add}}$ 1.02 Kg water , $\Delta T_b = 5.77^\circ \text{C}$
 \downarrow
compound
M.mass (compound) = ??

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

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

$m = \frac{\# \text{ mol of solute}}{\text{mass of solvent (Kg)}} \rightarrow \# \text{ mol of solute} = 11.27 \times 1.02 = 11.495 \text{ mol}$

$11.495 = \frac{\text{mass}}{\text{M.mass}} \rightarrow \text{M.mass} = 25.3 \text{ g/mol } \textcircled{c}$

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

$$\textcircled{7} \quad v.p \text{ (sefu)} = 757 \text{ mmHg} \rightarrow T = 378 \text{ K}$$

$$= 522 \text{ mmHg} \rightarrow T = 368 \text{ K}$$

$$\Delta H_{\text{vap}} = ?$$

الخط \rightarrow

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

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

$$\Delta H_{\text{vap}} \approx 42987 \frac{\text{J}}{\text{mol}} \xrightarrow{\times 10^{-3}} \approx 43.0 \frac{\text{KJ}}{\text{mol}} \quad \textcircled{e}$$

For which of the following will precipitation be expected?

Select one:



a.

$$Q_c = K_{sp}$$



b.

$$Q_c < K_{sp}$$



c.

$$Q_c > K_{sp}$$

$$K_{sp} = 1$$

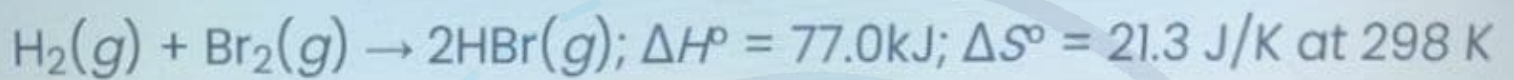


e.

$$Q_c = 1$$

The answer is C

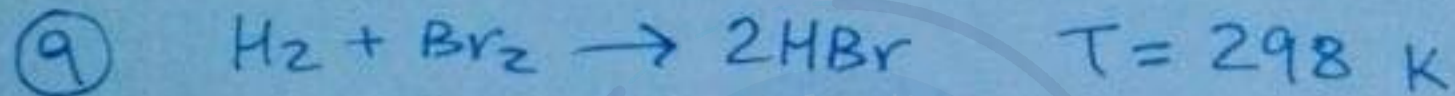
What is ΔG° at 298 K for the following reaction?



Select one:

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

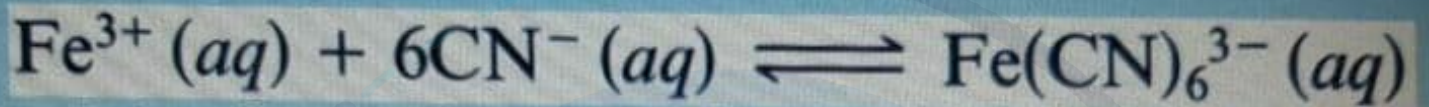
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$\Delta H^\circ = 77.0 \text{ KJ}$, $\Delta S^\circ = 21.3 \text{ J/K}$, $\Delta G^\circ = ?$

الحل \rightarrow $\Delta G = \Delta H - T\Delta S = 77 - 298 * 21.3 \times 10^{-3}$
 $= 70.65 \text{ KJ}$ (د)

In the following reaction, identify Lewis acid.



Select one:

- a.
 CN^{-}
- b.
 $\text{Fe}(\text{CN})_6^{3-}$
- c.
 Fe^{3+}
- d.
 OH^{-}
- e.
 H^{+}

The answer is C

What is the solubility product expression for $\text{Al}(\text{OH})_3$?

Select one:

a.



b.



c.



d.



e.



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? ($K_a = 1.80 \times 10^{-4}$ for HA)

Select one:

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

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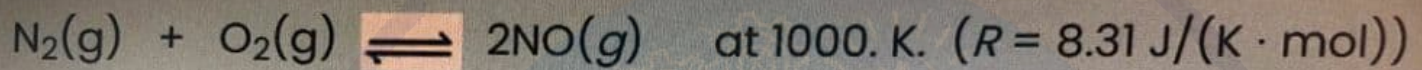
12) 20 mL, 0.1 M weak acid $\xrightarrow[\text{to}]{\text{Add}}$ 20 mL

0.1 M (Na⁺ + A⁻)^{ملح}, $K_a = 1.8 \times 10^{-4} \rightarrow \text{HA}$. PH=?

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

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

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



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}

$$\textcircled{13} \quad \Delta G^\circ = 77.7 \frac{\text{KJ}}{\text{mol}}, \quad T = 1000 \text{ K}$$

$$R = 8.31 \text{ J/K}\cdot\text{mol}$$

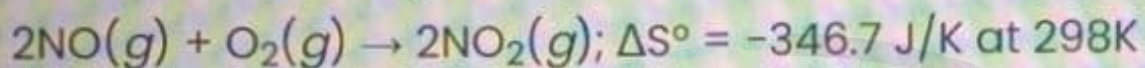
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$$\Delta G^\circ = -RT \ln K$$

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

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

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



Substance	S° (J/(mol · K)) at 298 K
$\text{NO}(g)$?
$\text{O}_2(g)$	205.1
$\text{NO}_2(g)$	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

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$$\textcircled{14} \quad \Delta S^\circ = \sum n S^\circ_P - \sum n S^\circ_R$$

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

$$? = 310.8 \text{ J/K } \textcircled{c}$$

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

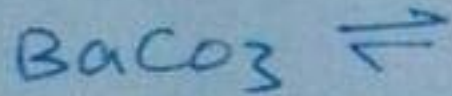
The answer is A

The concentration of barium carbonate (BaCO_3) in a saturated aqueous solution at 25°C is $6.03 \times 10^{-4} \text{ M}$. 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



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

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

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

$$K_{sp} = ?$$

$$K_{sp} = [\text{Ba}^{+2}] [\text{CO}_3^{-2}] = (6.03 \times 10^{-4})^2 = 3.64 \times 10^{-7} \quad \text{d}$$

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)~~ $X_{\text{solute}} = 0.3$

$$X_{\text{solvent (H}_2\text{O)}} = 1 - 0.3 = 0.7$$

$$\text{mass H}_2\text{O} = \frac{0.7 \text{ mol H}_2\text{O}}{\text{mol solution}} \times \frac{18 \text{ g H}_2\text{O}}{\text{mol H}_2\text{O}} \times \frac{1 \text{ Kg}}{1000 \text{ g}}$$

$$\rightarrow = 0.013 \text{ Kg H}_2\text{O}$$

mol solution

$$m \text{ (molality)} = \frac{0.3 \text{ mol solute}}{\text{mol solution}} \times \frac{1}{0.013 \text{ Kg H}_2\text{O}}$$

$$\rightarrow = 23.08 \text{ (b)}$$

* ملاحظة :- الجواب في الخيار مكتوب خطأ