Act 11 B.

1. $2Mg + O_2 \rightarrow 2MgO$

$n_{Mg} = \frac{6.0}{24.3} = 0.247 \text{ mole}$

0.247 Mg produces 150 kJ

2 moles of Mg releases

$\frac{2}{0.247} \times 150 = 1215 \text{ kJ}$

2. $n_C = \frac{6}{12} = 0.5$

$\Delta_r H = 0.5 \times -400$
$= -200 \text{ kJ}$

3. a. exothermic, ΔH is negative

b. 1 mole $H^+ \rightarrow -57.4 \text{ kJ}$

$\therefore$ 0.5 mole $H^+ \rightarrow \frac{0.5}{1} \times -57.4$

$= -28.4 \text{ kJ}$

4 a. 1 mole $N_2 \rightarrow -92 \text{ kJ}$

$\therefore$ 2 mole $N_2 \rightarrow \frac{2}{1} \times -92 = -184 \text{ kJ}$

b. 2 mole NH_3 form -92 kJ

$\therefore$ 0.5 mole NH_3 $\frac{0.5}{2} \times -92 = 23 \text{ kJ}$

c. 1 mole $N_2 \rightarrow -92$

$\rightarrow 1840$

$1 \times \frac{-1840}{92} = 20$ mol

5. a. 1 mole O_2 → −230 kJ

∴ 8 mole O_2 → 8 × −230 = −1840 kJ

b. moles of C = $\frac{6}{12}$ = 0.5

2 mole C → −230

∴ 0.5 mole C → $\frac{0.5 \times -230}{2}$ = −57.5 kJ

6. a. exothermic, ΔH is negative.

b. $n = c \times v$

$= 0.2 \times \frac{50}{1000}$

$= 0.01$ mol Cu^{2+}

1 mole Cu^{2+} → −216 kJ

∴ 0.01 mole Cu^{2} → $\frac{0.01 \times 216}{1}$ = −2.16 kJ

7. a. 1 mole H_2O_2 → −98.2 kJ

∴ 5 mole H_2O_2 → $\frac{5}{1} \times -98.2 = 491$ kJ

b. when 0.5 mole O_2 formed −98.2 kJ

1 g of O_2 = $\frac{1}{16 \times 2}$ moles = 0.03125 moles

when 0.03125 mole O_2 formed

= $\frac{0.03125}{0.5} \times -98.2 = 6.1375$ kJ

= 6.14 kJ

c. 1 mole H_2O_2 produces −98.2 kJ

to produce 600 kJ $\frac{-600}{98.2}$ = 6.1 moles

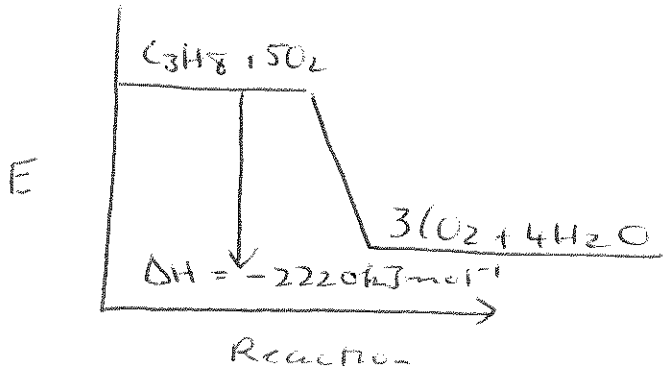
7c. (cont)

$n = \frac{m}{M}$ $\quad m = n \times M$

$= 6.1 \times 34$

$= 207.4\,g$

8.a.



b. 1 mole $C_3H_8 \rightarrow -2220\,kJ$

$11g\ C_3H_8 = \frac{11}{(3\times12+1\times8)} = 0.25\,mol$

$0.25\,mol\ C_3H_8$ produce $\frac{0.25}{1} \times -2220$

$= 555\,kJ$

c. 1 mole $C_3H_8 \rightarrow -2220\,kJ$

number of mole C_3H_8 to produce $10,000\,kJ$

$= \frac{10,000}{2220}$

$= 4.5$ mole

$m = n \times M$

$= 4.5 \times 44$

$= 198\,g$

9. a. $C_2H_6O + 3O_2 \rightarrow 2CO_2 + 3H_2O \quad \Delta H = -1367 kJ mol^{-1}$

b. 1 mole $C_2H_6O \rightarrow -1367 kJ$

$$n_{C_2H_6O} = \frac{4.71}{2\times12+6+16} = \frac{4.71}{46} = 0.102 mol$$

$$\text{Heat released} = \frac{0.102}{1} \times -1367$$

$$= 139 kJ.$$

10. a. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O \quad \Delta H = 890 kJ mol^{-1}$

$$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O \quad \Delta H = -3000 kJ mol^{-1}$$

b. $16g\ CH_4 \rightarrow -890 kJ$

$$1g\ CH_4 \rightarrow \frac{-890}{16} = 55.6 kJ/g$$

$58g\ C_4H_{10} \rightarrow -3000 kJ$

$$1g\ C_4H_{10} \rightarrow \frac{-3000}{58} = 51.7 kJ/g$$

$\therefore$ CH_4 produces more heat per gram.

11. a. 2 moles $HgO \rightarrow 182 kJ$

$$n_{HgO} = \frac{277}{200.1+16} = 1.28 mole$$

$$1.28 \text{ moles } HgO \rightarrow \frac{1.28}{2} \times 182 = 116.5 kJ$$

b. 2 moles $Hg \rightarrow 182 kJ$

$2 \times 200.1 = 400.2 g$

number g $Hg \rightarrow 555 = \frac{555}{182} \times 400.2 = 1220 kJ$

12. a. 2 moles $SO_2 \rightarrow 188\ kJ$

2 moles $= 2 \times (32+32) = 128g$

32 g of SO_2 will produce $\frac{32}{128} \times 188 = 47\ kJ$

b. $\frac{3000}{188} = 15.96$

mass of SO_2 required $15.96 \times 128g$
$= 2043g$

13. 4 moles $Fe \rightarrow 1648$

mass of Fe $4 \times 56 = 224g$

$\frac{448}{224} \times 1648 = 3296\ kJ$

14. $2 \times 63.0 = 126g$

$126g\ B_5H_9 \rightarrow -9036$

$1g\ B_5H_9 \rightarrow \frac{1}{126} \times -9036$

$= 71.7\ kJ$

15. 4 moles $NH_3 = 4 \times 17 = 68g$

$68g\ NH_3 \Rightarrow -912\ kJ$

$\frac{600 \times 10^3}{68} \times -912 = 8.05 \times 10^6\ kJ$

16. a. $2 \times (14+32) = 92g$

$92g\ NO_2$ requires $68\ kJ$

$\therefore \frac{500}{92} \times 68 = 369.6g$

b. $14 \times 2 = 28g\ N_2$ uses $68\ kJ$

$350/68 \times 28 = 144.1g$

17. $2 \times (14 \times 2 + 1 \times 4) = 64\,g$

64 g N_2H_4 produces $-1048\,kJ$

$\frac{100 \times 10^3}{64} \times -1048 = 1637500\ kJ$

$= 1.64 \times 10^6\ kJ$

18. a. 180 g glucose $\Rightarrow -2803\,kJ$

$\frac{10}{180} \times -2803 = 155.7\ kJ$

b. 1 mole glucose = 180 g $\Rightarrow -2803\,kJ$

energy / g $= -2803/180 = 15.6\,kJ$

1 mole sucrose = 342 g $\Rightarrow -5640\,kJ$

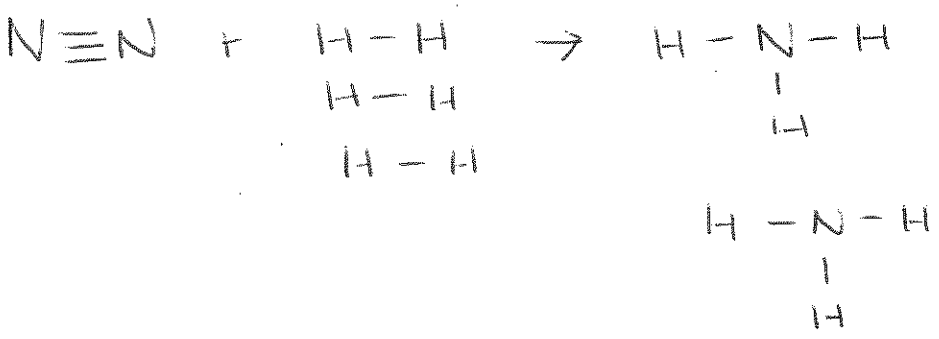
energy / g $= -5640/342 = 16.5\,kJ$

Sucrose produces more energy.

Act 11C

Q5a.i

$$N_2 + 3H_2 \rightarrow 2NH_3$$



Break		Make		
1 x N≡N	945	2x3 N-H	6x391	
3 x H-H	3x436			
	2253			2346

ΔH = bond break − bond make

$\Delta H = 2253 - 2346$

$= -93 kJ mol^{-1}$