Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) (i) **M1** **(could be scored by a correct mathematical expression which must have all ΔH symbols and the $\sum$ or SUM)**

M1 $\Delta H_r = \Sigma \Delta H_f$ **(products)** - $\Sigma \Delta H_f$ **(reactants)**

OR a correct cycle of balanced equations with 1C, $3H_2$ and $1O_2$

M2 $\Delta H_r = -201 + (-242) - (-394)$
$\Delta H_r = -201 - 242 + 394$
$\Delta H_r = -443 + 394$
(This also scores M1)

M3 = **– 49** (kJ mol^{-1})
(Award 1 mark ONLY for + 49)
Correct answer gains full marks
Credit 1 mark ONLY for + 49 (kJ mol^{-1})
For other incorrect or incomplete answers, proceed as follows

- *check for an arithmetic error (AE), which is either a transposition error or an incorrect multiplication; this would score 2 marks (**M1** and **M2**)*
- *If no AE, check for a correct method; this requires either correct cycle of balanced equations with 1C, $3H_2$ and $1O_2$ OR a clear statement of **M1** which could be in words and scores only **M1***

3

(ii) It is an element / elemental
Ignore reference to "standard state"

OR

By definition

1

(b) **M1** (The yield) increases / goes up / gets more
*If M1 is given as "decreases" / "no effect" / "no change" then CE= 0 for clip, but mark on only **M2** and **M3** from a blank M1*

M2 There are more moles / molecules (of gas) on the left / of reactants
OR fewer moles / molecules (of gas) on the right / products
OR there are 4 moles /molecules (of gas) on the left and 2 moles / molecules on the right.
OR (equilibrium) shifts / moves to the side with less moles / molecules

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*Ignore "volumes", "particles" "atoms" and "species" for **M2***

M3: Can only score M3 if M2 is correct

The (position of) equilibrium shifts / moves (from left to right) to oppose the increase in pressure

*For **M3**, not simply "to oppose the change"*

*For **M3** credit the equilibrium shifts / moves (to right) to lower / decrease the pressure*

(There must be a specific reference to the change that is opposed)

3

(c) **M1** Yield increases goes up

M2 The (forward) reaction / to the right is endothermic OR takes in/ absorbs heat

OR

The reverse reaction / to the left is exothermic OR gives out / releases heat

*If M1 is given as "decrease" / "no effect" / "no change" then CE= 0 for clip, but mark on only **M2** and **M3** from a blank **M1***

Can only score M3 if M2 is correct

M3 The (position of) equilibrium shifts / moves (from left to right) to oppose the increase in temperature **(QoL)**

*For **M3**, not simply "to oppose the change"*

*For **M3**, credit the (position of) equilibrium shifts / moves **(QoL)***

*to absorb the heat **OR***

*to cool the reaction **OR***

to lower the temperature

(There must be a specific reference to the change that is opposed)

3

(d) (i) An activity which has no net / overall (annual) carbon emissions to the atmosphere

OR

An activity which has no net / overall (annual) greenhouse gas emissions to the atmosphere.

OR

There is no change in the total amount / level of carbon dioxide /CO_2 carbon /greenhouse gas present in the atmosphere.

The idea that the carbon /CO_2 given out equals the carbon /CO_2 that was taken in from the atmosphere

1

(ii) CH_3OH + **1½** O_2 CO_2 + **2**H_2O

Ignore state symbols

Accept multiples

1

(iii) **3**H_2 + **1½** O_2 **3**H_2O

Ignore state symbols

OR

Accept multiples

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2H_2 + O_2 **2**H_2O

Extra species must be crossed through

1

(e) **M1** q = m c ΔT

Award full marks for <u>correct answer</u>

Ignore the case for each letter

OR q = 140 × 4.18 × 7.5

M2 = 4389 (J) OR 4.389 (kJ) OR 4.39 (kJ) OR 4.4 (kJ)(also scores M1)

M3 Using 0.0110 mol
therefore ΔH = **<u>– 399</u>** (kJmol^{-1})
OR **<u>– 400</u>**

*Penalise **M3** ONLY if correct numerical answer but sign is incorrect; +399 **gains 2 marks***

*Penalise **M2** for arithmetic error and mark on*

*In **M1**, do not penalise incorrect cases in the formula*

If ΔT = 280.5; score q = m c ΔT only

*If c = 4.81 (leads to 5050.5) penalise **M2** ONLY and mark on for **M3** = – 459*

+399 or +400 gains 2 marks

Ignore incorrect units

3

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Q2.

(a) (i) mol H_2 = 0.47

1

mol I_2 = 0.17

If answers reversed, ie
mol H_2 = 0.17
mol I_2 = 0.47
then allow one mark (for second answer).

1

(ii) $\frac{[HI]^2}{[H_2][I_2]}$

Penalise expression containing V
But mark on in (a)(iv)

Penalise missing square brackets *in this part*
(and not elsewhere in paper) but mark on in (a)(iv)

1

(iii) equal number of moles (on each side of equation)

OR

equal moles (top and bottom of *K*c expression)

1

(iv) $\frac{[1.94]^2}{[0.38][0,19]}$

Ignore V

If Kc wrong in (a)(ii) (wrong powers or upside down etc) no marks here

1

= 52(.1)

1

(b) (i) **D**

1

(ii) **B**

1

(iii) **A**

1

(iv) **C**

1

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