1. A charged particle accelerated to a velocity $\vec{v}$ enters the chamber of a mass spectrometer. A mass spectrometer is a device with a uniform magnetic field $\vec{B}$, directed perpendicular to $\vec{v}$, which separates particles with the same $\vec{v}$ according to their mass. After a particle enters the chamber, its trajectory is a
   
   (a) parabola
   (b) circle
   (c) spiral
   (d) straight line

2. Cosmic rays (for example, atomic nuclei stripped of some of their electrons) would continuously bombard Earth’s surface if most of them were not deflected by the Earth’s magnetic field. Given that the Earth is to a good approximation a magnetic dipole, with magnetic field as shown, the intensity of cosmic rays bombarding its surface, assumed to have velocities directed radially toward Earth, is greatest at
   
   (a) poles
   (b) mid-latitudes
   (c) equator
3. A rectangular loop is placed in a uniform magnetic field with the plane of the loop parallel to the direction of the field, as shown. If a current is made to flow through the loop in the sense shown by the arrows, the field exerts on the loop

(a) a net force
(b) a net torque
(c) a net force and a net torque
(d) neither a net force nor a net torque

4. For the loop and magnetic field shown above, the loop configuration with the lowest magnetic potential energy is given by

(a) present configuration
(b) plane of the loop perpendicular to the magnetic field, with current flow in the counter clockwise direction, viewed from above
(c) plane of the loop perpendicular to the magnetic field, with current flow in the clockwise direction, viewed from above
(d) present configuration, with the direction of current flow reversed