Electromagnetic Force Pro Set#2 2020

1. What **units** do you measure the strength of a *magnetic field* in?

2. A bar magnet sits on you desk; You measure the Magnetic field of the bar magnet with an App on your cell phone. The readings were 45mT and 23mT. Which reading was taken closer to the bar magnet, and what does "mT" stand for ?

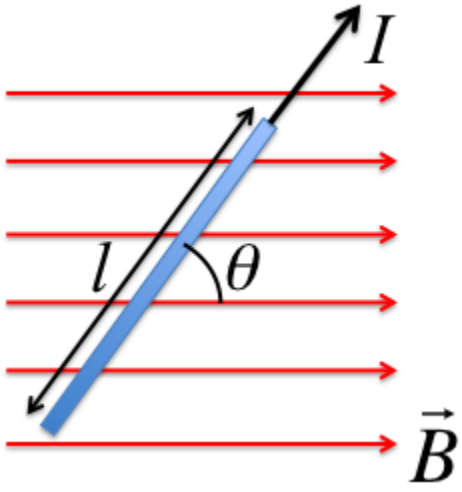
3. If current is put in a wire, it will feel a push or pull when it is near a magnet. *Name **two** modern devices that use this principle to operate*. Google: devices that use solenoids.

4. Using formulas, show how you could determine the *mass of an electron* if you projected it through a **magnetic field** and could measure:

   a) Its speed
   b) The strength of the magnetic field that it was passing through
   c) The charge on an electron
   d) And the radius of the path that the electron made as it passed through the magnetic field

5. What does the symbol μ_o? why do we need this constant? When could it change?

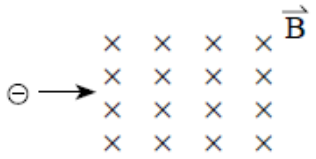
6. A wire is placed in a magnetic field as shown to the right. *Calculate the force felt by the wire* in Newtons, if the current in the wire is 12A, the Magnetic field is 0.56T, the length of the wire in the field is 50cm, and θ is 90°. *What direction will the force on the wire be?*



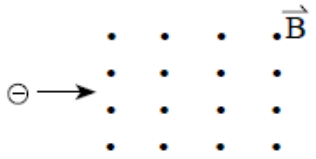
7.

In which diagram below would the electron experience **no** magnetic force upon entering the field?

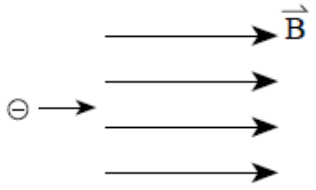
A.



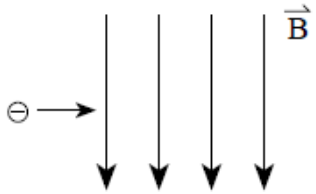
B.



C.

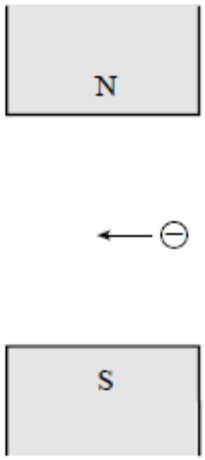


D.



8.

The diagram below shows an electron travelling to the left in a magnetic field.

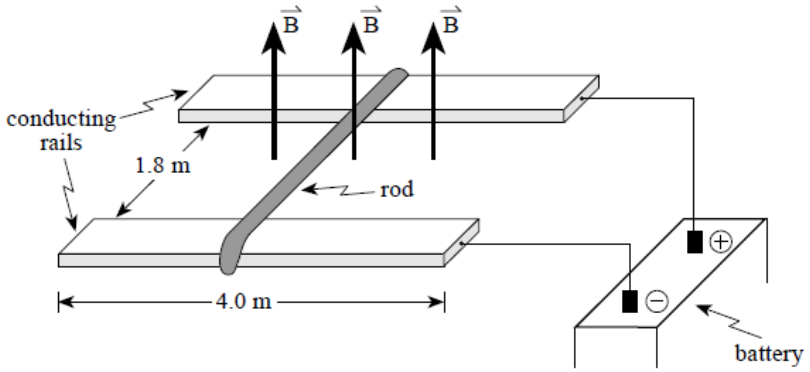


In which direction will the electron be deflected?

A. into the page
B. out of the page
C. towards the north pole
D. towards the south pole

9.

A metal rod is resting on top of two 4.0 m long conducting rails that are separated by 1.8 m. The force of friction between the rod and the rails is 1.2 N. A magnetic field of 5.2×10^{-2} T is directed upwards, as shown in the diagram below.



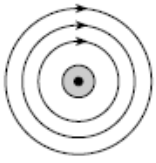
How much current must be sent through the rod before the rod begins to move **and** in what direction will the rod move?

	CURRENT	DIRECTION ROD WILL MOVE
A.	5.8 A	Towards the battery
B.	5.8 A	Away from the battery
C.	13 A	Towards the battery
D.	13 A	Away from the battery

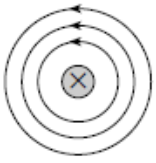
10.

Which of the following diagrams shows the magnetic field produced by a long current-carrying wire?

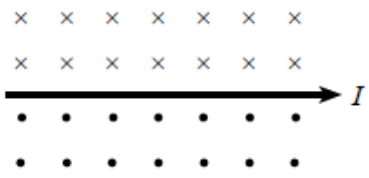
A.



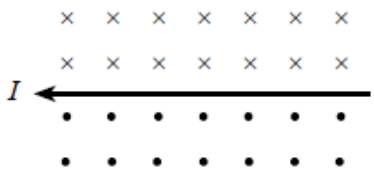
B.



C.



D.



11.

A doubly-ionized atom $(Q = 2e)$ with a mass of 6.8×10^{-27} kg enters a 3.0 T magnetic field with a speed of 5.0×10^{7} m/s. What is the radius of the circular path of the atom?

A. 0.35 m
B. 0.71 m
C. 1.4 m
D. 2.8 m

12.

Omitted. Don't do

13.

A potential difference of 22 V is placed across a 570-turn solenoid that has a resistance of 4.9 Ω. The solenoid has a diameter of 0.052 m and is 0.37 m long. What is the magnetic field strength in the centre of this solenoid?

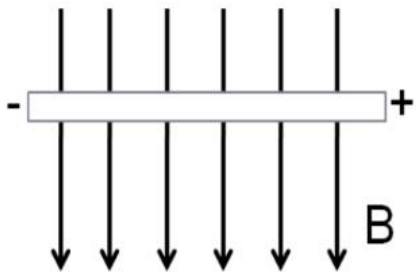
A. 8.7×10^{-3} T
B. 6.2×10^{-2} T
C. 1.2×10^{-1} T
D. 3.0×10^{-1} T

Answers 1-13:

1. Teslas (T)
2. 45mT, milliTeslas
3. Valves, switches, locks, release mechanisms etc.
4. $\frac{mv}{r} = qB$
5. Permeability constant of free space. Changes when a solenoid is wrapped around something other than empty space (iron core, steel core)
6. 3.36N, into page
7. C
8. A
9. D
10. D
11. A
12. Don't do
13. A

14.

A 0.25 m long wire carrying a current of 1.2 A passes through a 2.0 T magnetic field. Find the magnitude and direction of the force on the wire.



$F_m = BIl$

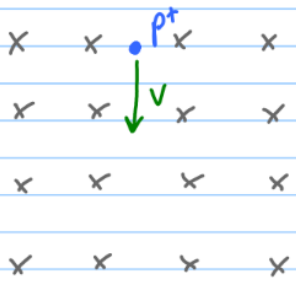
$= (2.0T)(1.2A)(0.25m)$

$= 0.60\,N$

out of page

15.

A proton enters a 0.75 T magnetic field at a velocity of 2500 m/s. What is the magnitude and direction of the deflecting force?



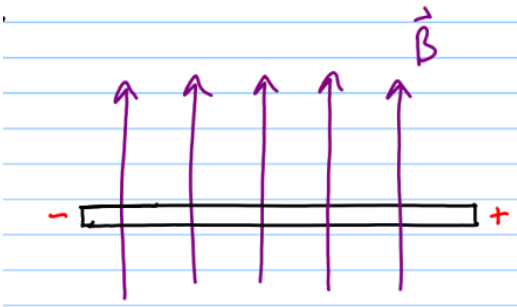
$F_m = qvB$

$= (1.6\times10^{-19}\,C)(2500\,m/s)(0.75T)$

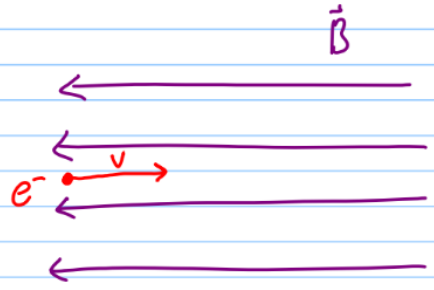
$= 3.0\times10^{-16}\,N$ right

16.

What is the direction of the deflecting forces on the wires or particles shown.

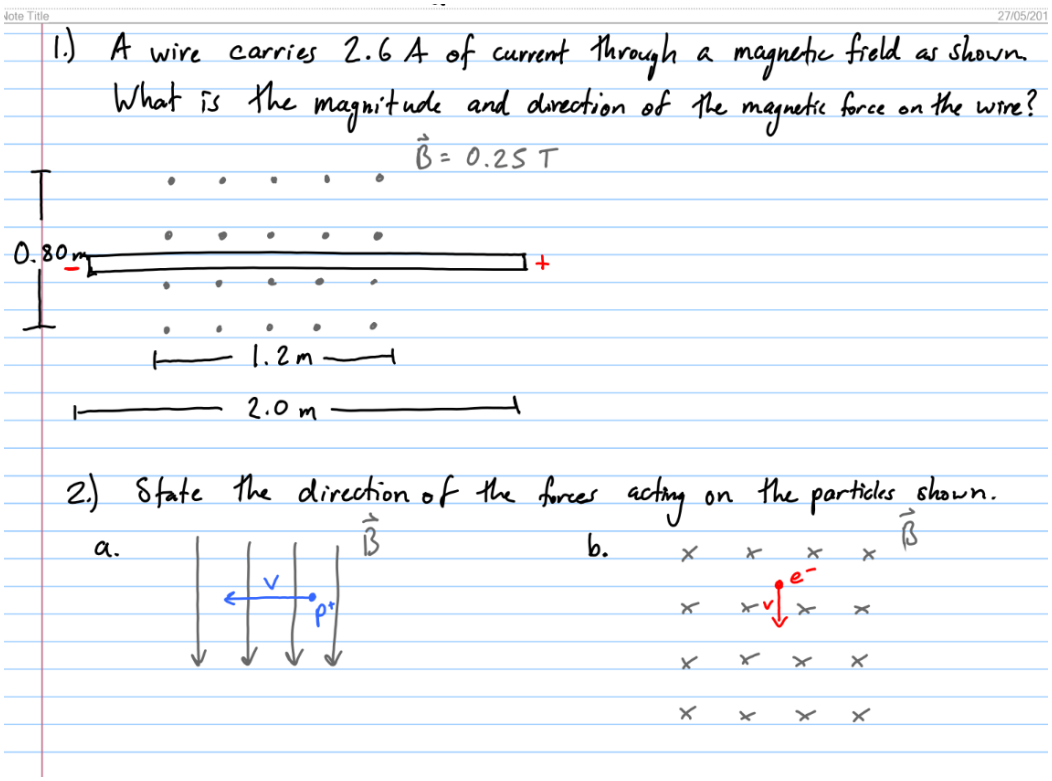


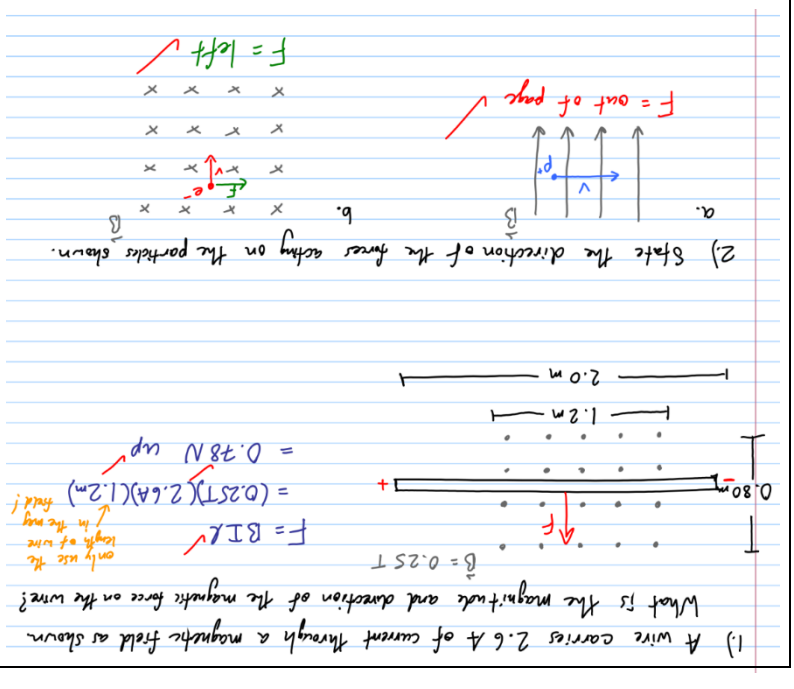
b.



Answers to #16 Into page No force

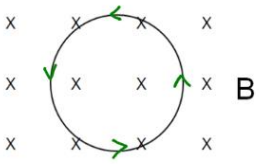
17.





18.

A 4.0×10^{-25} kg charged particle enters a 1.5 T magnetic field directed into the page. It travels in a counter-clockwise circle of radius 1.2×10^{-4} m at 2.5×10^{7} m/s. What is the **magnitude** and **polarity** of the charge?



using RHR charge is positive

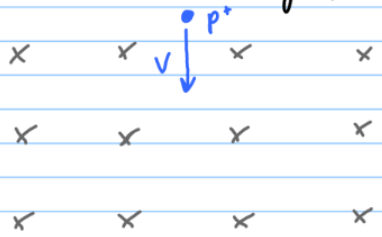
$$q = \frac{mv}{rB} = \frac{(4.0\times10^{-25}\,kg)(2.5\times10^{7}\,m/s)}{(1.2\times10^{-4}\,m)(1.5\,T)} = 5.6\times10^{-18}\,C$$

$$\frac{mv}{r} = qB$$

19.

27/05/2011

A proton enters a 0.50T magnetic field traveling at 5.0×10^{5} m/s.



a.) What is the radius of its arc?

b.) Sketch its path while in the field.

c.) If an electron were to enter the same field at the same point traveling at the same speed, explain how its path would differ (2 points)

a.) What is the radius of its arc?

$F_c = F_M$ ✓

$\frac{mv^2}{r} = qvB$

$\frac{mv}{r} = qB$

$r = \frac{mv}{qB} = \frac{(1.67\times10^{-27}\,kg)(5.0\times10^{5}\,m/s)}{(1.6\times10^{-19}\,C)(0.50\,T)}$

$= 0.010\,m$ ✓

b.) Sketch its path while in the field.

✓

c.) If an electron were to enter the same field at the same point traveling at the same speed, explain how its path would differ (2 points)

- Since e^- is negative it will move in a clockwise arc ✓
- Since $m_{e^-} << m_{p^+}$ and $r = \frac{mv}{qB}$ $\therefore r \propto m$

The electron's path will have a smaller radius ✓

20.

What current is required in the windings of a long solenoid that has 1 000 turns uniformly distributed over a length of 0.400 m in order to produce a magnetic field of magnitude 1.00×10^{-4} T at the center of the solenoid?

Answer: 31.8 mA