

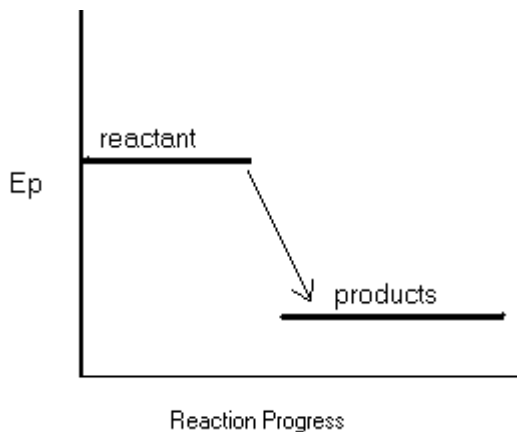
Enthalpy Test

SCH4U 05 - 06

Name: _____

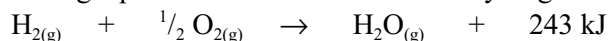
Multiple Choice (10)

1. Which statement concerning the accompanying diagram is true?



- ΔH is positive
- the system is endothermic
- the system releases heat to the surroundings
- the heat content of the reactants is less than the heat content of the products
- the enthalpy of the products is greater than the enthalpy of reactants

2. Consider the following equation for the combustion of hydrogen:



In order to produce 1215 kJ of heat, how many grams of H_2 must burn?

- 12.0 g
- 10.0 g
- 1.00 g
- 0.250 g
- 8.00 g

3. If 100 Joules of heat is added to 10.0 g samples of each of the metals below, initially at the same temperature, which metal will have the highest final temperature?

Metal	specific heat capacity($\text{J g}^{-1} \text{ } ^\circ\text{C}^{-1}$)
Copper	0.385
Cobalt	0.418
Silver	0.237
Gold	0.129

- A. Copper B. Cobalt C. Silver D. Gold

4. For the reaction: $\text{H}_2 + \text{F}_2 \longrightarrow 2\text{HF}$ $\Delta H = -542.2 \text{ kJ}$
Which of the following statements best accounts for this behavior?

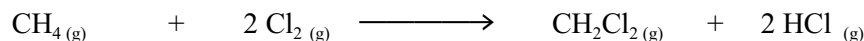
- The bonds in HF are stronger than those in H_2 and F_2 .
- HF is an ionic compound whereas H_2 and F_2 are covalent.
- More bonds are formed than broken.
- HF is unstable and can not exist.

- ## Multiple Choice Answers

2

In order to receive full credit, the method used and the steps involved in arriving at your answer must be shown clearly. It is possible to receive partial credit but, without your supporting work, you may receive little credit. You must pay particular attention to significant figures and to units.

1. Methane, $\text{CH}_4(\text{g})$, undergoes an explosive substitution reaction with chlorine gas, $\text{Cl}_2(\text{g})$, in the presence of ultra-violet light, a chain initiated by chlorine free radicals, according to:



a) Calculate the heat of this reaction, $\Delta H^\circ_{\text{rxn}}$, using the following data:

4

Substance	ΔH°_f (kJ mol ⁻¹)
$\text{CH}_4(\text{g})$	-74.9
$\text{CH}_2\text{Cl}_2(\text{g})$	-110.5
$\text{HCl}(\text{g})$	-92.5

b) State why the value for the ΔH°_f for Cl_2 is not given above.

1

c) Use the bond enthalpy values in Table 10 of the Data Book to calculate another value for the heat of this reaction, $\Delta H^\circ_{\text{rxn}}$.

4

Bond	ΔH° (kJ/mol)
C — H	412
Cl — Cl	242
C — Cl	338
H — Cl	431

d) Explain why the reaction is explosive in terms of bond energies of the products and the reactants.

2

e) Comment on the two values obtained for ΔH_{rxn}^0 in (a) and in (c) and explain which is the more reliable. 2

2. The combustion of isopropyl alcohol, $\text{C}_3\text{H}_8\text{O}_{(\text{l})}$, to form $\text{CO}_{2(\text{g})}$ and $\text{H}_2\text{O}_{(\text{l})}$ has $\Delta H_{\text{rxn}}^0 = -4011 \text{ kJ mol}^{-1}$, according to the following equation:



a. State the meaning of S^0 1

b. Using the Table of standard entropies, calculate the value of ΔS^0 for the above reaction at 25°C . 4

c. Explain the significance of the sign of the ΔS^0 obtained in (b) above. 1

d. In the following equation: $\Delta G^0 = \Delta H^0 - T\Delta S^0$, temperature is represented by T:
(i) give the meaning of the term ΔG^0 in the above equation. 1

(ii) Using the value of ΔH_{rxn}^0 given above and the ΔS^0 obtained in (b) above, determine if the above reaction is spontaneous or non-spontaneous at 25°C . 4

(iii) Calculate the temperature in $^\circ\text{C}$, at which the above reaction is spontaneous. 3