Name _____

AP Chemistry: Thermodynamics
Multiple Choice

(You may use a calculator.)

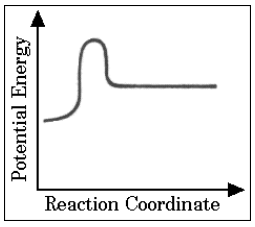
47. $CH_{4(g)} + 2\ O_{2(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(l)}$; $\Delta H_{rxn} = -889.1$ kJ

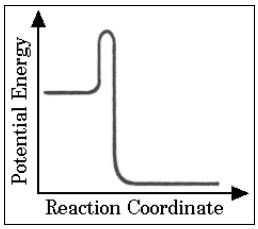
$\Delta H_f°\ H_2O_{(l)} = -285.8$ kJ / mole $\Delta H_f°\ CO_{2(g)} = -393.3$ kJ / mole

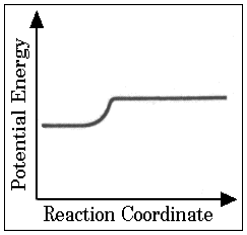
What is the standard heat of formation of methane, $\Delta H_f°\ CH_{4(g)}$, as calculated from the data above?

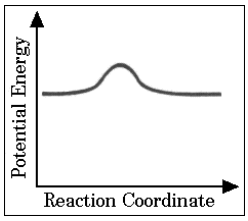
(A) −210.0 kJ/mole (B) −107.5 kJ/mole (C) −75.8 kJ/mole (D) 75.8 kJ/mole (E) 210.0 kJ/mole

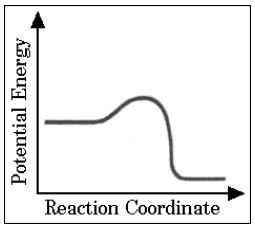
48. Which of the following is a graph that describes the pathway of reaction that is endothermic and has high activation energy?

(A) 

(B) 

(C) 

(D) 

(E) 

25.

$H_{2(g)} + 1/2\ O_{2(g)} \rightarrow H_2O_{(l)}$	$\Delta H° = x$
$2\ Na_{(s)} + 1/2\ O_{2(g)} \rightarrow Na_2O_{(s)}$	$\Delta H° = y$
$Na_{(s)} + 1/2\ O_{2(g)} + 1/2\ H_{2(g)} \rightarrow NaOH_{(s)}$	$\Delta H° = z$

Based on the information above, what is the standard enthalpy change for the following reaction?

$Na_2O_{(s)} + H_2O_{(l)} \rightarrow 2\ NaOH_{(s)}$

(A) x + y + z (B) x + y − z (C) x + y − 2z (D) 2z − x −y (E) z − x −y

30. The energy diagram for the reaction X + Y → Z is shown. The addition of a catalyst to this reaction would cause a change in which of the indicated energy differences?

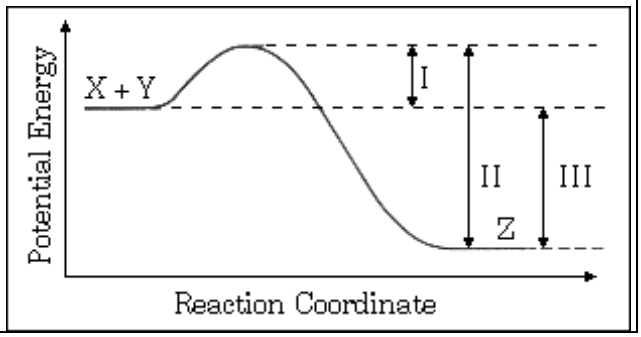
(A) I only

(B) II only

(C) III only

(D) I and II only

(E) I, II, and III



19. Which of the following best describes the role of the spark from the spark plug in an automobile engine?

(A) The spark decreases the energy of activation for the slow step.

(B) The spark increases the concentration of the volatile reactant.

(C) The spark supplies some of the energy of activation for the combustion reaction.

(D) The spark provides a more favorable activated complex for the combustion reaction.

(E) The spark provides the heat of vaporization for the volatile hydrocarbon.

61. $C_2H_{4(g)} + 3\ O_{2(g)} \rightarrow 2\ CO_{2(g)} + 2\ H_2O_{(g)}$

For the reaction of ethylene represented above, ΔH is −1,323 kJ. What is the value of ΔH if the combustion produced liquid water $H_2O_{(l)}$, rather than water vapor $H_2O_{(g)}$?

(ΔH for the phase change $H_2O_{(g)} \rightarrow H_2O_{(l)}$ is −44 kJ mol^{-1}.)

(A) −1,235 kJ (B) −1,279 kJ (C) −1,323 kJ (D) −1,367 kJ (E) −1,411 kJ

25. $3\ C_2H_{2(g)} \rightarrow C_6H_{6(g)}$

What is the standard enthalpy change, $\Delta H°$, for the reaction represented above?
($\Delta H°_f$ of $C_2H_{2(g)}$ is 230 kJ mol^{-1} ; $\Delta H°_f$ of $C_6H_{6(g)}$ is 83 kJ mol^{-1})

(A) −607 kJ (B) −147 kJ (C) −19 kJ (D) + 19 kJ (E) +773 kJ

83. $NH_{3(g)} + 2\ CH_{4(g)} + 5/2\ O_{2(g)} \leftrightarrow H_2NCH_2COOH_{(s)} + 3\ H_2O_{(l)}$

At constant temperature, ΔH, the change in enthalpy for the reaction above is approximately equal to…

(A) $\Delta E - (11/2)RT$ (B) $\Delta E - (7/2)RT$ (C) $\Delta E + RT$ (D) $\Delta E + (7/2)RT$ (E) $\Delta E\ (11/2)RT$