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| 1. A gas absorbs 0.0 J of heat and then performs 15.8 J of work. The change in internal energy of the gas is   |  |  |  | | --- | --- | --- | |  | a. | 31.6 J | |  | b. | 15.8 J | |  | c. | –31.6 J | |  | d. | –15.8 J | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 2. What is the kinetic energy of a 2.57-kg object moving at 92.5 km/hr?   |  |  |  | | --- | --- | --- | |  | a. | 8.48 × 102 kJ | |  | b. | 1.10 × 104 kJ | |  | c. | 8.48 × 10–4 kJ | |  | d. | 1.70 × 103 kJ | |  | e. | 3.30 × 101 kJ |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | kinetic energy | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 3. Which of the following statements correctly describes the signs of *q* and *w* for the following exothermic process at *P* = 1 atm and *T* = 370 K?                H2O(*g*) → H2O(*l*)   |  |  |  | | --- | --- | --- | |  | a. | *q* and *w* are negative. | |  | b. | *q* is positive, *w* is negative. | |  | c. | *q* is negative, *w* is positive. | |  | d. | *q* and *w* are both positive. | |  | e. | *q* and *w* are both zero. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 4. For a particular process *q* = 20 kJ and *w* = 15 kJ. Which of the following statements is true?   |  |  |  | | --- | --- | --- | |  | a. | Heat flows from the system to the surroundings. | |  | b. | The system does work on the surroundings. | |  | c. | Δ*E* = 35 kJ | |  | d. | All of the above are true. | |  | e. | None of the above are true. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 5. Which of the following statements is correct?   |  |  |  | | --- | --- | --- | |  | a. | The internal energy of a system increases when more work is done by the system than heat was flowing into the system. | |  | b. | The internal energy of a system decreases when work is done on the system and heat is flowing into the system. | |  | c. | The system does work on the surroundings when an ideal gas expands against a constant external pressure. | |  | d. | All statements are true. | |  | e. | All statements are false. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 6. For a particular process *q* = –17 kJ and *w* = 21 kJ. Which of the following statements is *false*?   |  |  |  | | --- | --- | --- | |  | a. | Heat flows from the system to the surroundings. | |  | b. | The system does work on the surroundings. | |  | c. | Δ*E* = +4 kJ | |  | d. | The process is exothermic. | |  | e. | None of the above is false. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 7. One mole of an ideal gas is expanded from a volume of 1.00 liter to a volume of 3.23 liters against a constant external pressure of 1.00 atm. How much work (in joules) is performed on the surroundings? Ignore significant figures for this problem. (T = 300 K; 1 L·atm = 101.3 J)   |  |  |  | | --- | --- | --- | |  | a. | 113 J | |  | b. | 226 J | |  | c. | 6.78 × 102 J | |  | d. | 327 J | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 8. Calculate the work for the expansion of CO2 from 1.0 to 2.2 liters against a pressure of 1.0 atm at constant temperature.   |  |  |  | | --- | --- | --- | |  | a. | 1.2 L·atm | |  | b. | 2.2 L·atm | |  | c. | 0 L·atm | |  | d. | –1.2 L·atm | |  | e. | –2.2 L·atm |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 9. A fuel-air mixture is placed in a cylinder fitted with a piston. The original volume is 0.345-L. When the mixture is ignited, gases are produced and 885 J of energy is released. To what volume will the gases expand against a constant pressure of 635 mmHg, if all the energy released is converted to work to push the piston?   |  |  |  | | --- | --- | --- | |  | a. | 10.1 L | |  | b. | 7.64 L | |  | c. | 10.7 L | |  | d. | 10.4 L | |  | e. | 1.74 L |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 10. Which statement is *true* of a process in which one mole of a gas is expanded from state A to state B?   |  |  |  | | --- | --- | --- | |  | a. | When the gas expands from state A to state B, the surroundings are doing work on the system. | |  | b. | The amount of work done in the process must be the same, regardless of the path. | |  | c. | It is not possible to have more than one path for a change of state. | |  | d. | The final volume of the gas will depend on the path taken. | |  | e. | The amount of heat released in the process will depend on the path taken. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 11. Calculate the work associated with the expansion of a gas from 42.0 L to 79.0 L at a constant pressure of 14.0 atm.   |  |  |  | | --- | --- | --- | |  | a. | 518 L·atm | |  | b. | –518 L·atm | |  | c. | –1.11 × 103 L·atm | |  | d. | 588 L·atm | |  | e. | 1.11 × 103 L·atm |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 12. Calculate the work associated with the compression of a gas from 121.0 L to 80.0 L at a constant pressure of 23.4 atm.   |  |  |  | | --- | --- | --- | |  | a. | –959 L atm | |  | b. | 959 L atm | |  | c. | 1.75 L atm | |  | d. | –1.75 L atm | |  | e. | 101 L atm |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 13. According to the first law of thermodynamics, the energy of the universe is constant. Does this mean that Δ*E* is always equal to zero?   |  |  |  | | --- | --- | --- | |  | a. | Yes, Δ*E* = 0 at all times, which is why *q* = -*w*. | |  | b. | No, Δ*E* does not always equal zero, but this is only due to factors like friction and heat. | |  | c. | No, Δ*E* does not always equal zero because it refers to the system's internal energy, which is affected by heat and work. | |  | d. | No, Δ*E* never equals zero because work is always being done on the system or by the system. | |  | e. | No, Δ*E* never equals zero because energy is always flowing between the system and surroundings. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| Consider a gas in a 1.0 L bulb at STP that is connected via a valve to another bulb that is initially evacuated. Answer the following concerning what occurs when the valve between the two bulbs is opened. |

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| 14. What is true about the value of *q*?   |  |  |  | | --- | --- | --- | |  | a. | It is greater than zero. | |  | b. | It is equal to zero. | |  | c. | It is less than zero. | |  | d. | More information is needed. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 6-1 | | *KEYWORDS:* | Chemistry | enthalpy | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 15. What is true about the value of *w*?   |  |  |  | | --- | --- | --- | |  | a. | It is greater than zero. | |  | b. | It is equal to zero. | |  | c. | It is less than zero. | |  | d. | More information is needed. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 6-1 | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 16. What is true about the value of Δ*E*?   |  |  |  | | --- | --- | --- | |  | a. | It is greater than zero. | |  | b. | It is equal to zero. | |  | c. | It is less than zero. | |  | d. | More information is needed. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 6-1 | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 17. What is true about the value of Δ*H*?   |  |  |  | | --- | --- | --- | |  | a. | It is greater than zero. | |  | b. | It is equal to zero. | |  | c. | It is less than zero. | |  | d. | More information is needed. | |  | e. | None of these. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 6-1 | | *KEYWORDS:* | Chemistry | enthalpy | enthalpy and internal energy | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 18. A property that is independent of the pathway is called an intensive property.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 19. A state function does not depend on the system's past or future.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 20. When a system performs work on the surroundings, the work is reported with a negative sign.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 21. In exothermic reaction, potential energy stored in chemical bonds is being converted to thermal energy via heat.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | potential energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 22. Of energy, work, enthalpy, and heat, how many are state functions?   |  |  |  | | --- | --- | --- | |  | a. | 0 | |  | b. | 1 | |  | c. | 2 | |  | d. | 3 | |  | e. | 4 |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 23. Which of the following properties is (are) intensive properties?   I.   mass II.   temperature III.  volume IV.  concentration  V.   energy   |  |  |  | | --- | --- | --- | |  | a. | I, III, and V | |  | b. | II only | |  | c. | II and IV | |  | d. | III and IV | |  | e. | I and V |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | enthalpy | enthalpy change | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/20/2017 1:26 AM | |

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| 24. For the reaction H2O(*l*) → H2O(*g*) at 298 K and 1.0 atm, Δ*H* is more positive than Δ*E* by 2.5 kJ/mol. This quantity of energy can be considered to be   |  |  |  | | --- | --- | --- | |  | a. | the heat flow required to maintain a constant temperature | |  | b. | the work done in pushing back the atmosphere | |  | c. | the difference in the H–O bond energy in H2O(*l*) compared to H2O(*g*) | |  | d. | the value of Δ*H* itself | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | enthalpy | enthalpy and internal energy | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 25. Which one of the following statements is *false*?   |  |  |  | | --- | --- | --- | |  | a. | The change in internal energy, Δ*E*, for a process is equal to the amount of heat absorbed at constant volume, *qv*. | |  | b. | The change in enthalpy, Δ*H*, for a process is equal to the amount of heat absorbed at constant pressure, *qp*. | |  | c. | A bomb calorimeter measures Δ*H* directly. | |  | d. | If *qp* for a process is negative, the process is exothermic. | |  | e. | The freezing of water is an example of an exothermic reaction. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 26. C2H5OH(*l*) + 3O2(*g*) → 2CO2(*g*) + 3H2O(*l*), Δ*H* = –1.37 × 103 kJ For the combustion of ethyl alcohol as described in the above equation, which of the following is true?   I.  The reaction is exothermic. II.  The enthalpy change would be different if gaseous water was produced. III. The reaction is not an oxidation–reduction one.  IV. The products of the reaction occupy a larger volume than the reactants.   |  |  |  | | --- | --- | --- | |  | a. | I, II | |  | b. | I, II, III | |  | c. | I, III, IV | |  | d. | III, IV | |  | e. | only I |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/23/2017 11:52 PM | |

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| 27. Consider the reaction:                C2H5OH(*l*) + 3O2(*g*) → 2CO2(*g*) + 3H2O(*l*); Δ*H* = –1.37 × 103 kJ Consider the following propositions:   I.  The reaction is endothermic II.  The reaction is exothermic. III. The enthalpy term would be different if the water formed was gaseous.  Which of these propositions is (are) true?   |  |  |  | | --- | --- | --- | |  | a. | I | |  | b. | II | |  | c. | III | |  | d. | I, II | |  | e. | II, III |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/23/2017 11:52 PM | |

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| 28. How much heat is required to raise the temperature of a 5.45-g sample of iron (specific heat = 0.450 J/g°C) from 25.0°C to 79.8°C?   |  |  |  | | --- | --- | --- | |  | a. | 2.41 J | |  | b. | 299 J | |  | c. | 664 J | |  | d. | 804 J | |  | e. | 134 J |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 29. Two metals of equal mass with different heat capacities are subjected to the same amount of heat. Which undergoes the smallest change in temperature?   |  |  |  | | --- | --- | --- | |  | a. | The metal with the higher heat capacity. | |  | b. | The metal with the lower heat capacity. | |  | c. | Both undergo the same change in temperature. | |  | d. | You need to know the initial temperatures of the metals. | |  | e. | You need to know which metals you have. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heat capacity | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 30. A 22.1 g piece of aluminum (which has a molar heat capacity of 24.03 J/°C·mol) is heated to 82.4°C and dropped into a calorimeter containing water (specific heat capacity of water is 4.18 J/g°C) initially at 22.3°C. The final temperature of the water is 25.8°C. Ignoring significant figures, calculate the mass of water in the calorimeter.   |  |  |  | | --- | --- | --- | |  | a. | 76.1 g | |  | b. | 2.05 kg | |  | c. | 2.30 g | |  | d. | 1.11 kg | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 4/5/2017 5:40 AM | |

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| 31. A 47.4 g sample of a metal is heated to 95.2°C and then placed in a calorimeter containing 120.0 g of water (*c* = 4.18 J/g°C) at 21.5°C. The final temperature of the water is 24.5°C. Which metal was used?   |  |  |  | | --- | --- | --- | |  | a. | Aluminum (*c* = 0.89 J/g°C) | |  | b. | Iron (*c* = 0.45 J/g°C) | |  | c. | Copper (*c* = 0.20 J/g°C) | |  | d. | Lead (*c* = 0.14 J/g°C) | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 32. You take 224.5 g of a solid at 30.0°C and let it melt in 425 g of water. The water temperature decreases from 85.1°C to 30.0°C. Calculate the heat of fusion of this solid.   |  |  |  | | --- | --- | --- | |  | a. | 122 J/g | |  | b. | 218 J/g | |  | c. | 436 J/g | |  | d. | 650 J/g | |  | e. | cannot solve without the heat capacity of the solid |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 33. The enthalpy of fusion of ice is 6.020 kJ/mol. The heat capacity of liquid water is 75.4 J/mol·°C. What is the smallest number of ice cubes at 0°C, each containing one mole of water, necessary to cool 500 g of liquid water initially at 20°C to 0°C?   |  |  |  | | --- | --- | --- | |  | a. | 1 | |  | b. | 7 | |  | c. | 14 | |  | d. | 15 | |  | e. | 126 |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 34. 30.0 mL of pure water at 282 K is mixed with 50.0 mL of pure water at 339 K. What is the final temperature of the mixture?   |  |  |  | | --- | --- | --- | |  | a. | 311 K | |  | b. | 318 K | |  | c. | 425 K | |  | d. | 621 K | |  | e. | 57 K |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 35. Consider the reaction                H2(*g*) + O2(*g*) → H2O(*l*)     Δ*H*° = –286 kJ Which of the following is true?   |  |  |  | | --- | --- | --- | |  | a. | The reaction is exothermic. | |  | b. | The reaction is endothermic. | |  | c. | The enthalpy of the products is less than that of the reactants. | |  | d. | Heat is absorbed by the system. | |  | e. | Both A and C are true. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heat | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 36. In the lab, you mix two solutions (each originally at the same temperature) and the temperature of the resulting solution decreases. Which of the following is true?   |  |  |  | | --- | --- | --- | |  | a. | The chemical reaction is releasing energy. | |  | b. | The energy released is equal to *s* × *m* × Δ*T*. | |  | c. | The chemical reaction is absorbing energy. | |  | d. | The chemical reaction is exothermic. | |  | e. | More than one of these. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 37. What is the specific heat capacity of a metal if it requires 169.6 J to change the temperature of 15.0 g of the metal from 25.00°C to 32.00°C?   |  |  |  | | --- | --- | --- | |  | a. | 0.619 J/g°C | |  | b. | 11.3 J/g°C | |  | c. | 24.2 J/g°C | |  | d. | 1.62 J/g°C | |  | e. | 275 J/g°C |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 38. A 140.0-g sample of water at 25.0°C is mixed with 120.9 g of a certain metal at 100.0°C. After thermal equilibrium is established, the (final) temperature of the mixture is 29.6°C. What is the specific heat capacity of the metal, assuming it is constant over the temperature range concerned?   |  |  |  | | --- | --- | --- | |  | a. | 0.32 J/g°C | |  | b. | 0.63 J/g°C | |  | c. | 0.24 J/g°C | |  | d. | 3.2 J/g°C | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 39. If 5.0 kJ of energy is added to a 15.5-g sample of water at 10.°C, the water is   |  |  |  | | --- | --- | --- | |  | a. | boiling | |  | b. | completely vaporized | |  | c. | frozen solid | |  | d. | decomposed | |  | e. | still a liquid |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heat capacity | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 40. Exactly 312.4 J will raise the temperature of 10.0 g of a metal from 25.0°C to 60.0°C. What is the specific heat capacity of the metal?   |  |  |  | | --- | --- | --- | |  | a. | 1.12 J/g°C | |  | b. | 0.893 J/g°C | |  | c. | 9.9 J/g°C | |  | d. | 74.7 J/g°C | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 41. A chunk of mercury at 80.8°C was added to 200.0 g of water at 15.5°C. The specific heat of mercury is 0.14 J/g°C, and the specific heat of water is 4.18 J/g°C. When the temperature stabilized, the temperature of the mixture was 20.9°C. Assuming no heat was lost to the surroundings, what was the mass of mercury added?   |  |  |  | | --- | --- | --- | |  | a. | 2.08 kg | |  | b. | 399 g | |  | c. | 494 g | |  | d. | 538 g | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/29/2017 12:08 PM | |

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| 42. On a cold winter day, a steel metal fence post feels colder than a wooden fence post of identical size because:   |  |  |  | | --- | --- | --- | |  | a. | The specific heat capacity of steel is higher than the specific heat capacity of wood. | |  | b. | The specific heat capacity of steel is lower than the specific heat capacity of wood. | |  | c. | Steel has the ability to resist a temperature change better than wood. | |  | d. | The mass of steel is less than wood so it loses heat faster. | |  | e. | Two of the above statements are true. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 43. What is the specific heat capacity of zinc if it requires 146 J to raise the temperature of 15 grams of zinc by 25°C?   |  |  |  | | --- | --- | --- | |  | a. | 2.5 J/g°C | |  | b. | 0.39 J/g°C | |  | c. | 0.23 J/g°C | |  | d. | 0.60 J/g°C | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 44. A 4.1-g sample of Colorado oil shale is burned in a bomb calorimeter, which causes the temperature of the calorimeter to increase by 5.0°C. The calorimeter contains 1.00 kg of water (heat capacity of H2O = 4.184 J/g°C) and the heat capacity of the empty calorimeter is 0.10 kJ/°C. How much heat is released per gram of oil shale when it is burned?   |  |  |  | | --- | --- | --- | |  | a. | 21 kJ/g | |  | b. | 42 kJ/g | |  | c. | 0 kJ/g | |  | d. | 5.2 kJ/g | |  | e. | 0.19 kJ/g |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | measuring heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 45. If a student performs an endothermic reaction in a calorimeter, how does the calculated value of Δ*H* differ from the actual value if the heat exchanged with the calorimeter is not taken into account?   |  |  |  | | --- | --- | --- | |  | a. | Δ*H*calc would be more negative because the calorimeter always absorbs heat from the reaction. | |  | b. | Δ*H*calc would be less negative because the calorimeter would absorb heat from the reaction. | |  | c. | Δ*H*calc would be more positive because the reaction absorbs heat from the calorimeter. | |  | d. | Δ*H*calc would be less positive because the reaction absorbs heat from the calorimeter. | |  | e. | Δ*H*calc would equal the actual value because the calorimeter does not absorb heat. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | measuring heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 46. A bomb calorimeter has a heat capacity of 2.47 kJ/K. When a 0.107-g sample of ethylene (C2H4) was burned in this calorimeter, the temperature increased by 2.18 K. Calculate the energy of combustion for one mole of ethylene.   |  |  |  | | --- | --- | --- | |  | a. | –5.29 kJ/mol | |  | b. | –50.3 kJ/mol | |  | c. | –648 kJ/mol | |  | d. | –0.264 kJ/mol | |  | e. | –1.41 × 103 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | measuring heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 47. Consider the reaction:            When a 27.8-g sample of ethyl alcohol (molar mass = 46.07 g/mol) is burned, how much energy is released as heat?   |  |  |  | | --- | --- | --- | |  | a. | 0.603 kJ | |  | b. | 0.827 kJ | |  | c. | 8.27 × 102 kJ | |  | d. | 3.81 × 104 kJ | |  | e. | 1.66 kJ |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 48. The Δ*H* value for the reaction is -90.8 kJ. How much heat is released when 88.1 g Hg is reacted with oxygen?   |  |  |  | | --- | --- | --- | |  | a. | 0.439 kJ | |  | b. | 8.00 × 103 kJ | |  | c. | 39.9 kJ | |  | d. | 90.8 kJ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 49. The total volume of hydrogen gas needed to fill the Hindenburg was 2.09 × 108 L at 1.00 atm and 25.4°C. How much energy was evolved when it burned?     |  |  |  | | --- | --- | --- | |  | a. | 8.54 × 106 kJ | |  | b. | 2.87 × 1010 kJ | |  | c. | 2.98 × 104 kJ | |  | d. | 2.44 × 109 kJ | |  | e. | 4.88 × 109 kJ |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/22/2017 5:45 AM | |

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| 50. CH4(*g*) + 4Cl2(*g*) → CCl4(*g*) + 4HCl(*g*), Δ*H* = –434 kJ Based on the above reaction, what energy change occurs when 1.2 moles of methane (CH4) reacts?   |  |  |  | | --- | --- | --- | |  | a. | 5.2 × 105 J are released. | |  | b. | 5.2 × 105 J are absorbed. | |  | c. | 3.6 × 105 J are released. | |  | d. | 3.6 × 105 J are absorbed. | |  | e. | 4.4 × 105 J are released. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 51. Given the equation S(*s*) + O2(*g*) → SO2(*g*), Δ*H* = –296 kJ, which of the following statement(s) is (are) true?   I.  The reaction is exothermic. II.   When 0.500 mole sulfur is reacted, 148 kJ of energy is released.  III.  When 32.0 g of sulfur are burned, 2.96 × 105 J of energy is released.   |  |  |  | | --- | --- | --- | |  | a. | All are true. | |  | b. | None is true. | |  | c. | I and II are true. | |  | d. | I and III are true. | |  | e. | Only II is true. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/23/2017 11:55 PM | |

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| 52. When 0.262 mol of a weak base (A–) is reacted with excess HCl, 6.91 kJ of energy is released as heat. What is Δ*H* for this reaction per mole of A– consumed?   |  |  |  | | --- | --- | --- | |  | a. | –37.9 kJ | |  | b. | –66.0 kJ | |  | c. | –26.4 kJ | |  | d. | 37.9 kJ | |  | e. | 26.4 kJ |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 53. What is the enthalpy change when 37.1 mL of 0.500 *M* sulfuric acid reacts with 15.9 mL of 0.101 *M* potassium hydroxide?   |  |  | | --- | --- | | H2SO4(*aq*) + 2KOH(*aq*) → K2SO4(*aq*) + 2H2O(*l*) | Δ*H*° = –111.6 kJ/mol |  |  |  |  | | --- | --- | --- | |  | a. | –0.0896 kJ | |  | b. | –2.25 kJ | |  | c. | –2.07 kJ | |  | d. | –0.179 kJ | |  | e. | –112 kJ |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | enthalpy | enthalpy change | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/23/2017 11:56 PM | |

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| 54. How much heat is liberated at constant pressure when 1.41 g of potassium metal reacts with 6.52 mL of liquid iodine monochloride (*d* = 3.24 g/mL)?   |  |  | | --- | --- | | 2K(*s*) + ICl(*l*) → KCl(*s*) + KI(*s*) | Δ*H*° = –740.71 kJ/mol |  |  |  |  | | --- | --- | --- | |  | a. | 2.22 × 103 kJ | |  | b. | 9.64 × 101 kJ | |  | c. | 1.23 × 102 kJ | |  | d. | 1.34 × 101 kJ | |  | e. | 7.41 × 102 kJ |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | enthalpy | enthalpy change | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/16/2017 6:12 AM | |

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| 55. Consider the following specific heats of metals.   |  |  | | --- | --- | | Metal | Specific Heat | | Aluminum | 0.897 J/(g°C) | | Magnesium | 1.02 J/(g°C) | | Lithium | 3.58 J/(g°C) | | Silver | 0.237 J/(g°C) | | Gold | 0.129 J/(g°C) |   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 temperature?   |  |  |  | | --- | --- | --- | |  | a. | Aluminum | |  | b. | Magnesium | |  | c. | Lithium | |  | d. | Silver | |  | e. | Gold |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 56. The heat of combustion of benzene, C6H6, is –41.74 kJ/g. Combustion of 4.48 g of benzene causes a temperature rise of 3.11°C in a certain bomb calorimeter. What is the heat capacity of this bomb calorimeter?   |  |  |  | | --- | --- | --- | |  | a. | 582 kJ/°C | |  | b. | 60.1 kJ/°C | |  | c. | 0.334 kJ/°C | |  | d. | 10 kJ/°C | |  | e. | 187 kJ/°C |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heat capacity | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 57. The specific heat capacities of metals are relatively low.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | True | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 58. The change in enthalpy can always be thought of as equal to energy flow as heat.   |  |  |  | | --- | --- | --- | |  | a. | True | |  | b. | False |  |  |  | | --- | --- | | *ANSWER:* | False | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | True / False | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | enthalpy | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 59. Which of the following statements is/are true?   |  | | --- | | I. *q* (heat) is a state function because Δ*H* is a state function and *q* = Δ*H*. | | II. When 50.0 g of aluminum at 20.0°C is placed in 50.0 mL of water at 30.0°C, the H2O will undergo a smaller temperature change than the aluminum. (The density of H2O = 1.0 g/mL, specific heat capacity of H2O = 4.18 J/g°C, specific heat capacity of aluminum = 0.89 J/g°C) | | III. When a gas is compressed, the work is negative since the surroundings are doing work on the system and energy flows out of the system. | | IV. For the reaction (at constant pressure) 2N2(*g*) + 5O2(*g*) → 2N2O5(*g*), the change in enthalpy is the same whether the reaction takes place in one step or in a series of steps. |  |  |  |  | | --- | --- | --- | |  | a. | I, II, IV | |  | b. | II, III | |  | c. | II, III, IV | |  | d. | II, IV | |  | e. | All of the above statements are true. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 60. Consider the following processes:   |  |  | | --- | --- | | 2A → (1/2)B + C | Δ*H*1 = 5 kJ/mol | | (3/2)B + 4C → 2A + C + 3D | Δ*H*2 = –15 kJ/mol | | E + 4A → C | Δ*H*3 = 10 kJ/mol |   Calculate Δ*H* for:    C → E + 3D   |  |  |  | | --- | --- | --- | |  | a. | 0 kJ/mol | |  | b. | 10 kJ/mol | |  | c. | –10 kJ/mol | |  | d. | –20 kJ/mol | |  | e. | 20 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 61. Consider the following processes:   |  |  | | --- | --- | |  | *ΔH* (kJ/mol) | | 3B → 2C + D | –125. | | (1/2)A → B | 150 | | E + A → D | 350 |   Calculate Δ*H* for: B → E + 2C   |  |  |  | | --- | --- | --- | |  | a. | 325 kJ/mol | |  | b. | 525 kJ/mol | |  | c. | –175 kJ/mol | |  | d. | –325 kJ/mol | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 62. Consider the following numbered processes:   |  |  | | --- | --- | | 1. | A → 2B | | 2. | B → C + D | | 3. | E → 2D |   Δ*H* for the process A → 2C + E is   |  |  |  | | --- | --- | --- | |  | a. | Δ*H*1 + Δ*H*2 + Δ*H*3 | |  | b. | Δ*H*1 + Δ*H*2 | |  | c. | Δ*H*1 + Δ*H*2 – Δ*H*3 | |  | d. | Δ*H*1 + 2Δ*H*2 – Δ*H*3 | |  | e. | Δ*H*1 + 2Δ*H*2 + Δ*H*3 |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 63. At 25°C, the following heats of reaction are known:   |  |  | | --- | --- | |  | Δ*H* (kJ/mol) | | 2ClF + O2 → Cl2O + F2O | 167.4 | | 2ClF3 + 2O2 → Cl2O + 3F2O | 341.4 | | 2F2 + O2 → 2F2O | –43.4 |   At the same temperature, calculate Δ*H* for the reaction: ClF + F2 → ClF3   |  |  |  | | --- | --- | --- | |  | a. | –217.5 kJ/mol | |  | b. | –130.2 kJ/mol | |  | c. | +217.5 kJ/mol | |  | d. | –108.7 kJ/mol | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 64. Calculate Δ*H*° for the reaction C4H4(*g*) + 2H2(*g*) → C4H8(*g*), using the following data:                Δ*H*°combustion for C4H4(*g*) = –2341 kJ/mol                Δ*H*°combustion for H2(*g*) = –286 kJ/mol                Δ*H*°combustion for C4H8(*g*) = –2755 kJ/mol   |  |  |  | | --- | --- | --- | |  | a. | –128 kJ | |  | b. | –158 kJ | |  | c. | 128 kJ | |  | d. | 158 kJ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 65. Given the heats of the following reactions:   |  |  |  | | --- | --- | --- | |  |  | Δ*H*°(kJ) | | I. | P4(*s*) + 6Cl2(*g*) → 4PCl3(*g*) | –1225.6 | | II. | P4(*s*) + 5O2(*g*) → P4O10(*s*) | –2967.3 | | III. | PCl3(*g*) + Cl2(*g*) → PCl5(*g*) | –84.2 | | IV. | PCl3(*g*) + O2(*g*) → Cl3PO(*g*) | –285.7 |   Calculate the value of Δ*H*° for the reaction below:            P4O10(*s*) + 6PCl5(*g*) → 10Cl3PO(*g*)   |  |  |  | | --- | --- | --- | |  | a. | –110.5 kJ | |  | b. | –610.1 kJ | |  | c. | –2682.2 kJ | |  | d. | –7555.0 kJ | |  | e. | None of these is within 5% of the correct answer. |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 66. Using the following thermochemical data:   |  |  | | --- | --- | | 2Y(*s*) + 6HF(*g*) → 2YF3(*s*) + 3H2(*g*) | Δ*H*° = –1811.0 kJ/mol | | 2Y(*s*) + 6HCl(*g*) → 2YCl3(*s*) + 3H2(*g*) | Δ*H*° = –1446.2 kJ/mol |   calculate Δ*H*° for the following reaction: YF3(*s*) + 3HCl(*g*) → YCl3(*s*) + 3HF(*g*)   |  |  |  | | --- | --- | --- | |  | a. | –3257.2 kJ/mol | |  | b. | 364.8 kJ/mol | |  | c. | 182.4 kJ/mol | |  | d. | 729.6 kJ/mol | |  | e. | –1628.6 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 67. Using the following thermochemical data, calculate Δ*H*f° of Ga2O3(*s*).   |  |  | | --- | --- | | 2GaCl3(*s*) + 3H2O(*l*) → Ga2O3(*s*) + 6HCl(*g*) | Δ*H*° = 263.9 kJ/mol | | 2Ga(*s*) + 3Cl2(*g*) → 2GaCl3(*s*) | Δ*H*° = –1049.4 kJ/mol | | 4HCl(*g*) + O2(*g*) → 2Cl2(*g*) + 2H2O(*l*) | Δ*H*° = –202.4 kJ/mol |  |  |  |  | | --- | --- | --- | |  | a. | –1089.1 kJ/mol | |  | b. | –987.9 kJ/mol | |  | c. | 1515.7 kJ/mol | |  | d. | –1110.9 kJ/mol | |  | e. | 583.1 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 68. The heat of formation of Fe2O3(*s*) is –826.0 kJ/mol. Calculate the heat of the reaction when a 43.20-g sample of iron is reacted.   |  |  |  | | --- | --- | --- | |  | a. | –159.7 kJ | |  | b. | –319.5 kJ | |  | c. | –638.9 kJ | |  | d. | –1278 kJ | |  | e. | –1.784 × 104 kJ |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 69. Which of the following does *not* have a standard enthalpy of formation equal to zero at 25°C and 1.0 atm?   |  |  |  | | --- | --- | --- | |  | a. | F2(*g*) | |  | b. | Al(*s*) | |  | c. | H2O(*l*) | |  | d. | H2(*g*) | |  | e. | They all have a standard enthalpy equal to zero. |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 70. Given the following two reactions at 298 K and 1 atm, which of the statements is true?   |  |  |  | | --- | --- | --- | | 1. | N2(*g*) + O2(*g*) → 2NO(*g*) | Δ*H*1 | | 2. | NO(*g*) + O2(*g*) → NO2(*g*) | Δ*H*2 |   ​   |  |  |  | | --- | --- | --- | |  | a. | Δ*H*f° for NO2(*g*) = Δ*H*2 | |  | b. | Δ*H*f° for NO(*g*) = Δ*H*1 | |  | c. | Δ*H*f° = Δ*H*2 | |  | d. | Δ*H*f° for NO2(g) = Δ*H*2 + Δ*H*1 | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/24/2017 12:03 AM | |

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| 71. Given:   |  |  | | --- | --- | | Cu2O(*s*) + O2(*g*) → 2CuO(*s*) | Δ*H*° = –144 kJ | | Cu2O(*s*) → Cu(*s*) + CuO(*s*) | Δ*H*° = +11 kJ |   Calculate the standard enthalpy of formation of CuO(*s*).   |  |  |  | | --- | --- | --- | |  | a. | –166 kJ | |  | b. | –299 kJ | |  | c. | +299 kJ | |  | d. | +155 kJ | |  | e. | –155 kJ |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 72. Using the following data, calculate the standard heat of formation of the compound ICl in kJ/mol:   |  |  | | --- | --- | |  | Δ*H*° (kJ/mol) | | Cl2(*g*) → 2Cl(*g*) | 242.3 | | I2(*g*) → 2I(*g*) | 151.0 | | ICl(*g*) → I(*g*) + Cl(*g*) | 211.3 | | I2(*s*) → I2(*g*) | 62.8 |   ​   |  |  |  | | --- | --- | --- | |  | a. | –211 kJ/mol | |  | b. | –14.6 kJ/mol | |  | c. | 16.8 kJ/mol | |  | d. | 245 kJ/mol | |  | e. | 439 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/24/2017 12:05 AM | |

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| 73. The heat combustion of acetylene, C2H2(*g*), at 25°C is –1299 kJ/mol. At this temperature, Δ*H*f° values for CO*2*(*g*) and H*2*O(*l*) are –393 and –286 kJ/mol, respectively. Calculate Δ*H*f° for acetylene.   |  |  |  | | --- | --- | --- | |  | a. | 2376 kJ/mol | |  | b. | 625 kJ/mol | |  | c. | 227 kJ/mol | |  | d. | –625 kJ/mol | |  | e. | –227 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 74. Choose the correct equation for the standard enthalpy of formation of CO(*g*), where Δ*H*f° for CO = –110.5 kJ/mol (gr indicates graphite).   |  |  |  | | --- | --- | --- | |  | a. | 2C(gr) + O2(*g*) → 2CO(*g*),       Δ*H*° = –110.5 kJ | |  | b. | C(gr) + O(*g*) → CO(*g*),            Δ*H*° = –110.5 kJ | |  | c. | C(gr) + O2(*g*) → CO(*g*),       Δ*H*° = –110.5 kJ | |  | d. | C(gr) + CO2(*g*) → 2CO(*g*),      Δ*H*° = –110.5 kJ | |  | e. | CO(*g*) → C(gr) + O(*g*),            Δ*H*° = –110.5 kJ |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 75. For the reaction:                AgI(*s*) + Br2(*g*) → AgBr(*s*) + I2(*s*), Δ*H*° = –54.0 kJ                Δ*H*f° for AgBr(*s*) = –100.4 kJ/mol                Δ*H*f° for Br2(*g*) = +30.9 kJ/mol The value of Δ*H*f° for AgI(*s*) is:   |  |  |  | | --- | --- | --- | |  | a. | –123.5 kJ/mol | |  | b. | +77.3 kJ/mol | |  | c. | +61.8 kJ/mol | |  | d. | –77.3 kJ/mol | |  | e. | –61.8 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 76. Using the information below, calculate Δ*H*f° for PbO(*s*)                PbO(*s*) + CO(*g*) → Pb(*s*) + CO2(*g*)     Δ*H*° = –131.4 kJ                Δ*H*f° for CO2(*g*) = –393.5 kJ/mol                Δ*H*f° for CO(*g*) = –110.5 kJ/mol   |  |  |  | | --- | --- | --- | |  | a. | –151.6 kJ/mol | |  | b. | –283.0 kJ/mol | |  | c. | +283.0 kJ/mol | |  | d. | –372.6 kJ/mol | |  | e. | +252.1 kJ/mol |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 77. For which of the following reaction(s) is the enthalpy change for the reaction *not* equal to Δ*H*f° of the product?   |  |  |  | | --- | --- | --- | |  | I. | 2H(*g*) → H2(*g*) | |  | II. | H2(*g*) + O2(*g*) → H2O2(*l*) | |  | III. | H2O(*l*) + O(*g*) → H2O2(*l*) |  |  |  |  | | --- | --- | --- | |  | a. | I | |  | b. | II | |  | c. | III | |  | d. | I and III | |  | e. | II and III |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 78. Consider the reaction: 2ClF3(*g*) + 2NH3(*g*) → N2(*g*) + 6HF(*g*) + Cl2(*g*) When calculating the Δ*H*°rxn, why is the Δ*H*f° for N2 not important?   |  |  |  | | --- | --- | --- | |  | a. | Because nitrogen is in its standard elemental state and no energy is needed for this product to exist. | |  | b. | Because any element or compound in the gaseous state requires a negligible amount of energy to exist. | |  | c. | Because the products are not included when calculating Δ*H*°rxn. | |  | d. | Because nitrogen is in its elemental state and does not contribute to the reaction itself. | |  | e. | Two of the above statements explain why N2 is not important when calculating Δ*H*°rxn. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 79. The following statements concerning petroleum are all true *except*:   |  |  |  | | --- | --- | --- | |  | a. | It is a thick, dark liquid composed mostly of hydrocarbons. | |  | b. | It must be separated into fractions (by boiling) in order to be used efficiently. | |  | c. | Some of the commercial uses of petroleum fractions include gasoline and kerosene. | |  | d. | It was probably formed from the remains of ancient marine organisms. | |  | e. | All of its hydrocarbon chains contain the same number of carbon atoms. |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 80. This fossil fuel was formed from the remains of plants that were buried and exposed to high pressure and heat over time.   |  |  |  | | --- | --- | --- | |  | a. | coal | |  | b. | natural gas | |  | c. | diesel fuel | |  | d. | propane | |  | e. | gasoline |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 81. The coal with the highest energy available per unit burned is   |  |  |  | | --- | --- | --- | |  | a. | Lignite. | |  | b. | Subbituminous. | |  | c. | Bituminous. | |  | d. | Anthracite. | |  | e. | They are equal in energy value. |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.5 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 82. All of the following statements about the greenhouse effect are true *except*:   |  |  |  | | --- | --- | --- | |  | a. | It occurs only on earth. | |  | b. | The molecules H2O and CO2 play an important role in retaining the atmosphere's heat. | |  | c. | Low humidity allows efficient radiation of heat back into space. | |  | d. | The carbon dioxide content of the atmosphere is quite stable. | |  | e. | A and D |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 83. Which of the following is both a greenhouse gas and a fuel?   |  |  |  | | --- | --- | --- | |  | a. | carbon dioxide | |  | b. | coal | |  | c. | freon | |  | d. | methane | |  | e. | nitrogen |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.5 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 84. One of the main advantages of hydrogen as a fuel is that:   |  |  |  | | --- | --- | --- | |  | a. | The only product of hydrogen combustion is water. | |  | b. | It exists as a free gas. | |  | c. | It can be economically supplied by the world's oceans. | |  | d. | Plants can economically produce the hydrogen needed. | |  | e. | It contains a large amount of energy per unit volume of hydrogen gas. |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 85. Which of the following is *not* being considered as an energy source for the future?   |  |  |  | | --- | --- | --- | |  | a. | ethanol | |  | b. | methanol | |  | c. | seed oil | |  | d. | shale oil | |  | e. | carbon dioxide |  |  |  | | --- | --- | | *ANSWER:* | e | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.6 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 86. The combustion of hydrogen gas releases 286 kJ per mol of hydrogen. If 11.0 L of hydrogen at STP was burned to produce electricity, how long would it power a 100-watt (W) light bulb? Assume no energy is lost to the surroundings. (1 W = 1 J/s)   |  |  |  | | --- | --- | --- | |  | a. | 23.4 min | |  | b. | 1.63 days | |  | c. | 1.40 hr | |  | d. | 8.73 hr | |  | e. | 3.90 hr |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.6 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 87. The \_\_\_\_\_\_\_\_\_\_ of a system is the sum of the kinetic and potential energies of all the particles in the system.   |  |  | | --- | --- | | *ANSWER:* | internal energy | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 88. \_\_\_\_\_\_\_\_\_\_ involves the transfer of energy between two objects due to a temperature difference.   |  |  | | --- | --- | | *ANSWER:* | Heat | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heat | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 89. Consider the reaction: N2(*g*) + 3H2(*g*) → 2NH3(*g*) Assuming this reaction takes place in an elastic balloon with an atmospheric pressure of 1.0 atm, and that you have a stoichiometric mixture of nitrogen and hydrogen, draw a microscopic diagram before and after the reaction occurs. See the example below to assist you.      ABC2(*g*) → AB(*g*) + C2(*g*)           (could be drawn as)  In addition, explain whether *w* (the work done) is positive, negative, or zero.   |  |  | | --- | --- | | *ANSWER:* | Work (*w*) will be positive since the surroundings are doing work on the system. The balanced reaction has fewer moles of product gases than moles of reactant gases, so the volume will get smaller (Δ*V* is negative) and the surroundings do compression work on the system. See Sec. 6.1 of Zumdahl, *Chemistry*. | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | first law of thermodynamics | general chemistry | thermochemistry | thermodynamics | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 90. Consider the following reaction:                2Al(*s*) + 3Cl2(*g*) → 2AlCl3(*s*);    Δ*H* = –1390.81 kJ a) Is the reaction exothermic or endothermic? b) How much heat is produced/required when 10.0 g AlCl3 forms. c) How many grams of Al are required to absorb/evolve 1.00 kJ of energy?   |  |  | | --- | --- | | *ANSWER:* | a) Exothermic; b) 52.2 kJ; c) 0.0388 g Al  See Sec. 6.2 of Zumdahl, *Chemistry*.  a) Exothermicity is apparent from the negative Δ*H*. b) 10.0 g \* (1 mol AlCl3/133.33 g) \* (-1390.81 kJ/2 mol AlCl3) = -52.2 kJ = 52.2 kJ produced c) 1.00 kJ \* (2 mol Al/1390.81 kJ) \* (26.98 g /mol Al) = 0.0388 g Al | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| To carry out the reaction N2 + 2O2 → 2NO2 requires 67.7 kJ. To carry out the reaction N2 + 2O2 → N2O4 requires 9.7 kJ. Consider the reaction 2NO2 → N2O4. |

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| 91. How much energy (absolute value) is involved in the reaction 2NO2 → N2O4?   |  |  | | --- | --- | | *ANSWER:* | 58.0 kJ    Apply Hess's law, see Sec. 6.3 of Zumdahl *Chemistry*. 2NO2 → N2 + 2O2    Δ*H* = –67.7 kJ N2 + 2O2 → N2O4    Δ*H* =  9.7 kJ –67.7 kJ + 9.7 kJ = –58.0 kJ | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 6-2 | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 92. Is the reaction endothermic or exothermic?   |  |  | | --- | --- | | *ANSWER:* | exothermic | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *PREFACE NAME:* | Ref 6-2 | | *KEYWORDS:* | Chemistry | general chemistry | heat | heats of reaction | thermochemistry | | *OTHER:* | Conceptual | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 93. Consider the following data:   |  |  | | --- | --- | |  | Δ*H*° (kJ) | | Ca(*s*) + 2C(graphite) → CaC2(*s*) | –62.8 | | Ca(*s*) + O2(*g*) → CaO(*s*) | –635.5 | | CaO(*s*) + H2O(*l*) → Ca(OH)2(*aq*) | –653.1 | | C2H2(*g*) + O2(*g*) → 2CO2(*g*) + H2O(*l*) | –1300 | | C(graphite) + O2(*g*) → CO2(*g*) | –393.51 |   Use Hess’ law to find the change in enthalpy at 25°C for the following equation:            CaC2(*s*) + 2H2O(*l*) → Ca(OH)2(*aq*) + C2H2(*g*)   |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | *ANSWER:* | –713 kJ    See Sec. 6.3 of Zumdahl *Chemistry*.   |  |  | | --- | --- | |  | Δ*H*° (kJ) | | CaC2(*s*) → 2C(graphite) + Ca(*s*) | +62.8 | | Ca(*s*) + O2(*g*) → CaO(*s*) | –635.5 | | CaO(*s*) + H2O(*l*) → Ca(OH)2(*aq*) | –653.1 | | 2CO2(*g*) + H2O(*l*) → C2H2(*g*) + O2(*g*) | +1300 | | 2C(graphite) + 2O2(*g*) → 2CO2(*g*) | –787.02 | | total | –713 kJ | | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.3 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | Hess's law | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 94. Consider the following standard heats of formation:                P4O10(*s*) = –3110 kJ/mol                H2O(*l*) = –286 kJ/mol                H3PO4(*s*) = –1279 kJ/mol Calculate the change in enthalpy for the following process:                P4O10(*s*) + 6H2O(*l*) → 4H3PO4(*s*)   |  |  | | --- | --- | | *ANSWER:* | –290 kJ    See Sec. 6.4 of Zumdahl *Chemistry*. 4(–1279) - [–3110 + 6(–286)] = –5116 + 3110 + 1716 = –290 | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 95. Acetylene (C2H2) and butane (C4H10) are gaseous fuels. Determine the ratio of energy available from the combustion of a given volume of acetylene to butane at the same temperature and pressure using the following data: The change in enthalpy of combustion for C2H2(*g*) = –49.9 kJ/g. The change in enthalpy of combustion for C4H10(*g*) = –49.5 kJ/g.   |  |  | | --- | --- | | *ANSWER:* | About 2.21 times the volume of acetylene is needed to furnish the same energy as a given volume of butane.    For stoichiometry of thermochemical processes, see Sec. 6.2 of Zumdahl *Chemistry*. At the same temperature and pressure, equal volumes will contain equal number of moles of gas. 1 mol C2H2 \* 26.03 g/mol \* –49.9 kJ/g = –1299 kJ 1 mol C4H10 \* 58.12 g/mol \* –49.5 kJ/g = –2877 kJ –2877 kJ/-1299 kJ = 2.21 | | *POINTS:* | 1 | | *DIFFICULTY:* | Difficult | | *REFERENCES:* | 6.6 | | *QUESTION TYPE:* | Subjective Short Answer | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 96. A gas absorbs 501 J of heat and then performs 941 J of work. The change in internal energy of the gas is   |  |  |  | | --- | --- | --- | |  | a. | 1442 J | |  | b. | 440 J | |  | c. | –440 J | |  | d. | –1442 J | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 97. A gas absorbs 606 J of heat and then has 273 J of work done upon it. The change in internal energy of the gas is   |  |  |  | | --- | --- | --- | |  | a. | 879 J | |  | b. | –333 J | |  | c. | 333 J | |  | d. | –879 J | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 98. A gas delivers 874 J of heat and then has 159 J of work done upon it. The change in internal energy of the gas is   |  |  |  | | --- | --- | --- | |  | a. | 1033 J | |  | b. | –715 J | |  | c. | 715 J | |  | d. | –1033 J | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 99. A gas delivers 919 J of heat and then performs 564 J of work. The change in internal energy of the gas is   |  |  |  | | --- | --- | --- | |  | a. | 1483 J | |  | b. | –355 J | |  | c. | 355 J | |  | d. | –1483 J | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.1 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | energy | general chemistry | heats of reaction | internal energy | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 100. For the complete combustion of 1.000 mole of methane gas at 298 K and 1 atm pressure, Δ*H*° = -890.4 kJ/mol.  What will be the heat released when 9.42 g of methane is combusted under these conditions?   |  |  |  | | --- | --- | --- | |  | a. | –524 kJ | |  | b. | 524 kJ | |  | c. | –1512 kJ | |  | d. | 1512 kJ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 101. For the complete combustion of 1.000 mole of ethane gas at 298 K and 1 atm pressure, Δ*H*° = -1560 kJ/mol.  What will be the heat released when 8.38 g of ethane is combusted under these conditions?   |  |  |  | | --- | --- | --- | |  | a. | –436 kJ | |  | b. | 436 kJ | |  | c. | 5585 kJ | |  | d. | –5585 kJ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 102. For the complete combustion of 1.000 mole of propane gas at 298 K and 1 atm pressure, Δ*H*° = -2220 kJ/mol.  What will be the heat released when 4.70 g of propane is combusted under these conditions?   |  |  |  | | --- | --- | --- | |  | a. | –237 kJ | |  | b. | 237 kJ | |  | c. | 20783 kJ | |  | d. | –20783 kJ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 103. For the complete combustion of 1.000 mole of butane gas at 298 K and 1 atm pressure, Δ*H*° = -2877 kJ/mol.  What will be the heat released when 6.05 g of butane is combusted under these conditions?   |  |  |  | | --- | --- | --- | |  | a. | –300 kJ | |  | b. | 300 kJ | |  | c. | 27581 kJ | |  | d. | –27581 kJ | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | b | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | stoichiometry and heats of reaction | thermochemical equation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 104. A 11.6 g piece of metal is heated to 98°C and dropped into a calorimeter containing 50.0 g of  water (specific heat capacity of water is 4.18 J/g°C) initially at 20.5°C. The empty calorimeter has a heat capacity of 125 J/K.  The final temperature of the water is 28.2°C. Ignoring significant figures, calculate the specific heat of the metal..   |  |  |  | | --- | --- | --- | |  | a. | 3.176 J/gK | |  | b. | 1.990 J/gK | |  | c. | 0.800 J/gK | |  | d. | 2.142 J/gK | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 3/4/2016 4:35 PM | |

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| 105. Nitric acid, HNO3, was first prepared 1200 years ago by heating naturally occurring sodium nitrate (called saltpeter) with sulfuric acid to produce sodium bisulfate and collecting the vapors of HNO3 produced.  Calculate Δ*H*°rxn for this reaction.  Δ*H*°f[NaNO3(s)] = -467.8 kJ/mol; Δ*H*°f[NaHSO4(s)] = -1125.5 kJ/mol; Δ*H*°f[H2SO4(l)] = -814.0 kJ/mol; Δ*H*°f[HNO3(g)] = -135.1 kJ/mol.  ​  NaNO3(s)  +  H2SO4(l)  =>   NaHSO4(s) + HNO3(g)   |  |  |  | | --- | --- | --- | |  | a. | -644.2 kJ | |  | b. | -21.2 kJ | |  | c. | 21.2 kJ | |  | d. | 644.2 kJ | |  | e. | -1606.8 kJ |  |  |  | | --- | --- | | *ANSWER:* | c | | *POINTS:* | 1 | | *DIFFICULTY:* | Easy | | *REFERENCES:* | 6.4 | | *QUESTION TYPE:* | Multiple Choice | | *HAS VARIABLES:* | False | | *KEYWORDS:* | Chemistry | general chemistry | heats of reaction | standard enthalpies of formation | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 3/4/2016 4:35 PM | | *DATE MODIFIED:* | 2/6/2017 8:09 AM | |

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| 106. A 45.2 g piece of aluminum (which has a molar heat capacity of 24.03 J/°C·mol) is heated to 82.4°C and dropped into a calorimeter containing water (specific heat capacity of water is 4.18 J/g°C) initially at 22.3°C. The final temperature of the water is 24.8°C. Ignoring significant figures, calculate the mass of water in the calorimeter.   |  |  |  | | --- | --- | --- | |  | a. | 222 g | |  | b. | 5.99 kg | |  | c. | 6.71 g | |  | d. | 2.31 kg | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | a | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 4/5/2017 5:51 AM | | *DATE MODIFIED:* | 4/5/2017 7:45 AM | |

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| 107. A chunk of lead at 91.7°C was added to 200.0 g of water at 15.5°C. The specific heat of lead is 0.129 J/g°C, and the specific heat of water is 4.18 J/g°C. When the temperature stabilized, the temperature of the mixture was 19.4°C. Assuming no heat was lost to the surroundings, what was the mass of lead added?   |  |  |  | | --- | --- | --- | |  | a. | 1.73 kg | |  | b. | 276 g | |  | c. | 332 g | |  | d. | 350 g | |  | e. | none of these |  |  |  | | --- | --- | | *ANSWER:* | d | | *POINTS:* | 1 | | *DIFFICULTY:* | Moderate | | *REFERENCES:* | 6.2 | | *QUESTION TYPE:* | Multi-Mode (Multiple choice) | | *HAS VARIABLES:* | True | | *KEYWORDS:* | calorimetry | Chemistry | general chemistry | heats of reaction | specific heat | thermochemistry | | *OTHER:* | Quantitative | | *DATE CREATED:* | 4/5/2017 6:00 AM | | *DATE MODIFIED:* | 4/5/2017 6:00 AM | |