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**Include file name:** Chemistry\_Worksheet\_0074

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1.

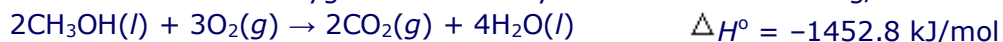
Consider the following processes used to produce energy. Which does *not* predominantly use potential energy?

**Student Response**

1. Fossil fuel plant
2. Burning natural gas
3. Hydroelectric power plant
4. Nuclear power plant
5. Windmills on wind farms

2.

How much heat is liberated at constant pressure when 19.9 mL of liquid methanol (CH<sub>3</sub>OH) combusts in excess oxygen? The density of methanol is 0.791 g/mL.



**Student Response**

1.  $7.14 \times 10^2$  kJ
2.  $2.91 \times 10^3$  kJ
3.  $1.45 \times 10^3$  kJ
4.  $7.26 \times 10^2$  kJ
5.  $3.57 \times 10^2$  kJ

3.

For the following *unbalanced* reaction, when the  $\Delta_r H^\circ$  value is calculated using only  $\Delta_f H^\circ$  values, which of the following would correctly represent the term used for the  $\Delta_f H^\circ$  of N<sub>2</sub>O(g) which would be substituted into the  $\Delta_r H^\circ$  summation equation?



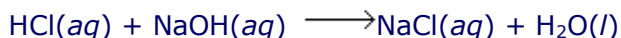
**Student Response**

1.  $\Delta_f H^\circ_{\text{N}_2\text{O}}$
2.  $-3 \Delta_f H^\circ_{\text{N}_2\text{O}}$
3.  $\frac{1}{3} \Delta_f H^\circ_{\text{N}_2\text{O}}$
4.  $-\Delta_f H^\circ_{\text{N}_2\text{O}}$
5.  $3 \Delta_f H^\circ_{\text{N}_2\text{O}}$

4.

When 0.0500 mol of HCl is reacted with 0.0500 mol of NaOH in 50.0 mL of water, the

temperature of the water increases by 13.7°C. Calculate the heat of the reaction for the following thermochemical equation:



Assume that the heat capacity of the system is 209.2 J/°C.

**Student Response**

1. +57,300 J/mol
2. -57,300 J/mol
3. -2870 J/mol
4. + 2870 J/mol
5. +115,000 J/mol

**5.**

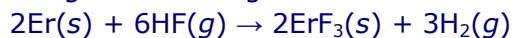
What is the *molar* heat of combustion of benzene, C<sub>6</sub>H<sub>6</sub>, if combustion of 1.00 g of benzene causes a temperature rise of 5.18°C in a bomb calorimeter that has a heat capacity of 8.07 kJ/°C? (Molar mass C<sub>6</sub>H<sub>6</sub> = 78.1.)

**Student Response**

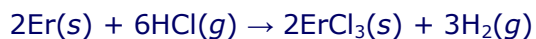
1. -3,260 kJ/mol
2. -41,800 kJ/mol
3. -41.8 kJ/mol
4. -4,180 kJ/mol
5. -48,700 kJ/mol

**6.**

Using the following thermochemical data,



$$\Delta H^\circ = -1795.4 \text{ kJ/mol}$$



$$\Delta H^\circ = -1443.6 \text{ kJ/mol}$$

calculate  $\Delta H^\circ$  for the following reaction.



**Student Response**

1. 703.6 kJ/mol
2. -1619.5 kJ/mol
3. 351.8 kJ/mol
4. -3239.0 kJ/mol
5. 175.9 kJ/mol

**7.**

In a calorimetry experiment, 0.0157 g of calcium metal are added to 42.8 mL of 0.706 M hydrochloric acid, initially at 22.78°C, in an insulated container. The temperature of the solution rises to 23.97°C. What is  $\Delta H^\circ$  for the following reaction? Assume the density and specific heat of the acid solution are the same as those of water, 1.00 g/mL and 4.184 J g<sup>-1</sup> °C<sup>-1</sup> respectively, and neglect the heat capacity of the container.



**Student Response**

1. -70.9 kJ/mol
2. -14.1 kJ/mol
3. -6.95 kJ/mol
4. -543 kJ/mol
5. 213 kJ/mol

8.

Which substance has a heat of formation equal to zero at 25°C and 1 atm?

**Student Response**

1. Br<sub>2</sub>(l)
2. Br<sub>2</sub>(g)
3. C<sub>2</sub>H<sub>6</sub>(g)
4. Br<sub>2</sub>(s)
5. C<sub>2</sub>H<sub>6</sub>(l)

9.

Which of the following equations represents the equation for the  $\Delta_f H^\circ$  for N, N-diethyl-m-toluamide, C<sub>12</sub>H<sub>17</sub>NO(l), the active ingredient in some insect repellents?

**Student Response**

1.  $12\text{C}(g) + 17\text{H}(g) + \text{N}(g) + \text{O}(g) \longrightarrow \text{C}_{12}\text{H}_{17}\text{NO}(l)$
2.  $12\text{C}(g) + 17\text{H}(g) + \text{N}(g) + \text{O}(g) \longrightarrow \text{C}_{12}\text{H}_{17}\text{NO}(g)$
3.  $12\text{C}(s) + \frac{17}{2}\text{H}_2(g) + \frac{1}{2}\text{N}_2(g) + \frac{1}{2}\text{O}_2(g) \longrightarrow \text{C}_{12}\text{H}_{17}\text{NO}(l)$
4.  $12\text{C}(l) + 17\text{H}(l) + \text{N}(l) + \text{O}(l) \longrightarrow \text{C}_{12}\text{H}_{17}\text{NO}(l)$
5.  $12\text{C}(s) + 17\text{H}(g) + \text{N}(g) + \text{O}(g) \longrightarrow \text{C}_{12}\text{H}_{17}\text{NO}(l)$

10.

To determine if an enthalpy value can be designated as  $\Delta H^\circ$ , which of the following parameters need *not* be set at a standard value?

**Student Response**

1. Temperature
2. Physical states
3. Concentration of solutions
4. Pressure
5. All of the above have set values.

11.

All of the following have a standard enthalpy of formation value of zero at 25°C and 1.00 atm *except*

**Student Response**

1. C(s).
2. CO(g).
3. Ne(g).
4. F<sub>2</sub>(g).
5. Fe(s).

**12.**

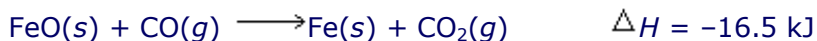
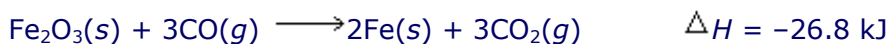
What would be the kinetic energy of a 1.75-ton car moving at exactly 70 mph?

**Student Response**

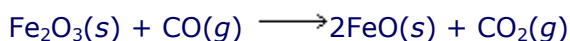
1.  $8.75 \times 10^3$  J
2.  $5.46 \times 10^1$  J
3.  $4.97 \times 10^4$  J
4.  $7.77 \times 10^6$  J
5.  $1.56 \times 10^6$  J

**13.**

The following two reactions are known:



Determine the  $\Delta H$  value for the reaction below.



**Student Response**

1. 6.2 kJ
2. 10.3 kJ
3. -10.3 kJ
4. -43.3 kJ
5. 22.7 kJ

**14.**

How much heat is gained by nickel when 500 g of nickel is warmed from 22.4 to 58.4°C?  
[The specific heat of nickel is 0.444 J/(g · °C).]

**Student Response**

1. 8000 J
2. 10,000 J
3. 4000 J
4. 2000 J
5. 6000 J

**15.**

Which answer lists all of the following responses that are endothermic and none that are exothermic?

1. boiling water
2. freezing water
3. condensation of steam
4. melting ice

**Student Response**

- A. 1 and 4 only
- B. 1 and 2 only
- C. 2 and 3 only
- D. 1, 2, and 3 only
- E. 2 and 4 only

**16.**

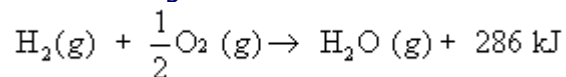
The kinetic energy of a 2.50 kg ball rolling down a hill at 0.500 m/s would be

**Student Response**

1. 5.00 J.
2. 0.625 J.
3. 1.25 J.
4. 0.313 J.
5. 0.200 J.

**17.**

Consider the reaction given below:



Which of the following is *true* for this reaction?

**Student Response**

1. The reactants have lower energy than the product.
2. The temperature of the system would decrease as the reaction proceeds.
3. The reaction is classified as endothermic.
4.  $\Delta H$  would be negative.
5. The reaction absorbs energy.

**18.**

What is the enthalpy change when 7.54 g of TiO(s) reacts with excess liquid bromine?



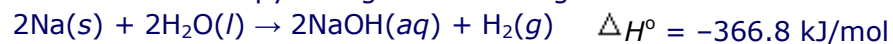
**Student Response**

1. 471 kJ
2. 27.8 kJ
3. 13.9 kJ
4. 1770 kJ

5. 887 kJ

**19.**

What is the enthalpy change when 83.1 g of sodium metal reacts with excess water?



**Student  
Response**

1. -1330 kJ
2. -183 kJ
3. 183 kJ
4. -663 kJ
5. 663 kJ

**20.**

The specific heat of iron is  $0.449 \text{ J g}^{-1} \text{ }^\circ\text{C}^{-1}$ . What is its molar heat capacity?

**Student Response**

1.  $25.1 \text{ J mol}^{-1} \text{ }^\circ\text{C}^{-1}$
2.  $4.18 \text{ J mol}^{-1} \text{ }^\circ\text{C}^{-1}$
3.  $0.00804 \text{ J mol}^{-1} \text{ }^\circ\text{C}^{-1}$
4.  $124 \text{ J mol}^{-1} \text{ }^\circ\text{C}^{-1}$
5.  $0.0399 \text{ J mol}^{-1} \text{ }^\circ\text{C}^{-1}$