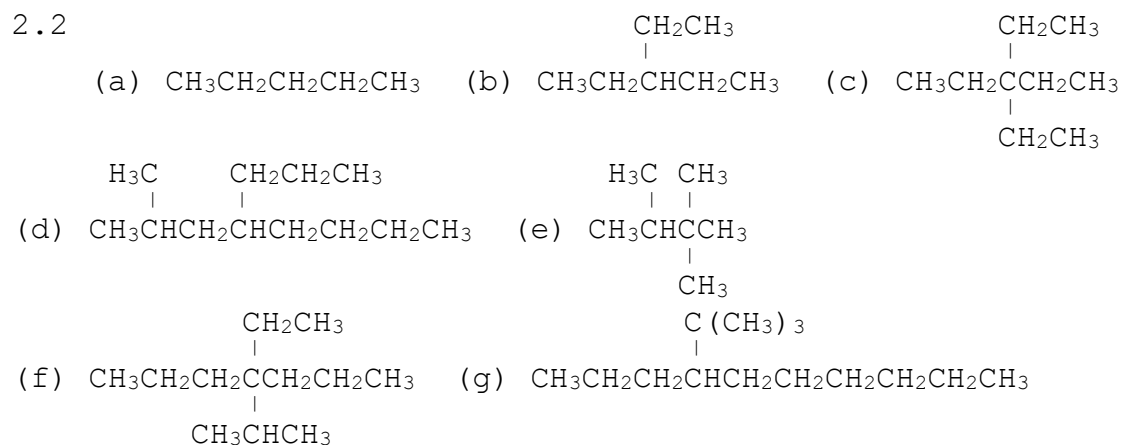
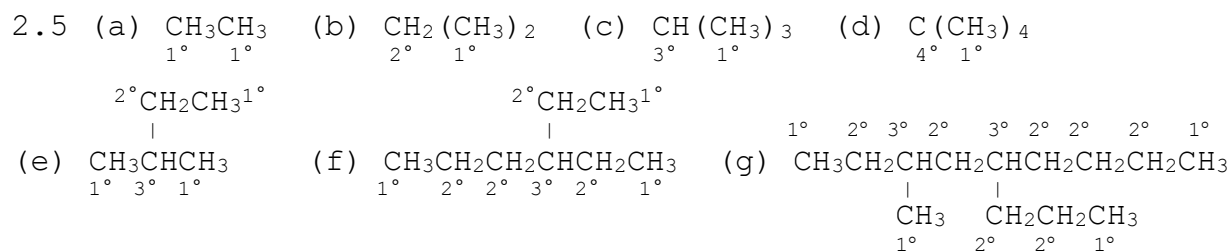
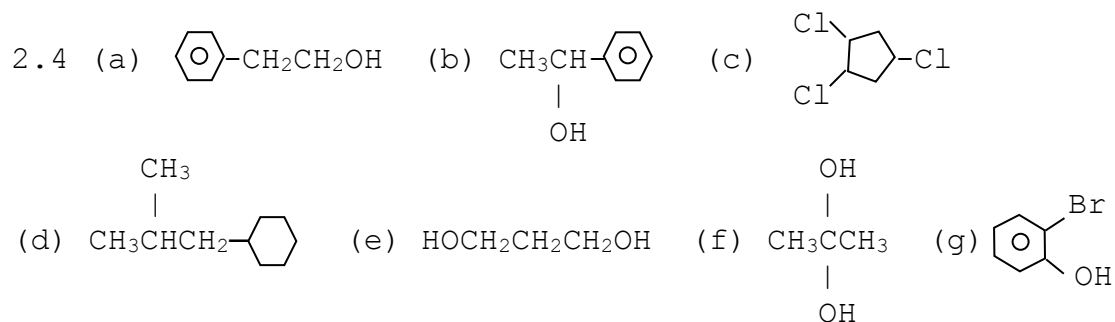


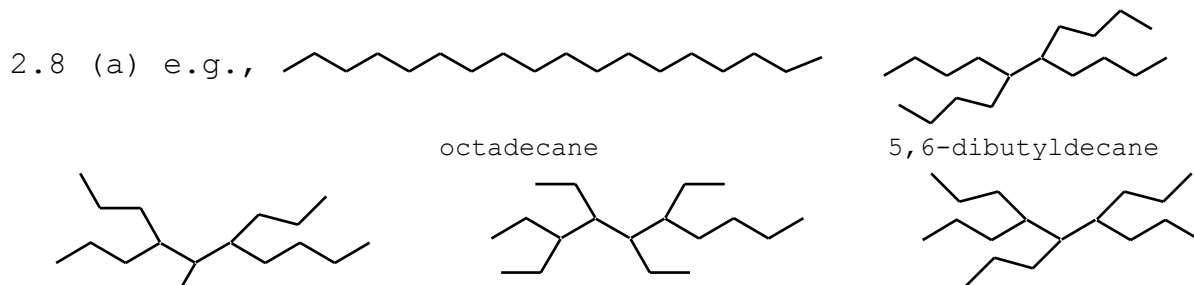
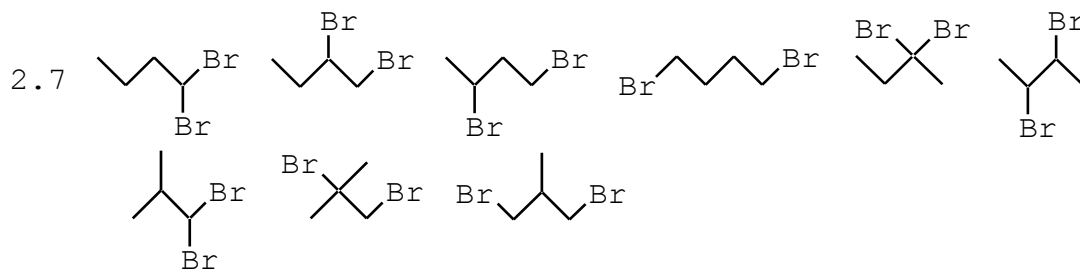
Answers to Puzzles of Chapter 2
Alkanes and Cycloalkanes

2.1 (a) ethane (b) propane (c) 2-methylpropane (d) 2,2-dimethylpropane
(e) 2-methylbutane (f) 3-ethylhexane (g) 3-methyl-5-propylnonane



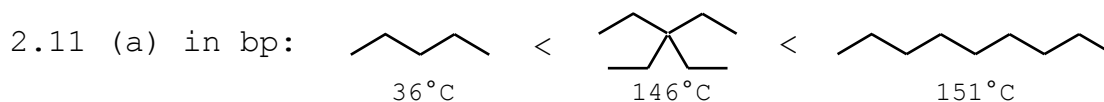
2.3 (a) 1,1,2,2-tetrabromoethane (b) hexabromoethane (c) 2-propanol
(d) 1,1-dichloro-2-ethylcyclobutane (e) 1-iodo-4-methylbenzene (f) 2-fluorocyclohexanol
(g) 5-methyl-3-hexanol (h) cyclohexylbenzene or phenylcyclohexane



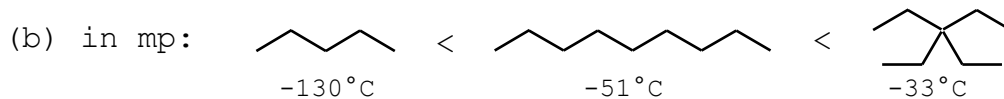


5-ethyl-4,6-dipropyldecane 3,4,5,6-tetraethyldecane 4,5,6-tripropylnonane
 (b) no; different chemicals have different chemical, physical, and biological properties.

2.10 (a) $C_9H_{11}BrO$ (b) 4 rings & π bonds (c) yes

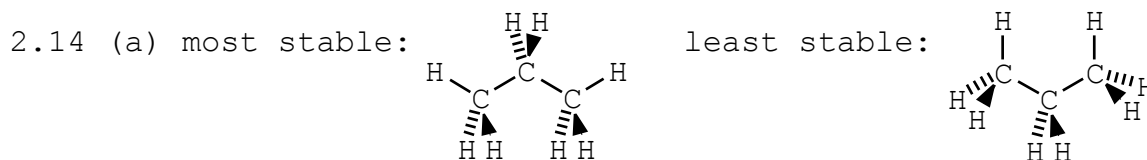
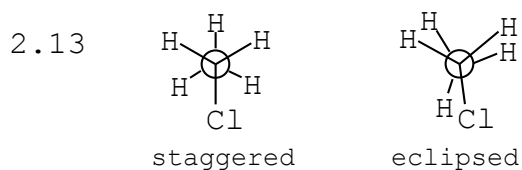


For nonpolar hydrocarbons, bp increases with surface area and this is the order for surface area.

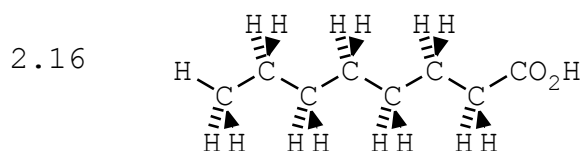
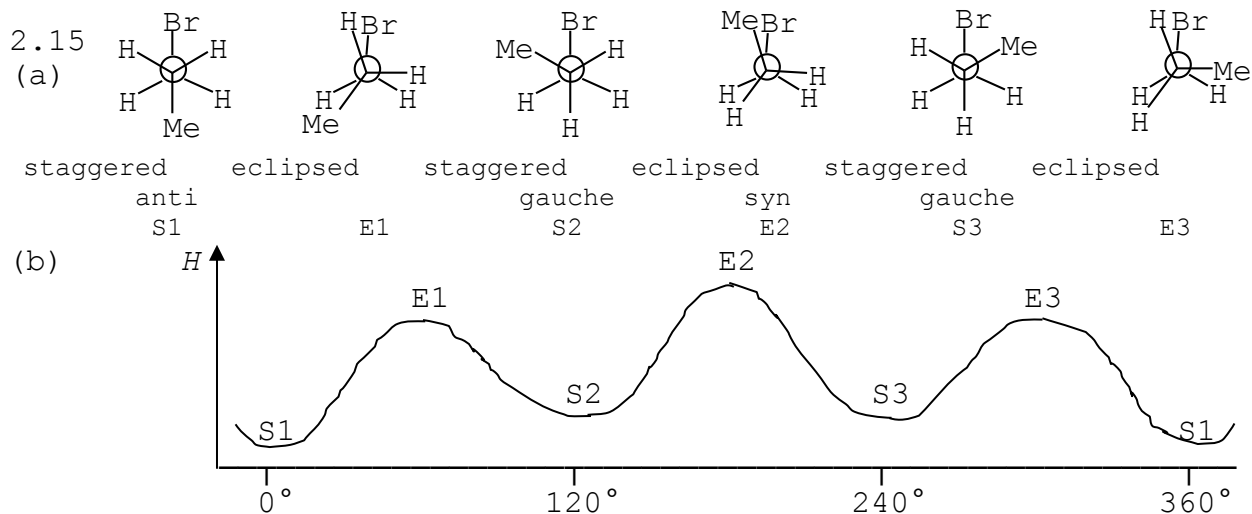


mp increases with surface area & with symmetry, and 3,3-diethylpentane has spherical symmetry.

2.12 (a) octane (b) 2,2,4-trimethylpentane because it has less surface area (c) e.g., hexane



(b) The stablest form has about $2 \times 14 = 28$ kJ/mol less enthalpy because it's fully staggered.



2.17 Chloromethane is more reactive because its C-Cl bond is polar with partial charges.

2.18 (a) $5981 \text{ kJ} - (658.3 \text{ kJ} \times 9) = 56 \text{ kJ/mol}$ ring strain.

(b) Cyclononane's ring strain of $56/9 = 6.2 \text{ kJ/mol}$ of CH_2 exceeds cyclooctane's ring strain of 5.8 kJ/mol of CH_2 .

2.19 (a) cyclopentane > cycloheptane > cyclohexane

(b) cycloheptane > cyclohexane > cyclopentane

2.20 (a) Models show that the strained ring pulls the eclipsed C-H bonds farther apart so that they repel each other less.

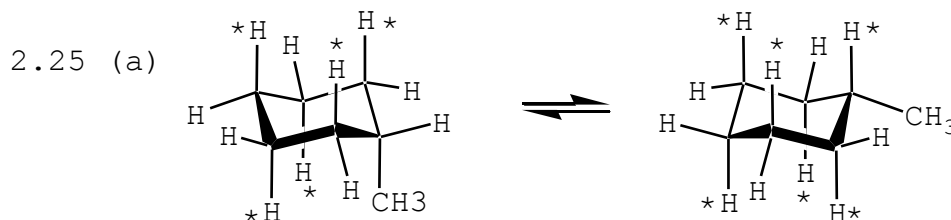
(b) Likewise, the ring forces the eclipsed C-C bonds closer together so that they join at a common carbon and repel each other more.

2.21 Use a model.

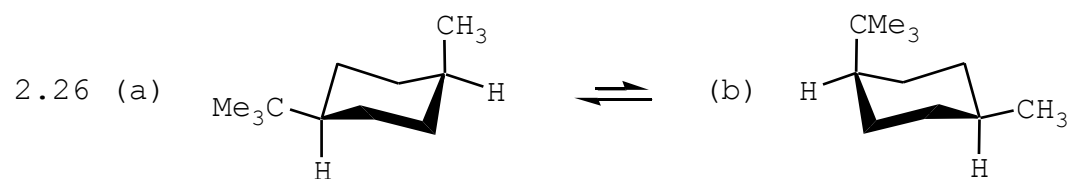
2.22 Methylcyclopropane emits more heat because with the same molecular formula, they yield the same amounts of the same products, but methylcyclopropane has more ring strain to release.

2.23 Plane puckering increases bond bending. So excessive plane puckering will bend bonds too far and destabilize cyclopentane.

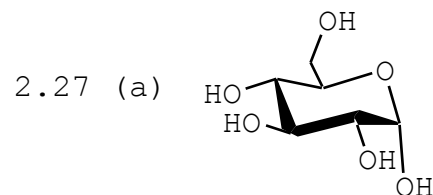
2.24 The five-membered ring is more likely because it has less ring strain and is stabler.



(b) Axial Hs are starred; all other Hs are equatorial



(c) The first is stabler because its larger substituent is equatorial, avoiding axial gauche repulsions.



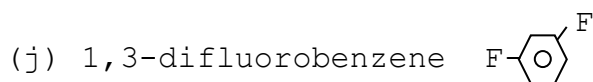
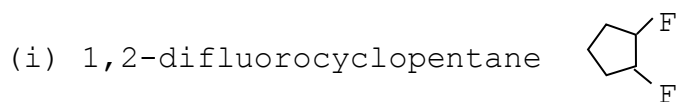
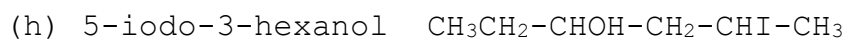
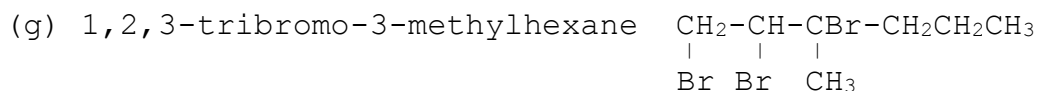
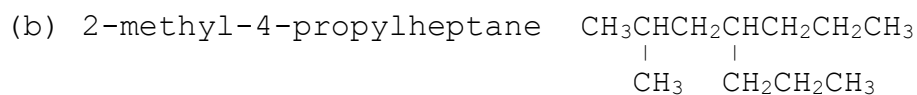
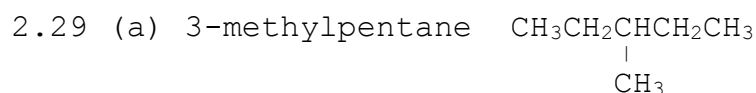
(b) The second is stabler because it has fewer axial substituents.

2.28 (a) 3,3-diethylpentane (b) tetrachloromethane (c) 3-iodo-2-butanol

(d) 1-bromo-3-isopropylcyclopentane

(e) 2,2,3-trifluoro-3-phenylbutane or 2,3,3-trifluoro-2-phenylbutane (f) 5-chloro-2,3-pentanediol

(g) 2-cyclopropylcyclopropanol (h) 1,4-dibromo-2-ethylbenzene



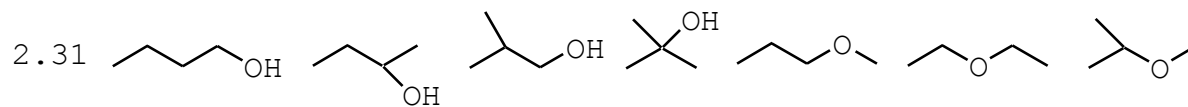
2.30 (a) infinite possibilities; e.g., 1°: $\text{CH}_3\text{CH}_2\text{Cl}$, chloroethane;

2°: $(\text{CH}_3)_2\text{CHBr}$, 2-bromopropane; 3°: $(\text{CH}_3)_3\text{CI}$, 2-iodo-2-methylpropane

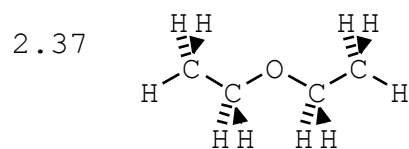
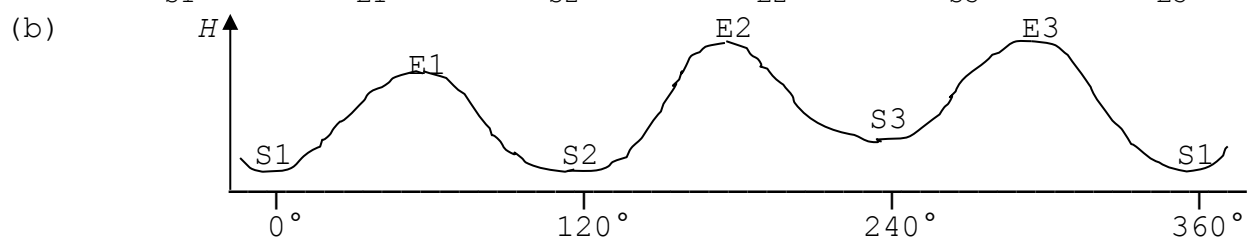
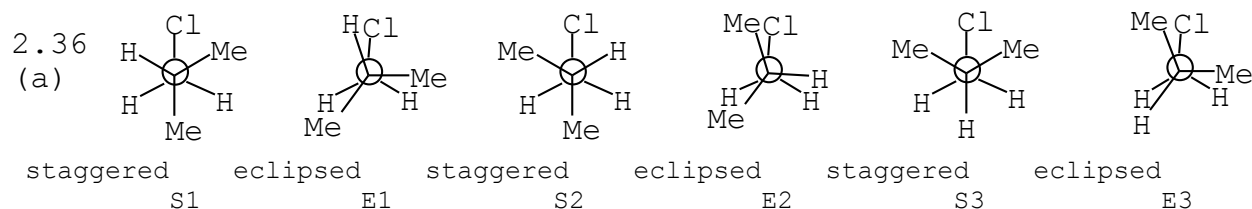
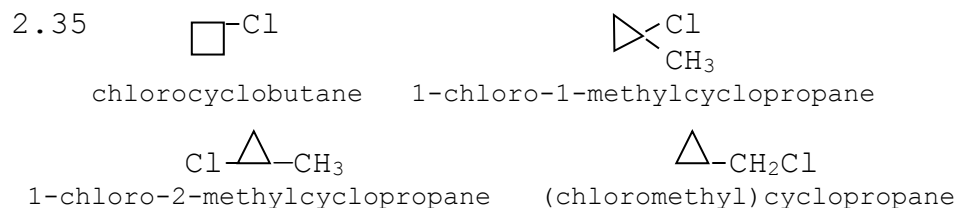
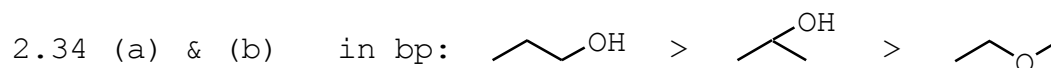
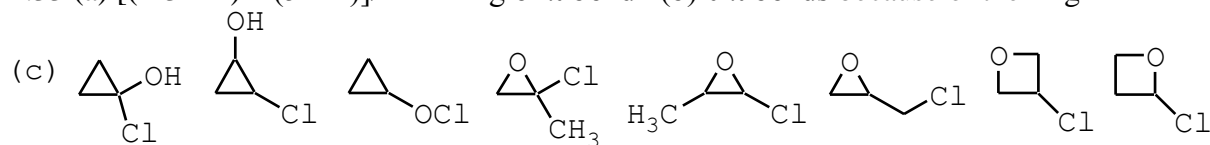
(b) infinite possibilities; e.g., 1°: $\text{CH}_3\text{CH}_2\text{OH}$, ethanol; 2°: $(\text{CH}_3)_2\text{CHOH}$, 2-propanol;

3°: $(\text{CH}_3)_3\text{COH}$, 2-methyl-2-propanol

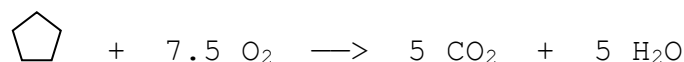
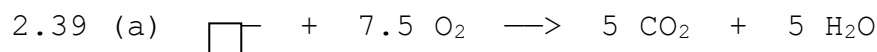
(c) no: C can have at most 4 bonds.



2.33 (a) $[(2 \cdot 3 + 2) - (5 + 1)]/2 = 1$ ring or π bond (b) 0 π bonds because of the ring



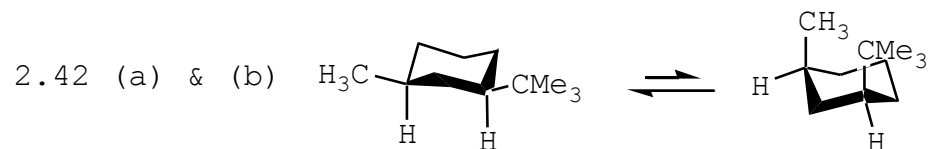
2.38 (a) partial charges (b) full charge (c) lone pair and partial charges (d) double bond (e) empty orbital on B (f) full charge, empty orbital on C



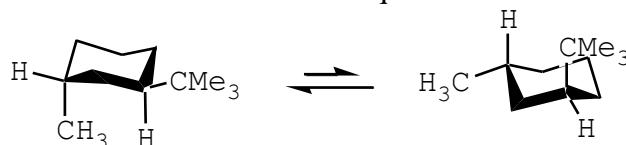
(b) First combustion evolves more heat because it releases more ring strain.

2.40 As ring size ↑, ring strain ↓ & reactant enthalpy ↓ & reactant reactivity ↓.

2.41 The first molecule has more strain because its methyl groups are eclipsed.

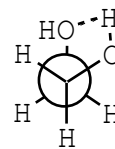


The first form is stabler because both substituents are equatorial.



The first form is stabler because its larger substituent is equatorial.

(c) With an axial substituent the 2nd molecule has more enthalpy and a larger heat of combustion.



2.43 A gauche conformation allows intramolecular H bonding:

2.44 Benzene does not have much ring strain because its carbons are sp^2 with 120° bond angles that fit a perfect hexagon. But with its bonds around the ring eclipsed, there is a little strain.

5/05