CHM151 Quiz 7B 25 Pts Fall 2019 Name: Key

SHOW ALL WORK TO RECEIVE CREDIT.

1. Which of the following has a standard enthalpy of formation value of zero at 25°C?
   A) $O_2(s)$
   B) $O(g)$
   C) $O_2(g)$
   D) $O_3(g)$
   E) $O_2(l)$

2. Given:

① $N_2(g) + \frac{3}{2}O_2(g) \rightarrow N_2O_3(s)$; $\Delta H = 83.7$ kJ
② $N_2(g) + O_2(g) \rightarrow 2NO(g)$; $\Delta H = 180.4$ kJ
③ $\frac{1}{2}N_2(g) + O_2(g) \rightarrow NO_2(g)$; $\Delta H = 33.2$ kJ

what is ΔH for the following reaction?
$N_2O_3(g) \rightarrow NO(g) + NO_2(g)$

① reversed $N_2O_3(g) \rightarrow N_2(g) + \frac{3}{2}O_2(g)$
② ÷ 2 $\frac{1}{2}N_2(g) + \frac{1}{2}O_2(g) \rightarrow NO(g)$
③ as is $\frac{1}{2}N_2(g) + O_2(g) \rightarrow NO_2(g)$

$N_2O_3(g) \rightarrow NO(g) + NO_2(g)$

ΔH (kJ)
−83.7
90.2
33.2

$\Delta H = 39.7$ kJ

3. Consider the following metals.

Metal	Specific Heat
copper	0.385 J/(g · °C)
magnesium	1.02 J/(g · °C)
mercury	0.138 J/(g · °C)
silver	0.237 J/(g · °C)
lead	0.129 J/(g · °C)

Lowest specific heat.

If the same amount of heat is added to 25.0 g of each of the metals, which are all at the same initial temperature, which metal will have the highest final temperature?

4. What is $\Delta H°$ of the following reaction?
$CO_2(g) + 2CH_4(g) \rightarrow C_3H_8(g) + O_2(g)$

Substance	$\Delta H°_f$ (kJ/mol)
$CO_2(g)$	−393.5
$CH_4(g)$	−74.9
$C_3H_8(g)$	−104.7

$\Delta H_{rxn} = \sum n\Delta H_{prod.} - \sum n\Delta H_{react.}$

$[(-104.7) + (0)] - [(-393.5) + 2(-74.9)]$

438.6 kJ

Key

5. What is the change in enthalpy at 25°C and 1 atm for the reaction of 2.0 mol of iron(II) oxide with excess oxygen gas?
$6FeO(s) + O_2(g) \rightarrow 2Fe_3O_4(s)$; $\Delta H° = -610$ kJ

$\frac{2.0 \text{ mol FeO}}{6 \text{ mol FeO}} \left| \frac{-610 \text{ kJ}}{} \right. = -203 \text{ kJ}$

6. Using the following data, calculate the standard enthalpy of reaction for the coal gasification process $2C(s) + 2H_2O(g) \rightarrow CH_4(g) + CO_2(g)$.

2 x #(1) $C(s) + H_2O(g) \rightarrow CO(g) + H_2(g)$; $\Delta H° = +131.3$ kJ
as is (2) $CO(g) + H_2O(g) \rightarrow CO_2(g) + H_2(g)$; $\Delta H° = -41.2$ kJ
as is $CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$; $\Delta H° = -206.1$ kJ

ΔH

x2 $2C(s) + 2H_2O(g) \rightarrow 2CO(g) + 2H_2(g)$ +262.6 kJ
$CO(g) + H_2O(g) \rightarrow CO_2(g) + H_2(g)$ −41.2 kJ
$CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$ −206.1 kJ

$2C(s) + 2H_2O(g) \rightarrow CH_4(g) + CO_2(g)$ +15.3 kJ

7. Which of the following reactions corresponds to the thermochemical equation for the standard enthalpy of formation of solid lead (II) nitrate?
A) $Pb^{2+}(aq) + 2NO_3^-(aq) \rightarrow Pb(NO_3)_2(s)$
B) $Pb(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(s) + H_2(g)$
C) $Pb(OH)_2(s) + 2HNO_3(aq) \rightarrow Pb(NO_3)_2(s) + 2H_2O(l)$
D) $Pb(s) + 2N(g) + 6O(g) \rightarrow Pb(NO_3)_2(s)$
E) $Pb(s) + N_2(g) + 3O_2(g) \rightarrow Pb(NO_3)_2(s)$

8. Given the thermochemical equation
(1) $2Al(s) + \frac{3}{2} O_2(g) \rightarrow Al_2O_3(s)$ $\Delta H = -1676$ kJ
find ΔH for the following reaction.
(2) $2Al_2O_3(s) \rightarrow 4Al(s) + 3O_2(g)$

#2 is #1 reversed and doubled.
So $\Delta H = 2(+1676) =$ 3352 kJ