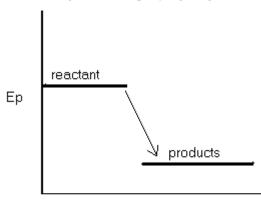
SCH4U 05 - 06

Name:

Multiple Choice (10)

1. Which statement concerning the accompanying diagram is true?





Reaction Progress

- a. AH is positive
- b. the system is endothermic
- c. the system releases heat to the surroundings
- d. the heat content of the reactants is less than the heat content of the products
- e. the enthalpy of the products is greater than the enthalpy of reactants
- 2. Consider the following equation for the combustion of hydrogen:

$$H_{2(g)}$$
 + $^{1}/_{2}O_{2(g)}$ \rightarrow $H_{2}O_{(g)}$ + 243 kg

In order to produce 1215 kJ of heat, how many grams of H₂ must burn?

a. 12.0 g

d. 0.250 g

b. 10.0 g

e. 8.00 g

- c. 1.00 g
- 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(J g ^{-1 o} C ⁻¹)
Copper	0.385
Cobalt	0.418
Silver	0.237
Gold	0.129

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

- For the reaction: $H_2 + F_2 \longrightarrow 2HF$
- $\Delta H = -542.2 \text{ kJ}$

Which of the following statements best accounts for this behavior?

- A. The bonds in HF are stronger than those in H_2 and F_2 .
- B. HF is an ionic compound whereas H₂ and F₂ are covalent.
- C. More bonds are formed than broken.
- D. HF is unstable and can not exist.

5.	Which equation	represents the bond	l enthalpy for the	H—F bond?
	1	1	1 2	

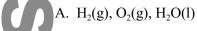
A.
$$HF(g) -> H(g) + F(g)$$

B.
$$HF(g) \longrightarrow 1/2H_2(g) + 1/2F_2(g)$$

C.
$$HF(aq) \rightarrow H^+(aq) + F(aq)$$

D.
$$HF(g) \longrightarrow H^{+}(g) + F^{-}(g)$$

6. When the substances $H_2(g)$, $O_2(g)$, $H_2O(l)$ are arranged in order of increasing entropy values at 25°C, what is the correct order?



B.
$$H_2(g)$$
, $H_2O(1)$, $O_2(g)$

C.
$$O_2(g)$$
, $H_2(g)$, $H_2O(1)$

D.
$$H_2O(1)$$
, $H_2(g)$, $O_2(g)$

Assuming ΔH and ΔS do not vary greatly with temperature, a reaction that is **NOT** spontaneous at low temperatures can become spontaneous at high temperatures **IF** ΔH is _____ and ΔS is _____

8. The signs of ΔH and ΔS for the process, $I_{2^{(g)}} \longrightarrow I_{2^{(g)}}$ are respectively:

A. positive and positive and the reaction is endothermic

- B. positive and positive and the reaction is exothermic
- C. positive and negative and the reaction is exothermic
- D. positive and negative and the reaction is endothermic

9. A large negative ΔG guarantees:

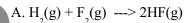
A. a fast reaction

B. a spontaneous reaction

C. a reaction that requires an input of large energy

D. a reaction that is slow and non-spontaneous

Which one of the following processes would be expected to have a value of ΔS° closest to zero?



B.
$$C_2H_4(g) + HBr(g) ---> C_2H_5Br(g)$$

C.
$$CO_2(g) \longrightarrow CO(g) + \frac{1}{2}O_2(g)$$

D.
$$2NO_{2}(g) ---> 2NO(g) + O_{2}(g)$$

Multiple Choice Answers

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, $CH_{4 (g)}$, undergoes an explosive substitution reaction with chlorine gas, $Cl_{2 (g)}$, in the presence of ultra-violet light, a chain initiated by chlorine free radicals, according to:

$$CH_{4(g)}$$
 + $2 Cl_{2(g)}$ \longrightarrow $CH_2Cl_{2(g)}$ + $2 HCl_{(g)}$

a) Calculate the heat of this reaction, ΔH^0_{rxn} , using the following data:

S
0
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Substance	ΔH ⁰ _f (kJ mo
$CH_{4(g)}$	-74.9
$CH_2Cl_{2(g)}$	-110.5
HCl _(g)	-92.5

b) State why the value for the $\Delta H^0_{\ f}$ for Cl_2 is not given above.



c) Use the bond enthalpy values in Table 10 of the Data Book to calculate another value for the heat of this reaction, ΔH^0_{rxn} .



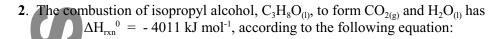
Bond	ΔH^0 (kJ/mol)
C — H	412
Cl — Cl	242
C — C1	338
H — Cl	431

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

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



$$C_3H_8O_{(l)} + 9/2 O_{2(g)} \longrightarrow 3 CO_{2(g)} + 4 H_2O_{(l)} \Delta H_{rxn}^{0} = -4011 \text{ kJ mol}^{-1}$$

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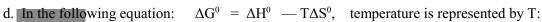
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a. State the meaning of S⁰

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.



(i) give the meaning of the term ΔG^0 in the above equation.

(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.



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