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Latent Heat
Quiz: Solutions

1. **Determine the amount of energy required to melt 5 pounds of ice at 0 ^{o}C.**

   $\Delta Q = mL_f$
   $\Delta Q = (5\ lb)(kg/2.205\ lbs)(1000\ g/kg)(333\ J/g)$
   $\Delta Q = 755000\ J$

2. **At the melting point, an unknown metal has a mass of 32 g and releases 365 J of energy as it solidifies. Identify the metal.**

   $\Delta Q = mL_f$
   $365\ J = (32\ g)(L_f)$
   $L_f = 11.4\ (J/g \cdot {}^{o}C)$
   The metal is mercury.

3. **A sample of gold has a mass of 50 g and an initial temperature of 720 ^{o}C. Determine the energy required to melt the sample.**

   $\Delta Q = mc\Delta T + mL_f$
   $\Delta Q = (50\ g)(0.129\ (J/g \cdot {}^{o}C))(1063\ {}^{o}C - 720\ {}^{o}C) + (50\ g)(64.4\ J/g)$
   $\Delta Q = 5430\ J$

4. **A sample of silver has a mass of 50 g and an initial temperature of 720 ^{o}C. Determine the energy required to melt the sample.**

   $\Delta Q = mc\Delta T + mL_f$
   $\Delta Q = (50\ g)(0.234\ (J/g \cdot {}^{o}C))(961\ {}^{o}C - 720\ {}^{o}C) + (50\ g)(88.2\ J/g)$
   $\Delta Q = 7230\ J$

5. A sample of iron has a mass of 50 g and an initial temperature of 720 ^{o}C. Determine the energy required to melt the sample.

$\Delta Q = mc\Delta T + mL_f$
$\Delta Q = (50\ g)(0.448\ (J/g\cdot{}^{o}C))(1538\ {}^{o}C - 720\ {}^{o}C) + (50\ g)(247\ J/g)$
$\Delta Q = 30700\ J$

6. Determine the amount of calories required to vaporize 10 g of water at 100 ^{o}C.

$\Delta Q = mL_v$
$\Delta Q = (10\ g)(2260\ J/g)(1\ calorie/4.184\ J)$
$\Delta Q = 5400\ cal$

7. Determine the amount of kilocalories required to vaporize 10 g of water at 70 ^{o}C.

$\Delta Q = mc\Delta T + mL_v$
$\Delta Q = (10\ g)(4.184\ (J/g\cdot{}^{o}C))(100\ {}^{o}C - 70\ {}^{o}C) + (10\ g)(2260\ J/g)$
$\Delta Q = 23855\ J\ (1\ cal / 4.184\ J)(1\ kcal / 1000\ cal)$
$\Delta Q = 5.7\ kcal$

8. Determine the amount of Calories required to bring 10 g of ice at 0 ^{o}C to a temperature of 25 ^{o}C.

$\Delta Q = mL_f + mc\Delta T$
$\Delta Q = (10\ g)(333\ J/g) + (10\ g)(4.184\ (J/g\cdot{}^{o}C))(25\ {}^{o}C - 0\ {}^{o}C)$
$\Delta Q = 4376\ J\ (1\ cal / 4.184\ J)(1\ Calorie / 1000\ cal)$
$\Delta Q = 1.05\ Cal$

9. A 50 g sample of water with a temperature of -15 ^{o}C absorbs 25 kJ of energy. Determine the final temperature of the water.

$\Delta Q = mc\Delta T + mL_f + mc\Delta T$
$25\ kJ(1000\ J / kJ) = (50\ g)(2.09\ (J/g\cdot{}^{o}C))(0\ {}^{o}C - (-15\ {}^{o}C)) + (50\ g)(333\ J/g) + (50\ g)(4.184\ J/(g\cdot{}^{o}C))(T - 0\ {}^{o}C)$
$T = 32.4\ {}^{o}C$