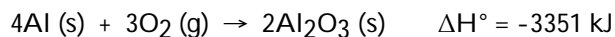


Name _____

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

- 1) Which of the following would require the largest volume of 0.100 M sodium hydroxide solution for neutralization? 1) _____
- A) 10.0 mL of 0.0500 M phosphoric acid
B) 10.0 mL of 0.0500 M hydrobromic acid
C) 10.0 mL of 0.0500 M sulfuric acid
D) 10.0 mL of 0.0500 M perchloric acid
E) 10.0 mL of 0.0500 M nitric acid
- 2) What volume (mL) of 7.48×10^{-2} M HClO_4 can be neutralized with 115 mL of 0.244 M sodium hydroxide? 2) _____
- A) 750 B) 188 C) 8.60 D) 125 E) 375
- 3) Which one of the following conditions would always result in an increase in the internal energy of a system? 3) _____
- A) The system gains heat and does work on the surroundings.
B) The system gains heat and has work done on it by the surroundings.
C) The system loses heat and does work on the surroundings.
D) The system loses heat and has work done on it by the surroundings.
E) None of the above is correct.
- 4) When a system _____, ΔE is always negative. 4) _____
- A) absorbs heat and does work
B) gives off heat and does work
C) gives off heat and has work done on it
D) absorbs heat and has work done on it
E) none of the above is always negative.
- 5) Which of the following is a statement of the first law of thermodynamics? 5) _____
- A) Energy lost by the system must be gained by the surroundings.
B) A negative ΔH corresponds to an exothermic process.
C) 1 cal = 4.184 J (exactly)
D) $E_k = \frac{1}{2}mv^2$
E) $\Delta E = E_{\text{final}} - E_{\text{initial}}$

6) The reaction 6) _____



is _____, and therefore heat is _____ by the reaction.

- A) endothermic, absorbed
- B) exothermic, released
- C) exothermic, absorbed
- D) endothermic, released
- E) thermoneutral, neither released nor absorbed

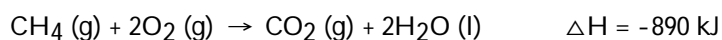
7) The units of specific heat are _____. 7) _____

- A) J/K or J/°C
- B) J/g-K or J/g-°C
- C) K/J or °C/J
- D) g-K/J or g-°C/J
- E) J/mol

8) For which one of the following reactions is $\Delta H^\circ_{\text{rxn}}$ equal to the heat of formation of the product? 8) _____

- A) $(1/2)\text{N}_2\text{ (g)} + \text{O}_2\text{ (g)} \rightarrow \text{NO}_2\text{ (g)}$
- B) $12\text{C (g)} + 11\text{H}_2\text{ (g)} + 11\text{O (g)} \rightarrow \text{C}_6\text{H}_{22}\text{O}_{11}\text{ (g)}$
- C) $6\text{C (s)} + 6\text{H (g)} \rightarrow \text{C}_6\text{H}_6\text{ (l)}$
- D) $\text{N}_2\text{ (g)} + 3\text{H}_2\text{ (g)} \rightarrow 2\text{NH}_3\text{ (g)}$
- E) $\text{P (g)} + 4\text{H (g)} + \text{Br (g)} \rightarrow \text{PH}_4\text{Br (l)}$

9) In the presence of excess oxygen, methane gas burns in a constant-pressure system to yield carbon dioxide and water: 9) _____



Calculate the value of q (kJ) in this exothermic reaction when 1.70 g of methane is combusted at constant pressure.

- A) -94.6
- B) 0.0306
- C) -9.46×10^4
- D) 32.7
- E) -0.0106

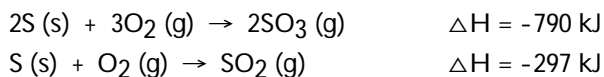
10) The photoelectric effect is _____. 10) _____

- A) a relativistic effect
- B) the production of current by silicon solar cells when exposed to sunlight
- C) the total reflection of light by metals giving them their typical luster
- D) the ejection of electrons by a metal when struck with light of sufficient energy
- E) the darkening of photographic film when exposed to an electric field

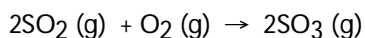
11) Electromagnetic radiation travels through vacuum at a speed of _____ m/s. 11) _____
A) 125
B) 10,000
C) 3.00×10^8
D) 186,000
E) It depends on wavelength.

12) What is the frequency (s^{-1}) of electromagnetic radiation that has a wavelength of 0.53 m? 12) _____
A) 1.3×10^{-33}
B) 1.8×10^{-9}
C) 1.6×10^8
D) 5.7×10^8
E) 1.3×10^{33}

13) Given the following reactions: 13) _____



the enthalpy of the reaction in which sulfur dioxide is oxidized to sulfur trioxide



is _____ kJ.

- A) 1087 B) -1384 C) -543 D) -196 E) 196

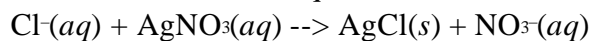
14) The energy of a photon that has a frequency of $8.21 \times 10^{15} s^{-1}$ is _____ J. 14) _____
A) 1.26×10^{-19}
B) 1.99×10^{-25}
C) 1.24×10^{49}
D) 5.44×10^{-18}
E) 8.08×10^{-50}

15) The energy of a photon of light is _____ proportional to its frequency and _____ proportional to its wavelength. 15) _____
A) directly, inversely
B) indirectly, not
C) inversely, inversely
D) directly, directly
E) inversely, directly

ESSAY. Write your answer in the space provided or on a separate sheet of paper.

- 16) A 25.00-mL sample of sodium chloride solution was titrated with 0.4500 M AgNO₃ solution, requiring 27.62 mL to reach the equivalence point.

The titration reaction equation is



A. What was the concentration of Cl⁻ ion in the original sample

B. How many grams of precipitate were formed?
(f.w. Ag Cl = 143.32 u).

17)

A 3.53-g sample of KNO_3 (f.w. = 101.11 u) was added to 97.77g of water in a coffee-cup calorimeter. The initial temperature of the water was 22.5 °C and the temperature of the solution after mixing was 20.4 °C. On the basis of this experiment, what is the heat of solution per mole of KNO_3 [f.w. = 101.11 u]? The specific heat of water is 4.184 J/g°C.