1. All contain polar bonds but only $\text{H}_2\text{O} + \text{PH}_3$ are polar. Thus $\text{CCl}_4$ would have the lowest $\text{bp}$.

2. Any bond strengths will be given. I used Table 5.1 on p. 139 of your text.

$$\text{(2)} \quad \text{C}_8\text{H}_{16} + 25\text{O}_2 \rightarrow 16\text{CO}_2 + 18\text{H}_2\text{O}$$

\[
\begin{array}{c}
\text{H} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{C} \quad \text{H} \\
\text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\
\text{H} \quad \text{H} \quad \text{H} \quad \text{H} \\
\end{array}
\]

$$\Delta H = \text{bonds broken} - \text{bonds formed}$$

$$= [36 \cdot \text{C-H} + 14 \cdot \text{C-C} + 25 \cdot \text{O}=0] - [32 \cdot \text{C-O} + 36 \cdot \text{H-O}]$$

$$= [36 \cdot 410 + 14 \cdot 350 + 25 \cdot 498] - [32 \cdot 732 + 36 \cdot 416]$$

$$= [14740 + 4900 + 12450] - [23424 + 16560] = -7874 \text{ kJ}$$

$$= -3937 \text{ kJ/mol}$$

3. a. $\text{exo (combustion)}$

b. $21.83 \text{ g CO}_2 \times \frac{1 \text{ mol CO}_2}{44.0 \text{ g}} \times \frac{1 \text{ mol C}}{1 \text{ mol CO}_2} = 0.496 \text{ mol} \times \frac{12 \text{ g}}{1 \text{ mol}} = 5.95 \text{ g C}$

$$4.47 \text{ g H}_2\text{O} \times \frac{1 \text{ mol H}_2\text{O}}{18 \text{ g}} \times \frac{2 \text{ g H}}{1 \text{ mol H}_2\text{O}} = 0.497 \text{ mol H} \times \frac{1 \text{ g}}{1 \text{ mol}} = 0.497 \text{ g H}$$

c. $\text{C}_0.496\text{H}_0.497 \Rightarrow \text{CH} \cdot -311 \text{ kJ} = -627.1 \text{ kJ/mol}$

d. $5.5 \text{ g} \times \frac{1 \text{ mol}}{13 \text{ g}} \times \frac{-627 \times 10^3 \text{ J}}{1 \text{ mol}} = 265.27 \text{ J released by x}$

$$\Delta E = 265.27 \text{ J} = s \cdot m \cdot \Delta T = 4.18 \text{ J} \cdot \text{g} \cdot \left(\frac{\Delta T}{\text{g} \cdot \text{C}}\right)$$

\[\Delta T = 95 \text{ C} \Rightarrow T_f = 98 \text{ C}\]

4. $\text{K}_2\text{O} - \text{ bigger charges}$

5. Note: $\Delta H_{fus, \text{vap}}$... $S_s + S_g$ would be given on test if needed

$$5500 \text{ g} \times \frac{1 \text{ mol}}{18 \text{ g}} = 305.6 \text{ g mol H}_2\text{O}$$
$\Delta E = \text{heat ice} + \text{melt ice} + \text{heat } H_2O + \text{boil } H_2O + \text{heat steam}$

\[2.03 \frac{J}{g^\circ C} \times 5500 \text{ g} \times 15^\circ C + 6.01 \times 10^3 \frac{J}{\text{mol}} \times 305.6 \text{ mol} + 4.184 \frac{J}{g^\circ C} \times 5500 \times 100^\circ C + 40.7 \times 10^3 \frac{J}{g^\circ C} \times 305.6 \text{ mol} + 2.01 \frac{J}{g^\circ C} + 5500 \times 150^\circ C = 1.49 \times 10^7 J\]

\[1.49 \times 10^7 J \times \frac{1 \text{ mol}}{880 \times 10^3 J} \times \frac{18g}{1 \text{ mol CH}_4} = 271 \text{ g CH}_4 \text{ needed}\]

6. $\Delta E = 8.214 \frac{kJ}{^\circ C} \times 5.321^\circ C = 43.71 \text{ kJ}$

\[
\frac{43.71 \text{ kJ}}{2.5 \text{ g} \times \frac{1 \text{ mol}}{180 \text{ g}}} = \frac{3147 \text{ kJ}}{\text{mol}} = \Delta H_{\text{comb glucose}}
\]

7. Use IMF type:

\[O_2 < CH_2CH_2OH < H_2O < CH_3 \quad \text{(larger mass)}
\]

\[\text{water} \quad \text{water} < \text{H bond} < 2 \text{ H bonds}
\]

8. $38 \times 10^3 J = 0.5 J \frac{9^\circ C}{g} \times Xg \times 90^\circ C + 21 J \times Xg + 0.5 J \frac{9^\circ C}{g} \times Xg \times 10^\circ C = 71 J \times Xg$

heat solid  \quad \text{melt}  \quad \text{heat}$

9. Want: $2 \text{NH}_3 + 2 \text{CH}_4 + 3 \text{O}_2 \rightarrow 2 \text{HCN} + 6 \text{H}_2 \text{O} \quad \Delta H = ??$

I used $\Delta H^0$: $\Delta H^0 = \left[2 \times 135.1 + 6 \times -241.8\right] - \left[2 \times -46.11 + 2 \times -74.81 + 3 \times 0\right]$

\[= -1416.44 \text{ kJ}\]

10. Repeat 4..2 - sorry.

11. $2 \text{H}_2(g) + \text{O}_2(g) \rightarrow 2 \text{H}_2\text{O}(g)$

\[P_{\text{Fin}} = \frac{nRT}{V} = \left(0.045 \text{ atm} + 0.015 \text{ atm}\right) \times \frac{0.015 \text{ mol}}{0.045 \text{ atm}} \times \frac{393 \text{ K}}{0.5 \text{ L}}\]

\[= 38 \text{ atm}\]

\[\text{Check my math!}\]