

## More other problems

### Problem 1:

One feature common to both the Debye theory and the Einstein theory of the specific heat of a crystal composed of  $N$  identical atoms is that the

- (A) average energy of each atom is  $3kT$
- (B) vibrational energy of the crystal is equivalent to the energy of  $3N$  independent harmonic oscillators
- (C) crystal is assumed to be continuous for all elastic waves
- (D) speed of the longitudinal elastic waves is less than the speed of the transverse elastic waves
- (E) upper cutoff frequency of the elastic waves is the same

### Problem 2:

When the beta-decay of  $^{60}\text{Co}$  nuclei is observed at low temperatures in a magnetic field that aligns the spins of the nuclei, it is found that the electrons are emitted preferentially in a direction opposite to the  $^{60}\text{Co}$  spin direction. Which of the following invariances is violated by this decay?

- (A) Gauge invariance
- (B) Time invariance
- (C) Translation invariance
- (D) Reflection invariance
- (E) Rotation invariance

### Problem 3:

The binding energy of a heavy nucleus is about 7 million electron volts per nucleon, whereas the binding energy of a medium-weight nucleus is about 8 million electron volts per nucleon. Therefore, the total kinetic energy liberated when a heavy nucleus undergoes symmetric fission is most nearly

- (A) 1876 MeV
- (B) 938 MeV
- (C) 200 MeV
- (D) 8 MeV
- (E) 7 MeV

**Problem 4:**

The average distance between molecules in the vapor phase of a substance is about 10 times the average distance between molecules in the solid phase. Which of the following statements about the density of the substance in the two phases must be true?

- (A) The density is about the same in both phases.
- (B) The density of the solid is about 0.1 times the density of the vapor.
- (C) The density of the solid is about 10 times the density of the vapor.
- (D) The density of the solid is about 100 times the density of the vapor.
- (E) The density of the solid is about 1000 times the density of the vapor.

**Problem 5:**

In the 1930s Lise Meitner proposed a mathematical theory that explained how barium was produced when a uranium nucleus was struck by a neutron. Which of the following best describes the significance of this work?

- (A) It described the process that would later be used to develop atomic energy.
- (B) It provided the basis for Einstein to develop the theory of relativity.
- (C) It described the processes of mass-energy transformations that occur in stars.
- (D) It verified earlier theories proposed by Fermi and Oppenheimer.
- (E) It described the radioactive decay of unstable atomic nuclei.