Essential Pre-Uni Chemistry F1.7

A Level

P P P

Specific heat capacity of water $= 4.18\,\mathrm{J\,g^{-1}\,K^{-1}}$.

$25.0\,\mathrm{cm^3}$ of sulfuric acid at $1.00\,\mathrm{mol\,dm^{-3}}$ and $19.10\,^{\circ}\mathrm{C}$ is placed in an insulated polystyrene cup. When $25.0\,\mathrm{cm^3}$ of sodium hydroxide at $2.00\,\mathrm{mol\,dm^{-3}}$ and $19.10\,^{\circ}\mathrm{C}$ is added, the temperature rises to $32.45\,^{\circ}\mathrm{C}$.

Assuming that no heat is lost, that the specific heat capacity of water may be used, and that the solutions have a density of $1.00\,\mathrm{g\,cm^{-3}}$ at $19.10\,^{\circ}\mathrm{C}$, find the enthalpy change of the reaction per mole of water produced by neutralisation.

Essential Pre-Uni Chemistry F1.6

A Level

Specific heat capacity of water $= 4.18\,\mathrm{J\,g^{-1}\,K^{-1}}$.

Calculate the enthalpy of combustion of propyne, C_3H_4, given that complete combustion of $65\,\mathrm{mg}$ of propyne raises the temperature of $800\,\mathrm{g}$ of water from $20.15\,^{\circ}\mathrm{C}$ to $21.09\,^{\circ}\mathrm{C}$.

Essential Pre-Uni Chemistry F1.4

A Level

Specific heat capacity of water $= 4.18 \, \mathrm{J\,g^{-1}\,K^{-1}}$.

The enthalpy change of combustion of decane, $C_{10}H_{22}$, is $-6778 \, \mathrm{kJ\,mol^{-1}}$. Calculate the mass required to raise the temperature of $450 \, \mathrm{g}$ of water by $80 \, ^{\circ}C$ when burnt completely, with no heat losses from the water. Give your answer to 2 significant figures.

Essential Pre-Uni Chemistry F1.5

A Level

P P P

Specific heat capacity of water $= 4.18\,\mathrm{J\,g^{-1}\,K^{-1}}$.

Complete combustion of $0.020\,\mathrm{mol}$ of ethane, with a standard enthalpy of combustion of $-1410.8\,\mathrm{kJ\,mol^{-1}}$ raises the temperature of the water in an insulated calorimeter from $17.4\,^\circ\mathrm{C}$ to $22.4\,^\circ\mathrm{C}$. Calculate the mass of the water in the calorimeter.

Essential Pre-Uni Chemistry F1.1

A Level

C | C | C

Specific heat capacity of water $= 4.18 \, \text{J} \, \text{g}^{-1} \, \text{K}^{-1}$.

Part A   **(a)**

Calculate the heat capacity of an object with mass $1.80 \, \text{kg}$ and specific heat capacity $0.32 \, \text{J} \, \text{g}^{-1} \, \text{K}^{-1}$.

Part B   **(b)**

Calculate the heat capacity of a calorimeter if its temperature is raised $2.5 \, \text{K}$ by $35 \, \text{kJ}$ of heat.

Part C   **(c)**

Calculate the expected increase in temperature when $2.4 \, \text{kJ}$ of heat is transferred to a calorimeter of heat capacity $720 \, \text{J} \, \text{K}^{-1}$.

Part D   **(d)**

Calculate the heat required to raise the temperature of a calorimeter of heat capacity $1.6 \, \text{kJ} \, \text{K}^{-1}$ by $3.8 \,^\circ\text{C}$.

Part E   **(e)**

Calculate the specific heat capacity of a calorimeter if it has a mass of $375 \, \text{g}$ and its temperature is raised $4.2 \, \text{K}$ by $2160 \, \text{J}$ of heat.

Part F   **(f)**

Calculate the heat required to raise the temperature of $3.14\,\mathrm{kg}$ of water by $12.2\,\mathrm{K}$.

Part G   **(g)**

Calculate the mass of water whose temperature is raised through $16.0\,\mathrm{K}$ by $6.7\,\mathrm{kJ}$ of heat.

Part H   **(h)**

A calorimeter consists of $140\,\mathrm{g}$ of aluminium and $300\,\mathrm{g}$ of water. $6100\,\mathrm{J}$ of heat raises its temperature by $4.42\,\mathrm{K}$. Calculate to three significant figures:

its heat capacity;

the specific heat capacity of aluminium.

Essential Pre-Uni Chemistry F1.3

A Level

Specific heat capacity of water $= 4.18 \, \mathrm{J \, g^{-1} \, K^{-1}}$.

The enthalpy change of combustion of naphthalene is $-5156 \, \mathrm{kJ \, mol^{-1}}$. Its molar mass is $128.2 \, \mathrm{g \, mol^{-1}}$. Calculate the temperature change expected when $1.00 \, \mathrm{mmol}$ is burnt in excess oxygen in a calorimeter containing $4.0 \, \mathrm{kg}$ of water.

Essential Pre-Uni Chemistry F1.4

A Level - Practice (P1)

Specific heat capacity of water $= 4.18\,\mathrm{J\,g^{-1}\,K^{-1}}$.

The enthalpy change of combustion of decane, $C_{10}H_{22}$, is $-6778\,\mathrm{kJ\,mol^{-1}}$. Calculate the mass required to raise the temperature of $450\,\mathrm{g}$ of water by $80\,^{\circ}\mathrm{C}$ when burnt completely, with no heat losses from the water. Give your answer to 2 significant figures.

Essential Pre-Uni Chemistry F1.1

A Level - Challenge (C1)

Specific heat capacity of water $= 4.18 \, \text{J} \, \text{g}^{-1} \, \text{K}^{-1}$.

Part A   (a)

Calculate the heat capacity of an object with mass $1.80 \, \text{kg}$ and specific heat capacity $0.32 \, \text{J} \, \text{g}^{-1} \, \text{K}^{-1}$.

Part B   (b)

Calculate the heat capacity of a calorimeter if its temperature is raised $2.5 \, \text{K}$ by $35 \, \text{kJ}$ of heat.

Part C   (c)

Calculate the expected increase in temperature when $2.4 \, \text{kJ}$ of heat is transferred to a calorimeter of heat capacity $720 \, \text{J} \, \text{K}^{-1}$.

Part D   (d)

Calculate the heat required to raise the temperature of a calorimeter of heat capacity $1.6 \, \text{kJ} \, \text{K}^{-1}$ by $3.8 \, ^\circ\text{C}$.

Part E   (e)

Calculate the specific heat capacity of a calorimeter if it has a mass of $375 \, \text{g}$ and its temperature is raised $4.2 \, \text{K}$ by $2160 \, \text{J}$ of heat.

Part F   **(f)**

Calculate the heat required to raise the temperature of $3.14\,\text{kg}$ of water by $12.2\,\text{K}$.

Part G   **(g)**

Calculate the mass of water whose temperature is raised through $16.0\,\text{K}$ by $6.7\,\text{kJ}$ of heat.

Part H   **(h)**

A calorimeter consists of $140\,\text{g}$ of aluminium and $300\,\text{g}$ of water. $6100\,\text{J}$ of heat raises its temperature by $4.42\,\text{K}$. Calculate to three significant figures:

its heat capacity;

the specific heat capacity of aluminium.

Essential Pre-Uni Chemistry F1.3

Specific heat capacity of water $= 4.18 \, \mathrm{J \, g^{-1} \, K^{-1}}$.

The enthalpy change of combustion of naphthalene is $-5156 \, \mathrm{kJ \, mol^{-1}}$. Its molar mass is $128.2 \, \mathrm{g \, mol^{-1}}$. Calculate the temperature change expected when $1.00 \, \mathrm{mmol}$ is burnt in excess oxygen in a calorimeter containing $4.0 \, \mathrm{kg}$ of water.

Essential Pre-Uni Chemistry F1.10

The enthalpies of combustion of three fuels are shown below:

Fuel	ΔH_c / kJ mol^{-1}
CH_4	-890.3
C_3H_8	-2219.2
C_4H_{10}	-2876.5

Part A   (a)

Which gives out most heat per gram?

Part B   (b)

Which gives out most heat per mole?

Part C   (c)

Which gives out most heat per cubic foot?

Essential Pre-Uni Chemistry F1.8

A Level

Specific heat capacity of water $= 4.18 \, \text{J g}^{-1} \, \text{K}^{-1}$

$30.0 \, \text{cm}^3$ of ethanoic acid at $1.60 \, \text{mol dm}^{-3}$ and $18.65 \, ^\circ\text{C}$ is placed in an insulated polystyrene cup. When $40.0 \, \text{cm}^3$ of sodium hydroxide at $1.00 \, \text{mol dm}^{-3}$ and $18.65 \, ^\circ\text{C}$ is added, the temperature rises to $25.80 \, ^\circ\text{C}$.

Assuming that no heat is lost, that the specific heat capacity of water may be used, and that the solutions have a density of $1.00 \, \text{g cm}^{-3}$ at $18.65 \, ^\circ\text{C}$, find the enthalpy change of the reaction per mole of water produced by neutralisation.

Essential Pre-Uni Chemistry F1.9

A Level

P P P

Specific heat capacity of water $= 4.18\,\mathrm{J\,g^{-1}\,K^{-1}}$.

When $5.0\,\mathrm{g}$ of ammonium nitrate dissolves in $100\,\mathrm{g}$ of water, the temperature of the water drops from $18\,^\circ\mathrm{C}$ to $14\,^\circ\mathrm{C}$. Calculate the enthalpy of solution of ammonium nitrate in $\mathrm{kJ\,mol^{-1}}$ using the following scheme.

Part A   Empirical formula

Write fown the formula of ammonium nitrate.

Part B   Formula mass

Calculate the formula mass of ammonium nitrate. Give your answer to 3 significant figures.

Part C   Number of moles

Calculate the number of moles of ammonium nitrate in $5.0\,\mathrm{g}$.

Part D   Heat loss of water

Calculate the heat lost from the $100\,\mathrm{g}$ of water. Give your answer to 2 significant figures.

Part E   Molar heat loss of ammonium nitrate

Calculate the heat lost per mole of ammonium nitrate.

Give the enthalpy of solution of ammonium nitrate.