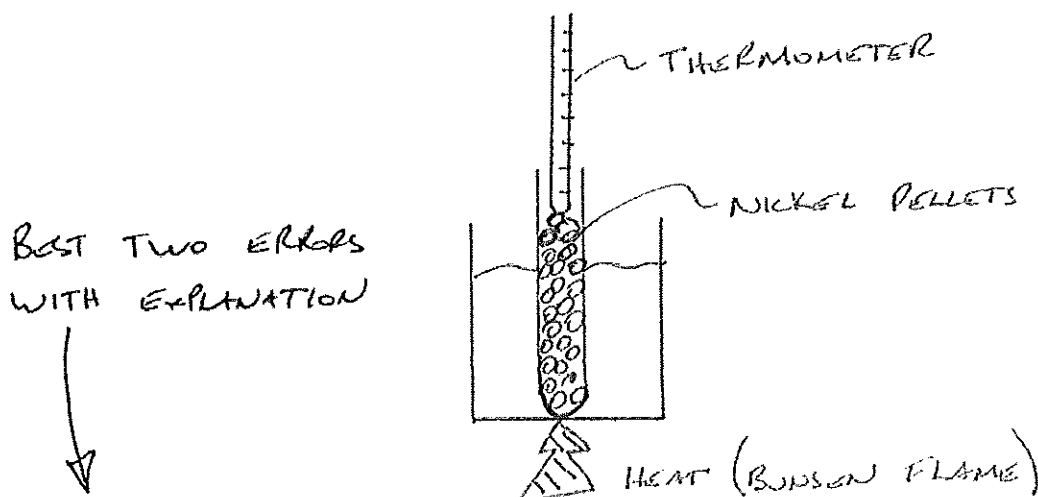


YR 11 HEAT VALIDATION QUIZ 2011Specific Heat of Nickel Experiment

1. Bill and Susan set up their equipment to heat their nickel pellets as below. Susan suggests that there are several things wrong with this initial set up. List two major errors in the table below which may give invalid readings. Include explanations as to why you think that the errors or perceived errors will produce invalid data.



Perceived Error	Explanation
PELLETS EXPOSED FROM WATER BATH.	THE SENSED TEMPERATURE OF THE NICKEL WILL BE LOWER THAN IT ACTUALLY IS.
LOCALISED OR CONCENTRATED HEATING OF THE PELLETS AT THE BASE OF THE TEST TUBE.	THE PELLETS AT THE BOTTOM WILL CONTAIN A LOT MORE HEAT THAN SENSED / MEASURED.
THE THERMOMETER SHOULD BE PLACED IN THE WATER BATH AND NOT AMONGST THE PELLETS.	IF THE WATER BATH TEMP. IS IN EQUILIBRIUM WITH THE NICKEL, THEN THE WATER BATH TEMP. WILL PROVIDE THE MOST ACCURATE MEAN TEMP. OF THE PELLETS.

2. During the experiment, Bill followed the instructions and heated the water bath to 90.0 degrees Celsius. He then quickly put the test tube containing the dry nickel pellets, which were initially at room temperature, into the water bath for four minutes. The pellets remained dry. Bill then removed the test tube containing the nickel pellets and quickly but carefully poured the pellets into the receiving water. He then measured the rise in temperature of the receiving water. What is the major flaw in Bill's procedure? Why is this a problem?

MAJOR FLAW - THE NICKEL HAS NOT BEEN IN
THE WATER LONG ENOUGH ① TO ATTAIN THE EQUIL - (2)
IBRIUM TEMP. OR KNOWN MEAN TEMP. (90°C).

IN SHORT, THE EXPERIMENTERS BELIEVE THAT THE
PELLETS CONTAIN A LOT MORE ENERGY THAN THEY
ACTUALLY DO. ①

3. What is the possible error resulting from using the same thermometer to measure the temperature of the heating bath and the receiving water? (2)

THE THERMOMETER WILL TRANSFER HEAT ②
 TO THE RECEIVING WATER.

4. Alex and Rory transfer their new found knowledge to calculate the specific heat of a recently discovered metal called Taylorium. Use the boys' data as listed below to determine the specific heat capacity of Taylorium. Assume that no energy is transferred to the calorimeter or the environment. Show neat and full working. (4)
- Given Information

- mass of Taylorium sample = 57.26g
- mass of receiving water = 45.0g
- initial temp of Taylorium = 93.0 C
- initial temp of receiving water = 19.0 C
- final temp of receiving water and Taylorium = 23.0 C

$$\overset{\text{METAL}}{Q_L} = \overset{\text{WATER}}{Q_G} \quad (1)$$

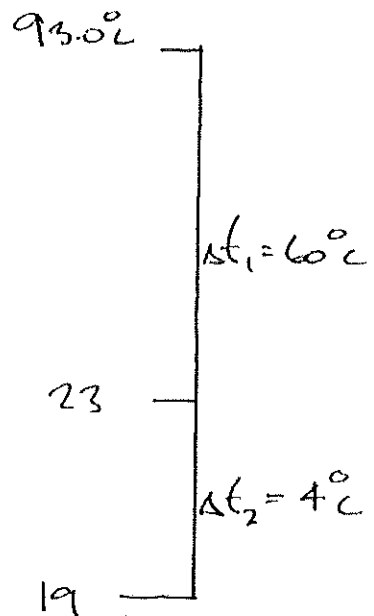
$$m_T c_T \Delta t_1 = m_W c_W \Delta t_2 \quad (1)$$

$$\therefore c_T = \frac{m_W c_W \Delta t_2}{m_T \Delta t_1}$$

$$= \frac{45 \times 10^{-3} \times 4180 \times 4}{57.26 \times 10^{-3} \times 60} \quad (1)$$

$$= \frac{188.1}{0.8589}$$

$$= 219 \text{ J kg}^{-1} \text{ K}^{-1} \quad (1)$$



Latent Heat of Fusion of Ice Experiment

5. If you used an aluminium calorimeter of the same mass as the copper calorimeter you used in your experiment, would you need more, the same or less ice (circle your response) to attain the same final temperature of the water as you achieved with the copper calorimeter? With reference to the equation for Q_{gained} , explain your choice above. (3)

Water + AL

$$Q_G = m_w c_w \Delta t_1 + m_{AL} \overset{900}{c_{AL}} \Delta t_1$$

①

SINCE $c_{AL} > c_{Cu} \Rightarrow$ MORE HEAT IS ①

$$900 > 390$$

TRANSFERRED AND

THEREFORE MORE ICE
IS REQUIRED TO ACHIEVE
THE SAME FINAL TEMP.

6. Michelle and Shirley repeat the Latent Heat of Fusion Experiment taking into account a better appreciation of what is actually going on. They note that the ice was actually initially at minus 2.00 degrees Celsius. Further, they noticed that the ice that they weighed actually had a water film which comprised 0.5% of the total measured "ice mass". Assuming that the water and the ice are pure, use the girls' data to calculate the thermal energy gained by adding 21.75g of "measured ice" when a final water temperature of 3.00C is achieved. Show full working used to obtain your answer below. (4)

FOR THERMAL ENERGY GAINED

FIRSTLY, CALCULATE THE ACTUAL MASS OF ICE...

$$m_i (\text{ACTUAL}) = \frac{21.75}{1} - \left(\frac{21.75}{1} \times \frac{0.5}{100} \right) = \underline{21.641\text{g}} \quad (1)$$

Now
WATCH C.O.

$$Q_G = (m_i c_i \Delta t_1) + (m_i L_f) + (m_i c_w \Delta t_2) \quad (1)$$

$$= \left(21.641 \times 2100 \times 2 \right) + \left(21.641 \times 3.34 \times 10^5 \right) + \left(21.641 \times 4180 \times 3 \right) \quad (1)$$

$$= 7.59036 \times 10^6$$

$$= \underline{7.59 \text{ MJ}} \quad (1)$$