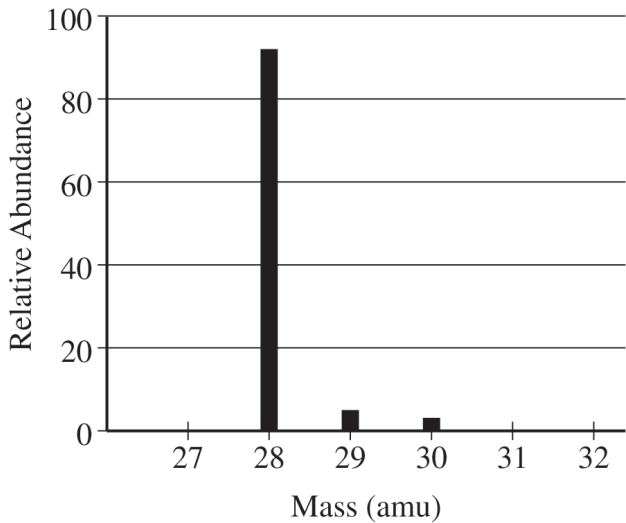


2. Answer the following questions about the element Si and some of its compounds.

(a) The mass spectrum of a pure sample of Si is shown below.



(i) How many protons and how many neutrons are in the nucleus of an atom of the most abundant isotope of Si ?

(ii) Write the ground-state electron configuration of Si.

Two compounds that contain Si are SiO₂ and SiH₄.

(b) At 161 K, SiH₄ boils but SiO₂ remains as a solid. Using principles of interparticle forces, explain the difference in boiling points.

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At high temperatures, SiH₄ decomposes to form solid silicon and hydrogen gas.

(c) Write a balanced equation for the reaction.

A table of absolute entropies of some substances is given below.

Substance	S° (J/(mol · K))
H ₂ (<i>g</i>)	131
Si(<i>s</i>)	18
SiH ₄ (<i>g</i>)	205

(d) Explain why the absolute molar entropy of Si(*s*) is less than that of H₂(*g*).

(e) Calculate the value, in J/(mol·K), of ΔS° for the reaction.

(f) The reaction is thermodynamically favorable at all temperatures. Explain why the reaction occurs only at high temperatures.

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(h) Using principles of atomic structure, explain why the first ionization energy of Ge is lower than that of Si.

(i) A single photon with a wavelength of 4.00×10^{-7} m is absorbed by the Si sample. Calculate the energy of the photon in joules.

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