CALORIMETRY – TEST 3

ERRORS IN CALORIMETRY

QUESTION 1
The heat of neutralisation for the reaction:

$$HCl(q) + NaOH(aq) \rightarrow H_2O(l) + NaCl(aq); \Delta H = -56.1 kJmol^{-1}$$

aas experimentally determined using a simple solution calorimeter. When the final calculations were completed, the value of ΔH was found to be –49.5 kJ mol^{-1}.

The most likely reason for this is that:

A The reaction did not go to completion in the calorimeter.
B The calorimeter was poorly insulated and some of the heat was lost.
C The temperature of the solution in the calorimeter was too cold.
D An error was made in the calculations.

QUESTION 2
A group of students used a bomb calorimeter to determine the energy content of a biscuit. They repeated the experiment several times, but they took a few shortcuts. Each time they,

- Weighed the sample of biscuit but forgot to set the electronic balance to zero.
- Recorded the initial temperature without any decimal places.
- Ignited the sample of biscuit in the bomb calorimeter.
- Chatted as the temperature rose (and didn't stir the water of the calorimeter).
- Recorded the final temperature without any decimal places.
- Performed their calculations with last week's calibration factor.

Which of the following is an example of systematic error?

A. Failing to set the electronic balance to zero.
B. Recording the temperatures without any decimal places.
C. Failing to stir the water of the calorimeter.
D. Using last week's calibration factor in their calculations.

QUESTION 3
A reaction between magnesium and dilute hydrochloric acid is carried out in a stoppered flask. The heat change is found to be 433.8 kJ. If the same reaction is carried out again without the stopper, what would be the enthalpy change?

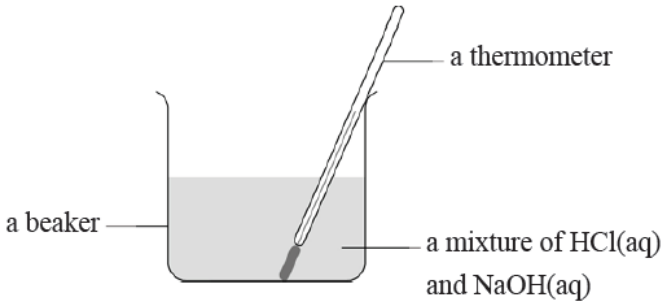
A. Below 433.8 kJ, as there is energy lost to the surroundings.
B. Same as 433.8 kJ, as the difference in work done between two cases is negligible.
C. Above 433.8 kJ, as the latter case does not have work done against the wall of flask.
D. Same as 433.8 kJ, as the enthalpy change is independent of volume or pressure of flask

QUESTION 4
Which of the following assumptions are made when using a simple calorimeter to determine the enthalpy change of a reaction?

(1) The density of the reaction mixture is the same as that of water.
(2) The specific heat capacities of the calorimeter and the thermometer are negligible.
(3) There is no heat loss to the surroundings.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

QUESTION 5
An experiment was carried to determine the enthalpy change of neutralization between $HCl_{(aq)}$ and $NaOH_{(aq)}$. The experimental set-up was shown below.



Which of the following statements concerning the above experiment are correct?

1. The enthalpy change would be the same if the same concentration and volume of sulfuric acid was used.
2. The experimental value is less negative than the theoretical value of the enthalpy change of neutralisation between $HCl_{(aq)}$ and $NaOH_{(aq)}$.
3. The major error of the experiment is heat loss to the surroundings due to convection, conduction and evaporation.

A. (1) and (2) only
B. (1) and (3) only
C. (2) and (3) only
D. (1), (2) and (3)

QUESTION 6
Which of the following is the least significant source of error when using the simple calorimetric methods to determine the standard enthalpy change of neutralisation?

A. The density of the reaction mixture deviates from that of water.
B. The specific heat capacities of the expanded polystyrene cup and the thermometer are not considered in calculation.
C. The reaction condition is not standard.
D. Taking reading from the thermometer by naked eyes.

SOLUTIONS

QUESTION 1 Answer is B

QUESTION 2 Answer is D

QUESTION 3 Answer is A

QUESTION 4 Answer is D

QUESTION 5 Answer is C

QUESTION 6 Answer is D