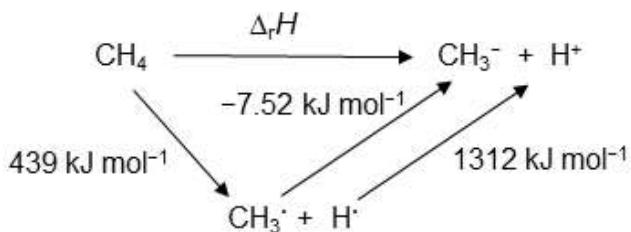


5. This question is about Superbases

(a)  $\Delta_r H$  (reaction 2) =  $(2.18 \times 10^{-18} \text{ J}) \times (6.02 \times 10^{23} \text{ mol}^{-1}) \times (10^{-3} \text{ kJ/J}) = 1312 \text{ kJ mol}^{-1}$



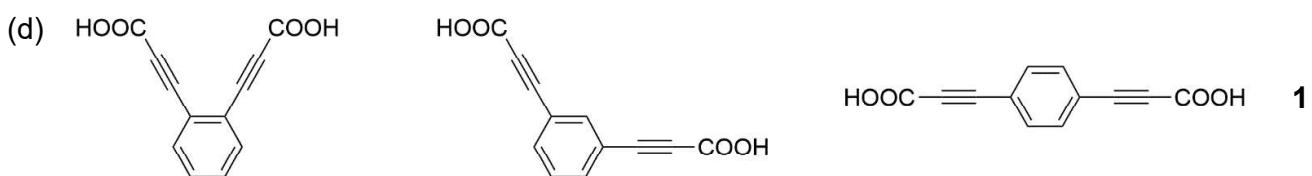
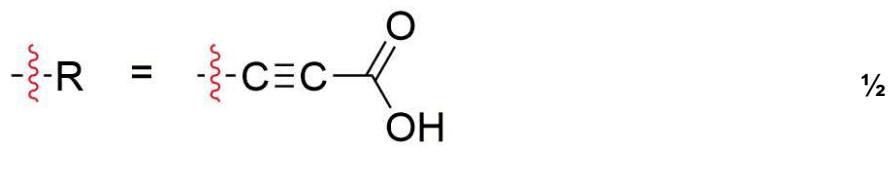
$$\begin{aligned}
 \Delta_{\text{acid}}H^\circ(\text{CH}_4) &= 439 \text{ kJ mol}^{-1} + (-7.52 \text{ kJ mol}^{-1}) + 1312 \text{ kJ mol}^{-1} \\
 &= 1743 \text{ kJ mol}^{-1}
 \end{aligned}$$

2

Correct answer with units scores both marks. One mark for correct conversion of enthalpy of reaction 2 into kJ mol<sup>-1</sup>.

(b)	oxalate ion	P	Q	
		CO <sub>2</sub>	CO	3
	One mark	One mark	One mark	
	Allow delocalised representation of the anion			

(c) Functional group: carboxylic acid ½

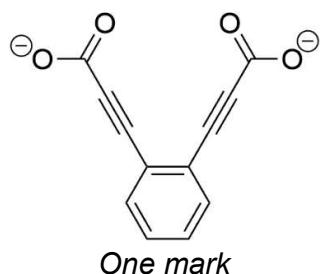
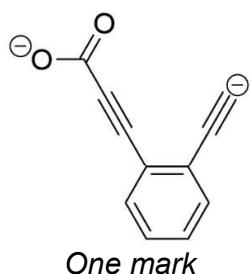
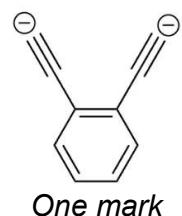


Allow ECF if they have the wrong R group in part (c) as long as they have used the same one here. Allow if they write R instead of drawing out the R group. Do not penalise for non-linear alkyne geometries. No partial credit.

	Signals		
6	7	5	2

All correct two marks. Two correct one mark. One correct ½ mark. Allow ECF if they have the wrong R group in part (c) as long as they have used the same one here and the number of signals they have suggested here is consistent with their R group. If they have just written R when drawing the disubstituted benzenes then you can award ECF for the number of <sup>13</sup>C signals in the benzene ring (which should be 3, 4 and 2 respectively).

(e)

 $B^{2-}$  $C^{2-}$  $DEB^{2-}$ 

3

If they have drawn the wrong disubstituted benzene isomer then no marks are awarded for  $B^{2-}$  but can give ECF on  $C^{2-}$  and  $DEB^{2-}$ . Allow delocalised representation of the carboxylate anions. Do not penalise for non-linear alkyne geometries.

Question Total 12