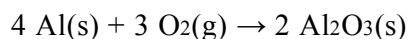


# Assignment: Putting it All Together

## Redox Questions

1. In any redox reaction, the substance that undergoes reduction will
- (1) lose electrons and have a decrease in oxidation number
  - (2) lose electrons and have an increase in oxidation number
  - (3) gain electrons and have a decrease in oxidation number
  - (4) gain electrons and have an increase in oxidation number

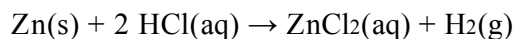
2. Given the reaction:



What is the oxidation number of oxygen in  $\text{Al}_2\text{O}_3$ ?

3. What is conserved during a chemical reaction?
- (1) mass, only
  - (2) charge, only
  - (3) energy, only
  - (4) mass, charge and energy

4. Given the reaction:



Which statement correctly describes what occurs when this reaction takes place in a closed system?

- (1) Atoms of  $\text{Zn(s)}$  lose electrons and are oxidized.
- (2) Atoms of  $\text{Zn(s)}$  gain electrons and are reduced.
- (3) There is a net loss of mass.
- (4) There is a net gain of mass.

5. In a redox reaction, how does the total number of electrons lost by the oxidized substance compare to the total number of electrons gained by the reduced substance?

- (1) The number lost is always greater than the number gained.
- (2) The number lost is always equal to the number gained.
- (3) The number lost is sometimes equal to the number gained.
- (4) The number lost is sometimes less than the number gained.

6. Which reaction is an example of an oxidation reduction reaction?

- (1)  $\text{AgNO}_3 + \text{KI} \rightarrow \text{AgI} + \text{KNO}_3$
- (2)  $\text{Cu} + 2 \text{AgNO}_3 \rightarrow \text{Cu(NO}_3)_2 + 2 \text{Ag}$
- (3)  $2 \text{KOH} + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2 \text{H}_2\text{O}$
- (4)  $\text{Ba(OH)}_2 + 2 \text{HCl} \rightarrow \text{BaCl}_2 + 2 \text{H}_2\text{O}$

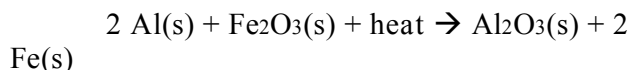
7. In which compound does chlorine have the highest oxidation number?

- (1)  $\text{NaClO}$
- (2)  $\text{NaClO}_2$
- (3)  $\text{NaClO}_3$
- (4)  $\text{NaClO}_4$

8. When a neutral atom undergoes oxidation, the atom's oxidation state

- (1) decreases as it gains electrons
- (2) decreases as it loses electrons
- (3) increases as it gains electrons
- (4) increases as it loses electrons

9. Given the reaction:

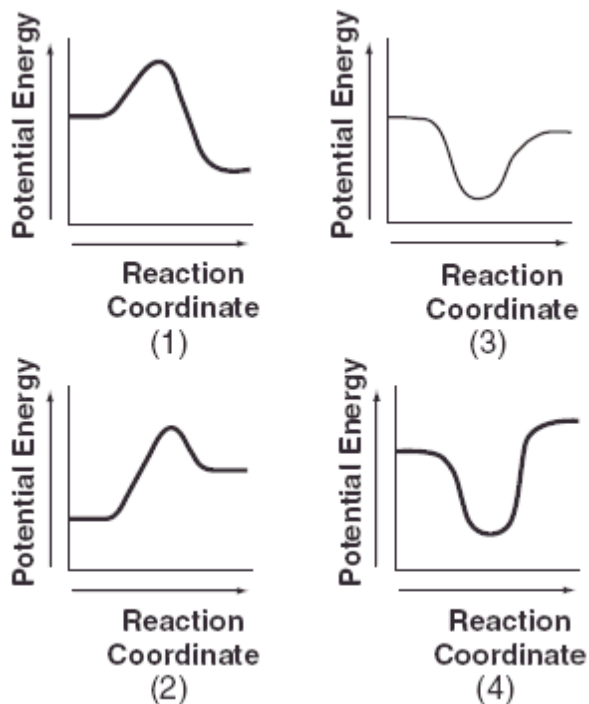


Which species undergoes reduction?

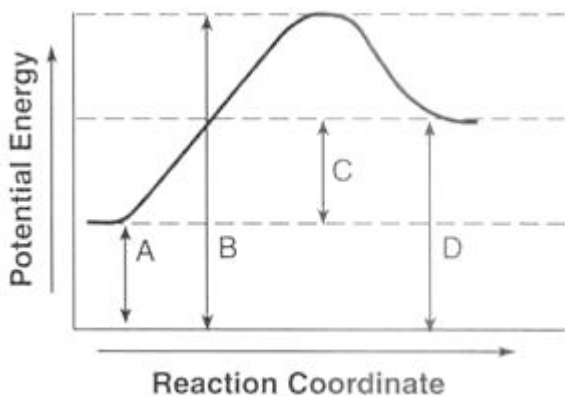
- (1)  $\text{Al}$
- (2)  $\text{Fe}$
- (3)  $\text{Al}^{3+}$
- (4)  $\text{Fe}^{3+}$

## PE Diagram Questions

1. According to Table I, which potential energy diagram best represents the reaction that forms  $\text{H}_2\text{O}(\text{l})$  from its elements?

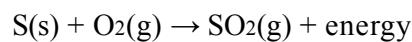


2. Chemical cold packs are often used to reduce swelling after an athletic injury. The diagram represents the potential energy changes when a cold pack is activated.

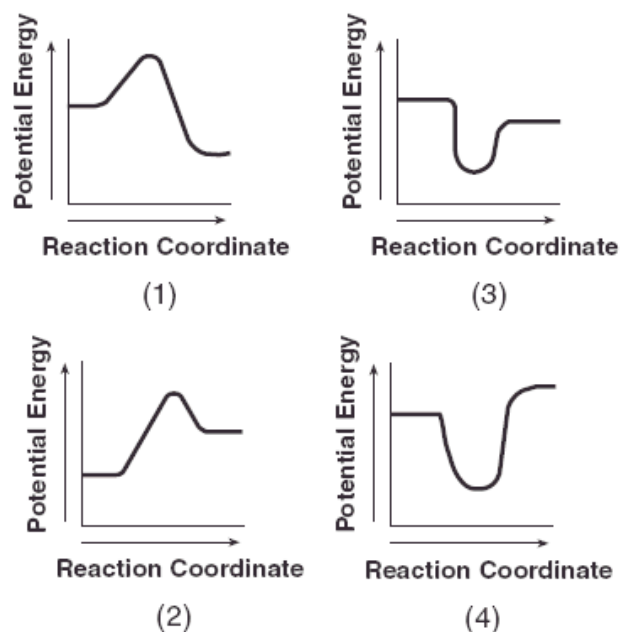


- Which lettered interval on the diagram represents the potential energy of the products?
- Which lettered interval on the diagram represents the heat of reaction?
- Identify a reactant listed in Reference Table I that could be mixed with water for use in a chemical cold pack.

3. Given the reaction:



Which diagram best represents the potential energy changes for this reaction?

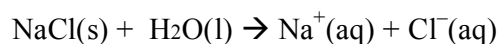


## Entropy Questions

1. Which sample has the *lowest* entropy?

- (1) 1 mole of KNO<sub>3</sub>(l)
- (2) 1 mole of KNO<sub>3</sub>(s)
- (3) 1 mole of H<sub>2</sub>O(l)
- (4) 1 mole of H<sub>2</sub>O(g)

2. Given the equation for the dissolving of sodium chloride in water:

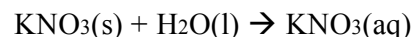


Describe what happens to entropy during this dissolving process.

3. Which phase change represents a *decrease* in entropy?

- (1) solid to liquid
- (2) gas to liquid
- (3) liquid to gas
- (4) solid to gas

4. Given the equation:



As H<sub>2</sub>O(l) is added to KNO<sub>3</sub>(s) to form KNO<sub>3</sub>(aq), the entropy of the system

- (1) decreases
  - (2) increases
  - (3) remains the same
- 

## Types of Change Questions

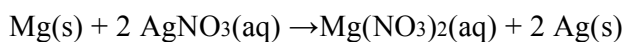
1. Which equation represents a double replacement reaction?

- (1)  $2 \text{Na} + 2 \text{H}_2\text{O} \rightarrow 2 \text{NaOH} + \text{H}_2$
- (2)  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$
- (3)  $\text{LiOH} + \text{HCl} \rightarrow \text{LiCl} + \text{H}_2\text{O}$
- (4)  $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$

2. Which process represents a chemical change?

- (1) melting of ice
- (2) corrosion of copper
- (3) evaporation of water
- (4) crystallization of sugar

3. Given the reaction:



Which type of reaction is represented?

- (1) single replacement
- (2) double replacement
- (3) synthesis
- (4) decomposition

## Kinetics and Equilibrium Questions

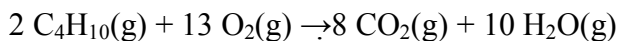
- Which statement correctly describes a chemical reaction at equilibrium?
  - The concentrations of the products and reactants are equal.
  - The concentrations of the products and reactants are constant.
  - The rate of the forward reaction is less than the rate of the reverse reaction.
  - The rate of the forward reaction is greater than the rate of the reverse reaction.
- The solid and liquid phases of water can exist in a state of equilibrium at 1 atmosphere of pressure and a temperature of
  - 0°C
  - 100°C
  - 273°C
  - 373°C
- Increasing the temperature increases the rate of a reaction by
  - lowering the activation energy
  - increasing the activation energy
  - lowering the frequency of effective collisions between reacting molecules
  - increasing the frequency of effective collisions between reacting molecules
- In most aqueous reactions as temperature increases, the effectiveness of collisions between reacting particles
  - decreases
  - increases
  - remains the same
- Based on the nature of the reactants in each of the equations below, which reaction at 25°C will occur at the fastest rate?
  - $C(s) + O_2(g) \rightarrow CO_2(g)$
  - $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
  - $CH_3OH(l) + CH_3COOH(l) \rightarrow CH_3COOCH_3(aq) + H_2O(l)$
  - $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$
- Explain how a catalyst may increase the rate of a chemical reaction.
- At STP, which 4.0-gram zinc sample will react fastest with dilute hydrochloric acid?
  - a lump
  - a bar
  - powdered
  - a sheet of the metal
- Given the reaction at equilibrium:
$$H_2(g) + Br_2(g) \rightarrow 2 HBr(g)$$
The rate of the forward reaction is
  - greater than the rate of the reverse reaction
  - less than the rate of the reverse reaction
  - equal to the rate of the reverse reaction
  - independent of the rate of the reverse reaction
- Which statement best explains the role of a catalyst in a chemical reaction?
  - A catalyst is added as an additional reactant and is consumed but not regenerated.
  - A catalyst limits the amount of reactants used.
  - A catalyst changes the kinds of products produced.
  - A catalyst provides an alternate reaction pathway that requires less activation energy.

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## Stoichiometry Questions

- If an equation is balanced properly, both sides of the equation must have the same number of
  - atoms
  - coefficients
  - molecules
  - moles of molecules
- Given the unbalanced equation:
$$Al + CuSO_4 \rightarrow Al_2(SO_4)_3 + Cu$$
When the equation is balanced using the *smallest* whole-number coefficients, what is the coefficient of Al?
  - 1
  - 2
  - 3
  - 4

3. Given the balanced equation:



What is the total number of moles of  $\text{O}_2(\text{g})$  that must react completely with 5.00 moles of  $\text{C}_4\text{H}_{10}(\text{g})$ ?

- (1) 10.0
- (2) 20.0
- (3) 26.5
- (4) 32.5

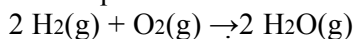
4. Given the unbalanced equation:



a) Balance the equation provided using the lowest whole-number coefficients.

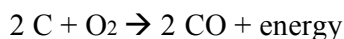
b) Identify the type of reaction represented.

5. Given the equation:



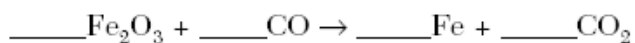
If 8.0 moles of  $\text{O}_2$  are completely consumed, what is the total number of moles of  $\text{H}_2\text{O}$  produced?

6. In the smelting of iron ore,  $\text{Fe}_2\text{O}_3$  is reduced in a blast furnace at high temperature by a reaction with carbon monoxide. Crushed limestone,  $\text{CaCO}_3$ , is also added to the mixture to remove impurities in the ore. The carbon monoxide is formed by the oxidation of carbon (coke), as shown in the reaction below:

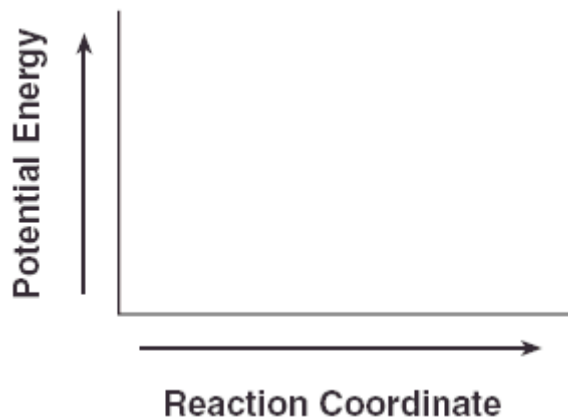


Liquid iron flows from the bottom of the blast furnace and is processed into different alloys of iron.

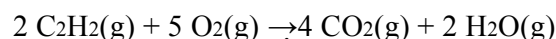
a) Balance the equation for the reaction of  $\text{Fe}_2\text{O}_3$  and  $\text{CO}$ , using the smallest whole-number coefficients.



b) Using the set of axes provided, sketch a potential energy diagram for the reaction of carbon and oxygen that produces carbon monoxide.



7. Given the equation:



How many moles of oxygen are required to react completely with 1.0 mole of  $\text{C}_2\text{H}_2$ ?

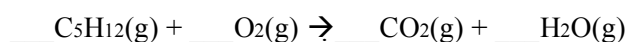
- (1) 2.5
- (2) 2.0
- (3) 5.0
- (4) 10

8. Which equation shows conservation of both mass and charge?

- (1)  $\text{Cl}_2 + \text{Br}^- \rightarrow \text{Cl}^- + \text{Br}_2$
- (2)  $\text{Cu} + 2 \text{Ag}^+ \rightarrow \text{Cu}^{2+} + \text{Ag}$
- (3)  $\text{Zn} + \text{Cr}^{3+} \rightarrow \text{Zn}^{2+} + \text{Cr}$
- (4)  $\text{Ni} + \text{Pb}^{2+} \rightarrow \text{Ni}^{2+} + \text{Pb}$

9.

a) Balance the equation below, using the smallest whole-number coefficients.



b) Using your balanced equation, show a correct numerical setup for calculating the total number of moles of  $\text{H}_2\text{O}(\text{g})$  produced when 5.0 moles of  $\text{O}_2(\text{g})$  are completely consumed