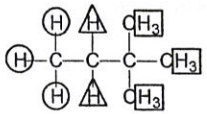
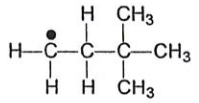
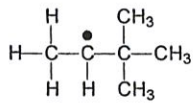
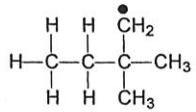
Alkanes

1	C	2	A

1 C



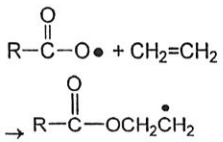
The 3 different forms of X• are:

2 A

1: $2R(CH_2CH_2)_nCH_2CH_2 \rightarrow [R(CH_2CH_2)_nCH_2CH_2]_2$

2:



3: $2RCH_2\dot{C}H_2 \rightarrow R(CH_2CH_2)_2R$

3(a) No formation of oxides of sulfur which causes **acid rain** OR

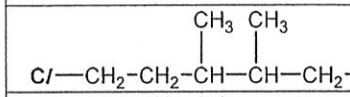
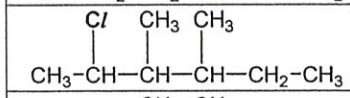
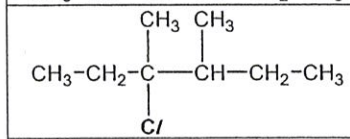
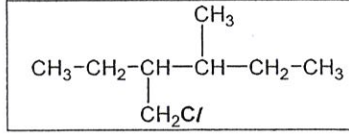
Efficient combustion **prevents photochemical smog** (less unburnt hydrocarbon OR less CO being released)

(b) (i) $W_8 = 8(1-0.89)^2 0.89^{(8-1)} = 0.0428$

Mass of C_8H_{18} = 0.0428 × 100 = 4.28 g
M_r of C_8H_{18} = (8 × 12) + 18 = 114
Number of moles of C_8H_{18} = 4.28 ÷ 114 = 0.0375 mol

(ii) Isomer **Y**.
Presence of plane of symmetry in the molecule
Hence rotation at each chiral centre cancels out / mirror images superimposable / no enantiomer

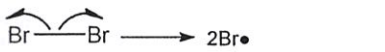
(iii)

Structural formula	No of hydrogen	Mole ratio
	6	3
	4	2
	2	1
	6	3

4(a) (i) Condition: high temperature or uv light [1]

Free Radical Substitution [3]
Mechanism:

Initiation



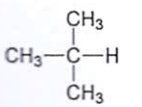
Propagation

$CH_3CH_3 + Br\bullet \longrightarrow \bullet CH_2CH_3 + HBr$
$\bullet CH_2CH_3 + Br_2 \longrightarrow BrCH_2CH_3 + Br\bullet$

Termination

$2\ \bullet CH_2CH_3 \longrightarrow CH_3CH_2CH_2CH_3$
$2\ Br\bullet \longrightarrow Br_2$
$\bullet CH_2CH_3 + Br\bullet \longrightarrow BrCH_2CH_3$

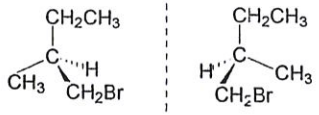
(ii) Alkane **B**: [1]



(iii) **C/D** = 2.3 : 1 or 7 : 3 or 21 : 9 [1]

Relative rate suggests 21 : 1, but there are 1 tertiary to 9 primary hydrogen atoms, hence this ratio becomes 21 : 9. [1]

(b) **(i)** Optical isomerism [1]



[2]

(ii) **I.** Boiling point / melting point / density [1]
II. Optical activity / Direction of rotation of plane–polarised light [1]

(iii) 2,2–dimethylpropane is more highly branched, thus it is more compact / spherical compared to 2–methylbutane. [1]

As a result, 2,2–dimethylpropane has a smaller surface area for instantaneous dipole–induced dipole attractions (or Van Der Waals forces) between molecules to operate. Hence, it has a much lower boiling point than 2–methylbutane. [1]