

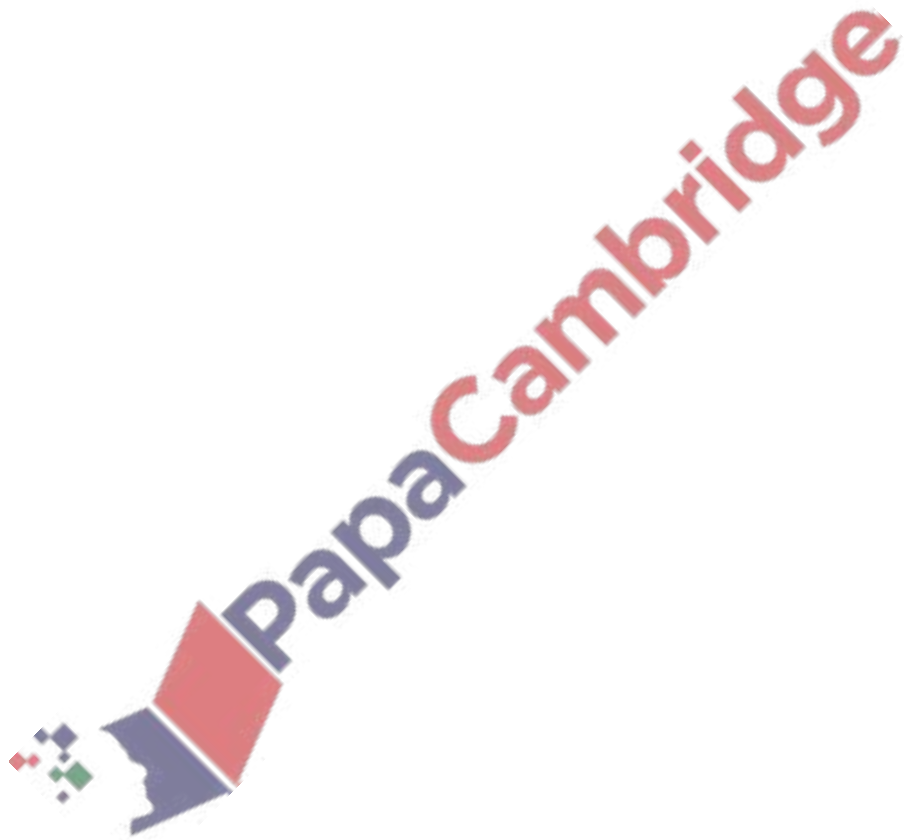


(ii) Suggest suitable reagents for steps 1 and 2.

step 1 .....

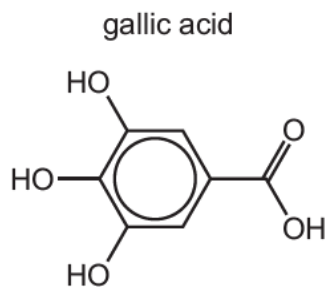
step 2 .....

[2]



2. March/2020/Paper\_42/No.5a

Gallic acid,  $C_7H_6O_5$ , is a naturally occurring aromatic molecule.



(a) Gallic acid contains the carboxylic acid and phenol functional groups.

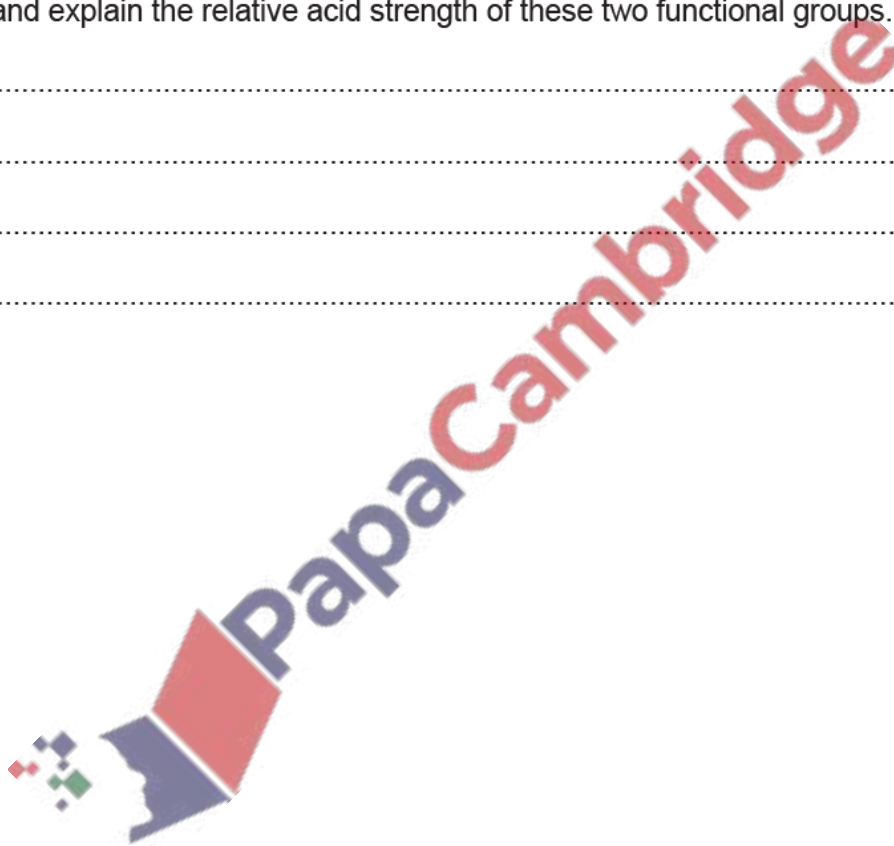
State and explain the relative acid strength of these two functional groups.

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.....

.....

..... [2]





- (c) Three tests were carried out on separate samples of the organic acids shown in the table. The following results were obtained.  
 ✓ = observed change  
 x = no observed reaction

test	reagent(s) and conditions	HCO <sub>2</sub> H	CH <sub>3</sub> COCO <sub>2</sub> H	HO <sub>2</sub> CCO <sub>2</sub> H	observed change
1	..... ..... .....	✓	x	x	
2	..... ..... .....	x	✓	x	
3	..... ..... .....	✓	x	✓	

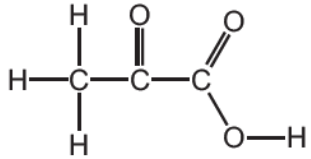
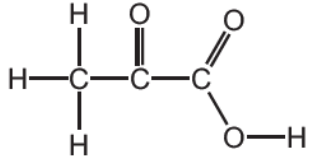
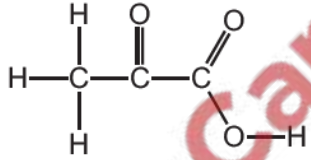
Complete the table with the reagent(s) and conditions and the observed change for each test. Assume these organic acids all have a similar acid strength. [5]



(d) A sample of pyruvic acid,  $\text{CH}_3\text{COCO}_2\text{H}$ , is analysed by carbon-13 NMR spectroscopy. Three peaks are observed.

Complete the table by:

- circling the carbon atom responsible for the chemical shift
- stating the hybridisation of the circled carbon atom.

chemical shift ( $\delta$ )	carbon atom responsible for chemical shift	hybridisation of the circled carbon atom
27	 <p>The structural formula of pyruvic acid is shown. The methyl carbon atom is circled in red.</p>	
163	 <p>The structural formula of pyruvic acid is shown. The carbonyl carbon atom is circled in red.</p>	
192	 <p>The structural formula of pyruvic acid is shown. The carboxyl carbon atom is circled in red.</p>	

[2]

