M1.D

[1]

M2. (a) (i) 0.86 **(1)**

(ii) total moles = 0.86 + 0.43 +0.085 = 1.375 **(1)**

$\therefore$ mole fraction of H_2 = $\frac{0.86}{1.375}$ = 0.625 **(1)**

(0.62 - 0.63)

Conseq on (i)

(iii) pp = mole fract^{n} × total P **(1)**
= 0.625 × 1.75 × 10^4
= 1.09 × 10^4 (kPa) **(1)**
or 1.1(0)
Ignore units
Conseq on (ii)

5

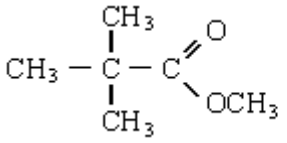
(b) (i) $K_p = \frac{P_{CH3OH}}{P^2_{H_2} \times P_{CO}}$ **(1)**
Penalise [ ]

(ii) $K_p = \frac{2710}{(12300)^2 \times (7550)}$ = 2.37 (2.4) × 10^{-9} **(1)**
OR 2.37 × 10^{-15}

Units: kPa^{-2} **(1)**
or Pa^{-2}
not conseq to wrong K_p expression

3

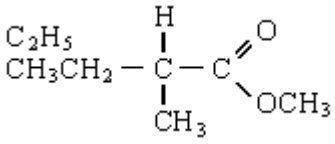
(c) *Isomer **E**:*



(1)

allow $(CH_3)_3CCOOCH_3$ or $(CH_3)_3CCO_2CH_3$

*Isomer **F**:*



(1)

2

[10]

M3. (a) ***R***: O - H (alcohols) **(1)**
S: C=O or carbonyl **(1)**

2

(b) aldehyde **(1)** - CHO or RCHO **(1)**

1

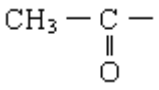
(c) (i) *Reason 1*: TMS inert or non-toxic or volatile / easily removed
Reason 2: single (intense) peak
peak of 12 protons
has 12 equivalent protons
all protons in same environment
OR
peak / signal upfield of others
highly shielded
more shielded
peak away from others or $\delta = 0$ or low

not solvent, not cheap

any 2 reasons × (1)

(ii) *Solvent*: $CDCl_3$ or CCl_4 **(NOT D_2O)**
Reason: proton free **(1)**
allow no hydrogens (atoms)
NOT H^+ / hydrogen ions

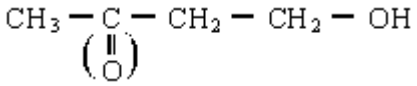
4

(d) (i)  **(1)**

(ii) –OH **(1)**

(iii) $–CH_2–CH_2–$ **(1)**

3

(e)  **(1)**

1

[11]

M4.C

[1]