

Chapter 4 key

2. $600 \text{ Cal} = 600 \text{ kcal}$

$$600 \text{ kcal} \times \frac{4.184 \text{ kJ}}{1 \text{ kcal}} = 2510.4 \text{ kJ}$$

x1

The US candy bar has less food energy with 2510.4 kJ.
The Swiss bar has 3000 kJ.

10. a. exothermic
b. endothermic
c. endothermic
d. exothermic

x1

11. a. CFCs contain Carbon bonded to chlorine, fluorine or other carbons. C-C bonds energy is 356 kJ/mol, C-Cl is 327 kJ/mol and C-F is 485 kJ/mol. These are amongst the highest values for single bonds.
- b. It takes 485 kJ to break a mole of C-F bonds but only 327 kJ to break a mole of C-Cl bonds.

x1

23. a. This fuel acts like a mixture of 92% iso-octane and 8% n-heptane. It will knock less than gas with an octane rating of 87.

x1

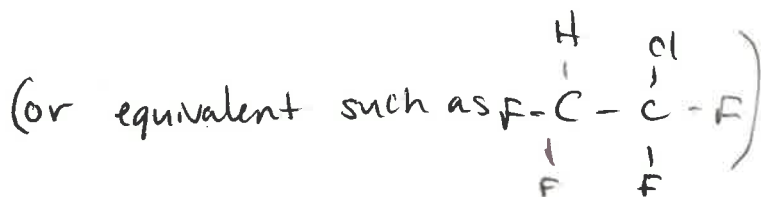
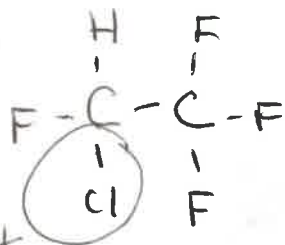
- b. It doesn't say it has oxygenates, but they are highly likely to be used for anti-knocking purposes.

28. a. C-Br bond is most easily broken. The Br radical will be free to destroy ozone (like Chlorine radical)

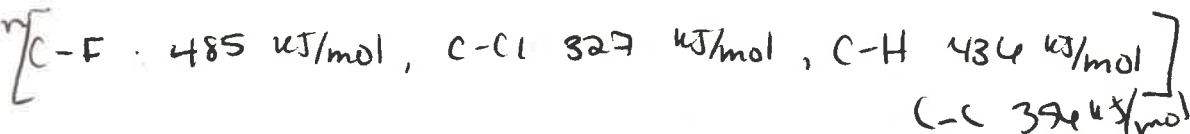
x1

- b. (next page)

286



most
easily
broken



Cl radicals will be formed as this compound decomposes, and can destroy O_3 .

30a. boiling pt

- b. position A+B will have fewer carbon atoms because they will have lower boiling pts. Position D will have more carbon atoms because it will have a higher boiling pt. +2

34a.

n-octane and iso-octane have very similar energy content but ^{very} different octane ratings. Octane rating is not a measure of the energy content. +2

- b. knocking produces objectionable sounds, loss of power, overheating + engine damage.

c.

36. +1

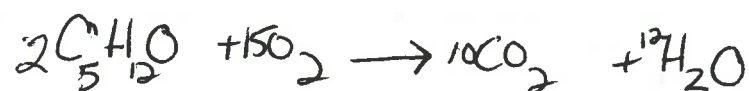
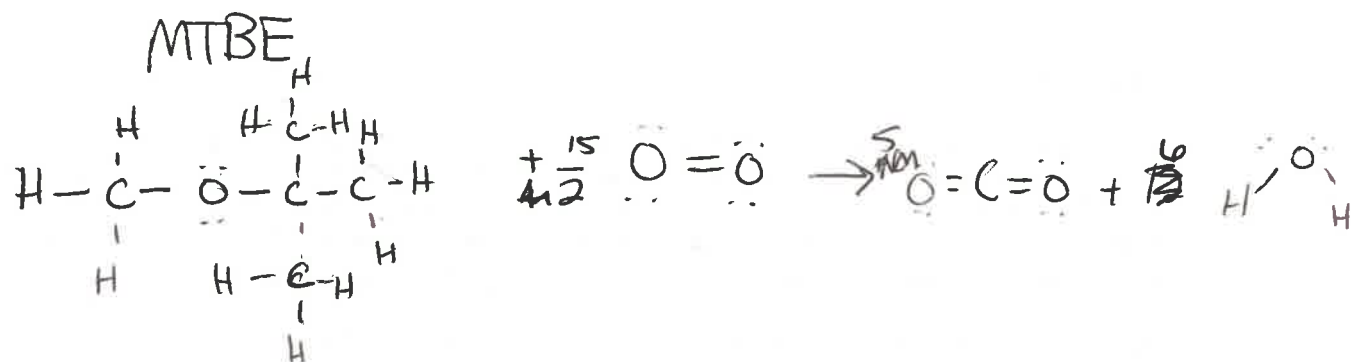
38ab +2

41 +2

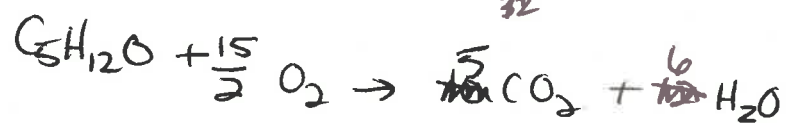
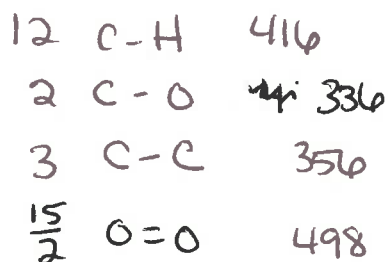
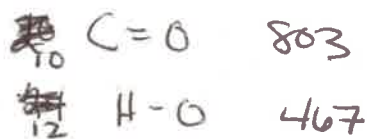
42 +1

49 +1

41



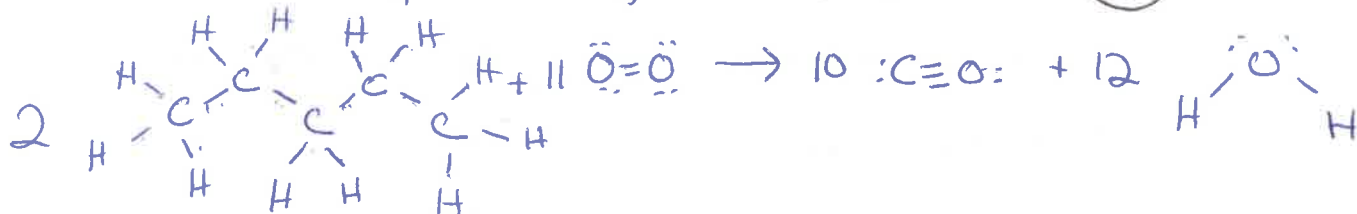
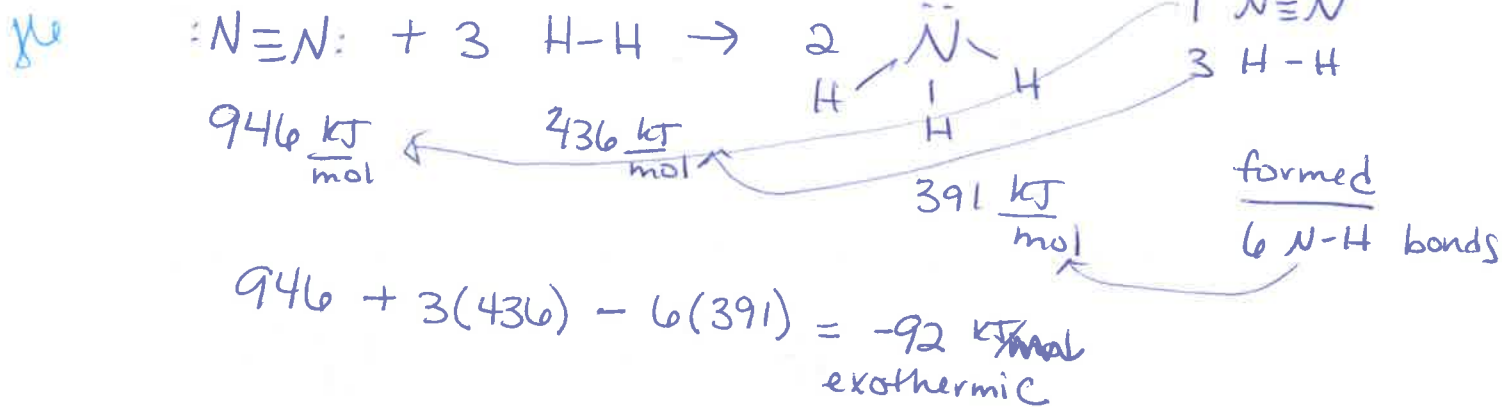
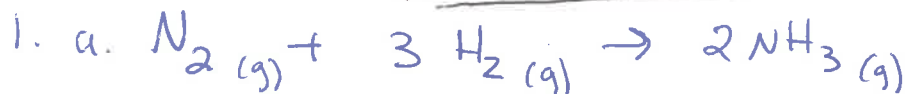
20 or

$$\begin{array}{c}
 10 \\
 12 \\
 \hline
 22
 \end{array}$$
bonds brokenbonds formed

$$12(416) + 336(2) + 3(356) + \frac{15}{2}(498) - 803(\frac{5}{2}) - 467(12) = -3167 \text{ kJ}$$

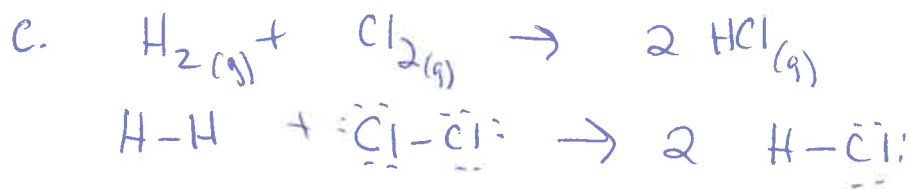
Extra Problems

all are gases unless noted



<u>broken</u>			<u>formed</u>		
24	C-H	416 kJ/mol	10	C≡O	1073 kJ/mol
11	O=O	498 kJ/mol	24	O-H	467 kJ/mol
8	C-C	356 kJ/mol			

$8(356) + 24(416) + 11(498) - 10(1073) - 24(467) = -6476 \frac{\text{kJ}}{\text{mol}}$
 exothermic



$$436 + 242 - 2(431) = -184 \text{ kJ/mol}$$

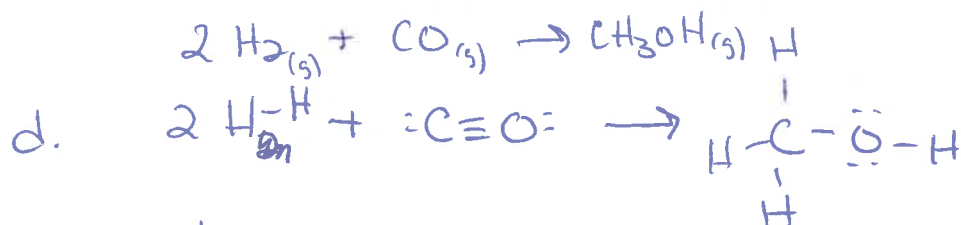
exothermic

broken

1 H-H	436 kJ/mol
1 Cl-Cl	242 kJ/mol

formed

2 H-Cl	431 kJ/mol
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$$2(436) + 1073 - 3(416) - 336 - 467 = -106 \text{ kJ/mol}$$

endothermic
etc

broken

2 H-H	436 kJ/mol
1 C≡O	1073 kJ/mol

formed

3 C-H	416 kJ/mol
1 C-O	336 kJ/mol
1 O-H	467 kJ/mol



$$436 + 498 - 2(467) - 146 = -146 \text{ kJ/mol}$$

exothermic

broken

H-H	436 kJ/mol
O=O	498 kJ/mol

formed

2 H-O	467 kJ/mol
1 O-O	146 kJ/mol



$$2(217) - 193 - 242 = -1 \text{ kJ/mol}$$

exothermic
(barely!)

broken

2 Br-Cl	217 kJ/mol
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formed

Br-Br	193 kJ/mol
Cl-Cl	242 kJ/mol

Extra # 2

#19

+1

Pentane liquid

Triacontane solid

Octane liquid

← not good for fuel
because it would be
hard to transport + pump
(it's not a liquid until
a temp of 450°C)