~~Replace Reaction #3 (Lesson Day #6)~~ Keep

AP Chemistry
Reaction Practice
Day 5

Name Key 2011
Date _____ **Period** _____

For each of the following three reactions, in part (i) write a BALANCED equation and in part (ii) answer the question about the reaction. In part (i), coefficients should be in terms of lowest whole numbers. Assume that solutions are aqueous unless otherwise indicated. Represent substances in solutions as ions if the substances are extensively ionized. Omit formulas for any ions or molecules that are unchanged by the reaction.

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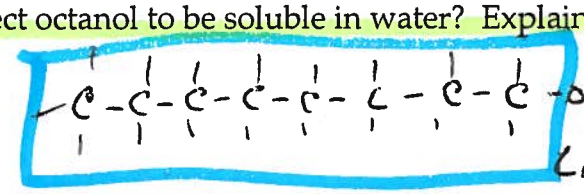
1. Octanol is burned in air

(i) $C_8H_{18}O + O_2 \rightarrow H_2O + CO_2$

(1) (12) (9) (8)

18 + 32

(ii) Would you expect octanol to be soluble in water? Explain your answer.

No;  due to the larger LDF component; H Bonding negligible so NP.

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2. Iron filings are added to a solution of iron (III) nitrate.

(i) $Fe + 2Fe^{3+} \rightarrow 3Fe^{2+}$

(ii) Write the oxidation and the reduction half reaction and label each.

$Fe \rightarrow Fe^{2+} + 2e^-$ oxidation

$2(e^- + Fe^{3+} \rightarrow Fe^{2+})$ Reduction

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3. Pieces of potassium are added to water.

(i) $2K + 2HOH \rightarrow 2K^+ + 2OH^- + H_2$

(ii) Would you expect the resulting solution to be able to conduct an electrical current? Explain.

Yes, because a strong base is produced, which completely ionizes (dissociates) to form K^+ & OH^- ions.

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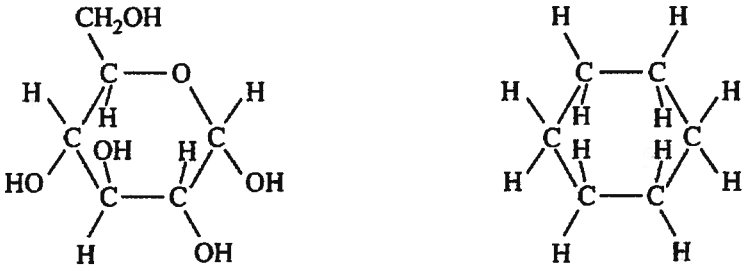
Question 6

6. Answer each of the following in terms of principles of molecular behavior and chemical concepts.

(a) The structures for glucose, $C_6H_{12}O_6$, and cyclohexane, C_6H_{12}, are shown below.



Identify the type(s) of intermolecular attractive forces in

(i) pure glucose

Hydrogen bonding OR dipole-dipole interactions OR van der Waals interactions (London dispersion forces may also be mentioned.)	One point is earned for a correct answer.

(ii) pure cyclohexane

London dispersion forces	One point is earned for London dispersion forces.

(b) Glucose is soluble in water but cyclohexane is not soluble in water. Explain.

The hydroxyl groups in glucose molecules can form strong hydrogen bonds with the solvent (water) molecules, so glucose is soluble in water. In contrast, cyclohexane is not capable of forming strong intermolecular attractions with water (no hydrogen bonding), so the water-cyclohexane interactions are not as energetically favorable as the interactions that already exist among polar water molecules. **OR** • Glucose is polar and cyclohexane is nonpolar. • Polar solutes (such as glucose) are generally soluble in polar solvents such as water. • Nonpolar solutes (such as cyclohexane) are not soluble in the polar solvent.	One point is earned for explaining the solubility of glucose in terms of hydrogen bonding or dipole-dipole interactions with water. One point is earned for explaining the difference in the polarity of cyclohexane and water. **OR** One point is earned for any one of the three concepts; two points are earned for any two of the three concepts.

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(2)

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Question 6 (continued)

(c) Consider the two processes represented below.

Process 1: $H_2O(l) \rightarrow H_2O(g)$ $\quad \Delta H° = +44.0 \text{ kJ mol}^{-1}$

Process 2: $H_2O(l) \rightarrow H_2(g) + \frac{1}{2} O_2(g)$ $\quad \Delta H° = +286 \text{ kJ mol}^{-1}$

(i) For each of the two processes, identify the type(s) of intermolecular or intramolecular attractive forces that must be overcome for the process to occur.

In process 1, hydrogen bonds (or dipole-dipole interactions) in liquid water are overcome to produce distinct water molecules in the vapor phase. In process 2, covalent bonds (or sigma bonds, or electron-pair bonds) within water molecules must be broken to allow the atoms to recombine into molecular hydrogen and oxygen.	One point is earned for identifying the type of intermolecular force involved in process 1. One point is earned for identifying the type of intramolecular bonding involved in process 2.

(ii) Indicate whether you agree or disagree with the statement in the box below. Support your answer with a short explanation.

When water boils, H_2O molecules break apart to form hydrogen molecules and oxygen molecules.

I disagree with the statement. Boiling is simply Process 1, in which only intermolecular forces are broken and the water molecules stay intact. No intramolecular or covalent bonds break in this process.	One point is earned for disagreeing with the statement and providing a correct explanation.

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(3)

Question 6 (continued)

(d) Consider the four reaction-energy profile diagrams shown below.

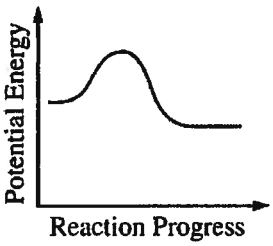

Diagram 1

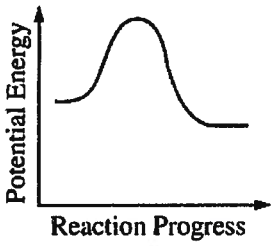

Diagram 2

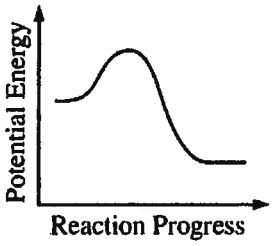

Diagram 3

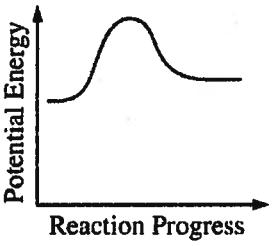

Diagram 4

(i) Identify the two diagrams that could represent a catalyzed and an uncatalyzed reaction pathway for the same reaction. Indicate which of the two diagrams represents the catalyzed reaction pathway for the reaction.

Diagram 1 represents a catalyzed pathway and diagram 2 represents an uncatalyzed pathway for the same reaction.	One point is earned for identifying the correct graphs and indicating which represents which pathway.

(ii) Indicate whether you agree or disagree with the statement in the box below. Support your answer with a short explanation.

> Adding a catalyst to a reaction mixture adds energy that causes the reaction to proceed more quickly.

I disagree with the statement. A catalyst does not add energy, but provides an alternate reaction pathway with a lower activation energy.	One point is earned for disagreeing with the statement and providing an explanation.