

# Magnetic Fields

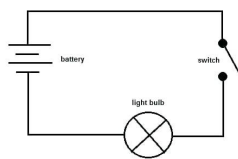
## 12PHYS - Electricity

Finn LeSueur

2019

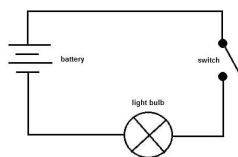
### Starter

The battery is 12V.



1. How many joules of energy does the cell supply to each coulomb of charge that flows out of the cell? **(A)**

\_\_\_\_\_



2. When the cell is switched on, the resistance of the lamp is  $9\Omega$ . Calculate the current flowing through the lamp. **(A)**
3. State the meaning of the term **resistance** in terms of electron flow. **(A)**

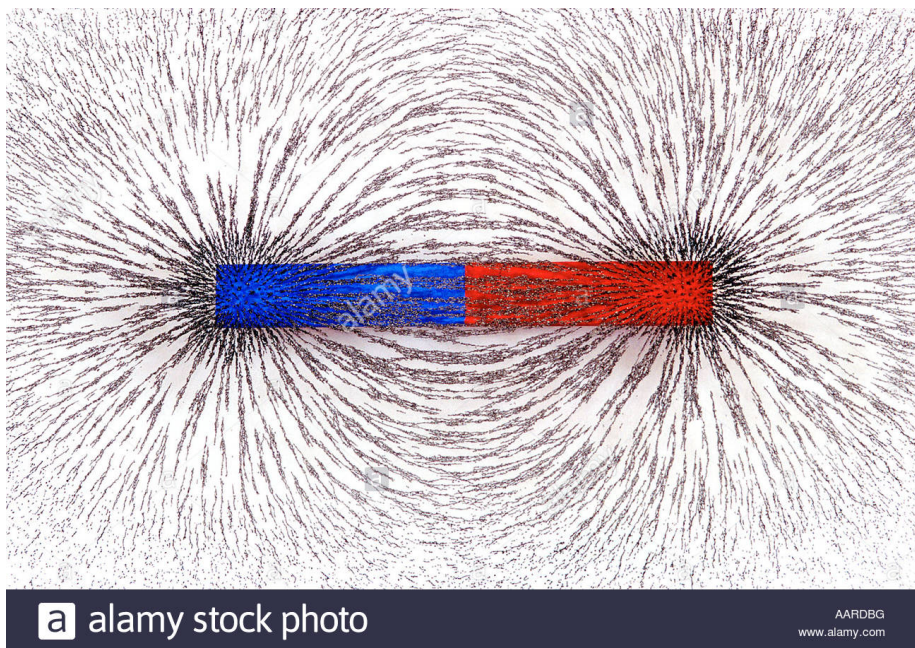
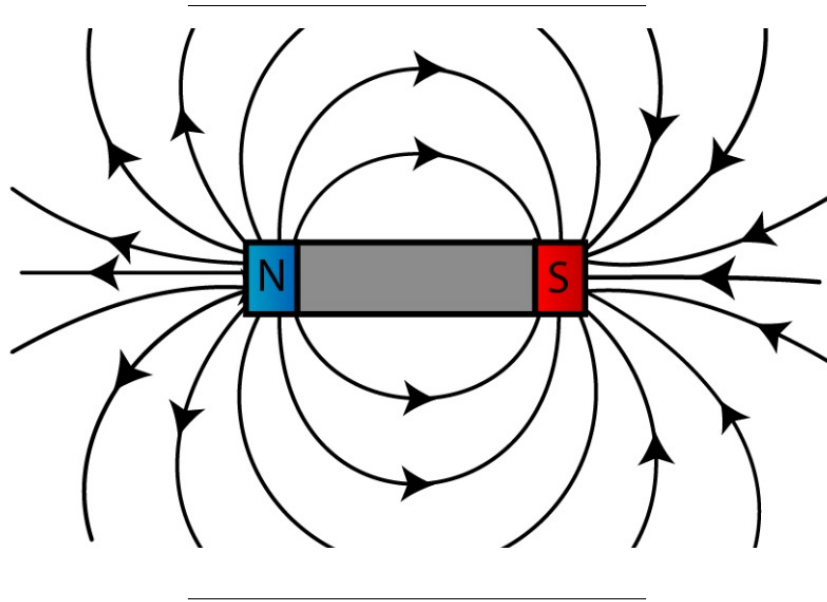
\_\_\_\_\_

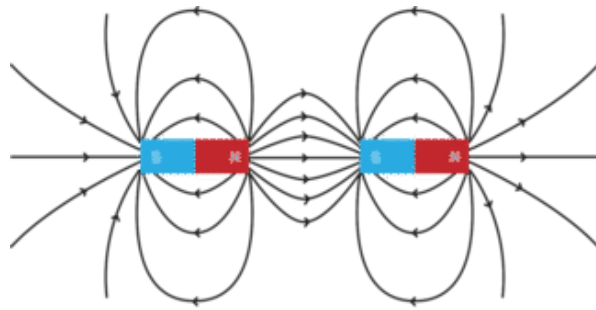
### Magnetic Fields

Magnetic fields can be found in two places:

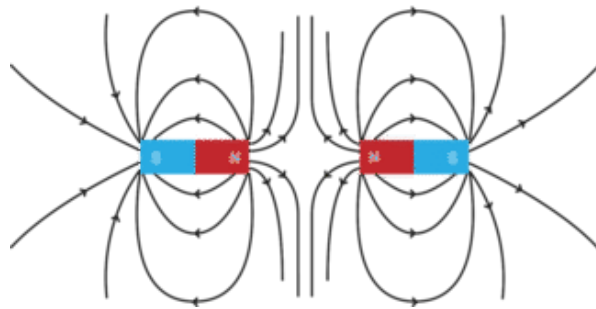
- Around magnetic objects

- Around current carrying wires



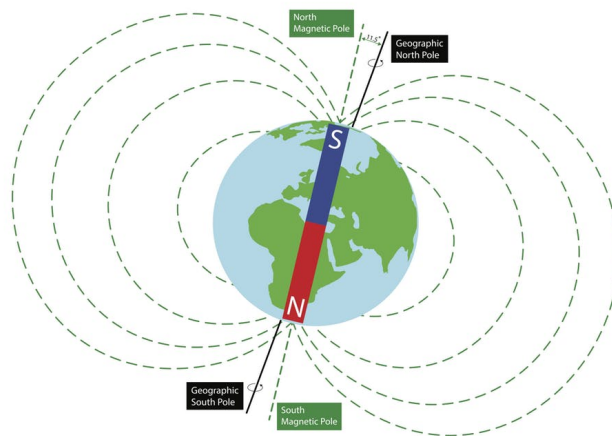


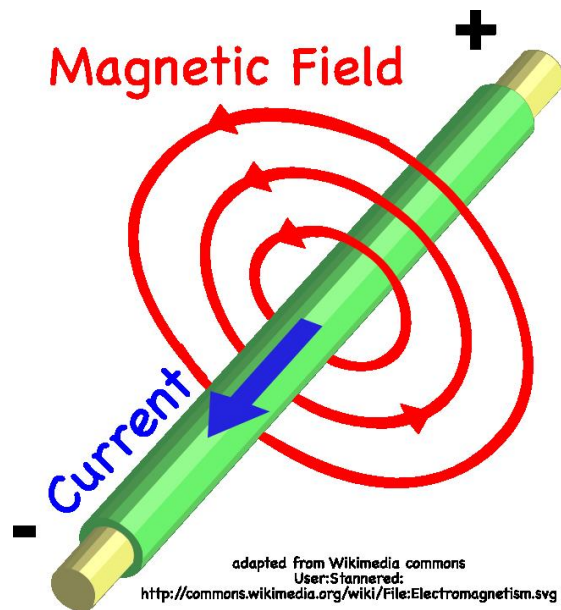
Lines of force around  
a north and south  
pole join together



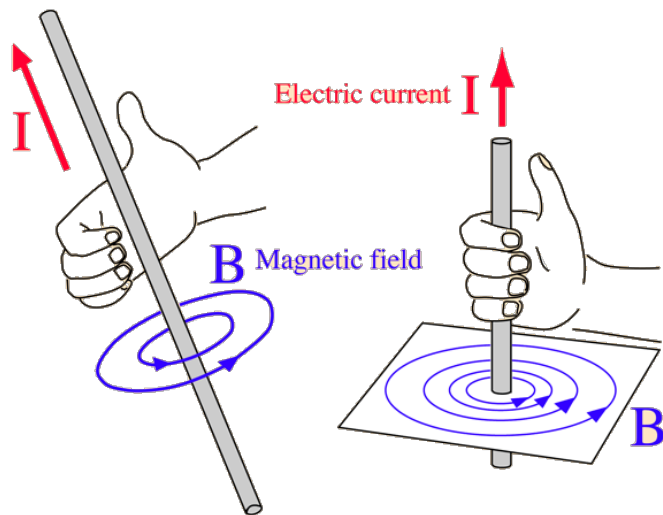
Lines of force around  
two north poles push  
apart

## The Earth's Magnetic Field





### Right Hand Grip Rule 1



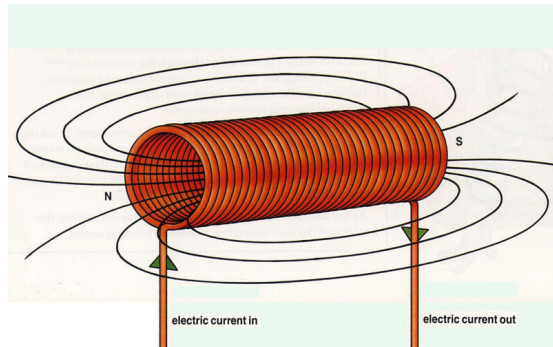


*Magnetic Field  
Out of Page*



*Magnetic Field  
Into Page*

## Solenoids



$$B = \mu_0 n I$$

## What is $\mu_0$ ?

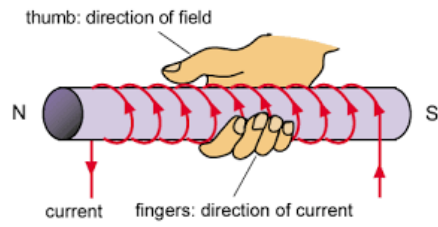
It is pronounced *mew nought* and goes by a variety of names: **vacuum permeability, permeability of free space, permability of vacuum, magnetic constant.**

I will endeavour to call it is the **permeability of free space** and it has the value:

$$\mu_0 = 1.25663706212(19) \times 10^{-6} H/m$$


---

## Right Hand Grip Rule 2



H		<div> <span style="background-color: #00FFFF; border: 1px solid black; padding: 2px;">Ferromagnetic</span> <span style="background-color: #800080; border: 1px solid black; padding: 2px;">Antiferromagnetic</span> <span style="background-color: #FFFF00; border: 1px solid black; padding: 2px;">Paramagnetic</span> <span style="background-color: #008000; border: 1px solid black; padding: 2px;">Diamagnetic</span> </div>																He	
3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Li	Be	B	C	N	O	F	Ne	Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca	Sc	Ti
11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Na	Mg	Al	Si	P	S	Cl	Ar	K	Ca	Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58
Rb	Sr	Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd	In	Sn	Sb	Te	I	Xe	Ce	Pr
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76
Cs	Ba	La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg	Tl	Pb	Bi	Po	At	Rn	Th	Pa
87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105	106
Fr	Ra	Ac																	
		<div> <span style="background-color: #00FFFF; border: 1px solid black; padding: 2px;">Ferromagnetic</span> <span style="background-color: #800080; border: 1px solid black; padding: 2px;">Antiferromagnetic</span> <span style="background-color: #FFFF00; border: 1px solid black; padding: 2px;">Paramagnetic</span> <span style="background-color: #008000; border: 1px solid black; padding: 2px;">Diamagnetic</span> </div>																	
58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77
Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu						