15-1 Energy

- Energy is the ability to do work or produce heat
  - Energy is conserved, where it changes form but isn't destroyed.

Energy in the form of heat is measured in 2 main units (calories & joules)

- 1 cal = energy required to raise 1 g of H_2O by 1°c
- 1 Cal (or kcal - food calorie) = 1,000 calories
- 1 joule = SI unit for energy = 0.2390 cal

  1 cal = 4.184 J

(c) Specific heat = energy required to raise 1 g of any substance by 1°c (varies for each substance)

Large c's = harder to heat up

small c's = easier to heat up

Heat formula = $\boxed{q = c \times m \times \Delta t}$

q = heat absorbed or released
c = specific heat
m = mass (grams)
Δt = change in temp. (°c)

$\Delta t = t_{final} - t_{initial}$

kg → g

$\frac{kg}{1} \frac{1000\ g}{1\ kg}$

If temp ↑, heat is absorbed

If temp ↓, heat is released

$$\boxed{q = c \times m \times \Delta t}$$

(2)

$$\boxed{1\ cal = 4.184\ J}$$

1. How much energy is absorbed when 5 g (m) of Iron ($c = 0.449\ J/g \cdot °C$) is heated from 20°C to 50°C?

Δt $50 - 20 = 30°C$ (Δt)

$q = 0.449 \times 5g \times 30° = \boxed{67.35\ J}$

b) How many calories? (cal)

$\frac{67.35\ J}{} \Big| \frac{1\ cal}{4.184\ J} = 16.10\ cal$

2. How much energy is released when 15 g (m) of aluminum ($c = 0.897\ J/g \cdot °C$) is cooled from 75°C to 53°C?

Δt $(75 - 53) = 22°C$

$q = c \times m \times \Delta t$

$q = 0.897 \times 15 \times 22$

$= \boxed{296.01\ J}$

b) how many calories?

$\frac{296.01\ J}{} \Big| \frac{1\ cal}{4.184\ J} = \boxed{70.75\ cal}$

3. What is the specific heat (c) of a substance that releases 220 J (q) when it has a mass of 8 g (m) & temp. cooled from 60°C to 23°C?

$\Delta t = 60 - 23 = 37°C$

$q = c \times m \times \Delta t$

$\frac{220\ J}{8 \times 37} = \frac{c \times \cancel{8} \times \cancel{37}}{\cancel{8} \times \cancel{37}}$

$\boxed{c = 0.74\ J/g \cdot °C}$