**HW 14.2 – Forces in a B-field Name: …………………………………**

Set: Monday 30 November 2020

Due: Friday 4 December 2020

Reading

Island Physics Magnetism sections 14.1 – 14.3 and College Physics chapter 19, sections 19.1 – 19.4

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| $$F\_{B}=BIl$$$$F\_{B}=Bqv$$$$F\_{E}=qE$$$$PE\_{E}=qV$$ | $$μ\_{0}=4π×10^{-7}$$$$e=1.6×10^{-19} C$$$$F\_{c}=\frac{mv^{2}}{r}$$ |

1. A proton travels at a speed of 2.5 × 106 m/s through a uniform magnetic field of strength 50mT. If the proton travels at an angle of 25˚ to the field calculate the force on the proton. Calculate the initial acceleration of the proton when entering this field. (3)
2. The velocity of a particle of charge +4.0 × 10-9 C and mass 2 × 10-4 kg is perpendicular to a 0.1 T magnetic field. If the particle’s speed is 3 × 104 m/s; what is the acceleration of the particle due to the magnetic force? (3)
3. A charged particle enters the magnetic field of a mass spectrometer at a speed of 2.5 × 106 m/s. It then traces out a circular path of radius 15 cm in a uniform magnetic field of magnitude 0.45 T having a direction perpendicular to the particle’s velocity. Find the particles charge to mass ratio. If a second particle with twice the charge-to-mass ratio enters the field with half the velocity, calculate the radius of its path. (4)
4. An electron is accelerated through 2400 V from rest and then enters a region where there is a uniform 1.70 T magnetic field. What is the magnitudes of the magnetic force acting on this electron? (2)
5. Determine the initial direction of the deflection of charged particles entering the magnetic fields shown below (4)





1. A wire 2.80 m in length carries a current of 5.00 A in a region where a uniform magnetic field has a magnitude of 0.390 T. Calculate the magnitude of the magnetic force on the wire assuming the angle between the magnetic field and the current is
2. 60.0° (1)
3. 90.0° (1)
4. 120° (1)
5. A current of 15 A is directed along the positive x-axis and perpendicular to a magnetic field. A magnetic force per unit length of 0.12 N/m acts on the conductor in the negative y-direction. Calculate the magnitude of the magnetic field in the region through which the current passes. (3)
6. A rod of mass 0.720 kg rests on two parallel rails that are d = 0.12 m apart and L = 0.45 m long. The rod carries a current of I = 48.0 A (in the direction shown) and slips along the frictionless rails under the action of the resultant force. A uniform magnetic field of magnitude 0.240 T is directed perpendicular to the rod and the rails. If it starts from rest, what is the speed of the rod as it leaves the rails? (4)

