

# What is Specific Heat Capacity?

## Worksheet

Specific heat capacity ( $c$ ) is the thermal energy required per kilogram per degree:  $c = Q/(mT)$ , measured in  $J/(kgC)$ . It's material-specific: water 4200  $J/(kgC)$ , aluminum 900.

$$c = Q / (m T)$$

## Questions

1. 50 kJ heats 2 kg by 10C. Specific heat capacity?

- A) 2500  $J/(kgC)$
- B) 1250  $J/(kgC)$
- C) 500  $J/(kgC)$
- D) 5000  $J/(kgC)$

2. Unit of  $c$ ?

- A)  $J/kg$
- B)  $J/C$
- C)  $J/(kgC)$
- D)  $kg/C$

3. Water vs copper: water heats slower because

- A) copper is denser
- B) water has higher  $c$
- C) water is transparent
- D) copper conducts better

4. How much energy to raise 5 kg of iron ( $c=450$ ) by 20C?

- A) 45,000 J
- B) 4500 J
- C) 9000 J
- D) 450 J

5. 100 kJ of heat raises 2 kg of water by 12C. What is  $c$ ?

6. Aluminum ( $c = 900 J/kgC$ ): how much energy to heat 0.5 kg by 30C?

7. Lead ( $c = 130 J/kgC$ ) vs water ( $c = 4200$ ): which needs less energy to heat?

8. Define: What is specific heat capacity?

9. Define: Why does water heat slowly?

10. Define: Unit of specific heat capacity?

## Answer Key

1. A)  $2500 \text{ J/(kgC)} - c = 50,000 \text{ J} / (2 \text{ kg } 10\text{C}) = 2500 \text{ J/(kgC)}$ .
2. C)  $\text{J/(kgC)}$  - Specific heat = energy per mass per temperature rise  $\text{J/(kgC)}$ .
3. B) water has higher  $c$  - Water  $c$  4200, copper  $c$  385. Higher  $c$  = more energy needed per degree.
4. A)  $45,000 \text{ J} - Q = 450 \cdot 5 \cdot 20 = 45,000 \text{ J}$ .
5.  $Q = 100,000 \text{ J}$   $m = 2 \text{ kg}$   $T = 12\text{C}$   $c = Q/(mT) = 100,000/(2 \cdot 12) = 4167 \text{ J/(kgC)}$
6.  $Q = c \cdot m \cdot T$   $Q = 900 \cdot 0.5 \cdot 30 = 13,500 \text{ J}$
7. Lead:  $130 \cdot 1 \cdot 10 = 1,300 \text{ J}$  Water:  $4200 \cdot 1 \cdot 10 = 42,000 \text{ J}$  Lead needs 32 less energy much easier to heat
8. Energy per kg per C needed to raise a substance's temperature:  $c = Q/(mT)$ , in  $\text{J/(kgC)}$ .
9. High specific heat capacity ( $\sim 4200 \text{ J/kgC}$ ) - requires lots of energy per degree.
10. Joules per kilogram per Celsius:  $\text{J/(kgC)}$  or  $\text{J/(kgK)}$ .

### Bounlu

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