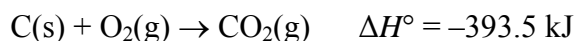


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Multiple-Choice Questions

Circle the letter for the choice that best completes the statement or answers the question.

- Which of the following is true regarding the standard enthalpy of reaction?
 - It is the enthalpy change of a chemical reaction at 0 °C and 100 kPa.
 - It is the enthalpy change of a chemical reaction at 0 °C and 0 kPa.
 - It is the enthalpy change of a chemical reaction at 25 °C and 100 kPa.
 - It is the enthalpy change of a chemical reaction at 100 °C and 25 kPa.
- To determine the enthalpy change of a reaction, you can
 - carry out a calorimetry lab
 - find reactions that have equations that add up to the target equation and use the enthalpies of reaction of those reactions
 - use the standard molar enthalpies of formation for the substances in the equation of the reaction
 - All of the above.
- According to Hess's law of heat summation, which of the following statements is true?
 - The enthalpy change is independent of the number of intermediate steps.
 - The enthalpy change depends on the pathway of the process.
 - The enthalpy change is independent of the pathway of the process.
 - Both A and C.
- A sample of natural gas consists of 5.0 mol methane and 1.0 mol ethane. Which of the following statements is **true**?
 - When ethane burns, it releases more heat per mole than methane.
 - When ethane burns, it uses less oxygen per mole than methane.
 - When burned, the heat released per mole of mixture will be equivalent to that of methane.
 - When burned, the heat released per mole of mixture will be less than that of methane, but more than that of ethane.
- Which is true about the following reaction?



- The enthalpy change is greater than the total enthalpy change of the formation of carbon dioxide via the following process:



- The enthalpy change is the same as the total enthalpy change of the formation of carbon dioxide via the following process:



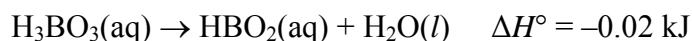
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- c) The enthalpy change is less than the total enthalpy change of the formation of carbon dioxide via the following process:



- d) There is not enough information to compare the enthalpy changes.

6. Given the target equation $2\text{H}_3\text{BO}_3(\text{aq}) \rightarrow \text{B}_2\text{O}_3(\text{s}) + 3\text{H}_2\text{O}(\text{l})$ and the following equations:



the enthalpy change of reaction for the target equation is:

- a) -28.8 kJ
 - b) -14.4 kJ
 - c) 14.4 kJ
 - d) 28.8 kJ
7. The enthalpy of reaction for the following equation, $\text{FeO(s)} + \text{CO(g)} \rightarrow \text{Fe(s)} + \text{CO}_2(\text{g})$, is:
- a) 776 kJ
 - b) -776 kJ
 - c) 11.0 kJ
 - d) -11.0 kJ
8. What is the principal source of electricity in Alberta?
- a) coal
 - b) natural gas
 - c) hydroelectric power
 - d) nuclear energy
9. Which of the following is a renewable resource?
- a) uranium
 - b) natural gas
 - c) biomass
 - d) coal
10. Which of the following is **not** one of the major energy sources in Canada today?
- a) coal
 - b) oil
 - c) solar energy
 - d) natural gas

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11. Which of the following uses the greatest amount of energy in the typical household?
- space heating
 - water heating
 - electrical appliances
 - lighting
12. What is the definition of “useful energy”?
- the ideal energy content of fuel
 - the amount of energy a fuel can produce
 - energy that is used to maintain and build power plants
 - energy that is delivered to a consumer in usable form
13. An electric kettle uses 860 kJ of electrical energy to heat 1600 g of water from 18 °C to 98 °C. What is the efficiency of the kettle for heating water?
- 0.624%
 - 160%
 - 1.60%
 - 62.4%
14. Which of the following uses of natural gas is the most efficient?
- used directly, such as in cooking devices
 - used to produce electricity in a power plant
 - transformed into another form of energy before reaching its final destination
 - as part of a chain of transformations between several different forms of energy
15. Which of the following methods for producing electrical energy is considered to be the cleanest?
- natural gas
 - hydroelectric
 - crude oil
 - propane

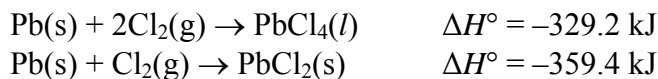
Numerical Response Questions

For each numerical response question, record the answer in the following response box.

16.
17.
18.
19.
20.

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16. What is the enthalpy change for the reaction $\text{PbCl}_2(\text{s}) + \text{Cl}_2(\text{g}) \rightarrow \text{PbCl}_4(\text{l})$, given

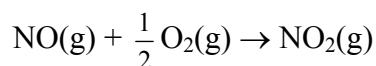


17. Rank the following compounds from most to least thermochemically stable.

- a) $\text{CO}_2(\text{g})$
- b) $\text{NaCl}(\text{s})$
- c) $\text{C}_2\text{H}_2(\text{g})$
- d) $\text{O}_2(\text{g})$

18. Given that the molar enthalpy of combustion for propan-1-ol, $\text{C}_3\text{H}_7\text{OH}(\text{l})$, is -2021 kJ/mol , what is the molar enthalpy of formation for propan-1-ol? (Assume that the water in the products condenses into its liquid state.)

19. How much energy is released in the production of 2.37 g of nitrogen dioxide according to the following equation?



20. A propane stove is 25.0% efficient. Given that the molar enthalpy of combustion of propane is -2043.9 kJ/mol in an open system, how much water could be heated by 50.0°C by the combustion of 0.0235 g of propane?

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Written Response Questions

Answer each question in the space provided. Use complete sentences and diagrams when necessary.

21. Alcohol burners are commonly used in high-school chemistry laboratories.

- a) Using standard molar enthalpies of formation, determine the molar enthalpy of combustion for methanol in an open system.

- b) Determine the efficiency of a methanol burner given the following laboratory data.

Initial mass of methanol burner	127.35 g
Final mass of methanol burner	125.28 g
Mass of aluminium can	47.35 g
Mass of aluminium can and water	193.23 g
Initial temperature of water	22.5 °C
Final temperature of water	31.3 °C

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c) What happened to the “wasted” energy?
