energy cycles [6 marks]

1. [Maximum mark: 1]

Consider the following equations:

$H_2(g) + F_2(g) \rightarrow 2HF(g) \quad \Delta H^{\boxtimes} = -x\ kJ$

$C(s) + 2F_2(g) \rightarrow CF_4(g) \quad \Delta H^{\boxtimes} = -y\ kJ$

$2C(s) + 2H_2(g) \rightarrow C_2H_4(g) \quad \Delta H^{\boxtimes} = +z\ kJ$

What is the $\Delta H^{\boxtimes}$ of the reaction?

$C_2H_4(g) + 6F_2(g) \rightarrow 2CF_4(g) + 4HF(g)$

A. $-x - y - z$

B. $-x - y + z$

C. $-2x + 2y - z$

D. $-2x - 2y - z$ [1]

2. [Maximum mark: 1]

What is the enthalpy change of reaction, $\Delta H^{\boxtimes}$ in kJ mol^{-1}, for the hydrogenation of propyne to propene?

$C_3H_4(g) + H_2(g) \rightarrow C_3H_6(g) \quad \Delta H^{\boxtimes} = ?$

$C_3H_4(g) + 2H_2(g) \rightarrow C_3H_8(g) \quad \Delta H^{\boxtimes} = -290\ kJ\ mol^{-1}$

$C_3H_6(g) + H_2(g) \rightarrow C_3H_8(g) \quad \Delta H^{\boxtimes} = -125\ kJ\ mol^{-1}$

A. $(-290) + (-125)$

B. (−290) − (−125)

C. −(−290) + (−125)

D. −(−290) − (−125) [1]

3. [Maximum mark: 1]

What is the correct formula for calculating enthalpy change of reaction, $\Delta H^{\ominus}$ reaction?

A. $\Delta H^{\ominus}$ reaction = $\Sigma \Delta H_f$ reactants − $\Sigma \Delta H_f$ products

B. $\Delta H^{\ominus}$ reaction = $\Sigma \Delta H_c$ products − $\Sigma \Delta H_c$ reactants

C. $\Delta H^{\ominus}$ reaction = $\Sigma \Delta H_{bonds}$ reactants − $\Sigma \Delta H_{bonds}$ products

D. $\Delta H^{\ominus}$ reaction = $\Sigma \Delta H_{bonds}$ products − $\Sigma \Delta H_{bonds}$ reactants [1]

4. [Maximum mark: 1]

Standard enthalpy changes of reaction are provided for the following reactions.

$C(s) + O_2(g) \rightarrow CO_2(g)$ $\Delta H^{\ominus} = -394\,kJ$

$H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$ $\Delta H^{\ominus} = -286\,kJ$

$C_2H_5OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(l)$ $\Delta H^{\ominus} = -1367\,kJ$

What is the standard enthalpy change, in kJ, of the following reaction?

$2C(s) + 3H_2(g) + \frac{1}{2}O_2(g) \rightarrow C_2H_5OH(l)$

A. $(-394 \times 2) - (286 \times 3) - 1367$

B. $(394 \times 2) + (286 \times 3) + 1367$

C. $(394 \times 2) + (286 \times 3) - 1367$

D. $(-394 \times 2) - (286 \times 3) + 1367$ [1]

5. [Maximum mark: 1]

Which compound has the smallest lattice enthalpy?

A. RbBr

B. SrO

C. $MgBr_2$

D. Na_2O [1]

6. [Maximum mark: 1]

Which expression represents the calculation used to obtain the $\Delta H^{\ominus}$ value for the conversion of oxygen to one mole of ozone (O_3)?

		$\Delta H^{\ominus}$, kJ
Eqn (i)	$2CO_2 \rightarrow 2CO + O_2$	+566
Eqn (ii)	$3CO + O_3 \rightarrow 3CO_2$	–992

A. −566 − 922

B. −566 + 992

C. $1.5 \times (-566) + 992$

D. $1.5 \times (-566) - 992$ [1]