PHENOL: ACIDITY

1. The position of equilibrium is affected by the stability of the negative ion formed. In the phenoxide ion, the charge is delocalised over the whole ion by involving the ring electrons. In the case of an ethoxide ion, $C_2H_5O^-$, formed when ethanol ionises, the whole charge remains on the oxygen. The delocalisation makes the phenoxide ion rather more stable than an ethoxide ion.

   However, oxygen is the most electronegative thing present, and so even with the delocalisation most of the charge is still dragged back towards the oxygen – so the ion isn't very stable, and soon picks up a hydrogen ion again to return to unionised phenol. It is a very weak acid.

2. a) The phenol will dissolve in sodium hydroxide to give a colourless solution, but doesn't react with the sodium carbonate solution to give carbon dioxide. This shows that it is acidic (because it dissolves much better in sodium hydroxide solution than it does in water), but is only a very weak acid (because it doesn't release carbon dioxide from sodium carbonate.)

   b) The pH of a solution of phenol is about 5 – 6. Litmus changes colour between pH 5 – 8, not showing its full red colour until pH 5. If you had a very dilute solution of phenol with a pH about 6, it would show the purplish "neutral" colour of litmus.

   c) Most simply: $2C_6H_5OH + 2Na \longrightarrow 2C_6H_5ONa + H_2$

   You could also show the ionic nature of sodium phenoxide as $C_6H_5O^-\ Na^+$ if you wish, but any structure you have drawn which has a line drawn between the O and the Na is wrong! That would suggest a covalent bond.