

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

.....

 [2]

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

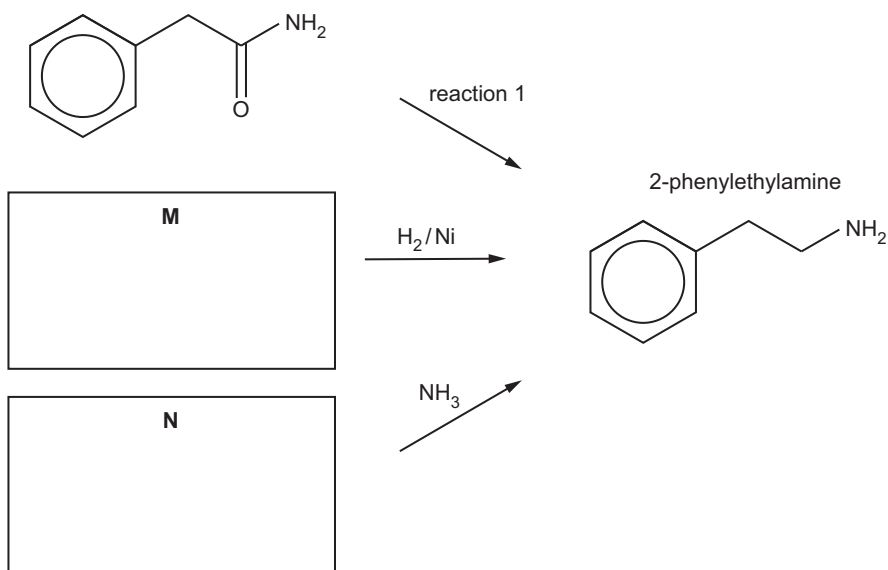


Fig. 9.1

(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.

..... [1]

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

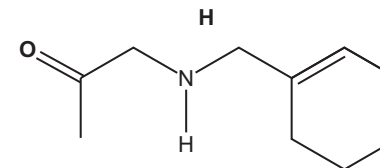


Fig. 9.2

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.

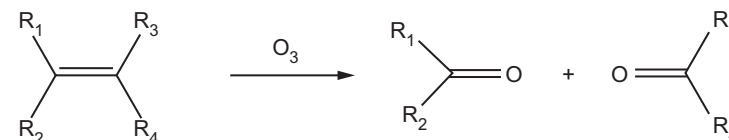


Fig. 9.3

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

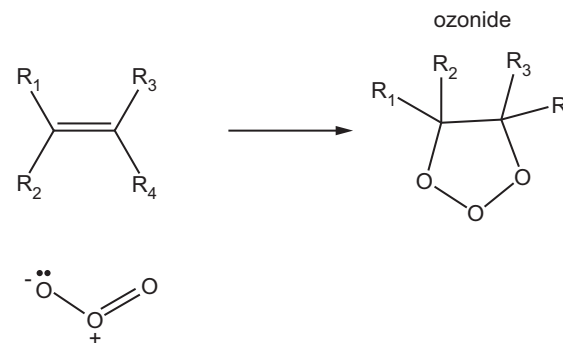
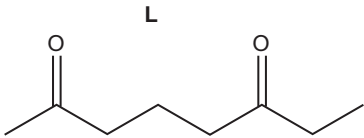


Fig. 9.4

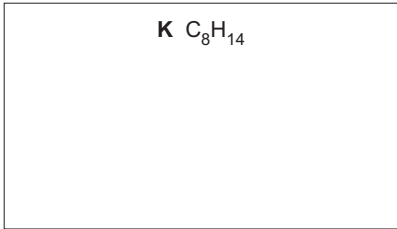
(i) On Fig. 9.4, draw **three** curly arrows to complete the mechanism of this step.

[2]

(ii) L is formed from alkene K, C₈H₁₄, 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 J g ⁻¹ K ⁻¹)

The Periodic Table of Elements

Group																			
1	2	1 H hydrogen 1.0															17	18	
		Key																	
3	4	atomic number atomic symbol name relative atomic mass																9	10
Li lithium 6.9	Be beryllium 9.0																	F fluorine 19.0	Ne neon 20.2
11	12																	17	18
Na sodium 23.0	Mg magnesium 24.3																	Cl chlorine 35.5	Ar argon 39.9
19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36		
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 78.9	Br bromine 79.9	Kr krypton 83.8		
37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54		
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	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		
55	56	57–71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86		
Cs caesium 132.9	Ba barium 137.3	lanthanoids		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	At astatine	Rn radon		
87	88	89–103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118		
Fr francium	Ra radium	actinoids	Rf rutherfordium	Db dubnium	Sg seaborgium	Bh bohrium	Hs hassium	Mt meitnerium	Ds darmstadtium	Rg roentgenium	Cn copernicium	Nh nihonium	Fl flerovium	Mc moscovium	Lv livermorium	Ts tennessine	Og oganeson		

lanthanoids

actinoids

57 La lanthanum 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.3	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.1	71 Lu lutetium 175.0
89 Ac actinium	90 Th thorium 232.0	91 Pa protactinium 231.0	92 U uranium 238.0	93 Np neptunium	94 Pu plutonium	95 Am americium	96 Cm curium	97 Bk berkelium	98 Cf californium	99 Es einsteinium	100 Fm fermium	101 Md mendelevium	102 No nobelium	103 Lr lawrencium