**Name of the Student**:_____
**Max. Marks : 17 Marks** **Time : 17 Minutes**

Mark Schemes

Q1.

(a) (i) M1 c(oncentrated) phosphoric acid / c(onc.) $H_3PO_4$
***OR*** c(oncentrated) sulfuric acid / c(onc.) $H_2SO_4$

*In **M1**, the acid must be concentrated.*
*Ignore an incorrect attempt at the correct formula that is written in addition to the correct name.*

M2 Re-circulate / re-cycle the (unreacted) ethene (and steam) / the reactants
***OR*** pass the gases over the catalyst several / many times

*In **M2**, ignore "remove the ethanol".*
*Credit "re-use".*

**2**

(ii) M1
(By Le Chatelier's principle) the equilibrium is driven / shifts / moves to the right / L to R / forwards / in the forward direction

**M2 depends on a correct statement of M1**
The equilibrium moves / shifts to

- oppose the addition of / increased concentration of / increased moles / increased amount of water / steam
- to decrease the amount of steam / water

**Mark M3 independently**
M3 Yield of product / conversion increase ***OR*** ethanol increases / goes up / gets more

**3**

(iii) M1 Poly(ethene) / polyethene / polythene / HDPE / LDPE

**M2 At higher pressures**
More / higher cost of electrical energy to pump / pumping cost
***OR***
Cost of higher pressure equipment / valves / gaskets / piping etc.
***OR*** expensive equipment

*Credit all converse arguments for **M2***

**2**

(b) M1 for balanced equation

M2 for state symbols in a correctly balanced equation

$2C(s / graphite) + 3H_2(g) +$

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$\frac{1}{2}O_2(g) \longrightarrow CH_3CH_2OH(l)$
$(C_2H_5OH)$

*Not multiples but credit correct state symbols in a correctly balanced equation.*

*Penalise $C_2H_6O$ but credit correct state symbols in a correctly balanced equation.*

**2**

(c) (i) M1 The <u>enthalpy change</u> / <u>heat change at constant pressure</u> when <u>1 mol</u> of a compound / substance / element

*If standard enthalpy of formation **CE=0***

M2 is <u>burned / combusts / reacts completely</u> in <u>oxygen</u>
***OR*** <u>burned / combusted / reacted in excess oxygen</u>

M3 with (all) <u>reactants and products /</u> (all) <u>substances in standard / specified states</u>
***OR*** (all) <u>reactants and products /</u> (all) <u>substances in normal states under standard conditions /</u> 100 kPa / 1 bar <u>and</u> specified T / 298 K

*For **M3***
*Ignore reference to 1 atmosphere*

**3**

(ii) M1

*Correct answer gains full marks*

<u>ΣB(**reactants**) − ΣB(**products**) = *ΔH*</u>

*Credit 1 mark for (+) 1279 (kJ mol$^{-1}$)*

OR
<u>Sum of bonds broken − Sum of bonds formed = ΔH</u>
OR
B(C-C) + B(C-O) + B(O-H) + 5B(C-H) + 3B(O=O) (LHS)
− 4B(C=O) − 6B(O−H) (RHS) = <u>*ΔH*</u>

M2 (also scores **M1**)
348+360+463+5(412)+3(496) [LHS = **4719**]
(2060) (1488)
− 4(805) − 6(463) [RHS = − **5998**] = *ΔH*
(3220) (2778)
OR using only bonds broken and formed (**4256 − 5535**)

*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 a correct cycle with 2C and 6H and 7O OR a clear statement of **M1** which could be in words and scores **<u>only M1</u>***

M3
ΔH= <u>**− 1279**</u> (kJ mol$^{-1}$)

*Allow a maximum of one mark if the only scoring point is LHS = 4719 **OR** RHS = 5998*

Award 1 mark for +1279

**Candidates may use a cycle and gain full marks**

**3**

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(d) (i) Reducing agent ***OR*** reductant ***OR*** electron donor
***OR*** to reduce the copper oxide

*Not "reduction".*

*Not "oxidation".*

*Not "electron pair donor".*

**1**

(ii) $CH_3COOH$

**1**

**[17]**

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