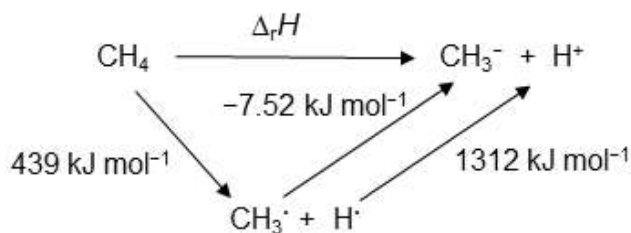


5. This question is about Superbases

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

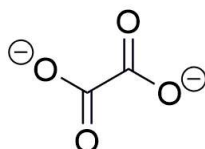


$$\Delta_{\text{acid}} H^\circ (\text{CH}_4) = 439 \text{ kJ mol}^{-1} + (-7.52 \text{ kJ mol}^{-1}) + 1312 \text{ kJ mol}^{-1} = 1743 \text{ kJ mol}^{-1}$$

2

Correct answer with units scores both marks. One mark for correct conversion of enthalpy of reaction 2 into kJ mol^{-1} .

(b) oxalate ion



One mark

Allow delocalised representation of the anion

P



One mark

Q

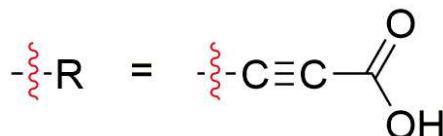


One mark

3

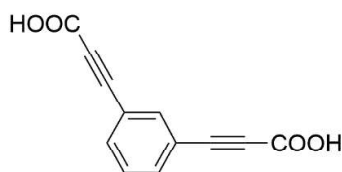
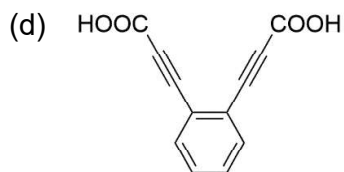
(c) Functional group: carboxylic acid

½



½

½ mark each



1

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

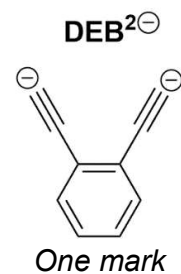
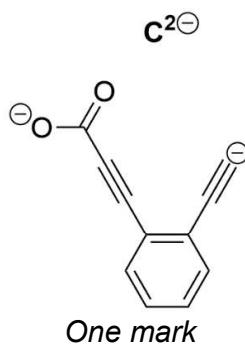
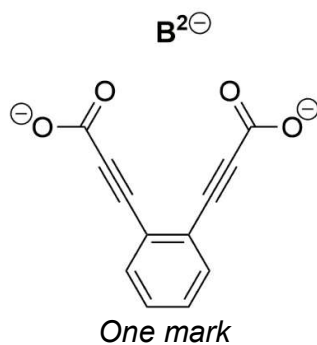
7

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 ^{13}C signals in the benzene ring (which should be 3, 4 and 2 respectively).

(e)



3

*If they have drawn the wrong disubstituted benzene isomer then no marks are awarded for **B²⁻** but can give ECF on **C²⁻** and **DEB²⁻**. Allow delocalised representation of the carboxylate anions. Do not penalise for non-linear alkyne geometries.*

Question Total 12