HEAT CAPACITY and SPECIFIC HEAT: PROBLEMS: I

1. When 1.50×10^3 J of heat energy is absorbed by a beaker of water, its temperature rises by 3.10 °C, What is the heat capacity of the beaker of water?
2. If 10.5 g of iron, at 25.0 °C, absorbs 128 J of heat, what will be the final temperature of the metal? (The specific heat of iron is 0.499J/g °C.)
3. Calculate the molar heat capacity of ethanol, $C_2H_5OH_{(l)}$. The specific heat of ethanol is 2.46 J/ g °C.
4. Determine the quantity if heat required to raise the temperature of 100 ml of water from 298.0 K to 373.0 K. (The specific heat of water is 4.18 J/ g K.)
5. The specific heat capacity of aluminium is 0.900 J/ g °C.
   f) How much energy is needed to raise the temperature of a 8.50×10^2 g block of aluminium from 22.8°C to 94.6°C
   g) What it the heat capacity of aluminium per mole?
6. A 28.2 g sample of nickel is heated to 99.8 °C and placed in a beaker containing 150.0 g of water at a temperature of 23.5 °C. After the metal cools, the final temperature of the metal and the water is 24.83 ^{O}C. Calculate the heat capacity of nickel, (assume no heat escapes to the surroundings or to the glass beaker) and the specific heat capacity of nickel.
7. In order to determine how much heat paraffin gives off on burning, a candle flame is used to heat some water in a calorimeter. The following data is obtained:

Mass of water in calorimeter	350 g
Initial mass of candle	150 g
Final mass of candle	112 g
Initial temperature of water	15°C
Final temperature of water	23°C

   Calculate (a) the temperature rise, (b) the heat absorbed by the water in the calorimeter, (c) the mass of paraffin burned and (d) the approximate value of the heat in J/g. Ignore the energy absorbed by the calorimeter.

8. Which kind of substances experiences the larger increase in temperature when it absorbs 100 J, something with a high or low specific heat? Explain.

9. What is the name of the thermal property whose values can have the following units?
   (a) J g^{-1} $^{O}C^{-1}$ (b) J mol^{-1} $^{O}C^{-1}$ (c) J $^{O}C^{-1}$

10. Which kind of substance needs more energy to undergo an increase of 5 ^{O}C, something with a high or with a low specific heat? Explain

11. If the specific heat values were in units of kJ kg^{-1} K^{-1}, instead of J mol^{-1} $^{O}C^{-1}$, would the values be numerically any different? Explain.

12. When 50.0 cm^3 of 1.0 mol dm^{-3} of $HCl_{(aq)}$ at 25.0 ^{O}C is mixed with 50.0 cm^3 of 1.0 mol dm^{-3} $NaOH_{(aq)}$ also at 25.0 ^{O}C. The temperature rises to 31.9 ^{O}C Determine the molar enthalpy of neutralization.

ANSWERS

(1) 4.8×10^2 J /°C (2) 49.0 °C (3) 113 J/mol K (4) 31.4 kJ
(5) (a) 54.9 kJ (b) 24.3 J/mol °C (6) 0.394 J/g.°C
(7) (a) 8°C (b) 11.7 kJ (c) 38 g (d) 308 J/g (8) low
(9) (a) specific heat capacity (b) molar heat capacity, (c) heat capacity
10. High (11) none (12) 57.7 kJ mol^{-1}