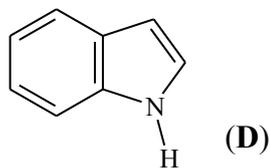
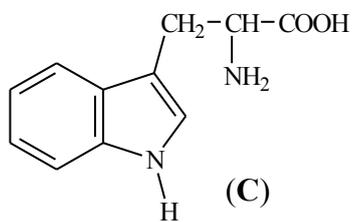


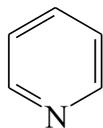
**Marks**  
**3**

- The side-chain of the amino acid tryptophan (**C**) is a substituted derivative of the heterocycle indole (**D**). Explain with the aid of diagrams whether you would expect indole to have aromatic stability or not. Would you expect the nitrogen atom of indole to be basic? Give reasons for your answer.

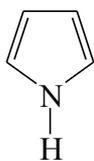


**Marks**  
**4**

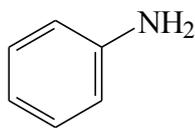
- Two of the following compounds are bases and two are not. Identify the two bases and explain, with the aid of diagrams, why they react with acids and why the other two compounds do not.



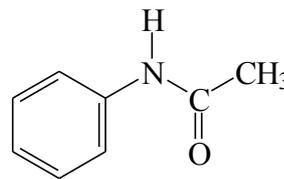
pyridine



pyrrole



aniline



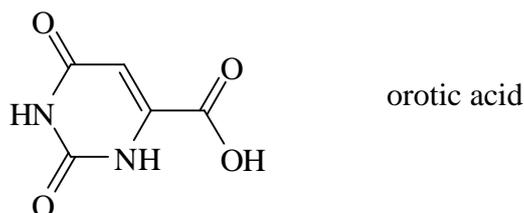
acetanilide

**Marks**  
**4**

- Lithium salts, especially lithium carbonate, are commonly used in the treatment of bipolar disorder. Write the net ionic equation for the reaction which occurs between lithium carbonate and hydrochloric acid in the stomach.

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Lithium orotate (as a monohydrate salt,  $\text{LiC}_5\text{H}_3\text{N}_2\text{O}_4 \cdot \text{H}_2\text{O}$ ) is a controversial alternative formulation sold in some health food stores. The orotate ion is the conjugate base of orotic acid, whose structure is shown below.



Like the carbonate, lithium orotate is taken orally. Using an equation, comment on any differences between the form in which lithium is bioavailable from these two lithium salts.

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Like three of the bases found in DNA and RNA, orotic acid is a derivative of pyrimidine. Also like those bases, orotic acid and its salts have tautomers. Draw the structural formula of a tautomer of lithium orotate.

lithium orotate	tautomer of lithium orotate
