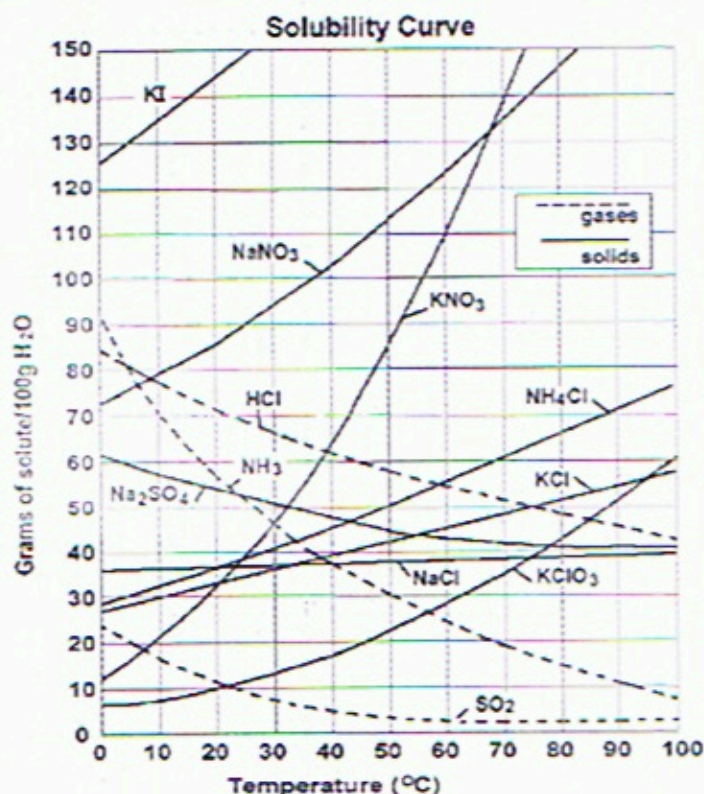


Use the solubility curve to answer questions 1-2.



1. If 150 g of NH<sub>4</sub>Cl are stirred into 200 g of water at 50°C, what type of solution will occur? Describe what happens.

*supersaturated, 100g will dissolve & 50g will be undissolved*

2. A solution of KCl has 70 g dissolved in 100 g of water at 70°C. What type of solution will occur?

*supersaturated*

3. How many moles are in 21 grams of lithium?  $21 \text{ g Li} \times \frac{1 \text{ mol Li}}{6.941 \text{ g Li}} = 3.0 \text{ mol Li}$

4. How many liters will 2.5 moles of CO gas at STP occupy?  $2.5 \text{ mol CO} \times \frac{22.4 \text{ L CO}}{1 \text{ mol CO}} = 56 \text{ L CO}$

5.  $2.67 \times 10^{23}$  molecules of NO<sub>3</sub> is how many moles?  $2.67 \times 10^{23} \text{ molecules NO}_3 \times \frac{1 \text{ mol NO}_3}{6.022 \times 10^{23} \text{ molecules NO}_3} = 0.443 \text{ mol NO}_3$

6. What is the empirical formula of a compound that is 50% sulfur and 50% oxygen by weight?

$50 \text{ g S} \times \frac{1 \text{ mol S}}{32.07 \text{ g S}} = 1.56 \text{ mol S}$   $50 \text{ g O} \times \frac{1 \text{ mol O}}{16 \text{ g O}} = 3.13 \text{ mol O}$  SO<sub>2</sub>

7. The ratio of carbon atoms to hydrogen atoms to oxygen atoms in a molecule of dicyclohexyl maleate is 4 to 6 to 1 (C<sub>4</sub>H<sub>6</sub>O). What is its molecular formula if its molar mass is 560 g?

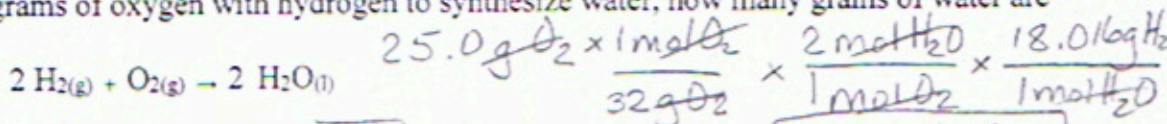
$\text{C}_4\text{H}_6\text{O} \rightarrow 4(12.01) + 6(1.008) + 16 = 70 \text{ g}$   $\frac{560 \text{ g}}{70} = 8$

$(\text{C}_4\text{H}_6\text{O}) \times 8 = \text{C}_{32}\text{H}_{48}\text{O}_8$

8. A student measures out 3.10 grams of zinc. She calculates that 3.10 grams of zinc should make 5.20 grams of  $ZnCl_2$ . In her lab she only makes 5.11 grams of  $ZnCl_2$ . What is her percent yield?

$$\frac{5.11g}{5.20g} \times 100 = 98.3\% \text{ yield}$$

9. If you react 25.0 grams of oxygen with hydrogen to synthesize water, how many grams of water are formed?



$$= 28.4g H_2O$$

10. What element will have the largest radius?

Fr

11. What elements would make a 2- ion?

oxygen, sulfur, selenium

12. What is the standard form of  $2.33 \times 10^3$ ?

2330

13. How many significant figures are in the measurement 28.12300 m?

7

14. A unknown sample's mass is measured and its mass is 22.88 g and its volume is 3.45 mL. When its density is calculated, how many significant figures should it have?

3

15. In a laboratory setting, a student calculates the density of a piece of gold to be 19.21 g/mL. What is the student's percent error?

$$\frac{|19.31 - 19.21|}{19.31} \times 100 = 0.5179\% \text{ error}$$

16. What is the volume of a sample of zinc that has a mass of 39.9 g?  $V = \frac{m}{D} = \frac{39.9g}{7.14g/cm^3} = 5.59cm^3$

17. A teacher needs 1000.0 mL of 0.25 M hydrochloric acid. How much 12.0 M hydrochloric acid should she measure out?

$$m_1V_1 = m_2V_2 \quad (0.25M)(1000.0mL) = (12.0M)V_2$$

$$V_2 = 21mL$$

18. What is the molarity of 0.55 L of solution that has 0.44 moles of solute dissolved in it?  $\frac{0.44 \text{ mol}}{0.55 L} = 0.80M$

19. A solution has a concentration of 0.30 M. How many moles are dissolved in 3.3 L of the solution?

$$0.30 \frac{\text{mol}}{L} \times 3.3L = 0.99 \text{ mol}$$

20. Why is the radius of As ( $r=120pm$ ) smaller than the radius of  $As^{3-}$  ( $r=222pm$ )?

the additional 3  $e^-$  in  $As^{3-}$  repel and decrease the ability of the nucleus to hold in the  $e^-$

21. What element has the largest electronegativity value? What element has the smallest electronegativity value?

largest Fluorine  
smallest francium

22. Which is the name of  $NO_3$ ? nitrogen trioxide

23. Write the formula (skeleton) equation for: Zinc + Gold (III) Nitrate  $\rightarrow$  Gold + Zinc Nitrate



24. Classify and balance the reaction type in problem #23. What are the reactants? What are the products?

single replacement

$Zn$  &  $Au(NO_3)_3$      $Au$  &  $Zn(NO_3)_2$

25. Electromagnetic radiation with short wavelengths have what kind of energy and frequency?

high energy, high frequency

26. How many unpaired electrons are in the orbital filling diagram for an atom of phosphorus?  $\cdot\ddot{P}\cdot$  3

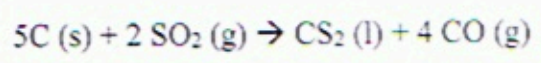
27. The Lewis dot diagram for carbon has how many electrons?  $\cdot\overset{\cdot}{C}\cdot$  4

28. The noble gas configuration  $[\text{Ar}]4s^23d^3$  belongs to what element? Vanadium

29. The electron configuration  $1s^22s^22p^63s^23p^4$  belongs to what element? Sulfur

30. What is the name of  $\text{FeCO}_3$  iron(II) carbonate

31. Carbon disulfide is an important industrial solvent. It is prepared by the reaction of coke with sulfur dioxide.



How many moles of  $\text{CS}_2$  form when 3.3 mol C reacts?

$$3.3 \text{ mol C} \times \frac{1 \text{ mol CS}_2}{5 \text{ mol C}} = \boxed{0.66 \text{ mol CS}_2}$$

Use the following information to answer #32-33:

Methane and oxygen combust at STP to produce carbon dioxide gas and water according to the balanced equation:  $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$

32. If 15.0 liters of oxygen are reacted, how many liters of carbon dioxide are produced?  
 $15.0 \text{ L O}_2 \times \frac{1 \text{ mol O}_2}{22.4 \text{ L O}_2} \times \frac{1 \text{ mol CO}_2}{2 \text{ mol O}_2} \times \frac{22.4 \text{ L CO}_2}{1 \text{ mol CO}_2} = \boxed{7.50 \text{ L CO}_2}$

33. If 55.0 grams of methane are reacted, how many moles of water will be produced?  
 $55.0 \text{ g CH}_4 \times \frac{1 \text{ mol CH}_4}{16.032 \text{ g CH}_4} \times \frac{2 \text{ mol H}_2\text{O}}{1 \text{ mol CH}_4} = \boxed{6.86 \text{ mol H}_2\text{O}}$

34. A lab technician has 33.0 L gas in a contained cylinder at a pressure of 44.0 kPa. If the technician increases the pressure to 55.0 kPa, without changing the temperature, what is the new volume?  
 $P_1V_1 = P_2V_2 \quad (44.0 \text{ kPa})(33.0 \text{ L}) = (55.0 \text{ kPa})V_2 \quad V_2 = \boxed{26.4 \text{ L}}$

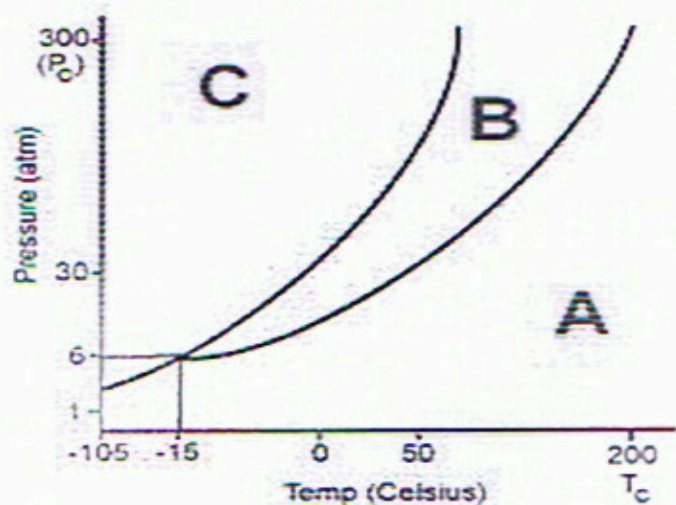
35. A chemist has 3.0L of  $\text{H}_2$  gas at 222.2 kPa and 222°C. How many moles of  $\text{H}_2$  does she have?  
 $PV = nRT \quad n = \frac{PV}{RT} = \frac{(222.2 \text{ kPa})(3.0 \text{ L})}{(8.314 \frac{\text{kJ} \cdot \text{K}}{\text{mol} \cdot \text{K}})(495 \text{ K})} = \boxed{0.16 \text{ mol H}_2}$   
 $222^\circ\text{C} + 273 = 495 \text{ K}$

36. An ideal gas is confined to a 11.1 L balloon at 720.0 mmHg at 25°C. What is the new volume of the balloon at 780.0 mmHg and 75°C?  
 $P_1V_1 = P_2V_2 \quad \frac{(720.0 \text{ mmHg})(11.1 \text{ L})}{298 \text{ K}} = \frac{(780 \text{ mmHg})V_2}{348 \text{ K}} \quad V_2 = \boxed{12.0 \text{ L}}$   
 $25^\circ\text{C} + 273 = 298 \text{ K}$   
 $75^\circ\text{C} + 273 = 348 \text{ K}$

37. What the strongest of the intermolecular forces? What is the weakest?  
hydrogen bonding  
London dispersion/Van der Waals (induced/temporary dipole)

Use the diagram below to answer question #38.

38. What is the freezing point of this substance at a pressure of 6 atm?



-15°C

39. What elements are classified as metalloids? *B, Si, Ge, As, Sb, Te*

40. Which type of compound would likely have the lowest melting point? *covalent*

41. Which compound is nonpolar, which are polar and which are ionic?

*H<sub>2</sub>O polar    HCl polar    BCl<sub>3</sub> non-polar    KBr ionic    NH<sub>3</sub> polar    CO<sub>2</sub> non-polar*

42. How many lone pairs are in the Lewis structure for the covalent molecule H<sub>2</sub>O? For NH<sub>3</sub>? For BCl<sub>3</sub>?

43. Which is the name of Fe(NO<sub>3</sub>)<sub>3</sub>?

*iron(III) nitrate*

