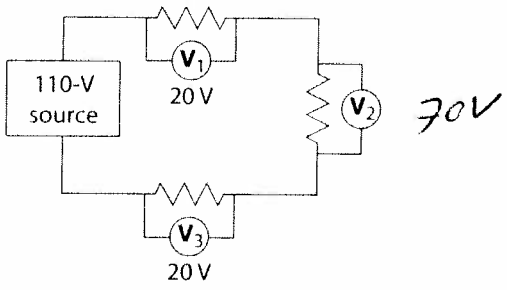
Review Questions

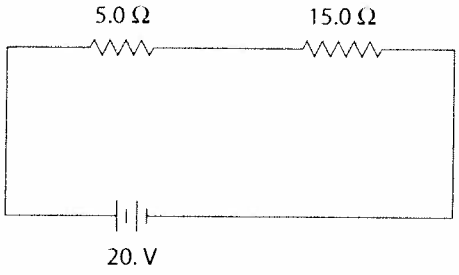
49. The circuit diagram below shows three voltmeters connected across resistors.



70V

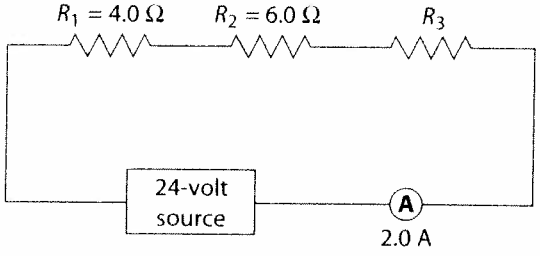
What is the reading of voltmeter V_2?

50. The diagram below shows two resistors connected to a 20.-volt battery.



If the current through the 5.0-ohm resistor is 1.0 ampere, what is the current through the 15.0-ohm resistor? 1A

51. The diagram below shows a circuit with three resistors.

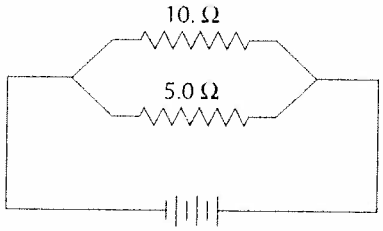


What is the resistance of resistor R_3? (1) 6.0 Ω (2) 2.0 Ω (3) 12 Ω (4) 4.0 Ω

52. An electric circuit contains an operating heating element and a lit lamp. Which statement best explains why the lamp remains lit when the heating element is removed from the circuit? (1) The lamp has less resistance than the heating element. (2) The lamp has more resistance than the heating element. (3) The lamp and heating element are connected in series. (4) The lamp and heating element are connected in parallel.

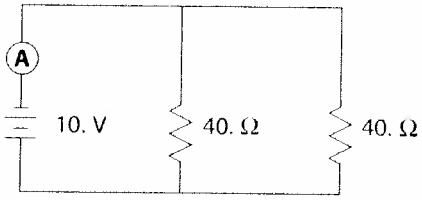
53. A 4-ohm resistor and an 8-ohm resistor are connected in series. If the current through the 4-ohm resistor is 2 amperes, the current through the 8-ohm resistor is (1) 1 A (2) 2 A (3) 0.5 A (4) 4 A

54. A 10.-ohm resistor and a 5.0-ohm resistor are connected as shown in the diagram below.



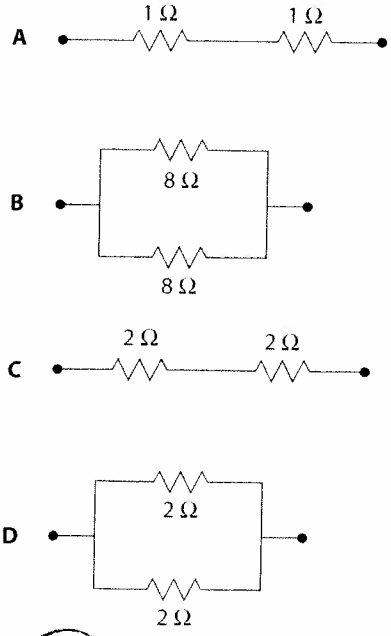
If the current through the 10.-ohm resistor is 1.0 ampere, then the current through the 5.0-ohm resistor is (1) 15 A (2) 2.0 A (3) 0.50 A (4) 0.30 A

55. In the circuit diagram below, ammeter A measures the current supplied by a 10.-volt battery.



The current measured by ammeter A is (1) 0.13 A (2) 2.0 A (3) 0.50 A (4) 4.0 A

56. Which two of the resistor arrangements below have the same equivalent resistance?

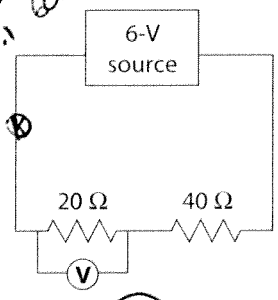


(1) A and B (2) B and C (3) C and D (4) D and A

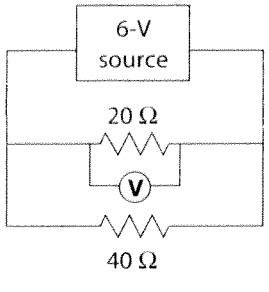
57. A physics student is given three 12-ohm resistors with instructions to create the circuit that would have the lowest possible resistance. The correct circuit would be a (1) series circuit with an equivalent resistance of 36 Ω (2) series circuit with an equivalent resistance of 4 Ω (3) parallel circuit with an equivalent resistance of 36 Ω (4) parallel circuit with an equivalent resistance of 4 Ω

58. If a 15-ohm resistor is connected in parallel with a 30.-ohm resistor, the equivalent resistance is (1) 15 Ω (2) 2.0 Ω (3) 10. Ω (4) 45 Ω

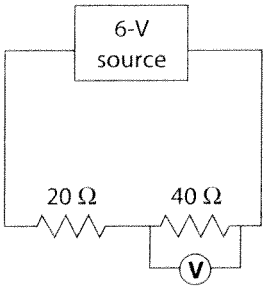
59. Which circuit below would have the lowest voltmeter reading?



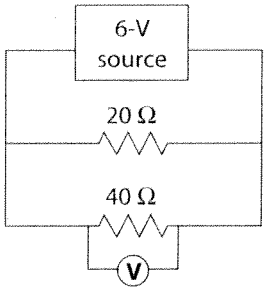
(1)



(3)



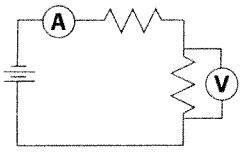
(2)



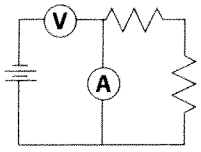
(4)

60. Which circuit below could be used to determine the total current and potential difference of a parallel circuit?

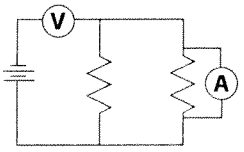
(1)



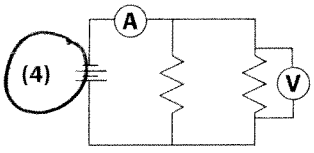
(3)



(2)



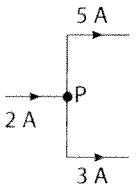
(4)



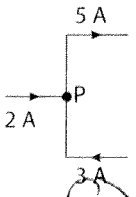
61. A simple electrical circuit contains a battery, a light bulb, and a properly connected ammeter. The ammeter has a very low internal resistance because it is connected in (1) parallel with the bulb to have little effect on the current through the bulb (2) parallel with the bulb to prevent current flow through the bulb (3) series with the bulb to have little effect on the current through the bulb (4) series with the bulb to prevent current through the bulb

62. Compared to the resistance being measured, the internal resistance of a voltmeter is designed to be very high so that the meter will draw (1) no current from the circuit (2) little current from the circuit (3) most of the current from the circuit (4) all the current from the circuit

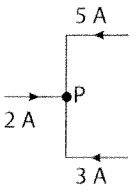
63. Which diagram below shows correct current direction in a circuit segment?



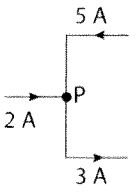
(1)



(2)

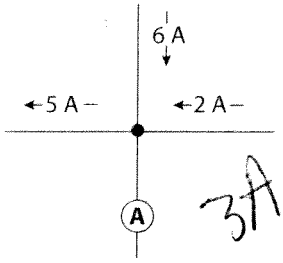


(3)



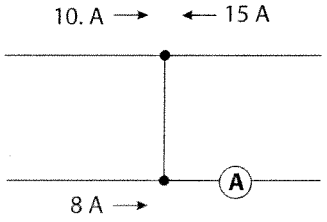
(4)

64. The diagram below shows currents in a segment of an electric circuit.



What is the reading of ammeter A?

65. The diagram below represents currents in branches of an electric circuit.



What is the reading on ammeter A? (1) 13 A (2) 17 A (3) 3 A (4) 33 A

66. Which combination of current and potential difference would use energy at the greatest rate?
(1) 7 A at 110 V (2) 6 A at 110 V (3) 3 A at 220 V
(4) 4 A at 220 V

67. How much time is required for an operating 100-watt light bulb to dissipate 10 joules of electrical energy? (1) 1 s (2) 0.1 s (3) 10 s (4) 1000 s

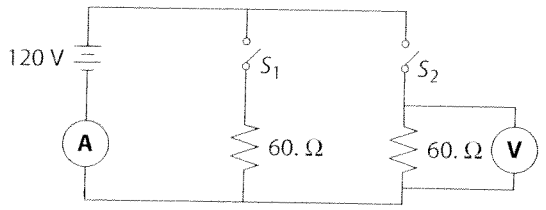
68. While operating at 120 volts, an electric toaster has a resistance of 15 ohms. The power used by the toaster is (1) 8.0 W (2) 120 W (3) 960 W (4) 1800 W

69. An electric dryer consumes 6.0×10^6 joules of energy when operating at 220 volts for 30. minutes. During operation, the dryer draws a current of approximately (1) 10. A (2) 15 A (3) 20. A (4) 25 A

70. What is the approximate amount of electrical energy needed to operate a 1600-watt toaster for 60. seconds? (1) 27 J (2) 1500 J (3) 1700 J (4) 96,000 J

71. To increase the brightness of a desk lamp, a student replaces a 60-watt light bulb with a 100-watt light bulb. Compared to the 60-watt light bulb, the 100-watt light bulb has (1) less resistance and draws more current (2) less resistance and draws less current (3) more resistance and draws more current (4) more resistance and draws less current

Base your answers to questions 72 through 75 on the diagram below, which represents a circuit containing a 120-volt power supply with switches S_1 and S_2 and two 60.-ohm resistors.



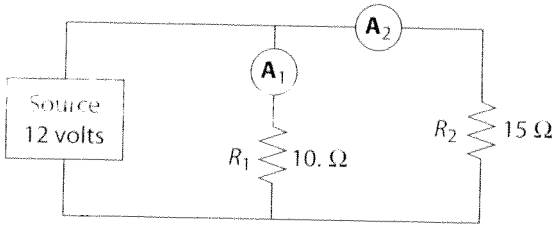
72. If switch S_1 is kept open and switch S_2 is closed, what is the circuit's resistance?

73. If switch S_2 is kept open and switch S_1 is closed, how much current will flow through the circuit?

74. When both switches are closed, what is the current in the ammeter?

75. When both switches are closed, what is the reading of the voltmeter?

Base your answers to questions 76 through 80 on the diagram below, which represents an electrical circuit.



76. The equivalent resistance of the circuit is (1) 25 Ω (2) 6.0 Ω (3) 5.0 Ω (4) 0.17 Ω

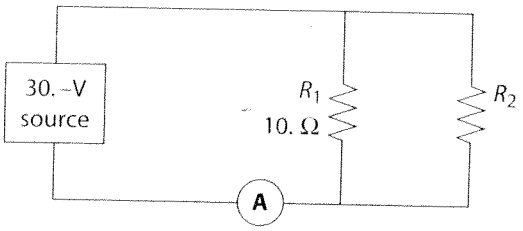
77. Determine the potential difference across resistor R_2.

78. Determine the magnitude of the current flowing through ammeter A_1.

79. Compared to the current in ammeter A_1, the current in ammeter A_2 is (1) less (2) greater (3) the same

80. If another resistor is added to the circuit in parallel, the equivalent resistance of the circuit would (1) decrease (2) increase (3) remain the same

Base your answers to questions 81 through 85 on the following information and diagram. Two resistors, R_1 and R_2, and an ammeter are connected to a constant 30.-volt source. The equivalent resistance of the circuit is 6.0 ohms.



81. The resistance of R_2 is equal to (1) 6.0 Ω (2) 2.0 Ω (3) 15 Ω (4) 4.0 Ω

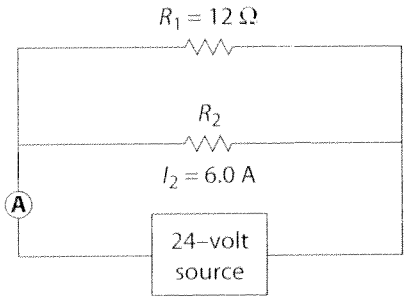
82. Determine the current read by ammeter A.

83. Determine the power developed in resistor R_1 alone.

84. Compared to the potential difference across the source, the potential difference across R_2 is (1) less (2) greater (3) the same

85. If the resistance of R_2 were increased, the current through R_2 would (1) decrease (2) increase (3) remain the same

Base your answers to questions 86 through 89 on the circuit diagram below.



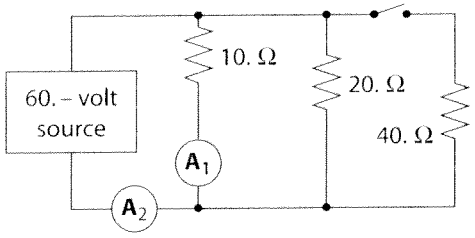
86. The current in ammeter A is (1) 1.0 A (2) 2.0 A (3) 6.0 A (4) 8.0 A

87. How much energy is used by the 12-ohm resistor in 30. minutes? (1) 48 J (2) 3.6×10^3 J (3) 1.1×10^4 J (4) 8.6×10^4 J

88. If resistance R_2 were removed, the potential difference across R_1 would (1) decrease (2) increase (3) remain the same

89. If resistance R_2 were removed, the current in ammeter A would (1) decrease (2) increase (3) remain the same

Base your answers to questions 90 through 94 on the electric circuit below. Note that the switch is in the open position.



90. What is the reading of ammeter A_1? (1) 0.16 A (2) 6.0 A (3) 60. A (4) 600 A

91. What is the reading of ammeter A_2? (1) 9.0 A (2) 2.0 A (3) 12 A (4) 18 A

92. Determine the power developed in the 10.-ohm resistor.

93. Compared to the potential drop across the 10.-ohm resistor, the potential drop across the 20.-ohm resistor is (1) less (2) greater (3) the same

94. Compared to the current through ammeter A_1 when the switch is open, the current passing through ammeter A_1 when the switch is closed is (1) less (2) greater (3) the same

Base your answers to questions 95 through 99 on the following information. An electric heater rated at 4800 watts is operated at 120 volts.

95. Determine the resistance of the heater.

96. Determine the amount of energy used by the heater in 10.0 seconds.

97. If the heater is replaced with one having a greater resistance, the amount of heat energy produced each second will (1) decrease (2) increase (3) remain the same

98. If another heater is connected in parallel with the first one and both operate at 120 volts, the current in the first heater will (1) decrease (2) increase (3) remain the same

99. If the original heater is operated at less than 120 volts, the amount of heat produced will (1) decrease (2) increase (3) remain the same

Magnetism

A **magnet** is a material in which the spinning electrons of its atoms are aligned with one another. This motion of charges relative to each other produces a **magnetic force.** Even if two magnets are at rest relative to each other, they exert magnetic force because the electrons within them are in motion. Many permanent magnets are made of an alloy of aluminum, nickel, and cobalt.

A magnet has two ends called poles, where the magnetic force is strongest. One end is called the north-seeking **magnetic pole** (N-pole), and the other end is the south-seeking magnetic pole (S-pole). No matter how many times a magnet is broken, each piece always has a north pole and a south pole. Like magnetic poles repel each other and unlike poles attract each other. **Magnetism** is the force of attraction or repulsion between magnetic poles. Unmagnetized pieces of iron and steel are readily magnetized by pulling them across a pole of a strong magnet or by having them interact with a direct current.

Earth is like a large magnet with a S-pole near the geographic North Pole (the northern end of its axis of rotation) and an N-pole near the geographic South Pole. The N-pole of a compass, a device having a magnetized needle that can spin freely, is attracted toward Earth's S-pole (geographic North Pole). Earth's magnetic field results from the motion of its molten iron and nickel core.

MAGNETIC FIELDS The region where magnetic force exists around a magnet or any moving charged object is called its **magnetic field.** Just as a gravitational or electric field allows objects to interact without coming into direct contact with each other, a magnetic field allows magnets to interact without touching. A magnetic field exerts a force on any moving charge and can be measured and detected by this effect.

MAGNETIC FLUX LINES Imaginary lines that map out the magnetic field around a magnet are known as **magnetic field lines** or **magnetic flux lines.** Iron filings sprinkled on a card and held above a magnet are often used to map a magnetic field. The filings show the effects of magnetic force in the region surrounding a magnet and produce a pattern similar to the magnetic field lines. Magnetic flux lines always form closed loops and never intersect. Concentrated lines of flux emerge from the N pole of a magnet, curve around the magnet, and then enter the S-pole of the magnet. The direction of a magnetic field is defined as the direction in which the N-pole of a compass would point in the field. When the field lines are curved, the direction of the field is determined by the direction of the N pole of a compass placed along the tangent to the field at that point. Figure 4-12 shows the locations of the lines of magnetic flux around some bar magnets and around a horseshoe magnet.

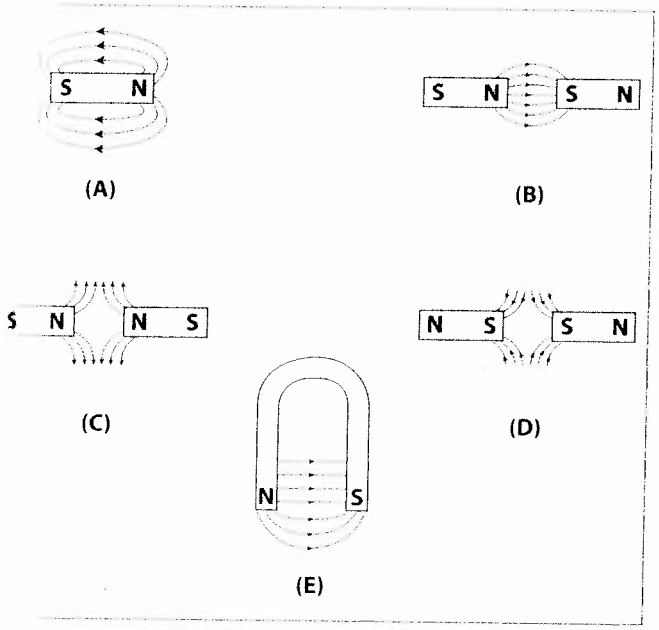


Figure 4-12. Lines of magnetic flux around some bar magnets and a horseshoe magnet

MAGNETIC FIELD STRENGTH The number of magnetic lines of flux per unit area passing through a plane perpendicular to the direction of the lines is called the **magnetic field strength,** B, or flux density. Magnetic field strength is a vector quantity, as are gravitational field strength and electric field strength. The **weber,** Wb, is a derived SI unit for measuring the number of lines of flux. The **tesla,** T, is the derived SI unit of flux density or magnetic field strength. One tesla is equal to one weber per square meter.

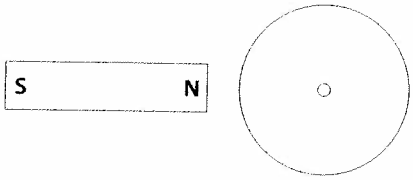
Review Questions

100. A magnetic field is produced by (1) moving electrons (2) moving neutrons (3) stationary protons (4) stationary ions

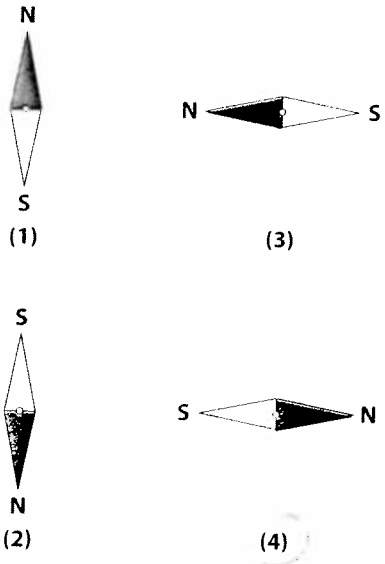
101. The presence of a uniform magnetic field may be detected by using a (1) stationary charge (2) small mass (3) beam of neutrons (4) magnetic compass

102. Which is the unit of magnetic flux in the SI system? (1) joule (2) weber (3) coulomb (4) ampere

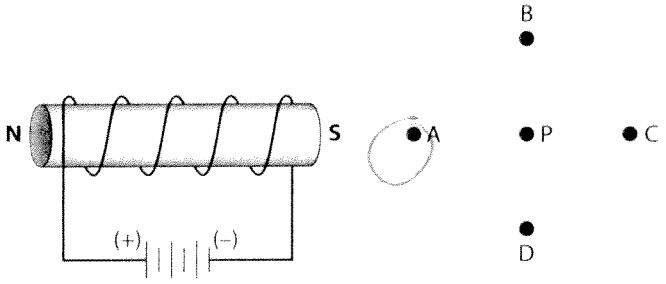
103. The diagram below shows a compass placed near the north pole, N, of a bar magnet.



Which diagram best represents the position of the needle of a compass as it responds to the magnetic field of the bar magnet?

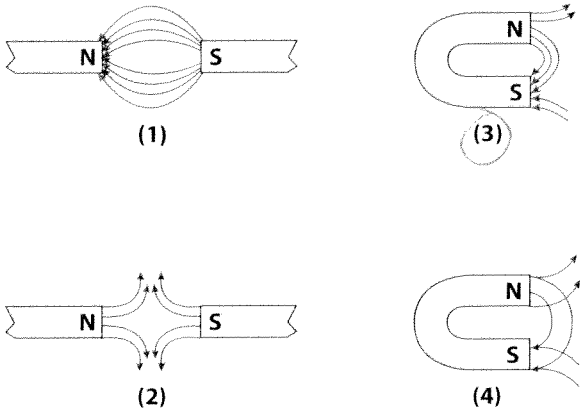


104. A coil of wire is wrapped around a piece of iron and connected to a battery. Due to the current through the coil, the iron develops a polarity as shown in the diagram below.

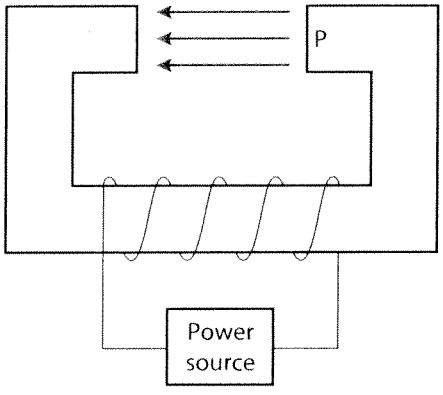


Toward which point would the north pole of a compass placed at point P point?

105. Which diagram correctly shows a magnetic field configuration?

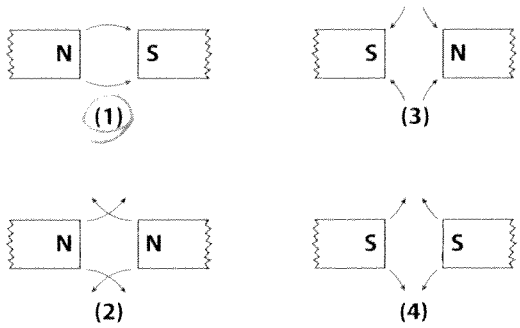


106. The diagram below shows a coil of wire connected to a power supply and wrapped around a U-shaped piece of iron. The arrows indicate the direction of the resulting magnetic field.

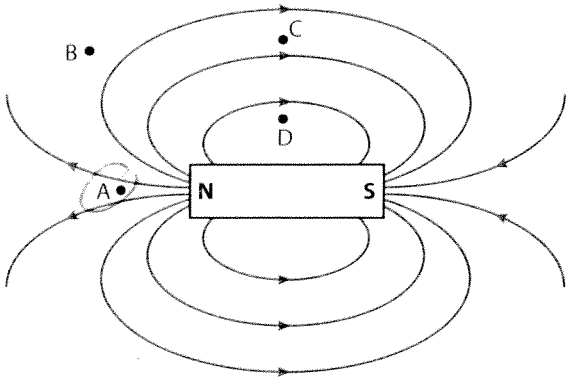


What is the polarity of P? (1) positive (2) negative (3) north (4) south

107. Which diagram best represents the lines of magnetic flux between the ends of two bar magnets?

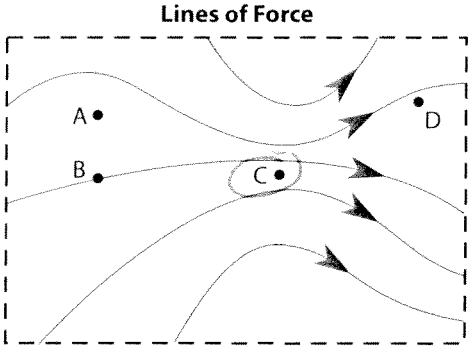


108. The diagram below represents the magnetic lines of force around a bar magnet.



At which point is the magnitude of the magnetic field strength of the bar magnet greatest?

109. The diagram below represents magnetic lines of force within a region of space.



At which point is the magnetic field strongest?