AQA GCSE Physics: Specific Heat Capacity & Thermal Energy Calculations

Question 1: The Warming Water

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 1 kg * 4200 J/kg°C * (100°C - 20°C) = **336,000 J**

Question 2: The Cooling Metal

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 0.5 kg * 900 J/kg°C * (20°C - 100°C) = **-36,000 J** (The negative sign indicates energy is lost)

Question 3: The Heated Iron

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 1.5 kg * 450 J/kg°C * (180°C - 20°C) = **108,000 J**

Question 4: The Mystery Metal

- **Answer:** Specific heat capacity = change in thermal energy / (mass * temperature change) = 10,000 J / (2 kg * 10°C) = **500 J/kg°C**

Question 5: The Mixed Water

- **Answer:** Let the final temperature be T. Heat lost by hot water = heat gained by cold water 1 kg * 4200 J/kg°C * (80°C - T) = 1 kg * 4200 J/kg°C * (T - 20°C) 80 - T = T - 20 2T = 100 T = **50°C**

Question 6: The Chocolate Challenge

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 0.1 kg * 1500 J/kg°C * (40°C - 20°C) = **3000 J**

Question 7: The Efficient Kettle

- **Answer:** Useful energy output = change in thermal energy of water = 1 kg * 4200 J/kg°C * (100°C - 10°C) = 378,000 J Efficiency = (useful energy output / total energy input) * 100% = (378,000 J / 350,000 J) * 100% = **108%** (This answer is likely due to rounding errors or inaccuracies in the kettle's claim. Efficiencies cannot be greater than 100%.)

Question 8: The Solar Panel

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 5 kg * 4200 J/kg°C * (35°C - 15°C) = **420,000 J**

Question 9: The Cooling Experiment

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 0.2 kg * 385 J/kg°C * (20°C - 100°C) = **-6160 J** (The negative sign indicates energy is lost)

Question 10: The Hot Drink

- **Answer:** Change in thermal energy = mass * specific heat capacity * temperature change = 0.25 kg * 4000 J/kg°C * (37°C - 80°C) = **-43,000 J** (The negative sign indicates energy is lost

by the drink and gained by the body)