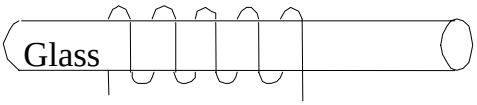
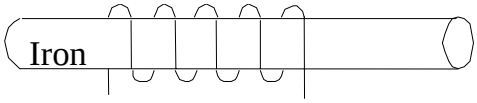
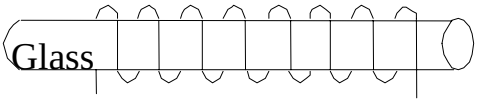
Power and Magnetism Questions

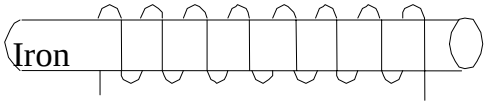
1 The current intensity is the same in each of the following electromagnets.

Which electromagnet has the strongest magnetic field?

A) 

C) 

B) 

D) 

2 What is the power loss of an electric kettle that has a resistance of 12 Ω and operates at a potential difference of 120 V?

A) 8.3 W

B) 1.0×10^2 W

C) 1.2×10^3 W

D) 1.4×10^3 W

3 Hydro-Quebec distributes large quantities of electrical energy. It would like to maintain the same quantity of transmitted power, while minimizing energy losses due to the "Joule effect".

Which one of the conditions below will allow Hydro-Quebec to reduce energy losses because of to the "Joule effect"?

A) High current intensity and low potential difference

B) High current intensity and high potential difference

C) Low current intensity and low potential difference

D) Low current intensity and high potential difference

4 Hydro-Quebec has to transport electrical energy over long distances, such as from James Bay to Montreal.

Which methods listed below are used by Hydro-Quebec to minimize energy losses?

1. Lowering the resistance of the conductors
2. Using the highest possible potential difference (voltage)
3. Using the lowest possible potential difference (voltage)
4. Increasing the resistance of the conductors

A) 1 and 2

B) 1 and 3

C) 2 and 4

D) 3 and 4

5 Hydro-Québec uses high-tension lines to reduce the loss of power caused by the Joule effect.

Why do high-tension lines reduce the loss of power?

A) When the power generated is constant, higher voltages result in greater current intensity.

B) When the power generated is constant, higher voltages result in lower current intensity.

C) When the power generated is constant, higher voltages result in an increase in the resistance of the lines.

D) When the power generated is constant, higher voltages result in a decrease in the conductance of the lines.

6 An electric circuit has a total resistance of 2 Ω. This circuit is connected to a source with a maximum power of 180 W. The source can provide three different voltages, namely 120 V, 180 V and 240 V.

Which of these voltages will result in the lowest power loss?

Justify your answer using calculations.

7 Given four electrical appliances in current use :

1. A fan
2. A toaster
3. A razor
4. A radiator

Which of the above appliances are used because of the Joule effect?

A) 1 and 2

B) 1 and 3

C) 2 and 4

D) 3 and 4

8 Explain why it is more advantageous to use a transmission line of 200 kV and a current of 10 A than to use a transmission line of 20 kV and a current of 100 A to furnish 2000 kW of electrical power?

($P = VI$ = 200 kV × 10 A = 20 kV × 100 A)

9 Which mathematical relation expresses the power dissipated by the Joule effect?

A) $P = VI^2$

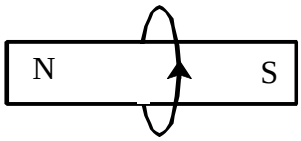
B) $P = RI^2$

C) $P = VI$

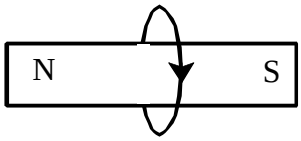
D) $P = RI$

10 Which of the following diagrams best illustrates the magnetic field surrounding a bar magnet?

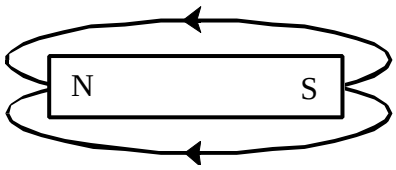
A)



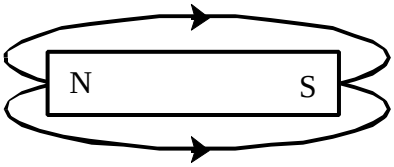
B)



C)



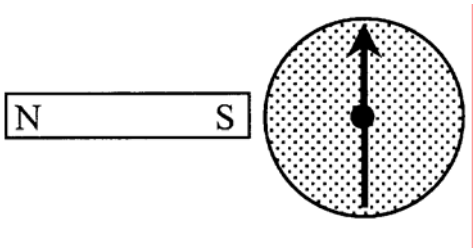
D)



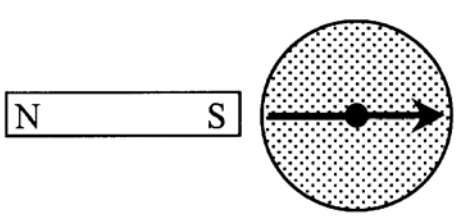
11 A magnetic compass is placed at one of the ends of a bar magnet.

Which of the following diagrams correctly shows the direction in which the compass needle will point?

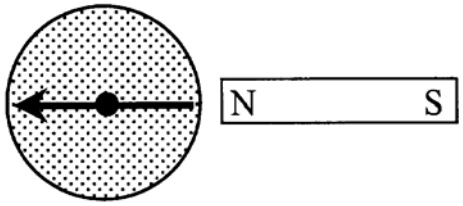
A)



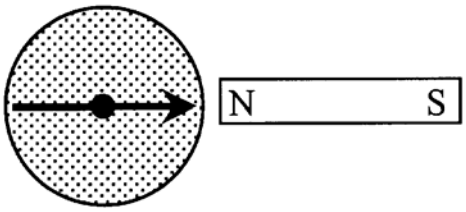
B)



C)

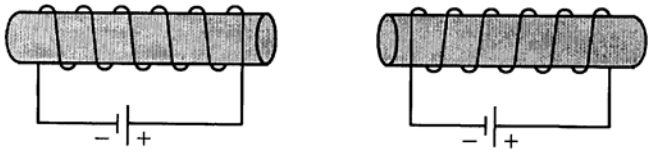


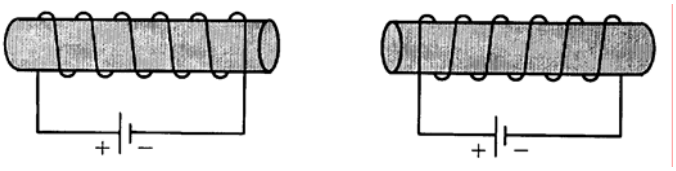
D)

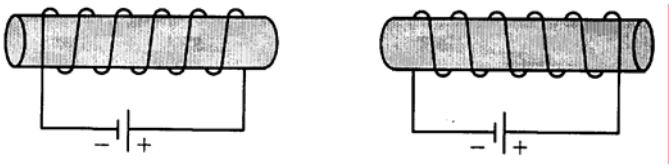


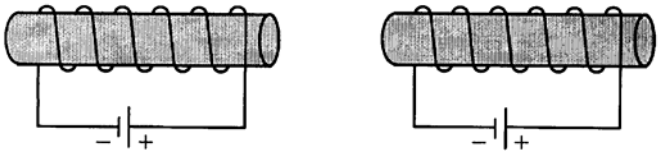
12 Two electromagnets are placed end to end.

In which one of the following diagrams do the electromagnets attract each other?

A) 

B) 

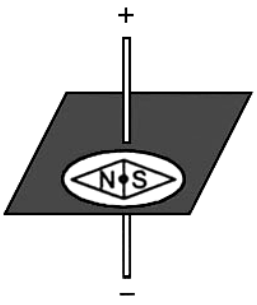
C) 

D) 

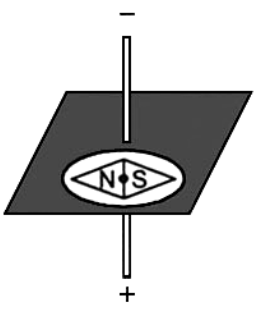
13 A compass is placed near a solenoid or a straight conductor. An electric current is flowing through both the solenoid and the straight conductor.

Which of the following diagrams shows the compass needle pointing in the correct direction?

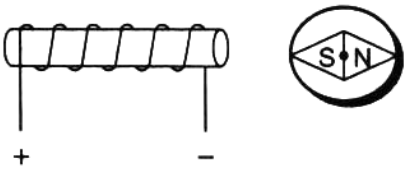
A)



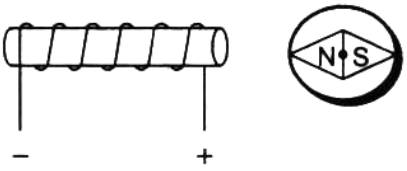
B)



C)

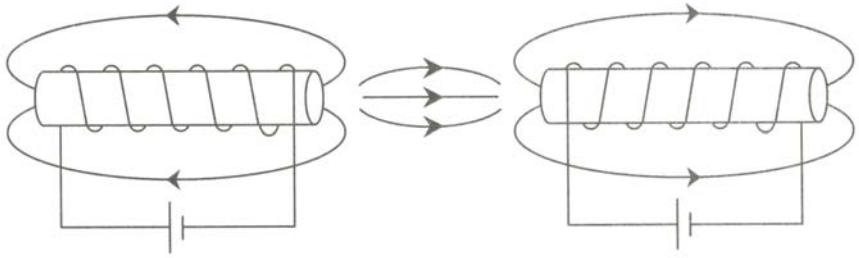


D)

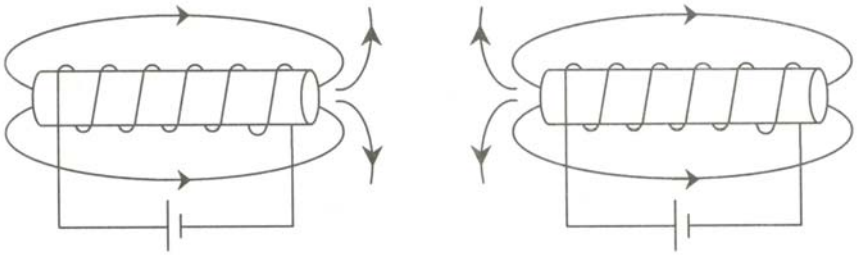


14 Which of the following diagrams correctly represents the magnetic lines of force between two solenoids?

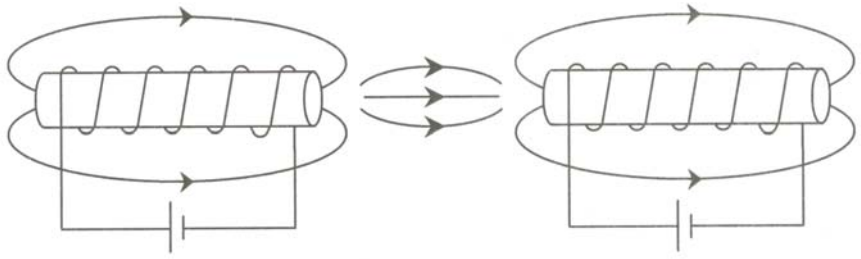
A)



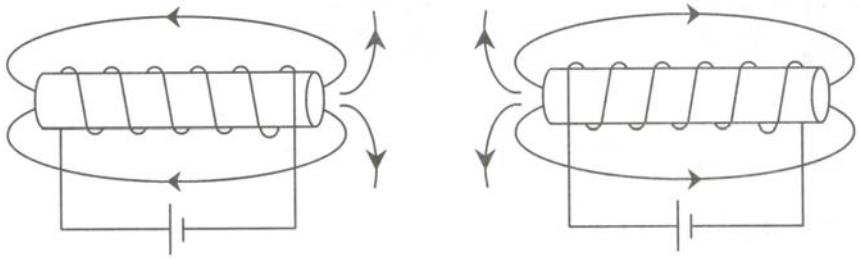
B)



C)



D)



15 In the laboratory, a student was given four electromagnets.

The student conducted tests and recorded the results in the following table. These results can be used to determine the magnetic field produced by each electromagnet.

Electromagnet	Number of Turns of Wire	Current Intensity
1	20	1 A
2	10	1 A
3	20	2 A
4	10	2 A

Which of these four electromagnets produces the strongest magnetic field?

A) Electromagnet 1

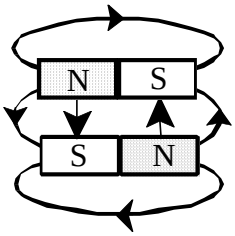
B) Electromagnet 2

C) Electromagnet 3

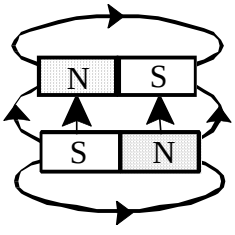
D) Electromagnet 4

16 Which of the following diagrams best represents the magnetic fields produced by two magnets?

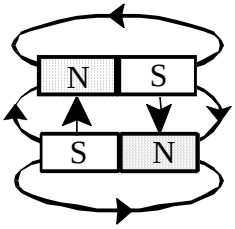
A)



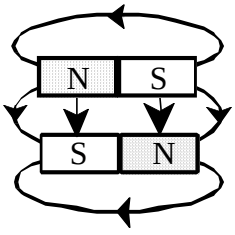
B)



C)

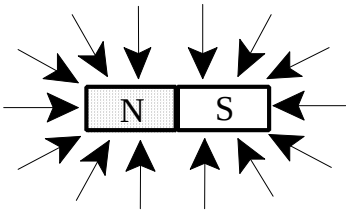


D)

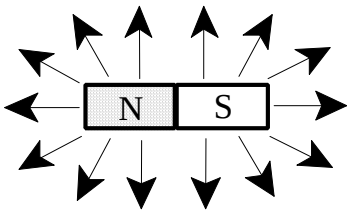


17 Which diagram best illustrates the magnetic field surrounding a bar magnet?

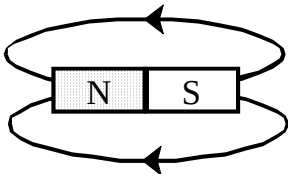
A)



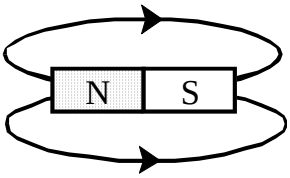
C)



B)



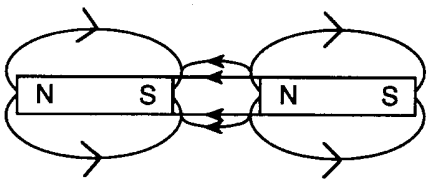
D)



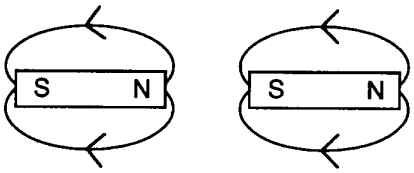
18 Two magnets are placed side by side.

Which of the following diagrams correctly represents the magnetic fields produced by these magnets?

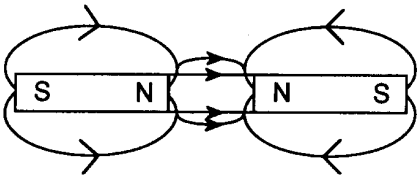
A)



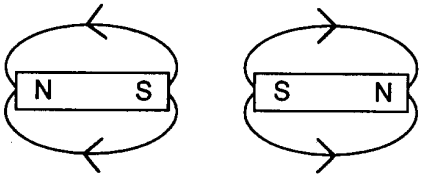
C)



B)



D)



19 Four circular pieces of metal were brought close to one another during a laboratory experiment. Only one of these pieces of metal is a magnet.

The following table shows whether or not these pieces of metal attracted one another.

Combination	Attraction	
	Yes	No
Piece 1 with piece 2		✓
Piece 1 with piece 3		✓
Piece 1 with piece 4		✓
Piece 2 with piece 3	✓	
Piece 2 with piece 4	✓	
Piece 3 with piece 4		✓

Which piece of metal is a magnet?

A) Piece 1

B) Piece 2

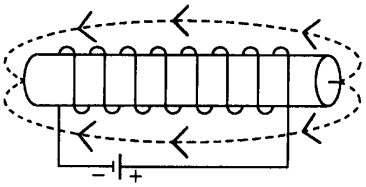
C) Piece 3

D) Piece 4

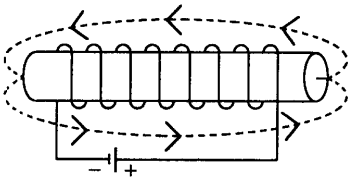
20 An electric current flows through a solenoid.

Which diagram correctly illustrates the magnetic field produced by this solenoid?

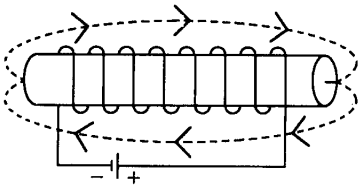
A)



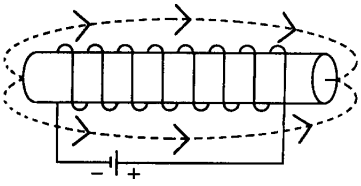
B)



C)

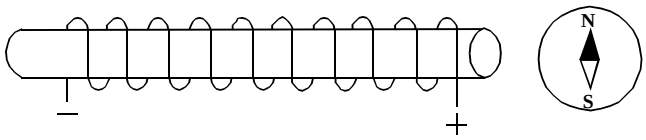


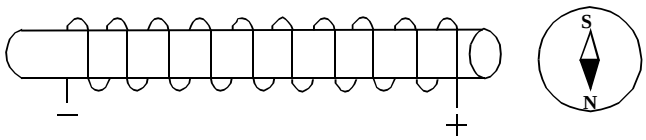
D)

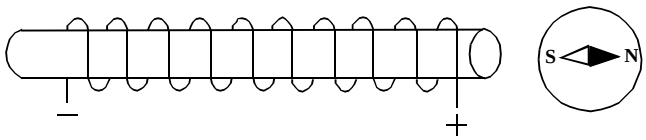


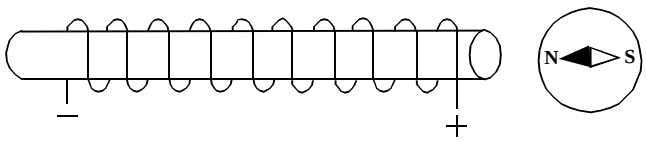
21 A compass is placed at one end of a solenoid.

In which illustration is the compass needle pointing in the right direction?

A) 

B) 

C) 

D) 

	Answers
1	D
2	C
3	D
4	A
5	B

6

1. Calculating the current when the potential difference is 120 V

$$I = \frac{P}{V}$$

$$I = \frac{180\ \text{W}}{120\ \text{V}} = 1.5\ \text{A}$$

2. Calculating the power lost when the potential difference is 120 V

$$P = I^2R$$

$$P = (1.5\ \text{A})^2 \times 2\ \Omega = 4.5\ \text{W}$$

3. Calculating the current when the potential difference is 180 V

$$I = \frac{P}{V}$$

$$I = \frac{180\ \text{W}}{180\ \text{V}} = 1.0\ \text{A}$$

4. Calculating the power lost when the potential difference is 180 V

$$P = I^2R$$

$$P = (1.0\ \text{A})^2 \times 2\ \Omega = 2.0\ \text{W}$$

5. Calculating the current when the potential difference is 240 V

$$I = \frac{P}{V}$$

$$I = \frac{180\ \text{W}}{240\ \text{V}} = 0.75\ \text{A}$$

6. Calculating the power lost when the potential difference is 180 V

$$P = I^2R$$

$$P = (0.75\ \text{A})^2 \times 2\ \Omega = 1.125\ \text{W}$$

Result

A potential difference of 240 V will result in the lowest power loss.

7

C

8	The circuit consumes part of the power through the Joule effect as can be expressed by $P=RI^2$. Since the power dissipated depends on the square of the current, the current must be minimized to reduce the power loss.
9	B
10	D
11	C
12	D
13	B
14	D
15	C
16	A
17	D
18	A
19	B

20	D
21	D