Q1.

Which reaction has an enthalpy change equal to the standard enthalpy of formation of lithium fluoride?

A $Li(g) + \frac{1}{2}F_2(g) \rightarrow LiF(s)$ ○

B $Li^+(g) + F^-(g) \rightarrow LiF(s)$ ○

C $Li^+(aq) + F^-(aq) \rightarrow LiF(s)$ ○

D $Li(s) + \frac{1}{2}F_2(g) \rightarrow LiF(s)$ ○

(Total 1 mark)

Q2.

Two reactions of iron with oxygen are shown.

$Fe(s) + \frac{1}{2}O_2(g) \rightarrow FeO(s)$ $\Delta H = -272$ kJ mol^{-1}

$2\,Fe(s) + \frac{3}{2}O_2(g) \rightarrow Fe_2O_3(s)$ $\Delta H = -822$ kJ mol^{-1}

What is the enthalpy change, in kJ mol^{-1}, for this reaction?

$$2\,FeO(s) + \frac{1}{2}\,O_2(g) \rightarrow Fe_2O_3(s)$$

A +550 ○

B –278 ○

C –1094 ○

D –1372 ○

(Total 1 mark)

Q3.

Some enthalpy change data are shown.

$$C(s) + 2\ H_2(g) \rightarrow CH_4(g) \qquad \Delta H = -75\ kJ\ mol^{-1}$$

$$H_2(g) \rightarrow 2\ H(g) \qquad \Delta H = +436\ kJ\ mol^{-1}$$

What is the enthalpy change, in kJ mol^{-1}, for the following reaction?

$$CH_4(g) \rightarrow C(s) + 4\ H(g)$$

A –947 ○

B –361 ○

C +361 ○

D +947 ○

(Total 1 mark)

Q4.

The temperature changed from 21.8 °C to 19.2 °C during a calorimetry experiment.

The uncertainty of each reading of the thermometer is ±0.1 °C

What is the percentage uncertainty in the temperature change?

A 0.5% ○

B 1.0% ○

C 3.8% ○

D 7.7% ○

(Total 1 mark)

Q5.

An experiment is done to determine the enthalpy of combustion of a fuel using a calorimeter containing water.

b = mass of fuel burned / g
w = mass of water heated / g
ΔT = temperature rise of water / K
M_r = relative molecular mass of fuel
c = specific heat capacity of water / J K^{-1} g^{-1}

Which expression gives the enthalpy of combustion (in J mol^{-1}), assuming there is no heat loss?

A $-\frac{c\,w\,\Delta T\,M_r}{b}$ ○

B $-\frac{c\,b\,\Delta T\,M_r}{w}$ ○

C $-\frac{c\,b\,w\,M_r}{\Delta T}$ ○

D $-\frac{c\,b\,w\,\Delta T}{M_r}$ ○

(Total 1 mark)

Q6.

Which reaction has an enthalpy change equal to the standard enthalpy of formation of silver iodide?

A $Ag(g) + \frac{1}{2}\,I_2(g) \rightarrow AgI(s)$ ○

B $Ag(s) + \frac{1}{2}\,I_2(s) \rightarrow AgI(s)$ ○

C $Ag^+(g) + I^-(g) \rightarrow AgI(s)$ ○

D $Ag^+(aq) + I^-(aq) \rightarrow AgI(s)$ ○

(Total 1 mark)

Q7.

Which equation represents the reaction that has a standard enthalpy change equal to the standard enthalpy of formation for barium chloride?

A $Ba(g) + Cl_2(g) \rightarrow BaCl_2(s)$ ⬭

B $Ba^{2+}(g) + 2\ Cl^-(g) \rightarrow BaCl_2(s)$ ⬭

C $Ba(s) + Cl_2(g) \rightarrow BaCl_2(s)$ ⬭

D $Ba^{2+}(s) + 2\ Cl^-(g) \rightarrow BaCl_2(s)$ ⬭

(Total 1 mark)

Q8.

Some fuel in a spirit burner is burned, and the heat produced is used to heat a container of water.
In this experiment:
The mass of water heated = m g
The temperature rise = y °C
The specific heat capacity of water = c J K^{-1} g^{-1}

What is the amount of heat energy absorbed by the water?

A mcy ⬭

B $mc(y + 273)$ ⬭

C y / mc ⬭

D $(y + 273) / mc$ ⬭

(Total 1 mark)

Q9.

Nitrogen dioxide is produced from ammonia and air as shown in these equations

$4\ NH_3(g) + 5\ O_2\ (g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$ $\Delta H = -909\ kJ\ mol^{-1}$

$2\ NO(g) + O_2\ (g) \rightarrow 2\ NO_2\ (g)$ $\Delta H = -115\ kJ\ mol^{-1}$

What is the enthalpy change (in kJ mol^{-1}) for the following reaction?

$4\ NH_3(g) + 7\ O_2\ (g) \rightarrow 4\ NO_2\ (g) + 6\ H_2O(g)$

A −679 ⬭

B −794 ⬭

C −1024 ⬭

D −1139 ⬭

(Total 1 mark)

Q10.

What is the enthalpy of formation of buta-1,3-diene, $C_4H_6(g)$?

Substance	**Enthalpy of combustion / kJ mol^{-1}**
$C_4H_6(g)$	–2546
C(s)	–394
$H_2(g)$	–286

A +112 kJ mol^{-1} ⬭

B –112 kJ mol^{-1} ⬭

C +746 kJ mol^{-1} ⬭

D –746 kJ mol^{-1} ⬭

(Total 1 mark)

Q11.

The table shows the standard enthalpy of formation, $\Delta_f H^\theta$, for some of the substances in the reaction

$$C_2H_6(g) + 6F_2(g) \longrightarrow C_2F_6(g) + 6HF(g) \qquad \Delta H^\theta = -2898 \text{ kJ mol}-1$$

	$C_2H_6(g)$	$C_2F_6(g)$
$\Delta_f H^\theta$ /kJ mol^{-1}	−84	−1344

What is the standard enthalpy of formation, in kJ mol^{-1}, for HF(g)?

A −1638 ○

B −273 ○

C +273 ○

D +1638 ○

(Total 1 mark)

Q12.

What is the temperature rise, in K, when 504 J of heat energy are absorbed by 0.110 kg of solid iron?
Specific heat capacity of iron = 0.448 J K^{-1} g^{-1}

A 9.78×10^{-2} ○

B 1.02×10^{1} ○

C 2.83×10^{2} ○

D 1.02×10^{4} ○

(Total 1 mark)

Q13.

Calculate the enthalpy change, in kJ, for this dissociation of mole of propan-1-ol.

$$C_3H_7OH(g) \longrightarrow 3C(g) + 8H(g) + O(g)$$

	C—H	C—C	C—O	O—H
Mean bond dissociation enthalpy / kJ mol^{-1}	412	348	360	463

A −4751 ○

B −4403 ○

C +4403 ○

D +4751 ○

(Total 1 mark)

Q14.

Hydrogen is produced by the reaction of methane with steam. The reaction mixture reaches a state of dynamic equilibrium.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g) \qquad \Delta H = +206 \text{ kJ mol}^{-1}$$

Some enthalpy data is given in the table.

Bond	C–H	O–H	H–H	C≡H
Bond enthalpy / kJ mol^{-1}	413	463	436	To be calculated

Use the information in the table and the stated enthalpy change to calculate the missing bond enthalpy.

A 234 ○

B 1064 ○

C 1476 ○

D 1936 ○

(Total 1 mark)