- 1. Give the principal product(s) when 1-butanol reacts with each of the following reagents.
 - (a) aqueous HBr, heat
 - (b) HNO₃
 - (c) NaH, THF
 - (d) CrO₃, pyridine, HCl
 - (e) p-toluenesulfonyl chloride, pyridine
 - (f) propylmagnesium bromide
 - (g) SOCl₂, pyridine
 - (h) product of (a) + Mg in ether
 - (i) product of (e) + t-BuO K⁺ in t-BuOH
- 2. Complete the following by giving the principal organic product(s) formed in each case.

(b)
$$CH_2CH_2CH_2OH$$
 $\frac{1. PBr_3}{2. Mg, ether}$ $\frac{1. H_2C=O}{2. H_3O^+}$

(d)
$$CH_3CHCH_2CH_2Ph$$
 $HCl, ZnCl_2$ \rightarrow OH

(e)
$$\begin{array}{c} & & \\ & & \\ \hline \\ & \\ \hline \\ & \\ \end{array}$$
 H₂SO₄ heat

(f)
$$\frac{PBr_3}{(CH_3)_3CO} \xrightarrow{K^+(CH_3)_3CO}$$

3. Explain the origin of the different products from the following alcohol under the different conditions.

$$\frac{HBr}{ZnBr_2}$$

$$\frac{TsCl}{pyridine}$$

$$\frac{LiBr}{acetone}$$

$$\frac{CH_2OH}{CH_2OH}$$

- 4. Devise an efficient synthesis of
 - (a) 2-deuterio-2-methylpentane from 2-methylpentan-2-ol
 - (b) 2-methylpent-1-ene from 2-methylpentan-2-ol
 - (c) PhCH₂CH₂Br from bromobenzene (PhBr)