KEY

## ***WS – 1 Heat Calculations***

1. Calculate the quantity of heat required to warm 250 mL of water from 22.0°C to 98.0°C in an electric kettle. Note: water has a density of 1 g/mL ∴ 1 mL has a mass of 1 g.

$Q = mc\Delta t$

$Q = (250\,g)(4.19\,J/g\cdot°C)(76.0°C)$

$= 79610\,J = \boxed{79.6\,kJ}$

2. A 35.0 g polystyrene foam cup containing coffee changes in temperature from 21.0°C to 55.0°C. Calculate the heat absorbed by the cup.

$Q = mc\Delta t$

$Q = (35.0\,g)(1.01\,J/g\cdot°C)(34.0°C)$

$= 1201.9\,J = \boxed{1.20\,kJ}$

3. What mass of aluminum in a car engine will absorb $1.00 \times 10^6$ J of heat when the temperature rises from 22°C to 102°C after the car is started?

$Q = mc\Delta t$

$(1.00 \times 10^6\,J) = m(0.897\,J/g\cdot°C)(80°C)$

$m = 13935.34\ldots\,g = 1.4 \times 10^4\,g$

$= \boxed{14\,kg}$

4. The liquid coolant in a car engine has a specific heat capacity of 3.88 J/g°C. Determine the mass of coolant that will absorb 1.00 MJ of heat during a temperature rise from 22°C to 102°C.

$Q = mc\Delta t$

$1.00\,MJ = m(3.88\,J/g\cdot°C)(80°C)$

$m = 0.0032216\,Mg = \boxed{3.22\,kg}$

5. In a laboratory experiment, 2.00 kJ of heat flowed to a 100 g sample of a liquid solvent, causing a temperature increase from 15.40°C to 21.37°C. Calculate the specific heat capacity of the liquid solvent.

$Q = mc\Delta t$

$2.00\,kJ = (100\,g)(c)(5.97°C)$

$c = 0.003350\ldots\,kJ/g\cdot°C$

$= \boxed{3.35\,J/g\cdot°C}$