Problems of Magnetic field

1) A horizontal wire 68 cm long and mass 5 g is placed at right angles to a magnetic file of 0.65 T. Find the current that must be passed through the wire so that it is self−supporting.
Answer: 0.111 A

2) A wire of length 1.3 m carrying a current of 3 A is placed at right angles to a magnetic field of value 2.25 T. Find the force exerted on the wire.
Answer: 8.78 N

3) Find the magnetic field at 120 cm distance of a wire carrying 13 A.
Data: Permeability of vacuum $\mu_0 = 4\pi\times10^{-7}$ T·m/A.
Answer: 2.17×10^{-6} T

4) A long straight wire carries an 11 A current. At what distance from the wire is the magnetic field 1.45×10^{-5} T?
Data: Permeability of vacuum $\mu_0 = 4\pi\times10^{-7}$ T·m/A.
Answer: 15.2 cm

5) Calculate the force per unit length between two parallel wires placed 70 cm apart in a vacuum each carrying a current of 11 A.
Data: Permeability of vacuum $\mu_0 = 4\pi\times10^{-7}$ T·m/A.
Answer: 3.46×10^{-5} N/m

6) A wire 3.1 m long carrying a current of 6 A is at right angles to a magnetic field. The force on the wire is 82.8 N. Calculate the strength of the magnetic field.
Answer: 4.45 T

7) A wire 1.45 m long carrying a current of 9.5 A is at an angle of 27° to a 4.85 T magnetic field. Find the magnetic force exerted on the wire.
Answer: 30.3 N

8) Two parallel wires separated by 130 cm carry currents of 17 A and 10 A in opposite directions. Find the value of the net magnetic field between the wires at a distance of 45 cm from the 17 A carrying wire. Distance is measured between the wires.
Data: Permeability of vacuum $\mu_0 = 4\pi\times10^{-7}$ T·m/A.
Answer: 9.91×10^{-6} T

9) A proton is travelling with a speed of 1.00×10^{7} m/s enters a magnetic field perpendicular to the field. Find the radius of the path of the proton if the value of the field is 0.035 T.
Data: Mass = 1.673×10^{-27} kg, charge = 1.602×10^{-19} C.

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10) An electron moves at right angles to a 0.3 T magnetic field. The electron has a velocity of 2.40×10^{7} m/s. What force acts on the electron? What force acts if the electron moves at an angle of 48° to the field?
Data: Mass = 9.109×10^{-31} kg, charge = 1.602×10^{-19} C.
Answer: 1.15×10^{-12} N, 8.57×10^{-13} N

11) How fast must an electron be traveling through a magnetic field of value 0.012 T if it follows a circular path of radius 7.2 mm?
Data: Mass = 9.109×10^{-31} kg, charge = 1.602×10^{-19} C.
Answer: 1.52×10^{7} m/s

12) An alpha particle is traveling at 2.40×10^{7} m/s through a perpendicular magnetic field of strength 1.55 T. Find the magnetic force acting on the alpha particle.
Data: Mass = 6.645×10^{-27} kg, charge = 3.204×10^{-19} C.
Answer: 1.19×10^{-11} N

13) An electron is traveling at 2.30×10^{7} m/s through a perpendicular magnetic field of strength 1.65 T. Find the magnetic force acting on the electron and its initial acceleration.
Data: Mass = 9.109×10^{-31} kg, charge = 1.602×10^{-19} C.
Answer: 6.08×10^{-12} N, 6.67×10^{18} m/s^2

14) An electron is traveling through a perpendicular magnetic field of strength 2.05 T. If the magnetic force that it experiences is 2.63×10^{-12} N, how fast is the electron moving?
Data: Mass = 9.109×10^{-31} kg, charge = 1.602×10^{-19} C.
Answer: 8.00×10^{6} m/s

15) Calculate the radius of curvature of an alpha particle moving at a speed of 1.30×10^{7} m/s at right angles to a magnetic field of value 3.1 T.
Data: Mass = 6.645×10^{-27} kg, charge = 3.204×10^{-19} C.
Answer: 8.7 cm

16) Find the magnetic field strength required to make a proton with a speed of 5.00×10^{5} m/s follow a circular path of radius 0.0227 m.
Data: Mass = 1.673×10^{-27} kg, charge = 1.602×10^{-19} C.
Answer: 0.23 T