Name: ___________________________ Date: _____________

___ **1.** A wire carrying a large current *i* from east to west is placed over an ordinary magnetic compass. The end of the compass needle marked "N":

A) points north
B) points south
C) points east
D) points west
E) continually rotates like an electric motor

___ **2.** Suitable units for the magnetic permeability constant μ_0 are:

A) tesla
B) newton/ampere^2
C) weber/meter
D) kilogram · ampere/meter
E) tesla · meter/ampere

___ **3.** Two long straight wires enter a room through a door. One carries a current of 3.0 A into the room while the other carries a current of 5.0 A out. The magnitude of the path integral $\oint \vec{B} \cdot d\vec{s}$ around the door frame is:

A) 2.5×10^{-6} T · m
B) 3.8×10^{-6} T · m
C) 6.3×10^{-6} T · m
D) 1.0×10^{-5} T · m
E) none of these

___ **4.** Two long straight wires are parallel and carry current in opposite directions. The currents are 8.0 and 12 A and the wires are separated by 0.40 cm. The magnetic field at a point midway between the wires is:

A) 0 **B)** 4.0×10^{-4} T **C)** 8.0×10^{-4} T **D)** 12×10^{-4} T **E)** 20×10^{-4} T

___ **5.** A coulomb of charge is:

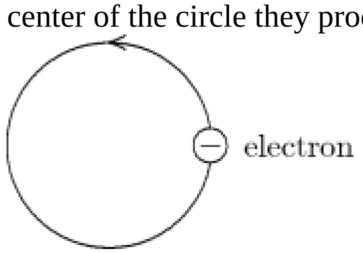
A) one ampere per second
B) the quantity of charge that will exert a force of 1 N on a similar charge at a distance of 1 m
C) the amount of current in each of two long parallel wires, separated by 1 m, that produces a force of 2×10^{-7} N/m
D) the amount of charge that flows past a point in one second when the current is 1 A
E) an abbreviation for a certain combination of kilogram, meter and second

___ **6.** A constant current is sent through a helical coil. The coil:
A) tends to get shorter
B) tends to get longer
C) tends to rotate about its axis
D) produces zero magnetic field at its center
E) none of the above

___ **7.** A long straight cylindrical shell has inner radius R_i and outer radius R_o. It carries current i, uniformly distributed over its cross section. A wire is parallel to the cylinder axis, in the hollow region ($r < R_i$). The magnetic field is zero everywhere outside the shell ($r > R_o$). We conclude that the wire:
A) is on the cylinder axis and carries current i in the same direction as the current in the shell
B) may be anywhere in the hollow region but must be carrying current i in the direction opposite to that of the current in the shell
C) may be anywhere in the hollow region but must be carrying current i in the same direction as the current in the shell
D) is on the cylinder axis and carries current i in the direction opposite to that of the current in the shell
E) does not carry any current

___ **8.** A long straight wire carrying a 3.0 A current enters a room through a window 1.5 m high and 1.0 m wide. The path integral $\oint \vec{B} \cdot d\vec{s}$ around the window frame has the value:
A) 0.20 T · m
B) 2.5×10^{-7} T · m
C) 3.0×10^{-7} T · m
D) 3.8×10^{-6} T · m
E) none of these

___ **9.** Electrons are going around a circle in a counterclockwise direction as shown. At the center of the circle they produce a magnetic field that is:



A) into the page **B)** out of the page **C)** to the left **D)** to the right **E)** zero

___ **10.** Lines of the magnetic field produced by a long straight wire carrying a current are:
A) in the direction of the current
B) opposite to the direction of the current
C) radially outward from the wire
D) radially inward toward the wire
E) circles that are concentric with the wire

___ **11.** In Ampere's law, $\oint \vec{B} \cdot d\vec{s} = \mu_0 i^{\text{enc}}$, the symbol $d\vec{s}$ is:
A) an infinitesimal piece of the wire that carries current i
B) in the direction of $\vec{B}$
C) perpendicular to $\vec{B}$
D) a vector whose magnitude is the length of the wire that carries current i^{enc}
E) none of the above

___ **12.** If the magnetic field $\vec{B}$ is uniform over the area bounded by a circle with radius R, the net current through the circle is:
A) 0 **B)** $2\pi RB/\mu_0$ **C)** $\pi R^2B/\mu_0$ **D)** $RB/2\mu_0$ **E)** $2RB/\mu_0$

___ **13.** In Ampere's law, $\oint \vec{B} \cdot d\vec{s} = \mu_0 i^{\text{enc}}$, the direction of the integration around the path:
A) must be clockwise
B) must be counterclockwise
C) must be such as to follow the magnetic field lines
D) must be along the wire in the direction of the current
E) none of the above

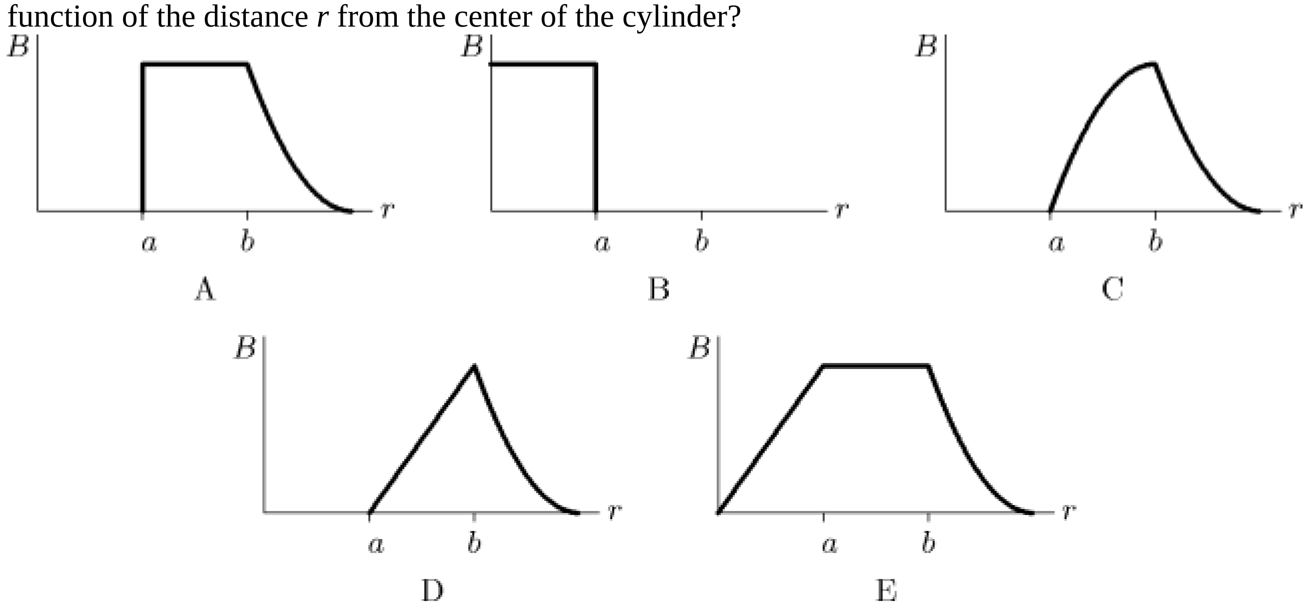
___ **14.** The magnetic field at any point is given by $\vec{B} = A\vec{r} \times \hat{k}$, where $\vec{r}$ is the position vector of the point and A is a constant. The net current through a circle of radius R, in the xy plane and centered at the origin is given by:
A) $\pi AR^2/\mu_0$ **B)** $2\pi AR/\mu_0$ **C)** $4\pi AR^3/3\mu_0$ **D)** $2\pi AR^2/\mu_0$ **E)** $\pi AR^2/2\mu_0$

___ **15.** The magnetic field $\vec{B}$ inside a long ideal solenoid is independent of:
A) the current
B) the core material
C) the spacing of the windings
D) the cross-sectional area of the solenoid
E) the direction of the current

___ **16.** A long straight cylindrical shell has inner radius R_i and outer radius R_o. It carries a current i, uniformly distributed over its cross section. A wire is parallel to the cylinder axis, in the hollow region ($r < R_i$). The magnetic field is zero everywhere in the hollow region. We conclude that the wire:

A) is on the cylinder axis and carries current i in the same direction as the current in the shell
B) may be anywhere in the hollow region but must be carrying current i in the direction opposite to that of the current in the shell
C) may be anywhere in the hollow region but must be carrying current i in the same direction as the current in the shell
D) is on the cylinder axis and carries current i in the direction opposite to that of the current in the shell
E) does not carry any current

___ **17.** A hollow cylindrical conductor (inner radius $= a$, outer radius $= b$) carries a current i uniformly spread over its cross section. Which graph below correctly gives B as a function of the distance r from the center of the cylinder?

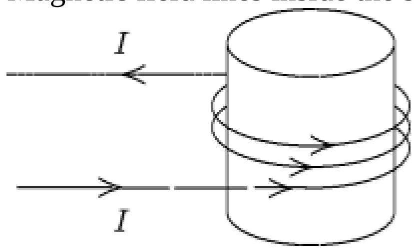


A) A **B)** B **C)** C **D)** D **E)** E

___ **18.** Two parallel wires carrying equal currents of 10 A attract each other with a force of 1 mN. If both currents are doubled, the force of attraction will be:

A) 1 mN **B)** 4 mN **C)** 0.5 mN **D)** 0.25 mN **E)** 2 mN

___ **19.** Magnetic field lines inside the solenoid shown are:



A) clockwise circles as one looks down the axis from the top of the page
B) counterclockwise circles as one looks down the axis from the top of the page
C) toward the top of the page
D) toward the bottom of the page
E) in no direction since $B = 0$

___ **20.** The magnetic field a distance 2 cm from a long straight current-carrying wire is 2.0×10^{-5} T. The current in the wire is:
A) 0.16 A **B)** 1.0 A **C)** 2.0 A **D)** 4.0 A **E)** 25 A

Answer Key

1. B
Origin: Chapter 30- Magnetic Fields Due to Currents, 9
2. E
Origin: Chapter 30- Magnetic Fields Due to Currents, 1
3. A
Origin: Chapter 30- Magnetic Fields Due to Currents, 32
4. E
Origin: Chapter 30- Magnetic Fields Due to Currents, 15
5. D
Origin: Chapter 30- Magnetic Fields Due to Currents, 2
6. A
Origin: Chapter 30- Magnetic Fields Due to Currents, 24
7. D
Origin: Chapter 30- Magnetic Fields Due to Currents, 37
8. D
Origin: Chapter 30- Magnetic Fields Due to Currents, 31
9. A
Origin: Chapter 30- Magnetic Fields Due to Currents, 3
10. E
Origin: Chapter 30- Magnetic Fields Due to Currents, 7
11. E
Origin: Chapter 30- Magnetic Fields Due to Currents, 29
12. A
Origin: Chapter 30- Magnetic Fields Due to Currents, 33
13. E
Origin: Chapter 30- Magnetic Fields Due to Currents, 30
14. D
Origin: Chapter 30- Magnetic Fields Due to Currents, 34
15. D
Origin: Chapter 30- Magnetic Fields Due to Currents, 39
16. E
Origin: Chapter 30- Magnetic Fields Due to Currents, 38
17. C
Origin: Chapter 30- Magnetic Fields Due to Currents, 35
18. B
Origin: Chapter 30- Magnetic Fields Due to Currents, 19
19. C
Origin: Chapter 30- Magnetic Fields Due to Currents, 41
20. C
Origin: Chapter 30- Magnetic Fields Due to Currents, 12