Faculty of science   **4ˢᵗ level student (Physics)**
Physics Department   **Second term, 2018-2019**
Time: 3 hours   **Date: 12/6/2019**

Magnetic resonance and Mossbauer

Answer all

Q.1 (20 Deg.)

A) - Crystal with one preferred magnetization axis, its magnetization will be

   a) Hard   c) easy   d) impossible

B) - The energy of ferromagnetic material reduced by making

a) Magnetic flux discontinues   b) Magnetic flux. Continues outside the materials,

c) Magnetic flux. Continues inside the materials

C) - The measured effective number of Bohr magnetons is always less than the
    theoretical one for

a) Para   b) Ferro   c) all magnetic types

D) - For Ferro magnetic materials cure temperature independent on

 a) Magnetic field   b) Weiss field   c) Magnetic moment

Q. 2 (20 Deg.)

A) - Define the closure domain – Bohr magnetone – Weiss field

B) - What do you know about the recoil energy

C) - Why the nuclear magnetic moment is smaller than electron magnetic moment

Q. 3 (20 Deg.)

A) - The effects of orbital motion of the electron to the magnetic properties may be
    (positive, negative, positive and negative). Choose the correct answer and clarify it.

B) – What is the relation between Curie temperature and Weiss field

Q. 3 (20 Deg.)

A) - The electron distribution probability around the nucleus is responsible for some
    defect in the nucleus energy, discuss this effect

B) - Draw only, the hysteresis loops for the Ferro, Para and diamagnetic materials, in the
    figure, write the magnetic constants

Answer

1- A- (a)   b- (c)   c- (C)   d- (a)

2- A- Domains form in such a way that opposite
poles are close to each other thereby confining the
path of the flux lines and reducing the net magnetization to a value close to zero. This reduces
the magnetostatic energy

it equals the magnetic quantum number when its value =1c

To model the interaction between the atomic moments, Weiss introduced the concept of the
molecular field. Each moment will experience an effective field that is a superposition of the
effects of its interactions with all the other moments in the material. This effective field has the
same effect as an applied magnetic field and Weiss assumed that this field is proportional to the
magnetization of the material. (This makes sense: stronger moments should lead to stronger
interactions.) Thus, the net field experienced by a moment is due to the applied field *H* and the
molecular field H_m, where
$$_m H = \lfloor M$$

B- Any bit of matter (say, an atom or molecule) emitting any type of radiation must recoil in order to
conserve energy and momentum. Both the recoil energy and the energy of the emitted photon must
come from the energy di_erence between the initial and _nal state energy levels of the emitting
source (h_ = E_i ⊡ E_f); thus the energy of the emitted photon (h_0) must be smaller than h_.
Likewise, an atom or molecule absorbing radiation (absorber) must recoil in order to conserve
energy and momentum. The energy of the photon to be absorbed (h_00) must be larger than h_ for
absorption to happen. Notice that emission and absorption work in opposite directions.
An approximate calculation gives the di_erence between the energy needed for absorption and the
energy needed for emission involving a particular transition:
c- this because the mas of nucleus is ver high comparing by the electron mass

3-   A- its always negative dut to the change in the electron frequency under the electrical field

Q4-a

B. ISOMER SHIFT (or CHEMICAL SHIFT). The S electrons from the atom have a signi_cant
probability of being at the nucleus (see any modern physics or chemistry textbook). Other electrons
may a_ect the S electrons, so they indirectly will have an e_ect on the nucleus. A nucleus in the
excited state is larger than a nucleus in the ground state, so the nucleus in the excited state will
have a larger overlap with the S electron than when in the ground state. This will decrease the
energy of the excited state relative to the ground state. If the source and absorber have di_erent
values of j (r = 0)j2 (i.e., di_erent electron probability densities at the site of respective nuclei),
there will be a shift in the resonance energy of one relative to the other, see Fig. 3(a). These
shifts will vary from zero to energies of the order of 10⊡7 eV. Note: although Fig. 3(a) shows the
isomer shift as a shift in only the excited state, the ground state (and any other excited state)
may also show a shift; moreover, shifts occur in the states of both the source and target, but the

spectrometer can only show a di_erence between the energy levels between the source and target. Iron in non-magnetic stainless steel does not have a (strong) magnetic _eld at the site of the nucleus (and thus no visible ma

4-b