5.1 Energetics

Question Paper

Course	DP IB Chemistry
Section	5. Energetics / Thermochemistry
Topic	5.1 Energetics
Difficulty	Medium

Time allowed: 20

Score: /10

Percentage: /100

Question 1

A student mixed 30.0 cm^3 of 0.0250 mol dm^{-3} potassium hydroxide solution with 30.0 cm^3 of 0.0250 mol dm^{-3} nitric acid. The temperature rose by 0.50 °C. Assume no heat was lost to the surroundings.

The mixture had a specific heat capacity of 4.18 J g^{-1} K^{-1}.

What is the molar enthalpy change for the reaction?

A. $-\frac{30 \times 4.18 \times 0.5 \times 1000}{0.025 \times 30}$

B. $-\frac{60 \times 4.18 \times 0.5}{0.025 \times 30}$

C. $-\frac{0.025 \times 30}{60 \times 4.18 \times 0.5 \times 1000}$

D. $-\frac{60 \times 4.18 \times 0.5}{0.025 \times 30}$

[1 mark]

Question 2

An experiment was carried out to determine the approximate value for the molar enthalpy change of neutralisation.

75 cm^3 of 3.00 mol dm^{-3} hydrochloric acid was placed in a polystyrene beaker of negligible heat capacity. Its temperature was recorded, and then 75 cm^3 of
3.00 mol dm^{-3} potassium hydroxide at the same temperature was quickly added, and the solution stirred.

The temperature rose by 14 °C. The resulting solution may be considered to have a specific heat capacity of 4.18 J g^{-1} K^{-1}.

Which calculation below is correct?

A. $-\frac{(75 \times 4.18 \times 14)}{(6.0 \times 0.150)}$ J mol^{-1}

B. $-\frac{(150 \times 4.18 \times 14)}{(3.0 \times 0.075)}$ J mol^{-1}

C. $-\frac{(150 \times 4.18 \times 14)}{(3.0 \times 75.0)}$ J mol^{-1}

D. $-\frac{(75 \times 4.18 \times 287)}{(6.0 \times 0.150)}$ J mol^{-1}

[1 mark]

Question 3

The table below discusses three types of enthalpy change:

'+' means that this type of standard enthalpy change can only have positive values,

'−' means that this type of standard enthalpy change can only have negative values,

'+/−' means that either positive or negative values are possible.

Which row is correct?

	formation	combustion	neutralisation
A	+	+	+/−
B	+/−	+	+/−
C	+/−	−	−
D	−	−	+

[1 mark]

Question 4

Using a spirit burner, ethanol is used to heat a container of water.

In this experiment:

Mass of ethanol burned, g	*a*
Mass of water, g	*b*
Specific heat capacity of water, $J\,g^{-1}\,K^{-1}$	*d*
Temperature rise, °C	*y*

How much heat energy is absorbed by the water?

A. ady

B. bdy

C. $bd(y+273)$

D. $(y+273)/ad$

[1 mark]

Question 5

An iron block with a mass of 0.11 kg absorbs 504 J of heat energy. What is the temperature rise in K?

Specific heat capacity of iron = 0.448 J g^{-1} K^{-1}

A. 1.02 x 10^{4}

B. 1.10

C. 10.23

D. 9.78 x 10^{-2}

[1 mark]

Question 6

Which statements are correct for an endothermic reaction?

I. The products are more stable than the reactants
II. The enthalpy change is positive
III. The temperature of the surroundings decreases

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

[1 mark]

Question 7

Which assumptions are correct when calculating the enthalpy change for a reaction in solution?

I. The density of the solution is 1 g cm^{-3}
II. The specific heat capacity of the solution is 4.18 J g^{-1} K^{-1}
III. The correct stoichiometric quantities of reactants for a complete reaction are used

A. I and II only

B. I and III only

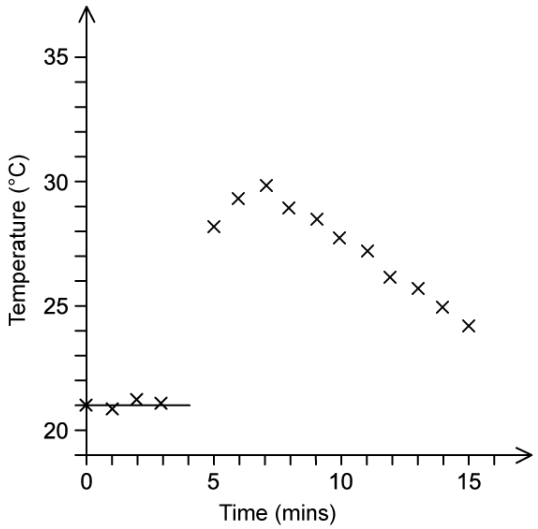
C. II and III only

D. I, II and III

[1 mark]

Question 8

What is the closest integer value of the temperature change for this reaction, from the graph



A. 8

B. 9

C. 11

D. 35

[1 mark]

Question 9

Which enthalpy changes correctly describe the following reactions?

Reaction 1: $HNO_3(aq) + NH_3(aq) \rightarrow NH_4NO_3(aq)$

Reaction 2: $CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$

Reaction 3: $S(s) + O_2(g) \rightarrow SO_2(g)$

	$\Delta H^{\ominus}_c$	$\Delta H^{\ominus}_f$	$\Delta H^{\ominus}_{neut}$	$\Delta H^{\ominus}_r$
A	2	2	1	3
B	3	2	1	2
C	3	3	1	2
D	2	3	1	3

[1 mark]

Question 10

Which systems are correctly described?

I. Matter and energy can be transferred across the boundary of an open system
II. Only matter can be transferred across the boundary of a closed system
III. Matter and energy cannot be transferred across the boundary of an isolated system

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

[1 mark]