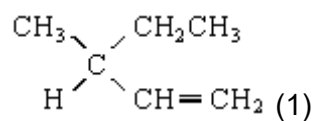
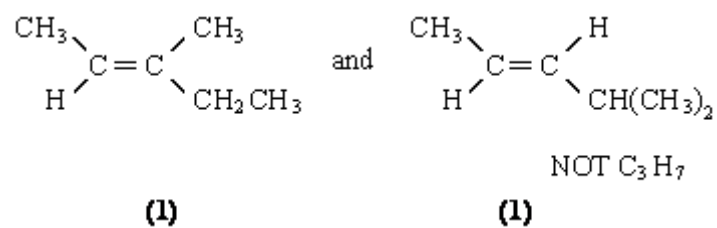


M1. (a) Structure of P:



Structures of Q and R:



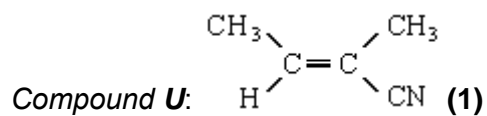
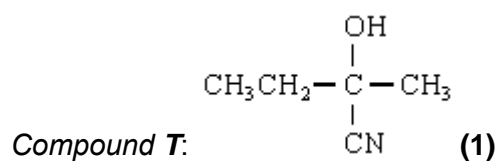
Q and R in any order

3

(b) (i) *Racemic mixture*: equal mixture of optical isomers / enantiomers
OR in explanation

Explanation: planar ($>\text{C}=\text{O}$) (1)
attack from either side is equally likely (1)

(ii) *Reagent S*: HCN or (KCN / HCl or H_2SO_4) (1)



6

[9]

M2.B

[1]

M3.D

[1]

M4. (a) (i) 0.86 (1)

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

$$\therefore \text{mole fraction of H}_2 = \frac{0.86}{1.375} = 0.625 \text{ (1)}$$

(0.62 - 0.63)

Conseq on (i)

(iii) pp = mole fractⁿ × total P (1)

$$= 0.625 \times 1.75 \times 10^4$$

$$= 1.09 \times 10^4 \text{ (kPa) (1)}$$

or 1.1(0)

Ignore units

Conseq on (ii)

5

(b) (i)
$$K_p = \frac{P_{\text{CH}_3\text{OH}}}{P_{\text{H}_2}^2 \times P_{\text{CO}}} \text{ (1)}$$

Penalise []

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

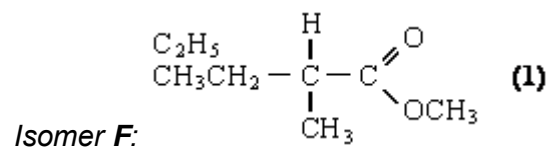
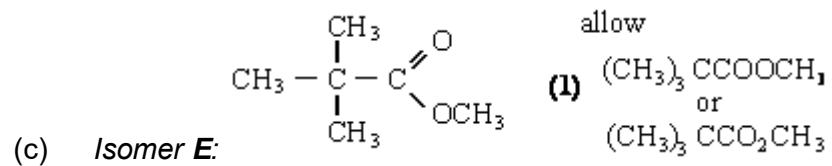
OR 2.37×10^{-15}

Units: kPa⁻² (1)

or Pa⁻²

not conseq to wrong K_p expression

3



2

[10]