

(a) Explain why amides are much weaker bases than amines.

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[2]

(b) Fig. 9.1 shows the preparation of 2-phenylethylamine,  $C_6H_5CH_2CH_2NH_2$ , by three different routes.

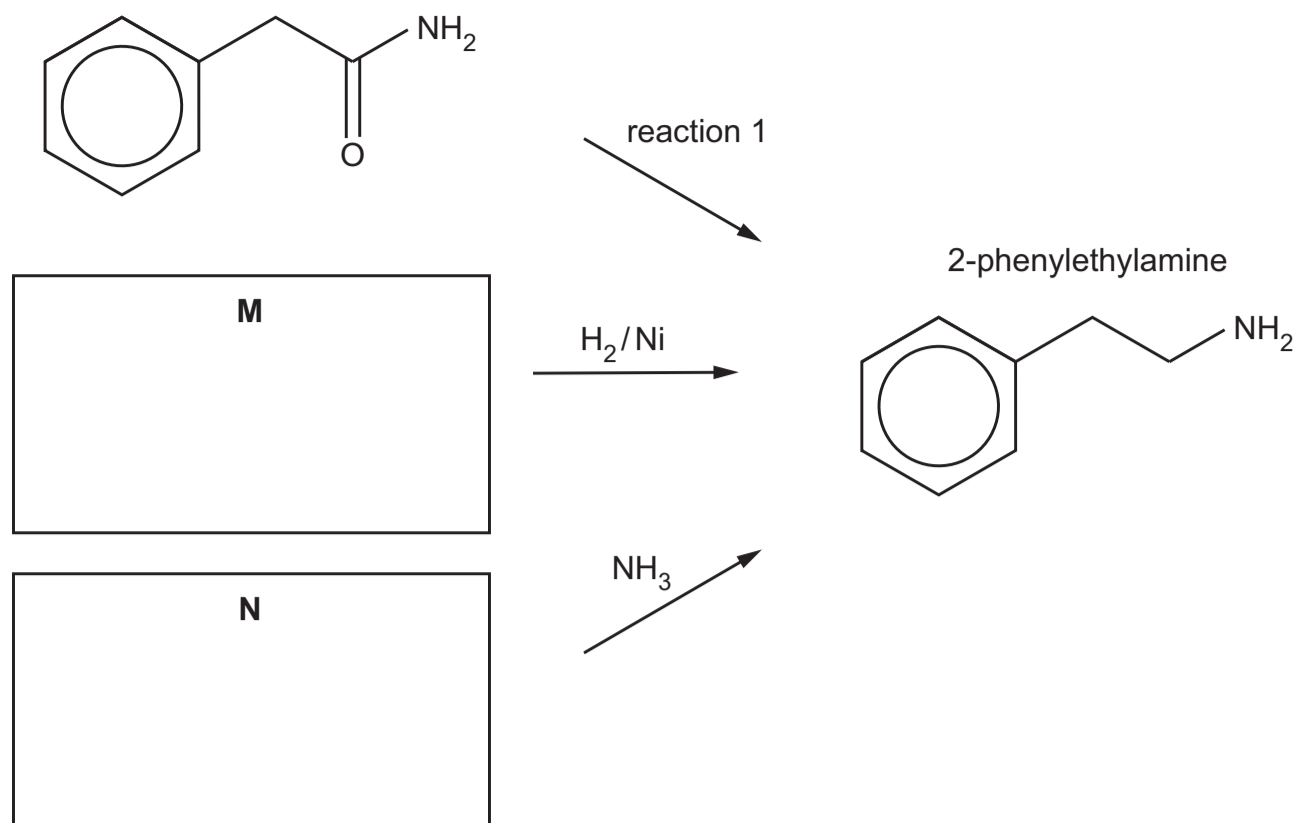


Fig. 9.1

(i) Suggest structures for compounds **M** and **N** and draw them in the boxes in Fig. 9.1. [2]

(ii) Give the reagents and conditions for reaction 1.

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[1]

(c) Fig. 9.2 shows compound **H** which is a useful starting material in organic synthesis.

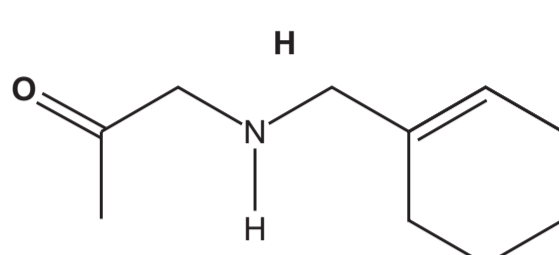


Fig. 9.2

**H** contains an alkene and an amine functional group.

Name the **other** functional group and give the classification of the amine group in **H**.

**other** functional group in **H** .....

classification of amine .....

[1]

(d) Ozonolysis involves the oxidative cleavage of a  $C=C$  bond in alkenes using ozone,  $O_3$ , as shown in Fig. 9.3.

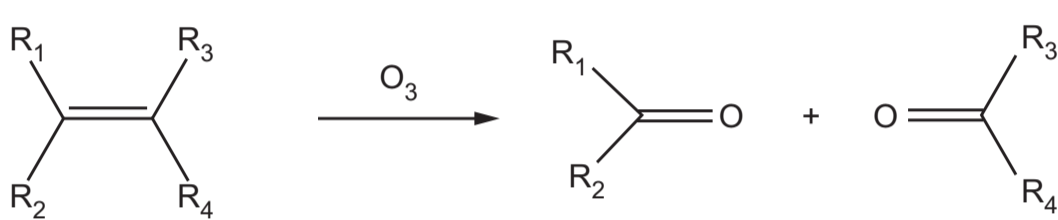


Fig. 9.3

Fig. 9.4 shows the first step in this reaction which involves the formation of an ozonide intermediate.

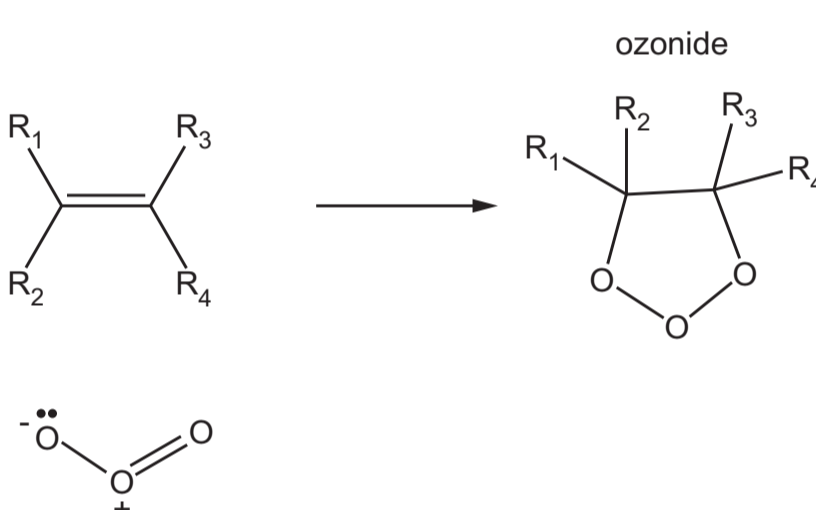
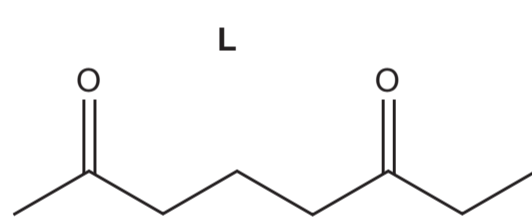


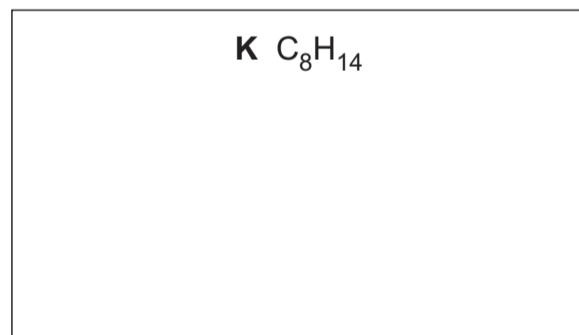
Fig. 9.4

(i) On Fig. 9.4, draw **three** curly arrows to complete the mechanism of this step. [2]

(ii) **L** is formed from alkene **K**,  $C_8H_{14}$ , by a similar reaction to that shown in Fig. 9.3.



Suggest the structure of **K**.



[1]

[Total: 9]

### Important values, constants and standards

molar gas constant	$R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$
Faraday constant	$F = 9.65 \times 10^4 \text{ C mol}^{-1}$
Avogadro constant	$L = 6.02 \times 10^{23} \text{ mol}^{-1}$
electronic charge	$e = -1.60 \times 10^{-19} \text{ C}$
molar volume of gas	$V_m = 22.4 \text{ dm}^3 \text{ mol}^{-1}$ at s.t.p. (101 kPa and 273 K) $V_m = 24.0 \text{ dm}^3 \text{ mol}^{-1}$ at room conditions
ionic product of water	$K_w = 1.00 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$ (at 298 K (25 °C))
specific heat capacity of water	$c = 4.18 \text{ kJ kg}^{-1} \text{ K}^{-1}$ (4.18 $\text{J g}^{-1} \text{ K}^{-1}$ )

### The Periodic Table of Elements

Group																																																																																						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																																																																					
1	2	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>Key</b>                      atomic number                      atomic symbol                      name                      relative atomic mass                 </div>																18																																																																				
1	2																	18																																																																				
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																																																																							
Li lithium 6.9	Be beryllium 9.0	B boron 10.8	C carbon 12.0	N nitrogen 14.0	O oxygen 16.0	F fluorine 19.0	Ne neon 20.2	Na sodium 23.0	Mg magnesium 24.3	Al aluminium 27.0	Si silicon 28.1	P phosphorus 31.0	S sulfur 32.1	Cl chlorine 35.5	Ar argon 39.9	K potassium 39.1	Ca calcium 40.1	Sc scandium 45.0	Ti titanium 47.9	V vanadium 50.9	Cr chromium 52.0	Mn manganese 54.9	Fe iron 55.8	Co cobalt 58.9	Ni nickel 58.7	Cu copper 63.5	Zn zinc 65.4	Ga gallium 69.7	Ge germanium 72.6	As arsenic 74.9	Se selenium 79.0	Br bromine 79.9	Kr krypton 83.8	Rb rubidium 85.5	Sr strontium 87.6	Y yttrium 88.9	Zr zirconium 91.2	Nb niobium 92.9	Mo molybdenum 95.9	Tc technetium 98.9	Ru ruthenium 101.1	Rh rhodium 102.9	Pd palladium 106.4	Ag silver 107.9	Cd cadmium 112.4	In indium 114.8	Sn tin 118.7	Sb antimony 121.8	Te tellurium 127.6	I iodine 126.9	Xe xenon 131.3	Cs caesium 132.9	Ba barium 137.3	La lanthanoids 138.9	Hf hafnium 178.5	Ta tantalum 180.9	W tungsten 183.8	Re rhenium 186.2	Os osmium 190.2	Ir iridium 192.2	Pt platinum 195.1	Au gold 197.0	Hg mercury 200.6	Tl thallium 204.4	Pb lead 207.2	Bi bismuth 209.0	Po polonium 209.0	At astatine 210.0	Rn radon 222.0	Fr francium 223.0	Ra radium 226.0	Ac actinoids 227.0	Th thorium 232.0	Pa protactinium 231.0	U uranium 238.0	Np neptunium 237.0	Pu plutonium 244.0	Am americium 243.0	Cm curium 247.0	Bk berkelium 247.0	Cf californium 251.0	Es einsteinium 252.0	Fm fermium 253.0	Mendelevium 258.0	No nobelium 259.0	Lr lawrencium 260.0

[1]