

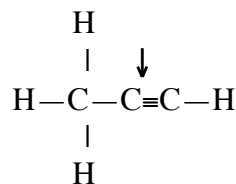
AP Free Response Practice

2003

Compound Name	Compound Formula	$\Delta H^\circ_{\text{vap}}$ (kJ mol ⁻¹)
Propane	CH ₃ CH ₂ CH ₃	19.0
Propanone	CH ₃ COCH ₃	32.0
1-propanol	CH ₃ CH ₂ CH ₂ OH	47.3

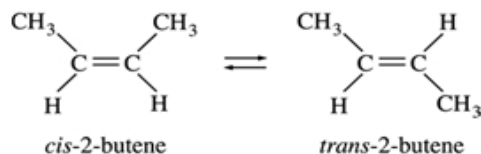
Using the information in the table above, answer the following questions about organic compounds.

- (a) For propanone,
- (i) draw the complete structural formula (showing all atoms and bonds);
 - (ii) predict the approximate carbon-to-carbon-to-carbon bond angle.
- (b) For each pair of compounds below, explain why they do not have the same value for their standard heat of vaporization, $\Delta H^\circ_{\text{vap}}$. (You must include specific information about both compounds in each pair.)
- (i) Propane and propanone
 - (ii) Propanone and 1-propanol
- (c) Draw the complete structural formula for an isomer of the molecule you drew in, part (a) (i).
- (d) Given the structural formula for propyne below,



- (i) indicate the hybridization of the carbon atom indicated by the arrow in the structure above;
- (ii) indicate the total number of sigma (σ) bonds and the total number of pi (π) bonds in the molecule

2004



The gas-phase conversion reaction between the geometric isomers *cis*-2-butene and *trans*-2-butene is represented by the equation above. The value of the equilibrium constant, K_{eq} , for the reaction is 3.2 at 298 K and 1.0 atm.

- (a) In a mixture of the isomers at equilibrium at 298 K and 1.0 atm, which is present at a higher concentration, *cis*-2-butene or *trans*-2-butene? Justify your answer.
- (b) If 1.00 mol of pure *cis*-2-butene and 1.0 mol of pure *trans*-2-butene were introduced into an evacuated container at 298 K, in which direction (to the right or to the left) would the reaction proceed to establish equilibrium? Justify your answer.
- (c) Given that K_{eq} for the reaction at 400 K has the value 1.3, predict whether the reaction is endothermic or exothermic. Justify your answer.
- (d) There are other structural isomers of *cis*-2-butene and *trans*-2-butene. Draw one of these isomers, including all atoms, and give its IUPAC name.

1991 D

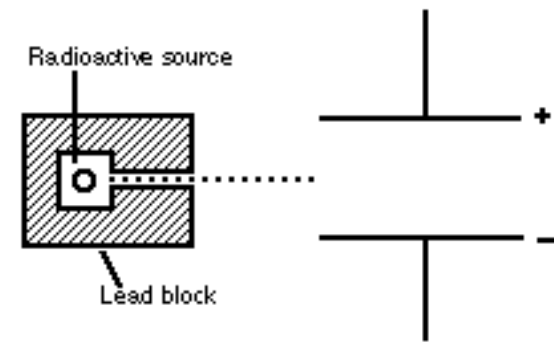
Explain each of the following in terms of nuclear models.

- (a) The mass of an atom of ${}^4\text{He}$ is less than the sum of the masses of 2 protons, 2 neutrons, and 2 electrons.
- (b) Alpha radiation penetrates a much shorter distance into a piece of material than does beta radiation of the same energy.
- (c) Products from a nuclear fission of a uranium atom such as ${}^{90}\text{Sr}$ and ${}^{137}\text{Ce}$ are highly radioactive and decay by emission of beta particles.
- (d) Nuclear fusion requires large amounts of energy and to get started, whereas nuclear fission can occur spontaneously, although both processes release energy.

1997 D

Answer each of the following questions regarding radioactivity.

- (a) Write the nuclear equation for decay of ${}^{234}_{94}\text{Pu}$ by alpha emission.
- (b) Account for the fact that the total mass of the products of the reaction in part (a) is slightly less than that of the original ${}^{234}_{94}\text{Pu}$.
- (c) Describe how α , β , and γ rays each behave when they pass through an electric field. Use the diagram below to illustrate your answer.



- (d) Why is it not possible to eliminate the hazard of nuclear waste by the process of incineration?