

CHAPTER 4 – 5 PRACTICE QUIZ (Sections 4.5 – 4.6 & 5.1 – 5.4)

MULTIPLE CHOICE – NO CALCULATOR ALLOWED

1. A solution is prepared by combining 100.0 mL of 0.20 M Na_2SO_4 with 100.0 mL of 0.50 M K_2SO_4 . Which of the following choices has correctly arranged the ions in this solution in order of increasing concentration?

	lowest concentration	→	highest concentration
(A)	SO_4^{2-}		K^+
(B)	Na^+		K^+
(C)	Na^+		SO_4^{2-}
(D)	K^+		SO_4^{2-}

2. A solution was prepared by dissolving 11 grams of anhydrous calcium chloride (F.W. = 110.98) into water so that the total volume is 500. mL. What is the concentration of chloride ions in this solution?
- (A) 0.10 M
(B) 0.20 M
(C) 0.30 M
(D) 0.40 M
3. How many grams of glucose (F.W. = 180.156) are present in 500. mL of a 0.50 M glucose solution?
- (A) 0.25 g
(B) 45 g
(C) 90. g
(D) 180 g

4. In order to prepare 250.0 mL of a hydrochloric acid solution that has a concentration of 0.10 *M*, how many milliliters of 10.0 *M* hydrochloric acid are needed?
- (A) 0.25 mL
 (B) 2.5 mL
 (C) 4.0 mL
 (D) 25 mL
5. What is the minimum volume of 2.0 *M* HNO₃ required to neutralize 0.50 mole of Ca(OH)₂ ?
- (A) 200 mL
 (B) 250 mL
 (C) 500 mL
 (D) 1000 mL
6. A student measured out 0.50 g of a solid monoprotic acid HX and dissolved it in 100. mL of water. This solution was titrated with a 0.10 *M* sodium hydroxide solution. If 20.0 mL of this sodium hydroxide solution was required to reach the equivalence point, what is the approximate molar mass of HX?
- (A) 25 g/mol
 (B) 100 g/mol
 (C) 250 g/mol
 (D) 500 g/mol
7. When Solutions #1 and #2 are combined together, silver chloride is produced. Which of the following choices would produce the greatest mass of silver chloride?

	Solution #1	Solution #2
(A)	100. mL of 0.10 <i>M</i> AgNO ₃	100. mL of 0.10 <i>M</i> NaCl
(B)	100. mL of 0.10 <i>M</i> AgNO ₃	100. mL of 0.20 <i>M</i> CaCl ₂
(C)	100. mL of 0.20 <i>M</i> AgNO ₃	100. mL of 0.10 <i>M</i> CaCl ₂
(D)	100. mL of 0.30 <i>M</i> AgNO ₃	100. mL of 0.10 <i>M</i> NaCl

8. A student was given the task of determining the mass percentage of iodide (I^-) in a potassium iodide (KI) tablet. A tablet with a mass of 0.500 g was dissolved in water and treated with excess $Pb(NO_3)_2(aq)$. This resulted in the formation of a yellow precipitate of $PbI_2(s)$ which was filtered, dried, and weighed. The mass of the precipitate was 0.200 g. Which of the following calculations is set up correctly to determine the mass percentage of iodide in the KI tablet?

(A) $\frac{(0.200)(126.9)}{(461.0)(0.500)} \times 100\%$

(B) $\frac{(0.200)(126.9)}{(461.0)(2)(0.500)} \times 100\%$

(C) $\frac{(0.200)(2)(126.9)}{(461.0)(0.500)} \times 100\%$

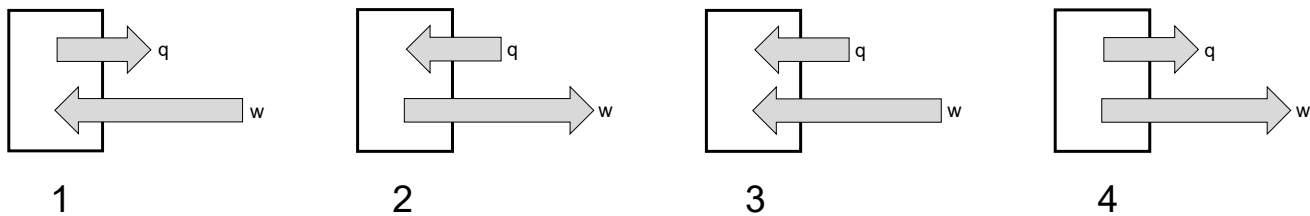
(D) $\frac{(0.200)(126.9)(0.500)}{(461.0)} \times 100\%$

9. In a certain experiment, 200 J of work is done by the surroundings on the system as a gas is compressed. In addition, 500 J of heat is transferred from the system to the surroundings. Which of the following has correctly identified the signs of q , w , and ΔE for the system?

	q	w	ΔE
(A)	-	+	+
(B)	-	+	-
(C)	+	-	+
(D)	+	-	-

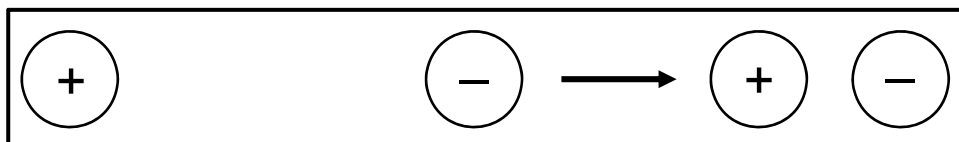
10. Under which of the following situations will the sign of ΔE always be positive?

- (A) heat is absorbed by the system and work is done on the system
 (B) heat is absorbed by the system and work is done on the surroundings
 (C) heat is released by the system and work is done on the system
 (D) heat is released by the system and work is done on the surroundings



11. The contents of the closed box in each of the diagrams above represent a system, and the arrows show the changes to the system during some process. The lengths of the arrows represent the relative magnitudes of q and w . Which of the following statements is true?

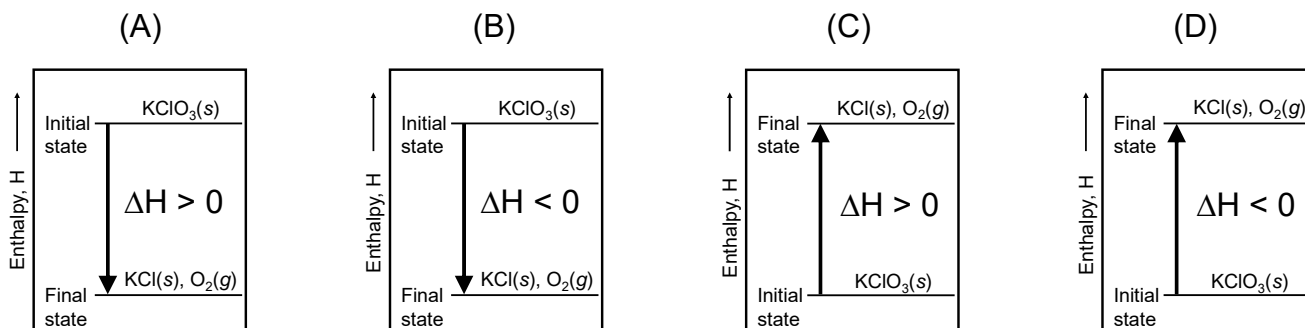
- (A) Process 1 represents an endothermic process.
- (B) Process 2 represents an endothermic process.
- (C) In Process 3, $\Delta E < 0$.
- (D) In Process 4, work is being done by the surroundings on the system.



12. Which of the following best describes and justifies the change in electrostatic potential energy that occurs when the two charged particles shown in the diagram above are brought closer together?

	Electrostatic Potential Energy	Justification
(A)	increases	the attraction between the particles increases
(B)	increases	the attraction between the particles decreases
(C)	decreases	the attraction between the particles increases
(D)	decreases	the attraction between the particles decreases

13. When solid potassium chlorate is heated in the presence of a catalyst, potassium chloride and oxygen gas are formed. Which of the following potential energy diagrams best illustrates this chemical reaction, including the change in enthalpy, ΔH ?





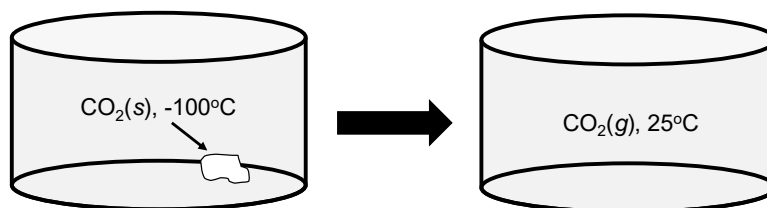
14. The synthesis of ammonia is illustrated by the thermochemical equation shown above. Which of the following calculations is set up correctly to determine the mass of ammonia produced when 875 J of heat is released in this reaction?

(A) $\frac{(875)(92.4)(17.034)}{(1000)(2)}$

(C) $\frac{(875)(1000)(92.4)(17.034)}{(2)}$

(B) $\frac{(875)(2)(17.034)}{(1000)(92.4)}$

(D) $\frac{(875)(1000)(2)(17.034)}{(92.4)}$



15. A sample of dry ice, $\text{CO}_2(s)$, at a temperature of -100°C is placed inside a rigid metal container. The container is then sealed tightly. Eventually, all of the dry ice undergoes sublimation, forming $\text{CO}_2(g)$ at 25°C . If we consider the system to be the substances inside the container, which of the following best describes the changes in the system?

	q	w	ΔE
(A)	+	zero	+
(B)	-	zero	-
(C)	+	-	cannot be determined
(D)	-	+	cannot be determined



16. Use the information given in the thermochemical equation shown above to help you choose the best answer to the following question. What will happen when solid MgSO_4 is dissolved completely in water at 25°C ?

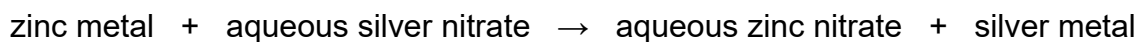
- (A) Heat will be absorbed by the system and the temperature of the water will increase.
 (B) Heat will be released by the system and the temperature of the water will increase.
 (C) Heat will be absorbed by the system and the temperature of the water will decrease.
 (D) Heat will be released by the system and the temperature of the water will decrease.

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FREE RESPONSE – CALCULATOR IS ALLOWED

1. A chemistry teacher needs to prepare a silver nitrate solution for a lab experiment.
- (a) Calculate the mass of solid silver nitrate that is needed to prepare 500.0 mL of a 0.110 *M* silver nitrate solution. Show the setup for your calculations below. Round off your final answer to the proper number of significant figures.

- (b) The experiment to be performed is based on the following chemical equation.



- (i) Write a balanced molecular equation for the reaction shown above.

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- (ii) Write a balanced net-ionic equation for the reaction shown above.

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- (c) In the experiment, a 1.50 g sample of zinc metal was combined with 250. mL of 0.110 *M* silver nitrate solution.
- (i) Identify the limiting reactant in this experiment, and show calculations to justify your answer.

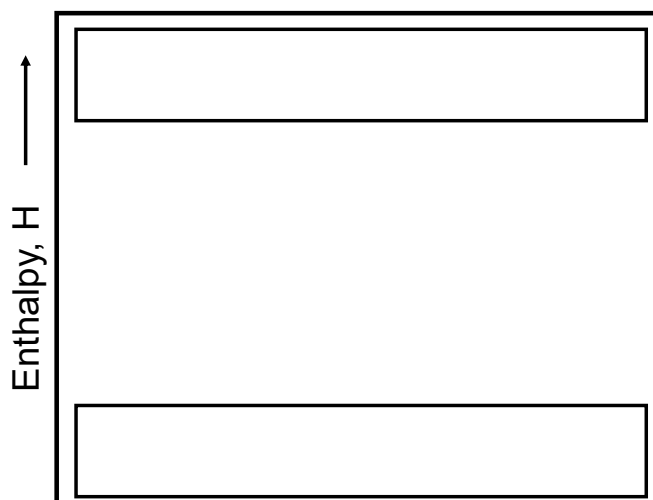
1. (c) (ii) On the basis of the limiting reactant identified in part (c)(i), determine the concentration of Zn^{2+} ions in the solution after the reaction is complete. Assume that the final volume of the solution remains unchanged.

2. A chemistry teacher needs to prepare a hydrochloric acid solution for a lab experiment.
 - (a) Calculate the volume of 6.0 *M* hydrochloric acid solution that is needed to prepare 500. mL of a 0.10 *M* hydrochloric acid solution. Show the setup for your calculations below. Round off your final answer to the proper number of significant figures.

 - (b) The experiment that was performed in the lab involved the addition of 50. mL of 0.10 *M* hydrochloric acid to 50. mL of 0.10 *M* sodium hydroxide. The temperature of the solution increased immediately after the two solutions were combined.
 - (i) The reaction between hydrochloric acid and sodium hydroxide should be classified as (endothermic exothermic) because heat was (absorbed released) by the system. The thermometer in this experiment is considered to be part of the (system surroundings).
 - (ii) It was determined that 279 J of heat was associated with the chemicals that reacted in this experiment. Calculate the value of ΔH (in units of $\text{kJ/mol}_{\text{rxn}}$) for the reaction that occurred in this experiment. Show the setup for your calculations below. Round off your final answer to the proper number of significant figures. The sign of ΔH should be consistent with your answer to (b)(i).

2. (c) Fill in the following missing information in the enthalpy diagram below.

- The chemical formulas of the reactants and the products, listed in the appropriate boxes, according to their relative enthalpy values
- An arrow indicating the direction of the reaction, from the reactants to the products



(d) Suppose that this experiment had been carried out by adding 50. mL of 0.20 *M* hydrochloric acid to 50. mL of 0.20 *M* sodium hydroxide.

- (i) Would the magnitude of q for this experiment be less than, more than, or equal to 279 J? Justify your answer.
- (ii) Would the magnitude of ΔH for this experiment be less than, more than, or equal to the magnitude of the ΔH value calculated in (b)(ii)? Justify your answer.