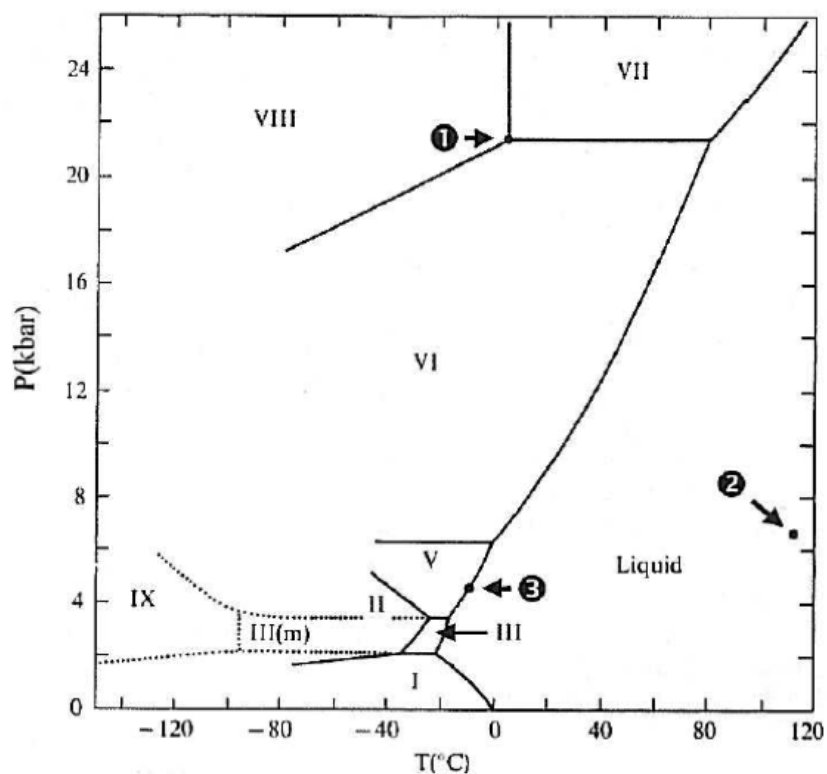


**Question 1.** *High Pressure Phase Diagram of Water*

Here is the phase diagram of water with attention given to phases at high pressure. Name all phases present at the markers 1, 2 and 3.



Rank the following in order of increasing density: VI, VII, VIII, liquid.

**Solution 1.**

**Question 2.** *Solubility of Hydrogen in Liquid Ammonia*

Comment on the solubility of hydrogen ( $\text{H}_2$ ) in liquid ammonia ( $\text{NH}_3$ ). State whether you expect hydrogen to be highly soluble or almost insoluble, and explain why.

Comment on the solubility of potassium iodide ( $\text{KI}$ ) in liquid iodine ( $\text{I}_2$ ). State whether you expect potassium iodide to be highly soluble or almost insoluble, and explain why.

**Solution 2.**

**Question 3.** *Solubility of Pandemonium Fluoride*

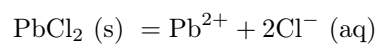
The fictitious compound, pandemonium fluoride ( $\text{PnF}_2$ ) has a  $K_{sp}$  value in water of  $3.091 \cdot 10^{-9} \text{M}^3$  at room temperature. Calculate the solubility of  $\text{PnF}_2$  in water. Express your answer in units of molarity.

How would you expect the solubility of pandemonium fluoride to vary in water that is warmer than room temperature?

**Solution 3.**

**Question 4.** *Solubility of Lead Chloride*

Lead chloride dissolves in water according to



The solubility in pure water has been measured to be 4.44 g/L. Calculate the solubility product of lead chloride in pure water. Your answer should be in units of molarity raised to the appropriate exponent.

Would you expect the solubility of  $\text{PbCl}_2$  in water to change dramatically if it were to be dissolved into a solution of  $3.091 \cdot 10^{-4}$  M KCl?

**Solution 4.**

**Question 5.** *Solubility Product of Administratium Fluoride*

The solubility of the fictitious compound, administratium fluoride ( $\text{AdF}_3$ ) in water is  $3.091 \cdot 10^{-4}$  M. Calculate the value of the solubility product  $k_{sp}$ .

**Solution 5.**

**Question 6.** *Solubility of Pandemonium Carbonate*

The fictitious compound, pandemonium carbonate  $\text{Pn}(\text{CO}_3)_2$  has a  $K_{sp} = 3.091 \cdot 10^{-9} M^3$  in water at room temperature. Calculate the solubility of  $\text{Pn}(\text{CO}_3)_2$  in an aqueous solution of 1.11 M pandemonium sulfate  $\text{Pn}(\text{SO}_4)_2$ . Express your answer in units of molarity.

**Solution 6.**

**Question 7.** *Enthalpy of Mixing Au-Pt*

Consider the gold-platinum system which has a value of  $\Delta w$  of -4250 J/mole;

- (a) Calculate the enthalpy of mixing for a solution of 10% platinum and 90% gold. Express your answer in units of kJ/mole.
- (b) Is the dissolution of 10% platinum into gold an endothermic or an exothermic process?

**Solution 7.**

**Question 8.** *Enthalphy of Mixing of Cimium (Ci) and Sadowium (Sd)*

Two new metallic elements have been discovered, Cimium (Ci) and Sadowium (Sd). Both the pure elements and their solutions form simple cubic lattices. The bond strengths of the Ci-Ci and Sd-Sd bonds are known, but not the Ci-Sd bond.

Ci-Ci: -245 kJ/mole Sd-Sd: -191 kJ/mole Ci-Sd: ? kJ/mole

Mixing a solution of 40% cimium and 60% sadowium is an endothermic process. According to your calorimeter, the solution draws 44.6 kJ/mol of heat when mixed. What is the strength of the Ci-Sd bond? Please give your answer in kJ/mol.

**Solution 8.**