

2. The following questions relate to sulfur and some of its compounds.
- (a) Write the balanced equation for the combustion of $S_8(s)$ to form $SO_2(g)$.
 - (b) Calculate the volume of $O_2(g)$, measured at 1.00 atm and 298 K, that is required to completely combust a 500.0 g sample of pure $S_8(s)$.
 - (c) A student claims that the combustion of S_8 is an oxidation-reduction reaction. Justify the claim by identifying the oxidation numbers of sulfur and oxygen both before and after the reaction.
 - (d) In the box below, draw a Lewis electron-dot diagram for one valid resonance structure of SO_2 .



- (e) Based on the diagram you drew in part (d), what is the approximate oxygen-sulfur-oxygen bond angle in SO_2 ?
 SO_2 can be oxidized to form SO_3 according to the following equation.
$$2 SO_2(g) + O_2(g) \rightarrow 2 SO_3(g) \quad \Delta H^\circ = -198 \text{ kJ/mol}_{rxn}$$
- (f) Is the value of ΔS° for the reaction represented above positive or negative? Justify your answer.
$$2 SO_2(g) + O_2(g) \rightarrow 2 SO_3(l)$$
- (g) Is the magnitude of ΔH° for the reaction to form $SO_3(l)$, represented above, greater than, less than, or equal to the magnitude of ΔH° for the reaction to form $SO_3(g)$? Justify your answer.
- (h) Based on the information above, how does the thermodynamic favorability of the reaction change as the temperature of the reaction system is decreased? Justify your answer.