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	(SEASSIONAL ASSIGNMENT)

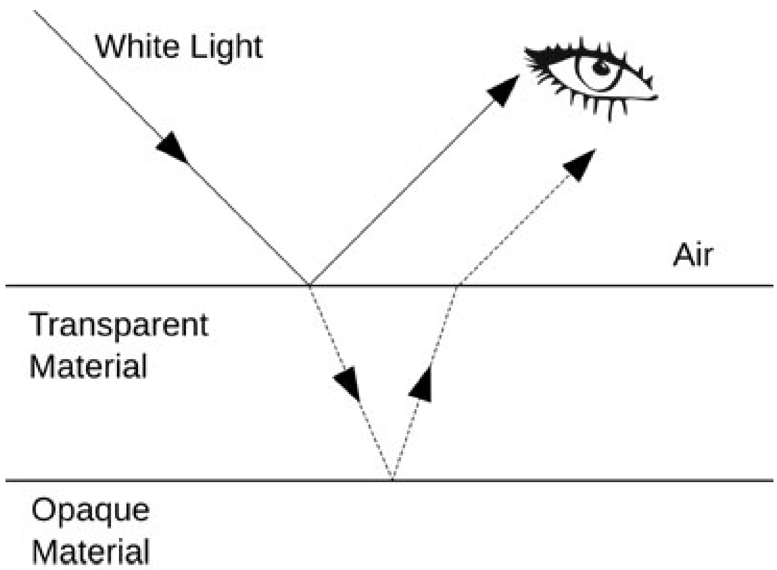
SUBJECT: (APPLIED PHYSICS)

SUBMITTED TO (SIR KHALID HAMID)

Question: 1

(A) DIFFERENCE BETWEEN REFLECTION AND REFRACTION

• Categorized under Science | Difference Between Reflection and Refraction



Reflection vs Refraction

The phenomenon of a light beam rebounding after hitting a surface is called reflection. To put it simply, the mirror images are what are called reflection generally. The light beam that hits the surface is called incident ray. The light beam that leaves the surface is called the reflected ray. There's another phenomenon called refraction. Here, the light changes direction, or 'bends' as it passes through the boundary between these two media. The images that are

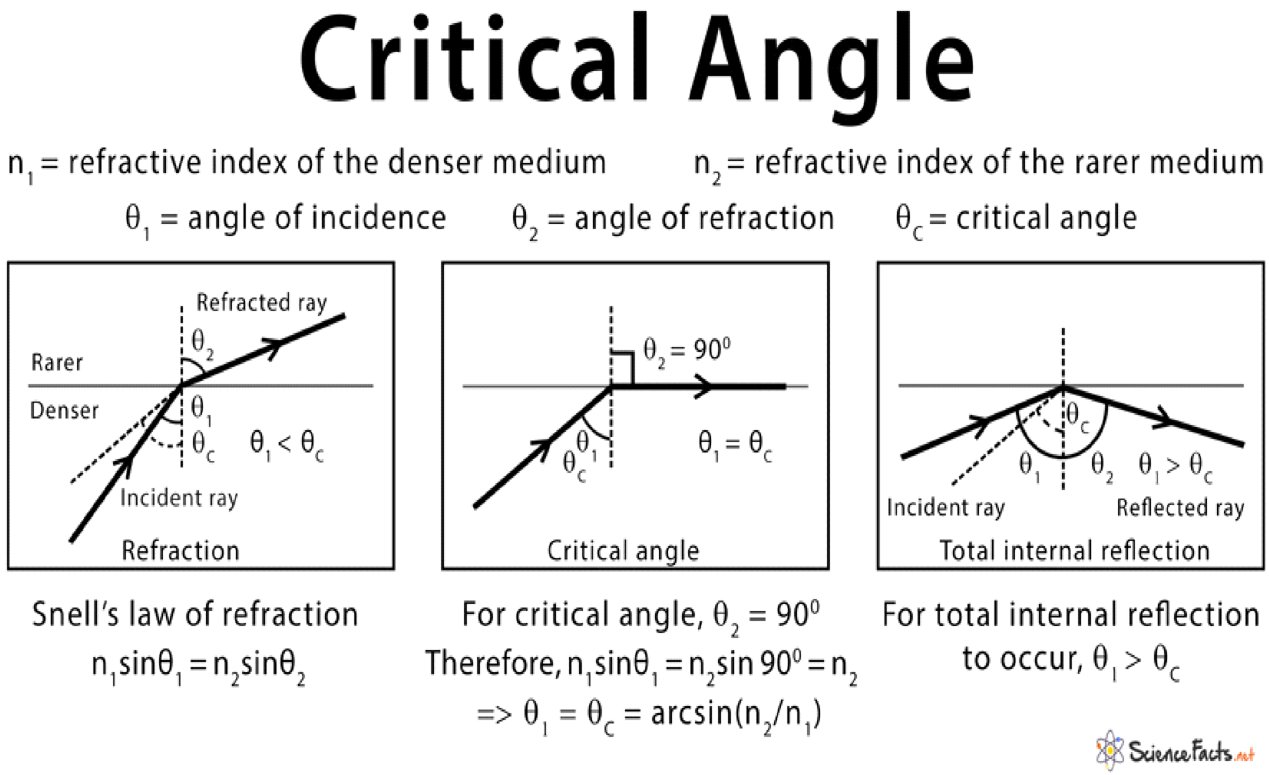
witnessed through the glass/see-through objects are a result of refraction.

The angle of incidence and angle of reflection are the same in the case of reflection. For example, when a ray of light strikes a horizontal surface at a 45-degree angle (angle of incidence), it always rebounds at the same 45-degree angle (angle of reflection). These angles are the same even when multiple rays hit the surface and bounce back. For example, a flat mirror produces an image that is upright, and of the same size as the object that is being reflects. The length between the image and object from the mirror also remains the same. This type of reflection is called specular reflection. While most of the objects reflect light in all directions in a microscopic level, the irregularities on the object's surface will determine the specific rate of reflection. When the light passes through a rough surface, the reflection also happens in different directions. This is called diffuse reflection.

(b) Definition: What is Critical Angle?

When a ray of light passes from a denser medium to a rarer medium, it bends away from the normal. As the angle of incidence increases, the refracted ray bends further and gets closer to the surface. If the angle of incidence angle is such that the angle of refraction makes 90° to the surface normal, then the incident angle is called the critical angle. Beyond this value, the ray of light is internally reflected from the interface into the denser medium. This phenomenon is known as total internal reflection and is closely related to the critical angle. Each pair of media has a specific critical angle value.

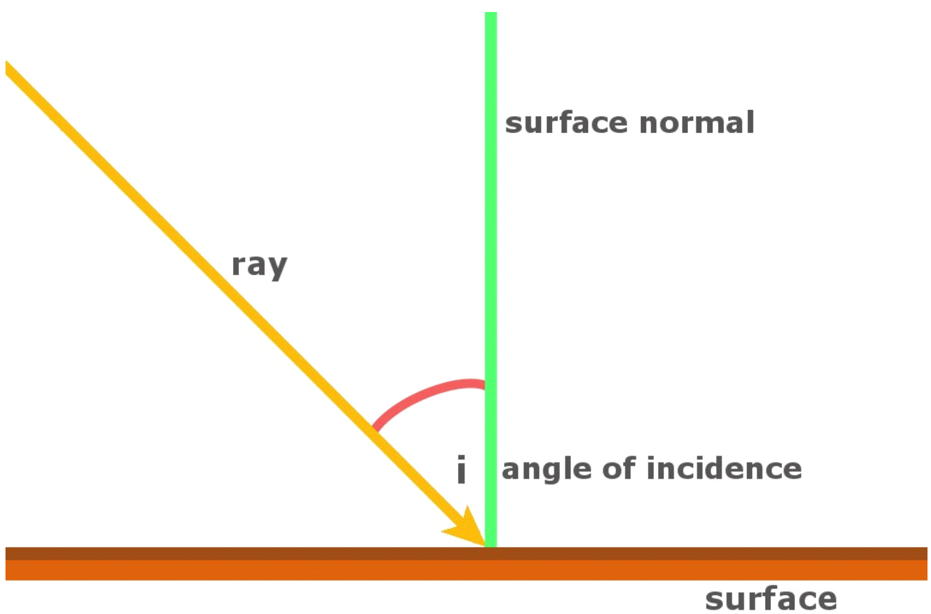
Formula for Critical Angle



(C) THE ANGLE OF INCIDENCE *can refer to a number of entities: in optics, the angle of incidence is the angle that the incident ray makes with the line drawn perpendicular from the point of contact on a surface. In aerodynamics, the angle of incidence refers to the angle between the chord of the wing of an aircraft and the longitudinal axis of the fuselage. Sometimes, the term 'angle of incidence' is used interchangeably with 'angle of attack', which refers to the angle between the undisturbed airflow and the chord of the of an aircraft.*

What is the angle of incidence?

In optics, the angle between the ray incident on a plane surface and the line perpendicular to the surface at the point of incidence (of the ray) is defined as the angle of incidence.



Angle 'i' is the angle of incidence.

For starters, a perpendicular line is one that goes straight up from a surface. In optics, they refer to this line as the 'normal'. The normal is very important when talking about angles in optics. This is not just optics; you'll come across this 'normal' all the time while studying physical laws.

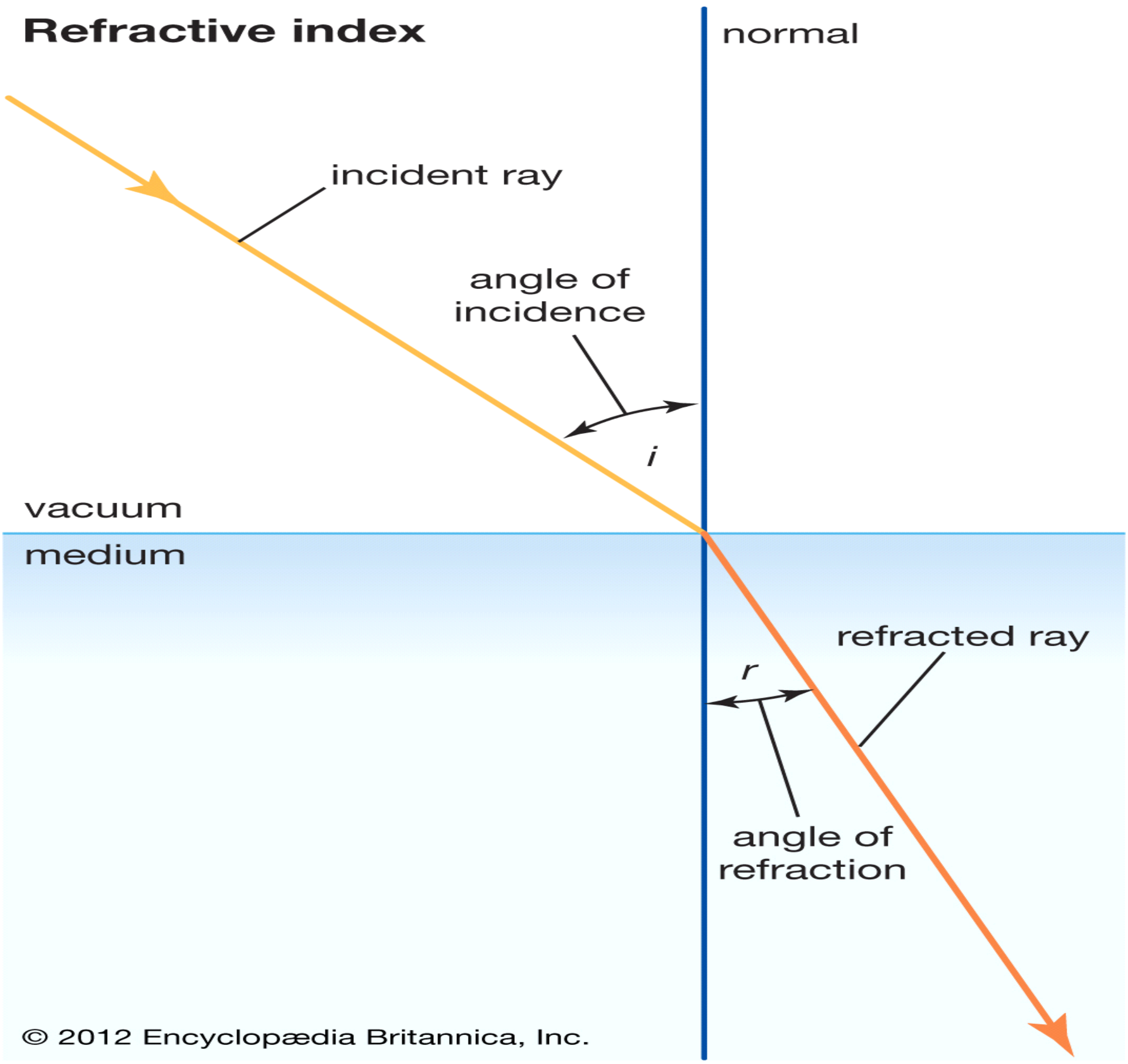
The angle of incidence involves two lines: the first is the incident light ray that falls on a surface. A normal is drawn at the point where the incident ray touches the surface. Now, the angle that the incident ray makes with the normal is called the angle of incidence.

(d) index of refraction

A measure of the extent to which a substance slows down light waves passing through it. The index of refraction of a substance is equal to the ratio of the velocity of light in a vacuum to its speed in that substance. Its value determines the extent to which light is refracted when entering or leaving the substance.

(OR)

A number that defines how the light passes through a medium is called the index of refraction or refractive index. From the refractive index value, the bending of the light ray that passes from one medium to other can be detected.



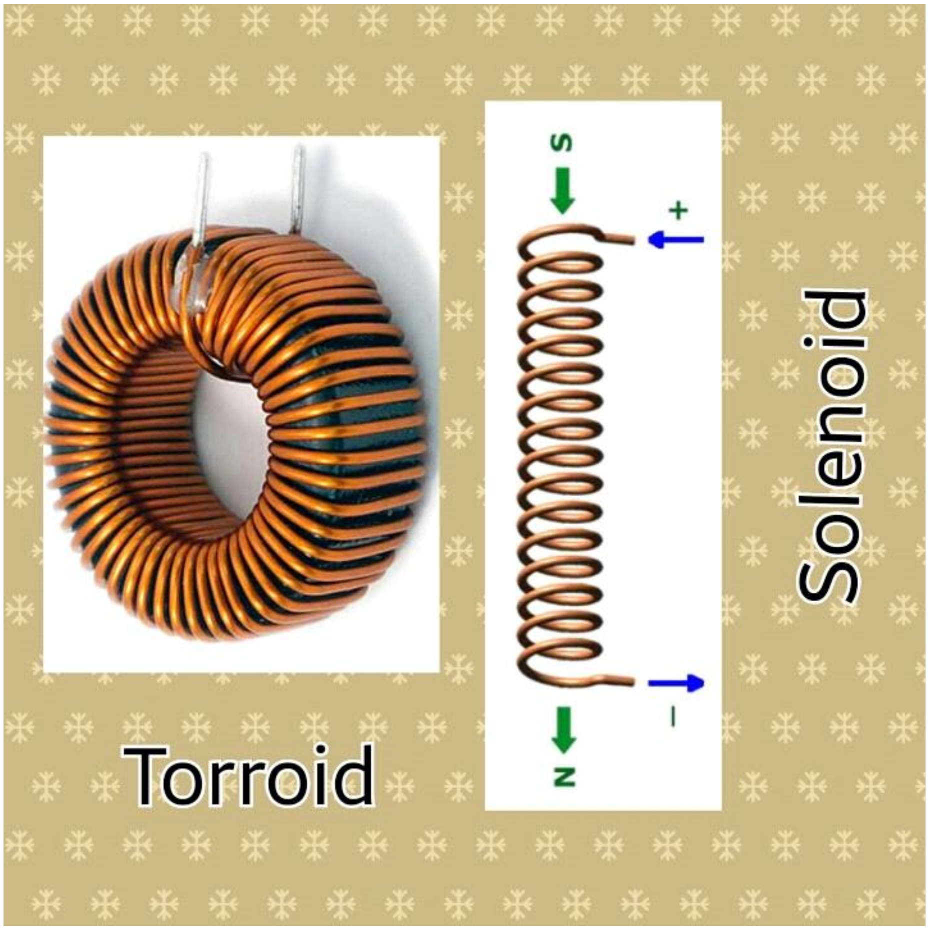
QUESTION (2)

(1) SOLENOID AND TOROIDS

The main difference between solenoid and toroid is that the solenoid is considered as the straight coil and the toroid is the bent solenoid which is having ring or doughnut shape. In toroid due to the ring shape the magnetic field is much stronger than solenoid at its center.

A solenoid is Straight shaped & a torroid is spherical or bent in shape,

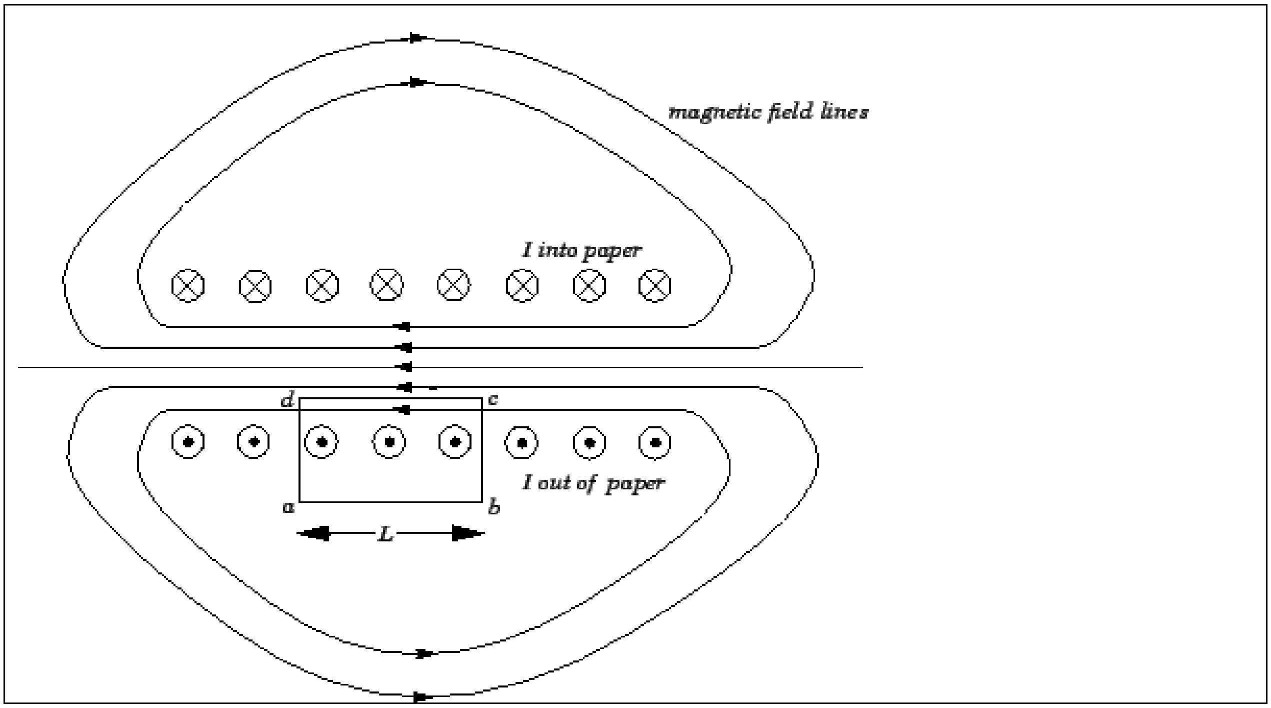
See the attachment, in a torroid B will be more & in solenoid less B (at centre) in both



(2) Magnetic Field of a Solenoid

A *solenoid* is a tightly wound helical coil of wire whose diameter is small compared to its length. The magnetic field generated in the centre, or *core*, of a current carrying solenoid is essentially *uniform*, and is directed along the axis of the solenoid. Outside the solenoid, the magnetic field is far weaker. Figure 27 shows (rather schematically) the magnetic field generated by a typical solenoid. The solenoid is wound from a single helical wire which carries a current I. The winding is sufficiently tight that each turn of the solenoid is well approximated as a circular wire loop, lying in the plane perpendicular to the axis of the solenoid, which carries a current I. Suppose that there are n such turns per unit axial length of the solenoid. What is the magnitude of the magnetic field in the core of the solenoid?

Figure 27: A solenoid.



In order to answer this question, let us apply Ampère's circuital law to the rectangular loop $abcd$. We must first find the line integral of the magnetic field around $abcd$. Along bc and da the magnetic field is essentially perpendicular to the loop, so there is no contribution to the line integral from these sections of the loop. Along cd the magnetic field is approximately uniform, of magnitude B, say, and is directed parallel to the loop. Thus, the contribution to the line integral from this section of the loop is $B\,L$, where L is the length of cd. Along ab the magnetic field-strength is essentially negligible, so this section of the loop makes no contribution to the line integral. It follows that the line integral of the magnetic field around $abcd$ is simply

$w = B\,L.$	

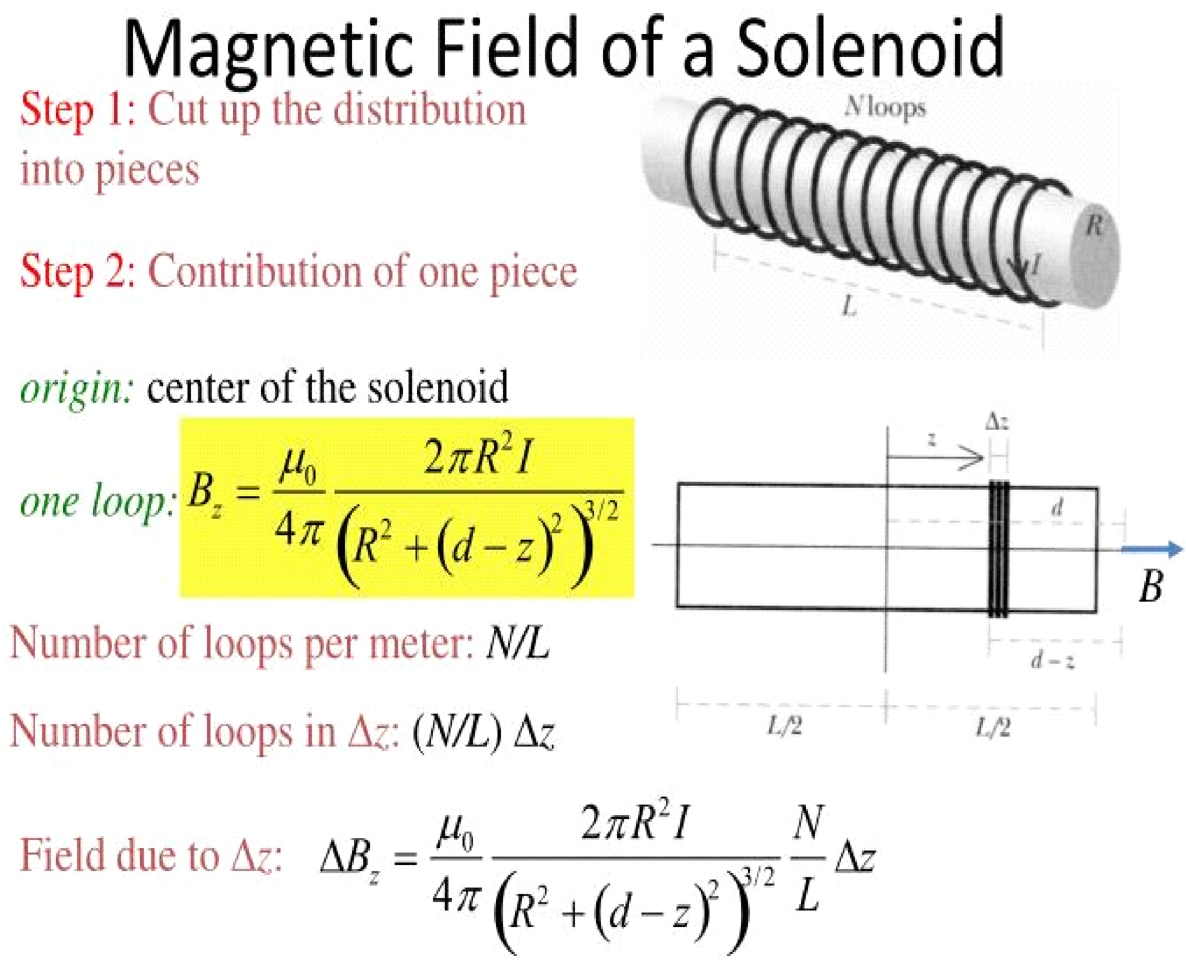
By Ampère's circuital law, this line integral is equal to μ_0 times the algebraic sum of the currents which flow through the loop $abcd$. Since the length of the loop along the axis of the solenoid is L, the loop intersects $n\,L$ turns of the solenoid, each carrying a current I. Thus, the total current which flows through the loop is $n\,L\,I$. This current counts as a positive current since if we look against the direction of the currents flowing in each turn (*i.e.*, into the page in the figure), the loop $abcd$ circulates these currents in an anti-clockwise direction. Ampère's circuital law yields

$B\,L = \mu_0\,n\,L\,I,$	

which reduces to

$B = \mu_0\,n\,I.$	

Thus, the magnetic field in the core of a solenoid is directly proportional to the product of the current flowing around the solenoid and the number of turns per unit length of the solenoid. This, result is *exact* in the limit in which the length of the solenoid is very much greater than its diameter.

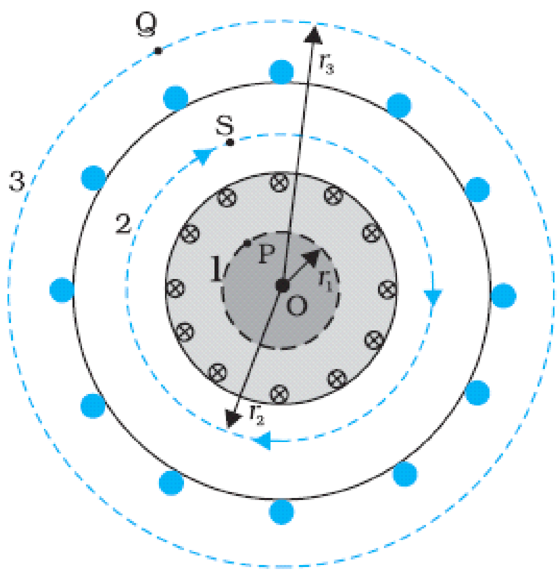


(3) Magnetic field of toroid:

TOROID - DEFINITION

If a solenoid is bent in a circular shape and the ends are joined, we get a toroid. Alternatively, one can start with a nonconducting ring and wind a conducting wire closely on it. The magnetic field in such a toroid can be obtained using Ampere's Law.

MAGNETIC FIELD DUE TO A TOROID - EXAMPLE



The magnetic field in the open space inside (point P) and exterior to the toroid (point Q) is zero. The field *B* inside the toroid is constant in magnitude for the ideal toroid of closely wound turns.The direction of the magnetic field inside is clockwise as per the right-hand thumb rule for circular loops. Three circular Amperian loops 1, 2 and 3 are shown by dashed lines. By symmetry, the magnetic field should be tangential to each of them and constant in magnitude for a given loop.

Example: The number of turns per unit length in a toroid is 10^3 and current flowing in it is $4\pi 1$ ampere, then the magnetic induction produced in it, is :

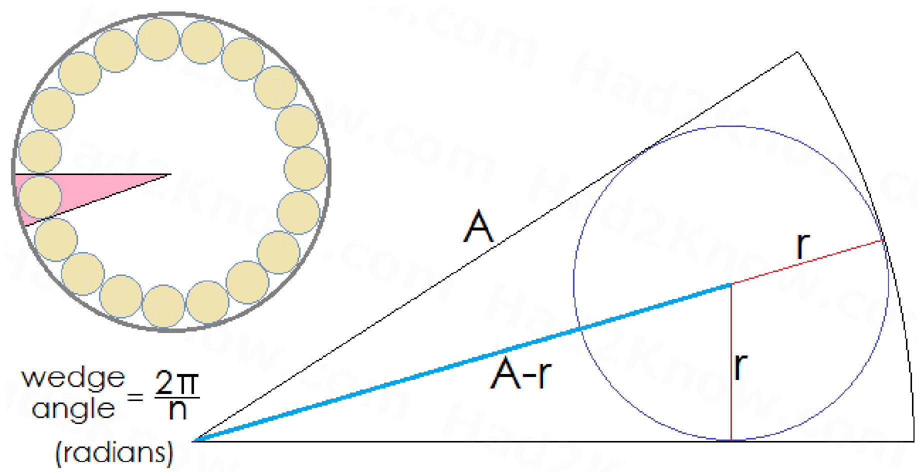
Magnetic field in a toroid $B=\mu_0 ni$

Given $n=10^3$ and $i=4\pi 1 A$

We know that $\mu_0=4\pi\times10^{-7}T/A$

$B=4\pi\times10^{-7}\times10^3\times4\pi 1=10^{-4}T$

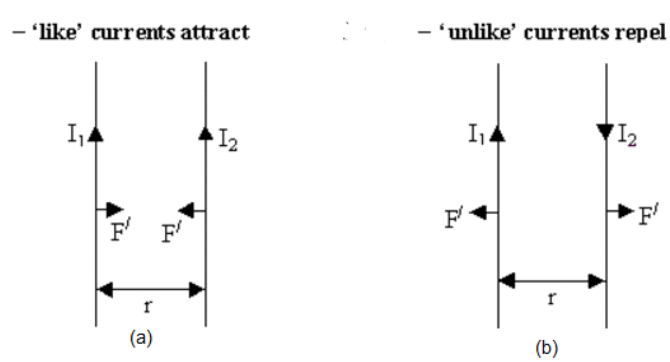
NUMBER OF TURNS IN A TOROIDAL COIL - FORMULA



The figure below shows a cross-sectional view of the inner radius of a toroid inductor and wire. The inner radius of the torus is **A**, the radius of the wire is **r**, and the maximum number of loops is **n.**
The equation that relates A, **r**, and **n** is:
$sin(n\pi)=A-rr$ in radians

n=arcsin$A-rr\pi$

OBSERVE THAT PARALLEL CURRENTS REPEL IN A SOLENOID AND TOROID - DEFINITION



Two parallel wires carrying currents will either attract or repel each other.
Consider diagram (a):
Apply the right-hand grip rule to the left-hand conductor - this indicates that the magnetic field at the right-hand conductor due to the current in the left-hand conductor is into the paper.
Now apply Flemings left hand rule to the right-hand conductor - this indicates that the field produces a force on the right-hand conductor to the left, as shown.

The directions of all the forces can be determined in a similar way.

The flux density B_1 produced by the left-hand conductor at the right-hand conductor is given by: $B_1 = 2\pi r \mu_0 I_1$