Multiple Choice

1. ANS: B
   Diffraction is a property of waves.
   PTS: 1

2. ANS: C
   The solution of the wave equations describes the probability of finding an electron and is called an orbital.
   PTS: 1

3. ANS: A
   Since heat is included as a reactant, the reaction is endothermic. In endothermic reactions, enthalpy of the product is greater than the enthalpy of the reactant, leading to a positive enthalpy change value.
   PTS: 1

4. ANS: A
   \[ \Delta E_{\text{sys}} = q + w = -155 \text{ kJ} - 22 \text{ kJ} = -177 \text{ kJ} \]
   \[ \Delta E_{\text{surr}} = -\Delta E_{\text{sys}} = +177 \text{ kJ} \]
   PTS: 1

5. ANS: C
   \[ \lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-34} \text{ Js}}{(9.11 \times 10^{-31} \text{ kg})(1.85 \times 10^7 \text{ m/s})} = 3.93 \times 10^{-11} \text{ m} \]
   \[ \nu = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m/s}}{3.93 \times 10^{-11} \text{ m}} = 7.63 \times 10^{18} \text{ s}^{-1} \]
   PTS: 1

6. ANS: C
   \[ q = C_{\text{cal}} x \Delta T = (6.18 \text{ kJ/}^\circ\text{C}) (27.3 ^\circ\text{C}) = -168.7 \text{ kJ} \] (neg. sign; exothermic)
   \[ 3.80 \text{ g} \times \frac{1 \text{ mol}}{114.26 \text{ g}} = 0.03326 \text{ mol} \]
   \[ \Delta H = \frac{-168.7 \text{ kJ}}{0.03326 \text{ mol}} = -5.07 \times 10^3 \text{ kJ/mol} \]
   PTS: 1
7. ANS: B

\[ E = \frac{hc}{\lambda} = \frac{(60626 \times 10^{-34} \text{ Js})(3.00 \times 10^8 \text{ m/s})}{5.52 \times 10^{-7} \text{ m}} = 3.60 \times 10^{-19} \text{ J/photon} \]

\[ 3.60 \times 10^{-19} \text{ J/photon} \times \frac{6.02 \times 10^{23} \text{ photons}}{1 \text{ mol photons}} = 2.17 \times 10^5 \text{ J} \]

PTS: 1

8. ANS: C

Substances with low specific heat will gain and lose heat easily. Therefore the lowest specific heat will attain the highest temperature.

PTS: 1

9. ANS: C

Blue light is to the left of the red light in the electromagnetic spectrum. Therefore it has higher frequency but shorter wavelength than red light.

PTS: 1

10. ANS: D

See lecture notes.

PTS: 1

11. ANS: C

\[ \frac{1.888 \text{ g H}_2 \times \frac{1 \text{ mol}}{2.016 \text{ g}} \times \frac{2 \text{ mol H}_2 \text{O}}{2 \text{ mol H}_2}}{0.9365 \text{ mol H}_2 \text{O}} = 0.9365 \text{ mol H}_2 \text{O} \]

\[ \Delta H = \frac{226.4 \text{ kJ}}{0.9365 \text{ mol H}_2 \text{O}} \times 2 = -483.5 \text{ kJ/2 mol H}_2 \text{O} \quad \text{(neg sign; exothermic)} \]

PTS: 1

12. ANS: C

Choice A is wrong since \( m_s \) cannot have a value of \(-1\)
Choice B is wrong since \( l \) cannot be 3 if \( n \) is 3
Choice C is wrong since \( m_l \) cannot be \(+3+\) if \( l \) is 2
Therefore choice D is correct

PTS: 1

13. ANS: D

Energy is directly proportional to frequency. Therefore the higher the frequency of the wave, the greater its energy.

PTS: 1

14. ANS: B

Heat flows from the surroundings into the system in an endothermic process.

PTS: 1
15. ANS: A

\[ \frac{1}{\lambda} = 1.097 \times 10^7 \left( \frac{1}{9} - \frac{1}{25} \right) = 1.282 \times 10^{-6} \text{m} = 1282 \text{nm} \]

PTS: 1