Name _____ Honors Chemistry ___/___/___

Multiple Choice Review Problems

Solve each of the following. Circle the correct answer and write the letter on the line.

1._____ For which of these is ΔH_f° not equal to zero?
(A) $Br_2(l)$ (B) $Fe(s)$ (C) $I_2(s)$ (D) $O_3(g)$

2. _____ The enthalpy change for which reaction represents the standard enthalpy of formation for hydrogen cyanide, HCN?
(A) $H(g) + C(graphite) + N(g) \rightarrow HCN(g)$ (B) $\frac{1}{2}H_2(g) + C(graphite) + \frac{1}{2}N_2(g) \rightarrow HCN(g)$
(C) $HCN(g) \rightarrow \frac{1}{2}H_2(g) + C(graphite) + \frac{1}{2}N_2(g)$ (D) $H_2(g) + 2C(graphite) + N_2(g) \rightarrow 2HCN(g)$

3. _____ What is the standard enthalpy of formation of $MgO(s)$ if 300.9 kJ is evolved when 20.15 g of $MgO(s)$ is formed by the combustion of magnesium under standard conditions?
(A) $-601.8\ kJ\cdot mol^{-1}$ (B) $-300.9\ kJ\cdot mol^{-1}$ (C) $+300.9\ kJ\cdot mol^{-1}$ (D) $+601.8\ kJ\cdot mol^{-1}$

4. _____ Which change occurs with the largest increase in entropy at 25˚C?
(A) $Br_2(l) \rightarrow Br_2(g)$ (B) $C(graphite) \rightarrow C(diamond)$
(C) $H_2O(s) \rightarrow H_2O(l)$ (D) $HCl(g) + H_2O(l) \rightarrow H_3O^+(aq) + Cl^-(aq)$

5. _____ What are the signs of ΔH° and ΔS° for a reaction that is spontaneous at all temperatures?

	ΔH°	ΔS°
(A)	+	+
(B)	+	–
(C)	–	+
(D)	–	–

6. _____ For the formation of one mole of each of these gases from their elements, which reaction is most endothermic?
(A) CO ($\Delta H_f^\circ = -110.5\ kJ\cdot mol^{-1}$) (B) NO_2 ($\Delta H_f^\circ = +33.9\ kJ\cdot mol^{-1}$)
(C) O_3 ($\Delta H_f^\circ = +142.2\ kJ\cdot mol^{-1}$) (D) SO_2 ($\Delta H_f^\circ = -300.4\ kJ\cdot mol^{-1}$)

7. _____ $4Li(s) + O_2(g) \rightarrow 2Li_2O(s)$
At 25°C, ΔH° for this reaction is –598.8 kilojoules per mole of $Li_2O(s)$ formed. What mass of Li should be reacted with excess $O_2(g)$ in order to release 150. kJ?
(A) 0.874 g (B) 1.74 g (C) 3.48 g (D) 6.98 g

8. _____ When these substances are arranged in order of increasing S° values at 25 °C, what is the correct order?
(A) $Na(s)$, $Cl_2(g)$, $NaCl(s)$ (B) $NaCl(s)$, $Cl_2(g)$, $Na(s)$
(C) $Cl_2(g)$, $NaCl(s)$, $Na(s)$ (D) $Na(s)$, $NaCl(s)$, $Cl_2(g)$

9. _____ $2NOCl(g) \rightarrow 2NO(g) + Cl_2(g)$ $\Delta H = 38$ kJ
If the activation energy for the forward reaction is 62 kJ, what is the activation energy for the reverse reaction?
(A) 24 kJ (B) 38 kJ (C) 62 kJ (D) 100 kJ (E) -24 kJ

10. _____ Which reaction occurs with an increase in entropy?
(A) $2C(s) + O_2(g) \rightarrow 2CO(g)$ (B) $2H_2S(g) + SO_2(g) \rightarrow 3S(s) + 2H_2O(g)$
(C) $4Fe(s) + 3O_2(g) \rightarrow 2Fe_2O_3(s)$ (D) $CO(g) + 2H_2(g) \rightarrow CH_3OH(l)$

11. _____ Consider this reaction. $2N_2H_4(l) + N_2O_4(l) \rightarrow 3N_2(g) + 4H_2O(g)$ $\Delta H = -1078$ kJ
How much energy is released by this reaction during the formation of 140. g of $N_2(g)$?
(A) 1078 kJ (B) 1797 kJ (C) 3234 kJ (D) 5390 kJ

12. _____ For the reaction $PCl_3(g) + Cl_2(g) \rightarrow PCl_5(g)$, $\Delta H° = -86$ kJ.
Under what temperatures is this reaction expected to be spontaneous?
(A) no temperatures (B) high temperatures only
(C) all temperatures (D) low temperatures only

13. _____ Use the information in the table to calculate the enthalpy of this reaction.
$C_2H_6(g) + 7/2\ O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$

Reaction	$\Delta H_f°$, kJ·mol^{-1}
$2C(s) + 3H_2(g) \rightarrow C_2H_6(g)$	–84.7
$C(s) + O_2(g) \rightarrow CO_2(g)$	–393.5
$H_2(g) + ½O_2(g) \rightarrow H_2O(l)$	–285.8

(A) –764 kJ (B) –1560 kJ (C) –1664 kJ (D) –3120 kJ

14. _____ Given the thermochemical equations:
$Br_2(l) + F_2(g) \rightarrow 2BrF(g)$ $\Delta H° = -188$ kJ
$Br_2(l) + 3F_2(g) \rightarrow 2BrF_3(g)$ $\Delta H° = -768$ kJ
determine $\Delta H°$ for the reaction
$BrF(g) + F_2(g) \rightarrow BrF_3(g)$ $\Delta H° = ?$
(A) -956 kJ (B) -580 kJ (C) -478 kJ (D) -290 kJ

15. _____ The evaporation of any liquid is expected to have:
(A) a positive ΔH and a negative ΔS (B) a negative ΔH and a negative ΔS
(C) a positive ΔH and a positive ΔS (D) a negative ΔH and a positive ΔS
(E) These predictions cannot be made

16. _____ Which reaction occurs with a decrease in entropy?
(A) $N_2(g) + O_2(g) \rightarrow 2NO(g)$ (B) $N_2O_4(g) \rightarrow 2NO_2(g)$
(C) $2CO(g) \rightarrow C(s) + CO_2(g)$ (D) $2HCl(aq) + Ag_2CO_3(s) \rightarrow 2AgCl(s) + CO_2(g) + H_2O(l)$

17. _____ The enthalpy change of which reaction corresponds to $\Delta H_f°$ for $Na_2CO_3(s)$ at 298 K?
(A) $2Na(s) + C(s) + 3/2\ O_2(g) \rightarrow Na_2CO_3(s)$ (B) $Na_2O(s) + CO_2(g) \rightarrow Na_2CO_3(s)$
(C) $2Na^+(aq) + CO_3^{2-}(aq) \rightarrow Na_2CO_3(s)$ (D) $2Na^+(aq) + 2OH^-(aq) + CO_2(aq) \rightarrow Na_2CO_3(s) + H_2O$

18. _____ Which applies to any endothermic reaction?
(A) $\Delta H < 0$ (B) $\Delta H > 0$ (C) $\Delta G < 0$ (D) $\Delta G > 0$

19. _____ Which reaction occurs with the greatest increase in entropy?
(A) $2H_2O(l) \rightarrow 2H_2(g) + O_2(g)$ (B) $2NO(g) \rightarrow N_2(g) + O_2(g)$
(C) $C(s) + O_2(g) \rightarrow CO_2(g)$ (D) $Br_2(g) + Cl_2(g) \rightarrow 2BrCl(g)$

20. _____ When a catalyst is added to the system represented by this energy-reaction coordinate diagram, which dimensions in the diagram are changed?
(A) 1 and 2 only (B) 1 and 3 only
(C) 2 and 3 only (D) 1, 2, 3