A simple model for most pulsars is exemplified by the Crab optical pulsar born in a supernova observed in 1054 A.D. This pulsar is a neutron star. Currently it has a time period of approximately 34 ms and can be thought of as a sphere of radius 25 km. Its magnetic axis does not coincide with its rotation axis, just like earth. Assume that all the pulsar's neutrons are aligned along an axis which makes an angle of 90° with the rotation axis. Assume further that the pulsar has a mass 2.7×10^{30}kg.

(a) What is the magnetic dipole moment of this star? The neutron's magnetic moment equals $\mu_n = -2e\hbar/(2m_{proton}) = -10.1016 \times 10^{-27} J/T$.

(b) Consider a point at a distance of $6{\times}10^{19}$m from the star and along its rotational axis. What is the electromagnetic flux received at this point assuming that all the radiation from the pulsar is due to magnetic dipole radiation in a vacuum?

(c) In this model the rate of rotation slowing down, $\dot{\omega}$ is proportional to $-\omega^n$. What is n? (The true model is more complicated.)