

Name: \_\_\_\_\_ SID: \_\_\_\_\_ Seat No.: \_\_\_\_\_ Room: \_\_\_\_\_

1.	What is the solubility product expression for $\text{PbCO}_3$ ?
	<p>A. <math>K_{\text{sp}} = [\text{Pb}][\text{C}][\text{O}]^3</math>                      C. <math>K_{\text{sp}} = [\text{Pb}^{2+}][\text{CO}_3^{2-}]</math></p> <p>B. <math>K_{\text{sp}} = [\text{Pb}^{2+}][\text{CO}]^3</math>                      D. <math>K_{\text{sp}} = [\text{Pb}^{2+}][\text{CO}_3^{2-}]^3</math></p>
2.	Determine the $K_{\text{sp}}$ for silver phosphate ( $\text{Ag}_3\text{PO}_4$ ). The molar solubility is $4.4 \times 10^{-5}$ mol/L.
	A. $1.0 \times 10^{-16}$ B. $3.7 \times 10^{-18}$ C. $1.9 \times 10^{-9}$ D. $8.6 \times 10^{-30}$
3.	Calculate the molar solubility of $\text{MgF}_2$ in water. The $K_{\text{sp}}$ of $\text{MgF}_2 = 3.7 \times 10^{-8}$ .
	<p>A. <math>9.7 \times 10^{-2}</math> mol/L                      C. <math>3.3 \times 10^{-3}</math> mol/L</p> <p>B. <math>2.1 \times 10^{-3}</math> mol/L                      D. <math>1.9 \times 10^{-4}</math> mol/L</p>
4.	Which statement is <b>true</b> concerning a mixture of 100 mL of 0.015 M $\text{AgNO}_3$ and 15 mL of 0.045 M $\text{BaCl}_2$ ? $K_{\text{sp}}(\text{AgCl}) = 1.6 \times 10^{-10}$ .
	<p>A. No precipitation will occur because the solution is unsaturated.</p> <p>B. No precipitation will occur because the solution is saturated.</p> <p>C. <math>\text{AgCl}</math> will precipitate because the solution is supersaturated.</p> <p>D. <math>\text{BaCl}_2</math> will precipitate because <math>Q &lt; K_{\text{sp}}</math>.</p>
5.	Which statement is <b>true</b> concerning the solubility of $\text{CuI}$ ( $K_{\text{sp}} = 5.1 \times 10^{-12}$ ) in a 0.10 M $\text{NaI}$ solution versus the solubility of $\text{CuI}$ in pure water?
	<p>A. The solubility is lower in pure water.</p> <p>B. The solubility is greater in pure water.</p> <p>C. The solubility is the same in either solution.</p> <p>D. The <math>K_{\text{sp}}</math> is smaller in pure water than in 0.10 M <math>\text{NaI}</math>.</p>

	6.	For which salts will the solubility depend upon the pH of the acidic solution? 1. Ni(CN) <sub>2</sub> 2. Ca(OH) <sub>2</sub> 3. AgCl      4. Ca <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>
		A. 1 and 4      B. 2 and 3      C. 1 and 2      D. 1, 2 and 4

	7.	The formation constant, $K_f$ , for the formation of $[\text{Cu}(\text{CN})_4]^{2-}$ is $1.0 \times 10^{25}$ . What is the <b>equilibrium concentration</b> of $\text{Cu}^{2+}$ in 750 mL of a solution that was originally 0.049 M $\text{Cu}^{2+}$ and had 57 g KCN (molar mass = 65.12 g/mol) dissolved in it? The reaction is $\text{Cu}^{2+}(\text{aq}) + 4 \text{CN}^{-}(\text{aq}) \rightleftharpoons [\text{Cu}(\text{CN})_4]^{2-}(\text{aq})$
		A. $1.6 \times 10^{-24}$ M    B. $1.3 \times 10^{-26}$ M    C. $5.5 \times 10^{-27}$ M    D. $4.6 \times 10^{-30}$ M

	8.	The electron configuration of $\text{Tc}^{3+}$ is:
		A. $[\text{Kr}]4d^4$ B. $[\text{Kr}]5s^2 4d^2$ C. $[\text{Kr}]5s^1 4d^3$ D. $[\text{Kr}]5s^2 4d^5$

	9.	What is the coordination number of platinum in $[\text{Pt}(\text{CN})_2(\text{H}_2\text{O})(\text{en})]\text{Cl}_2$ (en = ethylenediamine)?
		A. 2      B. 4      C. 5 D. 6

	10.	Which of these is the correct name for $[\text{NH}_4]_2[\text{Pd}(\text{CN})_2\text{Cl}_2]$ ?
		A. Diammonium bis(cyano)dichloropalladium(II) B. Bis(ammonium) dichlorodicyanopalladate(II) C. Ammonium dichlorodicyanopalladate(II) D. Ammonium bis(cyano)palladium(II) dichloride

	11.	The correct formula for tetraaquodihydroxoiron(III) chloride is:
		A. $[\text{Fe}(\text{H}_2\text{O})_4(\text{OH})_2]\text{Cl}$ C. $[\text{Fe}(\text{H}_2\text{O})_4(\text{OH})_2]\text{Cl}_2$ B. $[\text{Fe}(\text{H}_2\text{O})_4](\text{OH})_2\text{Cl}$ D. $[\text{Fe}(\text{H}_2\text{O})_2(\text{OH})_4]\text{Cl}_2$



17.	Which one of the following statements is <b>true</b> for a state function in a given state?
<p>A. The value of a state function is always a positive number.</p> <p>B. The value of a state function depends on how that state was reached.</p> <p>C. The value of a state function is always zero.</p> <p>D. The value of a state function does not depend on how that state was reached.</p>	
18.	Which statement is <b>true</b> ?
<p>A. The total internal energy of a <b>system</b> cannot be changed.</p> <p>B. The sum of heat absorbed and work done on a <b>system</b> gives the <b>change</b> in internal energy of a system.</p> <p>C. Perpetual motion machines can exist.</p> <p>D. When work is done by a system on the surroundings the work is positive.</p>	
19.	<p><math>\Delta E^\circ</math> for the reaction</p> $\text{Zn}(s) + 2 \text{HCl}(aq) \longrightarrow \text{ZnCl}_2(aq) + \text{H}_2(g)$ <p>is <math>-154.9 \text{ kJ}</math> at <math>25^\circ\text{C}</math>. What is <math>\Delta H^\circ</math> for the reaction at <math>25^\circ\text{C}</math>?</p> <p>A. <math>157.4 \text{ kJ}</math>      B. <math>-147.5 \text{ kJ}</math>      C. <math>-301.4 \text{ kJ}</math>      D. <math>-152.4 \text{ kJ}</math></p>
20.	<p>List the following in order of <b>increasing</b> <math>\Delta S</math> values: Assume one mole of each.</p> $\text{HF}(g), \text{NaF}(s), \text{SiF}_4(g), \text{SiH}_4(g), \text{Al}(s)$ <p>A. <math>\text{Al}(s) &lt; \text{HF}(g) &lt; \text{NaF}(s) &lt; \text{SiF}_4(g) &lt; \text{SiH}_4(g)</math></p> <p>B. <math>\text{HF}(g) &lt; \text{Al}(s) &lt; \text{SiH}_4(g) &lt; \text{NaF}(s) &lt; \text{SiF}_4(g)</math></p> <p>C. <math>\text{NaF}(s) &lt; \text{Al}(s) &lt; \text{HF}(g) &lt; \text{SiF}_4(g) &lt; \text{SiH}_4(g)</math></p> <p>D. <math>\text{Al}(s) &lt; \text{NaF}(s) &lt; \text{HF}(g) &lt; \text{SiH}_4(g) &lt; \text{SiF}_4(g)</math></p>
21.	<p>List the following reactions in order of <b>increasing</b> entropy.</p> <ol style="list-style-type: none"> <li><math>\text{KClO}_4(s) \longrightarrow \text{KCl}(s) + 2 \text{O}_2(g)</math></li> <li><math>\text{H}_2(g) + \text{Cl}_2(g) \longrightarrow 2 \text{HCl}(g)</math></li> <li><math>\text{CaCO}_3(s) \longrightarrow \text{CaO}(s) + \text{CO}_2(g)</math></li> <li><math>2 \text{H}_2(g) + \text{O}_2(g) \longrightarrow 2 \text{H}_2\text{O}(l)</math></li> </ol> <p>A. <math>4 &lt; 2 &lt; 3 &lt; 1</math>      C. <math>2 &lt; 1 &lt; 3 &lt; 4</math></p> <p>B. <math>4 &lt; 3 &lt; 2 &lt; 1</math>      D. <math>1 &lt; 4 &lt; 3 &lt; 2</math></p>

22.	For which one of the following reactions does $\Delta H$ for the reaction correspond to the heat of formation of nitrobenzene, $C_6H_5NO_2$ ?
	A. $6 C(\text{graphite}) + 5 H(g) + N(g) + 2 O(g) \rightarrow C_6H_5NO_2(l)$
	B. $2 C_6H_5NO_2(l) + \frac{29}{2} O_2(g) \rightarrow 12 CO_2(g) + 5 H_2O(l) + 2 NO_2(g)$
	C. $6 C(\text{graphite}) + \frac{5}{2} H_2(g) + \frac{1}{2} N_2(g) + O_2(g) \rightarrow C_6H_5NO_2(l)$
	D. $12 C(\text{graphite}) + 5 H_2(g) + N_2(g) + 2 O_2(g) \rightarrow 2 C_6H_5NO_2(l)$

23.	Calculate $\Delta G^\circ$ for								
	$3 NO_2(g) + H_2O(l) \rightarrow 2 HNO_3(l) + NO(g)$								
	given the following free energies of formation								
	$\Delta G_f^\circ(\text{kJ/mol})$								
	<table style="margin-left: auto; margin-right: auto;"> <tr> <td><math>H_2O(l)</math></td> <td style="text-align: right;">-237.2</td> </tr> <tr> <td><math>HNO_3(l)</math></td> <td style="text-align: right;">-79.9</td> </tr> <tr> <td><math>NO(g)</math></td> <td style="text-align: right;">86.7</td> </tr> <tr> <td><math>NO_2(g)</math></td> <td style="text-align: right;">51.8</td> </tr> </table>	$H_2O(l)$	-237.2	$HNO_3(l)$	-79.9	$NO(g)$	86.7	$NO_2(g)$	51.8
$H_2O(l)$	-237.2								
$HNO_3(l)$	-79.9								
$NO(g)$	86.7								
$NO_2(g)$	51.8								
	A. 179 kJ      B. -179 kJ      C. -152 kJ      D. 8.7 kJ								

24.	The following reaction
	$2 H(g) \rightleftharpoons H_2(g)$
	A. is spontaneous at all temperatures.      C. is spontaneous at high temperatures. B. is spontaneous at low temperatures.      D. is never spontaneous.

25.	Sodium carbonate can be made by heating sodium bicarbonate:
	$2 NaHCO_3(s) \rightarrow Na_2CO_3(s) + CO_2(g) + H_2O(g)$
	given that $\Delta H^\circ = 128.9 \text{ kJ}$ and $\Delta S^\circ = 321.5 \text{ J/K}$ at $25^\circ\text{C}$ , above which temperature will the reaction become spontaneous under standard conditions?
	A. 249 K      B. 401 K      C. 2.49 K      D. 450. K