CHEMISTRY ONLINE
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CHEMISTRY

Physical Chemistry

Level & Board	AQA (A-LEVEL)
TOPIC:	ENERGETICS
PAPER TYPE:	SOLUTION - 2
TOTAL QUESTIONS	10
TOTAL MARKS	38

Energetics - 2

1.

(a)

Experimental values can be added to table (only) given after experiment:

Temp/ °C		Mass /g	
Initial		Burner before	
Final		Burner after	
ΔT		(Mass heptane burned)	

(2)

(b)

Following are two disadvantages of using a glass beaker on a tripod and gauze

Poor Heat Conductivity: Glass has lower heat conductivity compared to copper.

Reduced Heat Transfer Efficiency: Tripod and gauze setup might hinder efficient heat transfer.

(2)

(c)

Two reasons for less enthalpy of combustion from this experiment :

Heat loss to surroundings or calorimeter: Loss of heat to the surroundings or the calorimeter can lower the measured enthalpy of combustion.

Incomplete combustion: If the fuel doesn't completely react with oxygen, it leads to less energy released, resulting in a lower observed enthalpy of combustion.

(2)

(d)

Using a wind shield to reduce heat loss would improve the accuracy of the obtained enthalpy value.

I am Sorry !!!!!

(1)

2. (D) (1)

3. (D) (1)

4. (A) (1)

5.

(a)

Given:

Volume of ethanoic acid solution (V) = 25 cm^3 = 25 × 10^{-3} dm^3

Molarity of ethanoic acid solution = 2.0 mol dm^{-3}

Moles of ethanoic acid = Molarity × Volume

Moles of ethanoic acid = 2.0 mol dm^{-3} × 25 × 10^{-3} dm^3

= 0.05 moles

Moles of sodium hydroxide = 0.05 moles (since equal volumes and molarities are used)

The enthalpy change (ΔH) given is -56.1 kJ mol^{-1}

ΔH = -56.1 kJ mol^{-1}

= -56,100 J mol^{-1}

So the heat released will be:

Heat released = ΔH × moles

Heat released = 56,100 J mol^{-1} × 0.05 mol

= 2,805 J

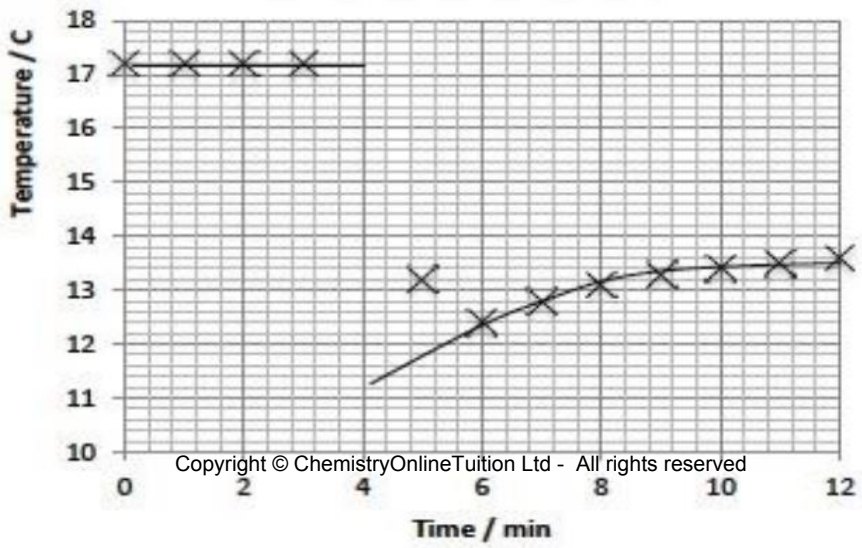
ΔT= Heat released / m.c

ΔT = 2,805 J / (50 g × 4.18 J K^{-1} g^{-1})

= 13.4 °C

(4)

(b)



17.2 value from graph line at 4 minutes) ± 0.2 (°C)

(6)

6. (B)

(1)

7. (C)

(1)

8.

(a)

$C_6H_{11}OH + 8½O_2 \rightarrow 6CO_2 + 6H_2O$

(1)

(b)

Given:

Temperature rise (ΔT) = 20.1°C

Specific heat capacity of water (c) = 4.18 J/g°C

Mass of water (m) = 50.0 g

Mass of alcohol burned = 0.54 g

Molar mass of alcohol = 100.0 g/mol

Using the formula $q=mc\Delta T$ to find the heat absorbed by water:

$q=mc\ \Delta T$

$q=50.0g \times 4.18J/g°C \times 20.1°C$

$q=4201J$

Calculate the number of moles of alcohol burned:

Moles of alcohol burned (n) = Mass of alcohol burned / Molar mass of alcohol

$n=0.54g/100.0g/mol$

n=0.0054mol
Calculate the heat change per mole of alcohol:
Heat change per mole (ΔH)
= ΔH=4201J/0.0054mol
ΔH=-778kJ/mol or -778,000 J/mol

(4)

(c)
The experimental value obtained may be less negative than the reference due to factors like heat loss, incomplete combustion, alcohol evaporation, or unaccounted heat transfer to the beaker.

(2)

(d)
Water has a known density of 1.0 g/cm^3. Hence, a volume of 50.0 cm^3 could be measured out to correspond to a mass of 50.0 g of water.

(2)

9. (B)

(1)

10.
(a)
Enthalpy change is termed as heat (energy) change at constant pressure. It is denoted as ΔH

(1)

(b)
The bond energies are as follows:
C–H: 412 kJ/mol
C=O: 743 kJ/mol
O–H: 463 kJ/mol
O=O: 496 kJ/mol
$H_2O(l) \longrightarrow H_2O(g)$ $\Delta H = +41$ kJ/mol

Using the bond energies provided, the given reaction can be expressed in terms of bond energies:

$C_3H_8(g) + 5\ O_2(g) \longrightarrow 3\ CO_2(g) + 4\ H_2O(l)$ $\Delta H = -2046$ kJ mol^{-1}

For this reaction

(Broken) 2(C–C)+8(C–H)+5(O=O) = 5776 +2(C–C)
(Made) 6(C=O)+8(O–H) = 8162

Now, including the vaporization of water ($H_2O_{(l)} \longrightarrow H_2O_{(g)}$), we use 4 × 41 kJ/mol

2(C–C)
= 6(C=O) + 8(O–H) + 4(41) – 2046 – 8(C–H) – 5(O=O)
= 6(743) + 8(463) + 4(41) – 2046 – 8(412) – 5(496)
2(C–C) = 504
(C–C)= 504 / 2
= 252 kJ mol^{-1}

(4)

(c)
The value given for the O=O bond enthalpy is not a mean value because Oxygen / O_2 is the only substance that has O=O bond

(1)

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