CH-5 NCERT Examples
Magnetism And Matter

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Example.1

(a) What happen - - - - - - its Length.

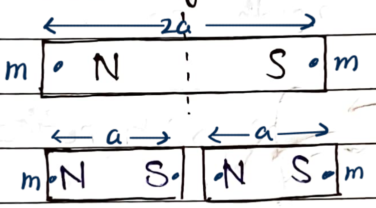
Solution :-

In both the cases, we will get two magnets having North and South poles.

In both the cases, the magnetic moment is halved ($m \to$ pole strength, $2a \to$ length of magnet)

$$M = m \times 2a$$

Transversally cut.

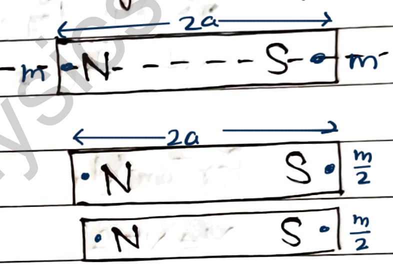


m = Same

Length = half = a

$M' = m \times a = \frac{2ma}{2} = \frac{M}{2}$ $\boxed{M' = \frac{M}{2}}$

Longitudinally Cut.



m = half

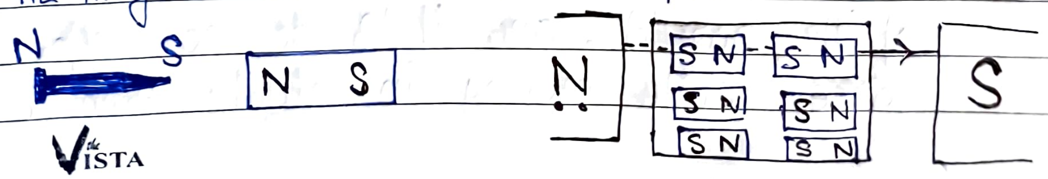
Length = Same = $2a$

$M' = \frac{m}{2} \times 2a = ma = \frac{M}{2}$

(b) A magnetised - - - - - - - - - - to a torque.

In a uniform mag. field, the magnetised needle has net force equal to zero. Because there are two equal and opposite force. But their line of action are different, so they form a couple and so needle experiences a torque.

The iron nail experiences a non-uniform mag. field due to a bar magnet. So it experiences both net force as well as net torque. The nature of net force is attractive because the induced South pole in the nail is closer to the North pole of the magnet than induced north pole.



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(c) must - - - - - - - - - - - - - - due to a toroid.

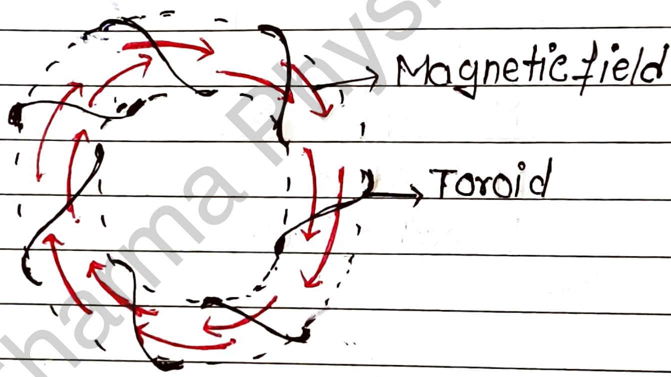
No, it is not necessary. The pole exist only when the source of magnetic field has a net non-zero magnetic moment.

It is not true for toroid because it has zero net dipole (magnetic) moment.

They do not have starting and ending points they do not have open ends. Hence they do not have north and south poles.

For Toroid,

M ⇒ NIA



(d) Two identical - - - - - - - - - - - - the bars A and B.

Firstly, bring the two ends of two bars near to each other, if they show force of repulsion in any one case than both the bars are magnetised. And if they always show attraction, then one bar is magnetised and other is simple iron bar. To find which bar is a magnet and which is an iron, Follow the steps place one bar on the table (Say A) and bring one end of bar 'B' close to the one end of A. The bar 'B' experiences a force of attraction then move bar 'B' towards the middle of the bar 'A', and if 'B' do not experience force while moving in middle, then bar 'A'

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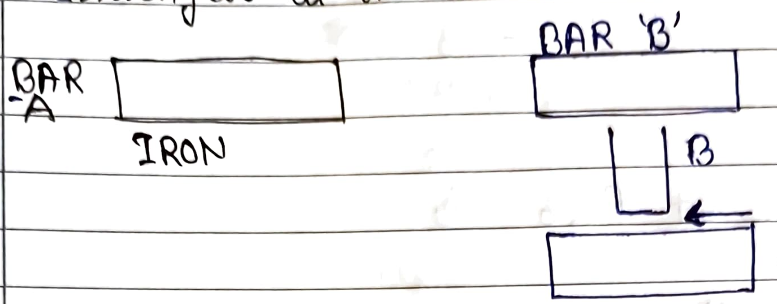
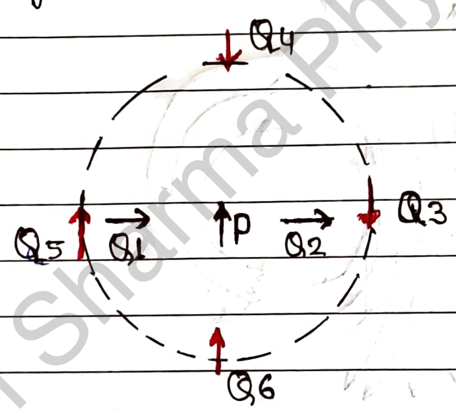
is a magnet and bar 'B' is simply an iron piece.
[we Know, In a bar magnet, the ~~mg~~ mag. field is strongest at the two ends and weakest at the region]



Example 2

(a) A small magnetised - - - - - - - Needle.



(a) $\tau = 0 = mB \sin\theta$ [$\theta = 0°, 180°$] ↳ equilibrium

↳ eq

↳ $\tau \neq 0$ not in eq

→ PQ_1 ⇒ Torque $\neq 0$ not equilibrium

→ PQ_2 → Torque $\neq 0$ not equilibrium

(b) (i) Stable m, B, $\theta = 0°$

PQ_3 and PQ_6

(ii) Unstable m, B, $\theta = 180°$

PQ_4 and PQ_5

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(c) Which Configuration .... Configuration shown?

Potential energy $U_m = -MB\cos\theta$

$= -MB\cos 0^\circ \quad [\theta = 0^\circ]$

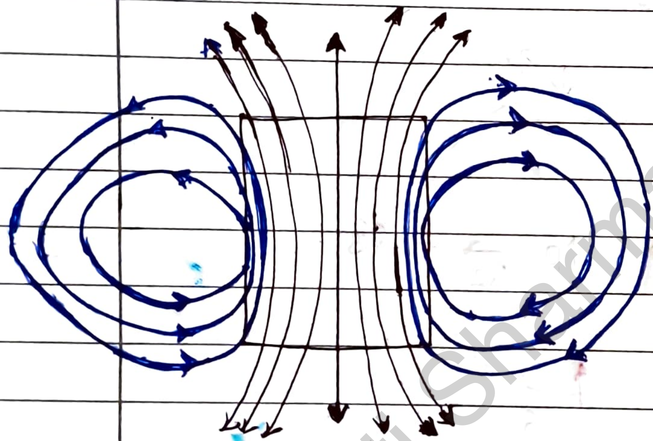
$= -MB \times 1$

$= -MB$

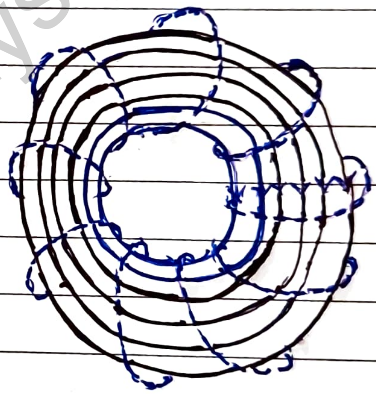
More -ve at PQ6 Ans

Example 3 (5.3)

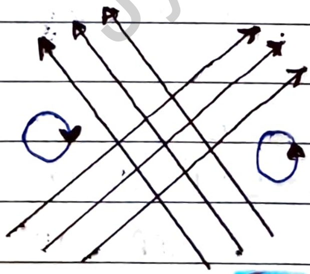
Many of diagrams .... out which ones.



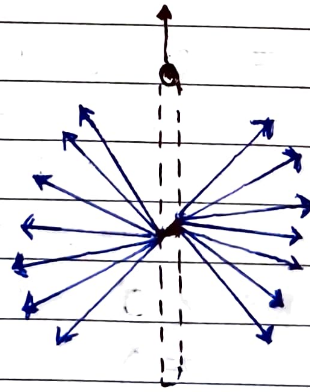
Right (e)



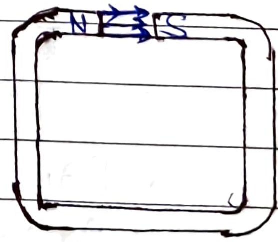
Right (C)



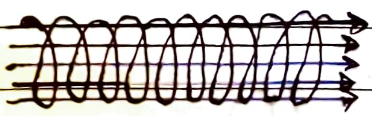
Wrong (b)



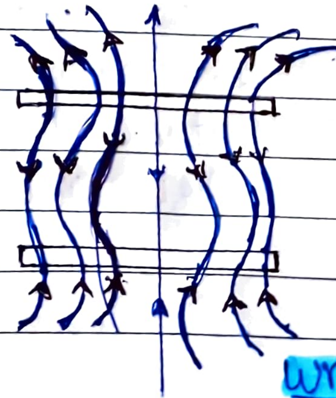
Wrong (a)



Wrong (g).



Wrong (d)



(f)

wrong

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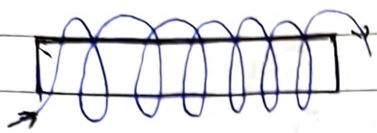
Example 5 :-

A solenoid - - - - - - - - - magnetising Current Im.



$\mu_r = 400$

$i = 2A$

$n = 1000$ turns/metre.

(a)

$H = nI$

$= 1000 \times 2 = 2 \times 10^3$ A/m

(b)

$B = \mu_r \mu_0 H \quad [H = nI]$

$= 400 \times 4\pi \times 10^{-7} \times 1000 \times 2$

$= 32 \times \pi \times 10^{-7} \times 100000$

$= 32 \times 3.14 \times 10^{-7} \times 10^5$

$= 100.48 \times 10^{-2}$

$= \frac{100.48}{10^2} = \frac{100.48}{100} = 1.0048\,T$

$B \approx 1T$ Ans

(c)

$B = B_0 + B_m$

$\mu_0 \mu_r nI = \mu_0 H + \mu_0 m$

$\mu_0 \mu_r H = \mu_0 [H + m]$

$\mu_r H = H + m$

$\mu_r H - H = m$

$\therefore m = H\mu_r - H$

$= H(\mu_r - 1)$

$= 2000 [400 - 1]$

$= 2000 \times 399$

$= 798000$

$= 7.98 \times 10^5$

$\approx 8 \times 10^5$ A/m Ans

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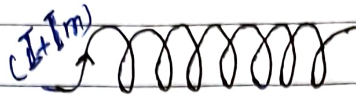
(d) $B = 1T$



$$B = \mu_0 n (I + I_m)$$

$$1 = 4\pi \times 10^{-7} \times 1000 (2 + I_m)$$

$$\Rightarrow \frac{1}{4\pi \times 10^{-7} \times 1000} = 2 + I_m$$

$$\Rightarrow \frac{1}{4 \times 3.14 \times 10^{-4}} = 2 + I_m$$

$$\Rightarrow \frac{10^4}{12.56} = 2 + I_m$$

$$\Rightarrow \frac{10000}{12.56} = 2 + I_m$$

$$\Rightarrow 796.178 = 2 + I_m \Rightarrow 796.178 - 2 = I_m$$

$$\Rightarrow 794.178 = I_m$$

$I_m \approx 794\ A$ Ans