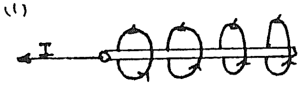
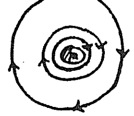
1. (1)

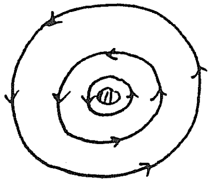


(2)



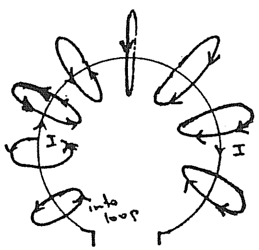
I in

(3)

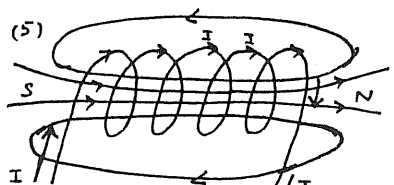


I out

(4)



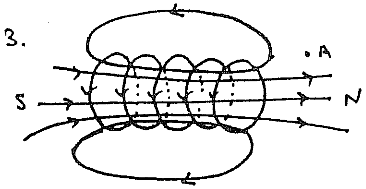
(5)



2. (1) The magnitude of the vector field is shown by the number of lines per area. ie stronger field ⟹ more lines per area.

(2) direction by the arrows on the lines.

3.



Uniform field in the middle of the solenoid. (lines nearly parallel)

(iv) at A ↗
at B ←
at C →

4. (1) + (2)

$F = BI\Delta l \sin\theta$

$\therefore F = 1.1 \times 0.6 \times .15 \times 1$

$F = 0.099$ N. is the total force on the wire.

The force per unit length ie force per m is

$\frac{F}{l} = \frac{0.099}{.15} = \underline{0.66\ N}$

(3) By a right hand rule the force is perpendicularly out of the page.

5.

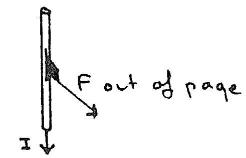
$F = BI\Delta l \sin\theta$

$\therefore F = 0.9 \times 1.9 \times .4 \times \sin 31°$

$F = \underline{0.35\ N}$

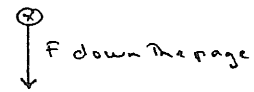
Direction is into the page at 90° to the current.

6. (1)

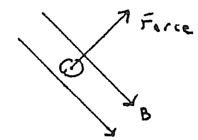


(2) no force

(3)



(4)

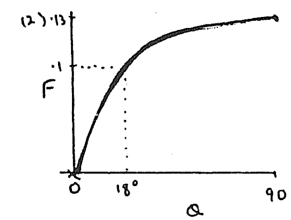


7. (1) $F = BI\Delta l \sin\theta$

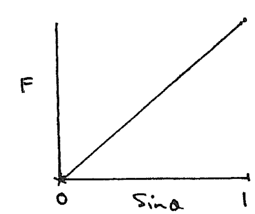
$\therefore 0.1 = B \times 0.9 \times 0.8 \sin 18°$

$\therefore \underline{B = 0.45T}$

(2)



at $\theta = 90°$, $F = 0.13N$



8.

(1) Out of the page.

(2) Into the page.

9. (1) $F = BI\Delta l \sin\theta$

$\therefore \frac{F}{\Delta l} = BI\sin\theta$

$\therefore \frac{F}{\Delta l} = 8.0\times10^{-4} \times 1.5 \times \sin 30°$

$\therefore \frac{F}{\Delta l} = 6.0\times10^{-4}\ N m^{-1}$.

(2) on a 20cm section of wire

$F = 6.0\times10^{-4} \times \Delta l$

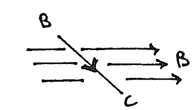
$\therefore F = 6.0\times10^{-4} \times 0.2$

$F = 1.2\times10^{-4}\ N$

10. (1) no force ($\theta = 0°$)

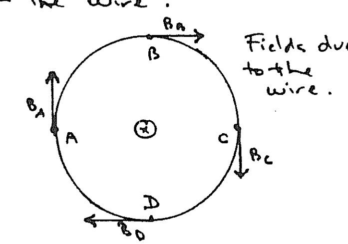
(2) no force ($\theta = 0°$)

(3)



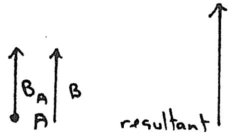
out of the page

11. Vector addition of the permanent magnetic field B and that generated by the current in the wire.

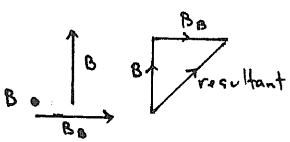


Fields due to the wire.

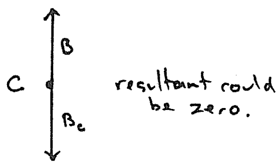
11. at A



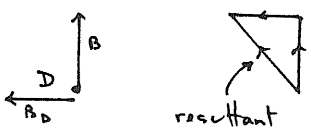
at B



at C



at D



12. (1)

(2) The initial current would cause the cone to move out / in once producing a single pulse. Then no further movement ∴ no further sound.

(3) The cone would move in & out producing a continuous wave of pulses ∴ sound at the frequency of the switching

(4) A stronger magnet produces a stronger magnetic field and as the force is ∝ to the field strength a bigger force is produced.

(5) In this way the coil current is always at 90° to the magnetic field lines ∴ maximum force.

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13. (1) $C = \pi d = \pi \times 0.02$

∴ length of 1 turn is

$0.063\ m.$

(2) ∴ total length

$= 400 \times 0.063$

$= 25.13\ m.$

(3) $F = BI\Delta l \sin\theta$

$\theta = 90^\circ$

$\therefore F = 1.6 \times 1.0 \times 10^{-3} \times 25.13$

$F = 0.04\ N.$

(4) $a = F/m$

$= \frac{0.04}{0.045}$

$= 0.89\ ms^{-2}$

(5) $S = V_0 t + \frac{1}{2}at^2$

$S = 0 + \frac{1}{2} \times 0.89 \times (.05)^2$

$S = 0.001\ m$

$S = 1\ mm.$

1 (1) $F = Bqv \sin\theta$ $(\theta = 90^\circ)$

$\therefore F = Bqv$

$\therefore F = 0.16 \times 1.6 \times 10^{-19} \times 8.0 \times 10^6$

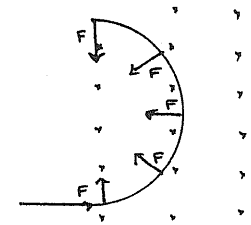
$F = 2.05 \times 10^{-13}\ N.$

(2) $r = \frac{mV}{Bq}$

$r = \frac{1.673 \times 10^{-27} \times 8.0 \times 10^6}{0.16 \times 1.6 \times 10^{-19}}$

$r = 0.52\ m$

(3)



(4) The magnetic force is always at 90° to the velocity of the proton ∴ it moves in a circle i.e. the force is a centripetal force.

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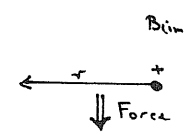
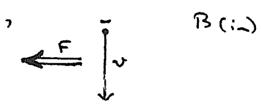
2. (1)



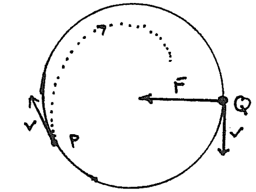
(2)



(3) no force

(4) no force.

3. (1) by a right hand rule – negative.



(4) $r = \frac{mv}{Bq}$ $\therefore r \propto V$

∴ radius decreases if it slows down.

(............ on diagram)

(5) $r \propto mv$

$\therefore \frac{r_1}{r_2} = \frac{m_1 V_1}{10 m_1 V_2} = 1$

$\therefore V_1 = 10 V_2$

(6) $F = \frac{mv^2}{r}$ $\therefore F \propto mv^2$

$\therefore \frac{F_1}{F_2} = \frac{m_1 V_1^2}{m_2 V_2^2} = \frac{m_1 (10V_2)^2}{10 m_1 V_2^2}$

$\therefore \frac{F_1}{F_2} = \frac{100 V_2^2}{10 V_2^2} = \frac{10}{1}$

$\therefore F_1 = 10 F_2$

4. (1) By a right hand rule:

A is positive

C is negative

(2) • charge C is bigger than A's

• mass A is bigger than the mass of C.

• velocity of A could be bigger than C's velocity