Worksheet 6.1
Specific heat capacity

NAME: **CLASS:**

INTRODUCTION

The **specific heat capacity** of a substance is the energy required to raise the temperature of one gram of the substance by one degree Celsius. The specific heat capacities of some common substances are shown in the table below.

Substance	State at 25°C, 101 kPa	Specific heat capacity ($J\ g^{-1}\ °C^{-1}$)
Aluminium	Solid	0.90
Nickel	Solid	0.44
Copper	Solid	0.39
Water	Liquid	4.18
Ethanol	Liquid	2.46
Propanone (acetone)	Liquid	2.13

No.	Question	Answer
1	When equal masses of water and glycerol, another liquid, are heated side by side on the same hotplate for the same length of time, the change in temperature is greater for glycerol. Which of these two substances has the higher specific heat capacity?	
2	Why is the specific heat capacity of water greater than that of ethanol? (*Hint:* Consider intermolecular forces, and how many molecules of each would be present in a 1.0 g sample.)	
3	Knowing that temperature is a measure of the average kinetic energy of particles in a system, how difficult is it to increase the kinetic energy of particles in 1 g of aluminium compared to 1 g of nickel?	

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No.	Question	Answer
4	Compound X is a liquid at 25°C and 101 kPa. Its molar mass is similar to that of ethanol, but compound X is non-polar. How would the specific heat capacity of compound X compare to that of ethanol?	

Specific heat capacity (c) can be experimentally determined by measuring the temperature change ($\Delta T = |T_f - T_i|$) in °C that a known mass (m) undergoes when it loses or gains a quantity of heat (q).

$$c = \frac{q}{m \times \Delta T} \quad \text{so it follows that } \boldsymbol{q = m \times c \times \Delta T}$$

Recall that the density of pure water = 1.00 g mL^{-1}, so that for water, 100 g = 100 cm^3.

No.	Question	Answer
5	100.0 g of water is cooled from 30.10°C to 25.05°C. How much heat energy is released?	
6	100.0 g of water at 25.00°C absorbs 100 J of heat. What is its final temperature?	
7	A stone weighing 2.0 g absorbs 5.0 J of heat and warms by 3.0°C. What is the specific heat capacity of the stone?	
8	80.0 g of propanone was heated from 25.5°C to 63.4°C. How much energy was transferred to the propanone during heating?	
9	The latent heat of fusion of water is 6.01 kJ mol^{-1}. This means that 6.01 kJ of energy is needed to melt one mole of ice. How much energy is needed to melt 54.0 g of ice?	
10	A 25.0 g block of a metal alloy at 100°C is dropped into an insulated flask containing 110 g of ice; 5.30 g of the ice melted. What is the specific heat capacity of the alloy?	