

Quarter 3 Review Worksheet-Accel

Name: Key Period: _____

UNIT 7- KMT and Gas Laws

1. What is an elastic collision? energy is transferred
2. How does the kinetic energy of particles change when temperature changes? KE ↑ as temp ↑
3. Use KMT to describe how gases are compressible and expandable. lots of space between particles, so they can move closer (compressible) or further apart (expandable)
4. What are the 3 assumptions of KMT? constant random motion, elastic collisions, kinetic energy is the same for all gases at the same temp.
5. Use your knowledge of gas properties to describe what is happening in the following situations:
 - a. Your car tires appear flat in the morning after a cold night. As temp ↓ the gas particles slowed down so fewer collisions means pressure ↓
 - b. Your ears "pop" as you are driving up a mountain and increasing in elevation at quick rate. as elevation increases pressure decreases b/c there is less air above!
6. If I initially have a gas at a pressure of 10 atm, a volume of 15 liters, and a temperature of 300 K, and then I raise the pressure to 12 atm and decrease the temperature to 200 K, what is the new volume of the gas?

$$\frac{10 \text{ atm} \times 15 \text{ L}}{300 \text{ K}} = \frac{12 \text{ atm} \times V_2}{200 \text{ K}}$$

$$V_2 = 8.33 \text{ L}$$

7. If I have 20 liters of gas at a temperature of 30 °C and a pressure of 20 atm, what will be the pressure of the gas if I raise the temperature to 45 °C and decrease the volume to 15 liters?

$$\frac{20 \text{ atm} \times 20 \text{ L}}{303 \text{ K}} = \frac{P_2 \times 15 \text{ L}}{318 \text{ K}}$$

$$P_2 = 28.0 \text{ atm}$$

8. What units do the following variables need to be in for the ideal gas law?

a. pressure: atm

b. volume: L

c. "n": moles

d. temperature: K

9. If I contain 20 g of chlorine gas in a container with a volume of 40 liters and at a temperature of 300 K, what is the pressure inside the container?

$$\frac{20 \text{ g Cl}_2}{70.90 \text{ g Cl}_2} \times 1 \text{ mol Cl}_2 = 0.282 \text{ mol}$$

$$P \cdot 40 \text{ L} = 0.282 \text{ mol} \cdot 0.0821 \cdot 300 \text{ K}$$

$$P = 0.174 \text{ atm}$$

10. If I have 15 moles of gas held at a pressure of 10 atm and a temperature of 500 K, what is the volume of the gas?

$$10 \text{ atm} \cdot V = 15 \text{ mol} \cdot 0.0821 \cdot 500 \text{ K}$$

$$V = 61.6 \text{ L}$$

Unit 8 Thermochemistry

Part 1: Enthalpy and Specific Heat

11. The symbol used to represent change in enthalpy is ΔH
12. When a chemical reaction gains heat, it is an endothermic reaction, and its enthalpy value is (positive/negative)
13. When a substance goes from a solid to a liquid, it is an (endothermic/exothermic) process. The sign for ΔH is +.
14. H₂O (g) → H₂O (s) is an (endothermic/exothermic) process. The sign for ΔH is -.
15. When a chemical reaction releases heat, it is an exothermic reaction, and its enthalpy value is (positive/negative)
16. Describe the difference between temperature and heat.
Temp is the average KE
Heat is the transfer of energy from a warmer object to a cooler object
17. The amount of energy required to raise the temperature of 1 gram of a substance 1°C is called specific heat.

Calculate the following and show your work!

18. What is the mass of a piece of iron that absorbs 1100 J of energy when its temperature changes from 25°C to 175°C?

(specific heat of iron: 0.450 J/g °C) $1100 \text{ J} = m \cdot 0.450 \cdot 150 \text{ °C}$

$$m = 16.3 \text{ g}$$

19. How many joules of heat are needed to raise the temperature of 15.0 g of aluminum from 20°C to 55°C, if the specific heat of aluminum is 0.90 J/g°C? $q = mc\Delta T$

$$q = 15.0g \times .90 \times 35^\circ C$$

$$q = 473J$$

20. The products in an exothermic reaction have a (greater/smaller) enthalpy than the reactants.

21. How much heat will be released when 10.0g of sulfur reacts with excess O₂ according to the following equation?



$$\frac{10.0g S}{32.0g S} \times \frac{791.4 kJ}{2 \text{ mol S}} = 123 kJ$$

22. Use the standard enthalpies of formation (pg. 975) to calculate the overall change in enthalpy for the reaction.

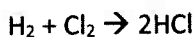
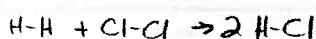
$$\Delta H_{rxn} = \sum \Delta H_f \text{ products} - \sum \Delta H_f \text{ reactants}$$

$$\Delta H_{rxn} = (-393.5 + 2(-285.8)) - (-74.6 + 2(0))$$

$$\Delta H_{rxn} = -890.5 kJ$$

H-H	436 kJ/mol	C-H	413 kJ/mol	C=C	614 kJ/mol
H-Cl	431 kJ/mol	C-C	348 kJ/mol	C≡C	839 kJ/mol
H-F	567 kJ/mol	C-N	293 kJ/mol	C=O	799 kJ/mol
N-H	391 kJ/mol	C-O	358 kJ/mol	O=O	495 kJ/mol
N-O	201 kJ/mol	C-F	485 kJ/mol	C≡O	1072 kJ/mol
O-H	463 kJ/mol	C-Cl	328 kJ/mol	C=N	615 kJ/mol
O-O	146 kJ/mol	C-S	259 kJ/mol	N=N	418 kJ/mol
F-F	155 kJ/mol	Cl-Cl	242 kJ/mol	N≡N	941 kJ/mol
				C≡N	891 kJ/mol

23. Estimate the enthalpy change (ΔH_{rxn}) using bond energies.



$$436 + 242 - 2(431)$$

$$-184 kJ$$

Part 2: Entropy and Gibbs Free Energy

24. Explain what a spontaneous process is.

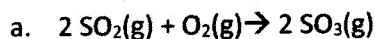
occurs without any outside intervention (energy)

25. Define entropy.

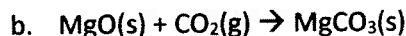
measure of disorder

26. What is the symbol used to represent change in entropy? ΔS

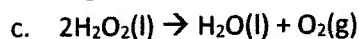
27. Predict the sign on the change in entropy for the following equations:



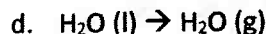
$-\Delta S$



$-\Delta S$

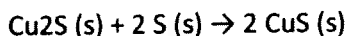


$+\Delta S$



$+\Delta S$

28. Copper (I) sulfide reacts with sulfur to produce copper (II) sulfide under standard conditions (298K). The process is exothermic ($\Delta H^\circ = -26.7 \text{ kJ/mol}$) with a decrease in disorder ($\Delta S^\circ = -19.7 \text{ J/(mol}\cdot\text{K)}$). Determine the spontaneity of the reaction by calculating ΔG° .



$$\Delta G = \Delta H - T\Delta S$$

$$-26.7 kJ - 298K(-0.0197 kJ)$$

$$\Delta G = -20.8 kJ$$

Spontaneous

29. A reaction has $\Delta H^\circ = -100.0 \text{ kJ}$ and $\Delta S^\circ = -80.0 \text{ J/K}$ at 298 K. Is this reaction spontaneous?

$$\Delta G = -100.0 kJ - 298K(-0.080 kJ)$$

$$\Delta G = -76.2 kJ \text{ spontaneous}$$

UNIT 9- Solutions

30. What factors determine whether one substance will dissolve in another (solubility)?

like dissolves like polarity polar dissolves polar + ionic

31. What three factors influence the rate of solvation?

agitation, temp., particle size

32. What are the two components of a solution? Define each component.

solute - gets dissolved

solvent - does the dissolving

33. As the temperature increases, what happens to the solubility of a solid? Of a gas?

solid - ↑ temp ↑ solubility

gas - ↑ temp ↓ solubility

34. How is a supersaturated solution created?

Heat the solution to dissolve more solute than should be possible & then cool the solution in an ice water bath

35. Explain the meaning of the phrase "like dissolves like"?

when the solute & solvent are similar in polarity

polar dissolves polar and ionic nonpolar dissolves nonpolar

36. How would you prepare 100. ml of a 0.500M HNO₃ solution if you have a 12.0M stock solution of HNO₃?

$$12.0M \times V_1 = 0.500M \times 100mL \quad V_1 = 4.17mL$$

measure 4.17ml of stock solution in a volumetric flask. Add some H₂O to mix. Fill to the calibration mark w/ distilled H₂O cap & invert to mix.

37. What volume of a 6.0M NaCl solution can be made from 3.51g of NaCl?

$$6.0M = \frac{0.0601mol NaCl}{L} \quad \frac{3.51g NaCl}{58.4427g NaCl} \times \frac{1mol NaCl}{1mol NaCl} = 0.0601mol NaCl$$

$$L = 0.0100L$$

38. How many grams of solvent are necessary to dissolve 325g of lithium bromide at 50°C if the solubility of LiBr is 203g/100g water at this temperature?

$$\frac{325g LiBr}{x g H_2O} = \frac{203g}{100g H_2O}$$

$$160g H_2O$$

39. What is the molar concentration (molarity) of a 125ml solution made by dissolving 34.2g of sucrose, C₁₂H₂₂O₁₁, in water?

$$\frac{34.2g C_{12}H_{22}O_{11}}{342.30128g C_{12}H_{22}O_{11}} \times \frac{1mol}{1mol} = 0.0999mol \quad \frac{0.0999mol}{0.125L} = 0.799M$$

40. What mass of water is needed to make a 1.35m solution with 8.20mol NaOH?

$$1.35m = \frac{8.20mol}{x}$$

$$6.07kg H_2O$$

41. Calculate the molality of a solution of 50.0 g nickel (II) chloride in 100.0 g of water.

$$\frac{50.0g NiCl_2}{129.596g NiCl_2} \times \frac{1mol NiCl_2}{1mol NiCl_2} = 0.386mol NiCl_2 \quad \frac{0.386mol NiCl_2}{0.100kg} = 3.86m$$

42. 12.5 g barium chloride dissolves in 250. ml of water. Calculate the mass percent concentration.

$$\% mass = \frac{mass solute}{mass solution} \times 100 \quad \frac{12.5g}{262.5g} \times 100 = 4.76\%$$

43. What is the new boiling point is 25.0 g of calcium chloride is dissolved in 500. ml of water? K_b = 0.512

$$\frac{25g CaCl_2}{110.986g CaCl_2} \times \frac{1mol CaCl_2}{1mol CaCl_2} = 0.225mol \quad \frac{0.225mol}{0.500kg} = 0.45m$$

$$\Delta T_b = iK_b m \quad \Delta T_b = 3 \cdot 0.512 \cdot 0.45 = 0.6912^\circ C \quad BP = 100^\circ C + 0.6912^\circ C = 100.6912^\circ C$$

44. Which of the following substances will affect the boiling point the most? CH₄, NaCl, or MgCl₂?

MgCl₂ because it dissociates into 3 ions
covalent i=1 i=2 i=3

