حل تجميعة أسئلة وفق الهيكل الوزاري بريدج

تاريخ نشر الملف على موقع المناهج: 16-03-2024 19:01:33

Academic Year العام الدراسي	2024/2023
Term الفصل	2
Subject الموضوع	Physics (Bridge)
Grade الصف	12
Stream المسار	General / العـام
Number Of MCQ عدد الأسئلة الموضوعية	15
Marks of MCQ درجة الأسئلة الموضوعية	4
Number of FRQ عدد الأسئلة المقالية	4
Marks Per FRQ الدرجات للأسئلة المقالية	8
Type of All Questions نوع كافة الأسئلة	MCQ/ الأسئلة الموضوعية FRQ/ الأسئلة المقالية
Maximum Overall Grade الدرجة القصوى الممكنة	100
Exam Duration مدة الامتحان	150 min.
Mode of Implementation طريقة التطبيق	Swift Assess & Paper-Based
Calculator الآلة الحاسبة	Allowed مسموحة

12 General

TERM2 –2023-24

EOT BASED REVIEW

Um Al Emarat ,523,AlHilli, DhanyaCS

METRIC PREFIXES

Multiple	Prefix	Symbol
10^{-18}	atto	a
10^{-15}	femto	f
10^{-12}	pico	p
10^{-9}	nano	n
10^{-6}	micro	μ
10^{-3}	milli	m
10^{-2}	centi	c
10^{-1}	deci	d
10^{1}	deka	da
10^{2}	hecto	h
10^{3}	kilo	k
10^{6}	mega	M
10^{9}	giga	G
10^{12}	tera	T

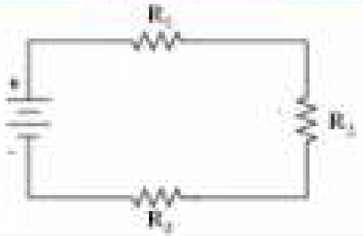
Quantity	Symbol	Unit
Electric current	I	Ampere(A)
Potential difference	V	Volt(V)
Resistance	R	Ohm(Ω)
Power	P	Watt(W)
Magnetic field	B	Tesla (T)
Velocity	v	Meter per second (m/s)
Length	l	Meter(m)
Force	F	Newton (N)
Charge	q	Coulomb (C)

1	يشرح خصائص دائرة التوالي. Explain the characteristics of a series circuit.	كما ورد في الكتاب As mentioned in textbook	82
2	يحل مسائل لإيجاد التيار وفروق الجهد والمقاومات في دائرة توالي. Solve problems to find the current, voltages and resistances in a series circuit.	Example 1 مثال تقويم الوحدة 4- 50،49،45 Unit 4 Assessment- 45,49,50	84 98
3	يحسب المقاومة المكافئة في دائرة توالي يشرح خصائص دائرة التوازي. Calculate the equivalent resistance and the total current passing through a series circuit Calculate the equivalent resistance of a parallel circuit	تقويم الوحدة (4)44 و43 Unit 4 Assessment- 43,44	98
4	يستخدم دائرة مجزئ الجهد كدائرة توالي لحساب المقاومات وانخفاض الجهد عبر مكونات الدائرة. Use the voltage divider circuit as a series circuit to calculate resistances and voltage drop across the components.	مثال2 Examples 2	85
5	يذكر قاعدة الحلقة لكيرشوف، ويربطها بقانون حفظ الطاقة. يذكر قاعدة الوصلة لكيرشوف، ويربطه بقانون حفظ الطاقة. State Kirchhoff's loop rule and relate it to the conservation of energy. State Kirchhoff's junction rule and relate it to the conservation of charge.	كما ورد في الكتاب As mentioned in textbook	89 90
6	يطبق قاعدة الوصلة لكيرشوف على الدوائر الكهربائية. Apply Kirchhoff's junction rule to electric circuits.	كما ورد في الكتاب As mentioned in textbook Section 2 review - مراجعة القسم2 30	90 95
7	يعرف دائرة القصر ويوضح آثرها. Define a short circuit and describe its effects.	كما ورد في الكتاب As mentioned in textbook	91
8	يوضح الدائرة الكهربائية المركبة. Describe a combined series-parallel circuit.	كما ورد في الكتاب As mentioned in textbook	93
9	يذكر خصائص الفولتميتر والأميتر من حيث مقاومة كل منهما. يحدد التوصيل الصحيح لأجهزة الأميتر والفولتميتر في الدائرة الكهربائية. State the properties of voltmeters and ammeters, in terms of their resistance. Identify the correct placements of ammeters and voltmeters in electric circuits	كما ورد في الكتاب As mentioned in textbook	95

10	يوضح خواص المغانط. Describe the properties of magnets.	كما ورد في الكتاب As mentioned in textbook	107
11	يوضح النطاقات المغناطيسية ويربطها بالخصائص المغناطيسية للمواد عالية النفاذية. Describe magnetic domains and relate them to the magnetic properties of ferromagnetic materials.	كما ورد في الكتاب As mentioned in textbook	108
12	يعرف التدفق المغناطيسي. Define magnetic flux.	كما ورد في الكتاب As mentioned in textbook	110
13	يرسم خطوط المجال المغناطيسي حول حلقة سلكية تحمل تيارا كهربائيا ويطبق قاعدة اليد اليمنى لتحديد اتجاه المجال المغناطيسي. Draw the magnetic field lines around a loop of current-carrying wire and apply the right-hand rule to indicate the direction.	كما ورد في الكتاب As mentioned in textbook	112
14	يرسم خطوط المجال المغناطيسي داخل وحول ملف لولبي يحمل تيا را كهربائيا ويحدد قطبيه. Draw the magnetic field lines inside and around a solenoid carrying current and identify its poles.	كما ورد في الكتاب As mentioned in textbook	112
15	يوضح المغناطيس الكهربائي والعوامل التي تؤثر على شدة مجاله المغناطيسي ومميزاته على المغناطيس الدائم. Describe an electromagnet, the factors affecting its strength, and its advantages over a permanent magnet.	كما ورد في الكتاب As mentioned in textbook	112

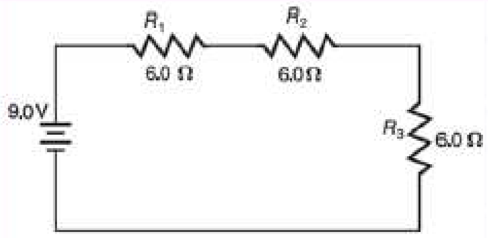
16	حل مسائل لإيجاد التيار وفروق الجهد والمقاومات في دائرة توازي. Solve problems to find the current, voltages and resistances in a parallel circuit.	مثال Example 3 Ch4 Assessment -59 تقويم-الوحدة 4 - 59	88 99
17	يحسب المقاومة المكافئة في دائرة كهربائية مركبة. يحسب فرق الجهد ومقدار التيار الكهربائي المار والقدرة الكهربائية المبددة لكل مقاوم في دائرة كهربائية مركبة Calculate the equivalent resistance of combined series-parallel circuits. Calculate the voltage, current, and power dissipation for any resistor in a combined series-parallel circuit.	مثال Example 4 Ch4 Assessment -73 ,78 تقويم الوحدة 4 - 73و78	94 100
18	يطبق قاعدة اليد اليمنى لتحديد اتجاه القوة المؤثرة على سلك يمر به تيار وموضوع في مجال مغناطيسي. يطبق المعادلة ($F = ILB\sin(\theta)$)لحساب مقدار القوة المؤثرة على جزء مستقيم من سلك يحمل تيارا كهربائيا في مجال مغناطيسي منتظم. Apply the right-hand rule to find the direction of the force on a current-carrying wire placed in an external magnetic field. Apply the equation $F = ILB\sin(\theta)$ to calculate the magnitude of the force on a straight segment of a current-carrying wire placed in a uniform magnetic field.	مثال Example 1 تطبيقات Applications 21,23 تقويم الوحدة 5 -70 و71 Ch5 Assessment 70, 71	116 126
19	يشرح أهمية مجزئ الجهد لتوليد فرق الجهد المطلوب. يشرح كيف تعمل المنصهرات وقواطع الدائرة الكهربائية وقاطع التيار بسبب الأعطال على حماية الدوائر الكهربائية Explain how fuses, circuit breakers and ground-fault interrupters protect electric circuits and make them safe to operate. Explain the importance of a voltage-divider circuit to achieve a desired potential difference. Describe the principle and working of a simple electric motor and the energy conversions that occur.	كما ورد في الكتاب As mentioned in textbook	83 91
	يوضح القوى المغناطيسية التي تؤثر عند تقريب مغناطيسين متشابهين او مختلفين في مغناطيسين دائمين من بعضهما (من حيث التفاعل واتجاه خطوط المجال). Describe the forces that occur when like or unlike poles of two permanent magnets are brought close together (in terms of the interaction between the magnetic fields and the orientation of the magnetic field lines).	كما ورد في الكتاب As mentioned in textbook	110
20	يطبق المعادلة ($F = qvB\sin(\theta)$) لحساب مقدار القوة المؤثرة على جسيم مشحون يتحرك في مجال مغناطيسي. يطبق قاعدة اليد اليمنى لتحديد اتجاه القوة المؤثرة على جسيم مشحون يتحرك في مجال مغناطيسي. Apply the equation $F = qvB\sin(\theta)$ to calculate the magnitude of the force acting on a charged particle moving in a magnetic field. Apply the right-hand rule to determine the direction of the force acting on a charged particle moving in a magnetic field.	مثال 2، تطبيق 26 Example2, Exercise 26	120

1	Explain the characteristics of a series circuit. يشرح خصائص دائرة التوالي.	كما ورد في الكتاب As mentioned in textbook	82

Series circuit

There is only one path for the current
The current produced by the battery is the same current passes through each resistor $I = I_1 = I_2 = I_3$
The potential difference across the battery is not the same across each resistor $V = V_1 + V_2 + V_3$
The equivalent resistance is $R_{eq} = R_1 + R_2 + R_3$
To find the current through the entire circuit $I = \frac{V_{Battery}}{R_{eq}}$ or $I = \frac{V_1}{R_1} = \frac{V_2}{R_2} = \frac{V_3}{R_3}$
To find the voltage across the battery $V_{Battery} = I \times R_{eq}$ To find the voltage across each resistor $V_1 = I \times R_1,\ V_2 = I \times R_2,\ V_3 = I \times R_3$

Q.9: *2* Current across the battery

Mark(s): 5/5



ثلاث مقاومات متماثلة مقاومة كل منها (6.0 Ω) تتصل ببطارية (9.0V) كما هو مبين في الشكل. ما شدة التيار الكهربائي المار في البطارية؟

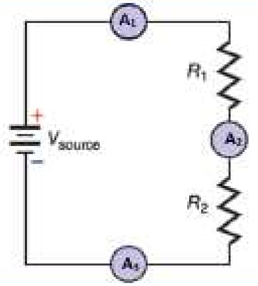
Three identical resistors of 6.0 Ω, are connected. in parallel across a 9.0 V battery as shown in the figure. What is the current through the battery?

$I = V/(R1+R2+R3)$

$= 9/(6+6+6) = 0.5\ A$

Q.5: *2* Connecting resistors in a circuit

Mark(s): 5/5



يُبيّن الشكل مقاومين يتصلان ببطارية في دائرة كهربائية بسيطة. يتصل في الدائرة ثلاث أميترات A_1, A_2, A_3 أي من العبارات التالية صحيحة حول التيارات المارة في الأميترات الثلاثة؟

The figure shows two resistors connected to a battery in a simple electric circuit. Three Ammeters A_1, A_2, A_3 are connected to the circuit. Which statement is correct about the electric currents through each of three ammeters?

$I = I1 = I2$

2	يحل مسائل لإيجاد التيار وفروق الجهد والمقاومات في دائرة توالي. Solve problems to find the current, voltages and resistances in a series circuit.	Example 1 مثال تقويم الوحدة 4- 45،49،50 Unit 4 Assessment- 45,49,50	84 98

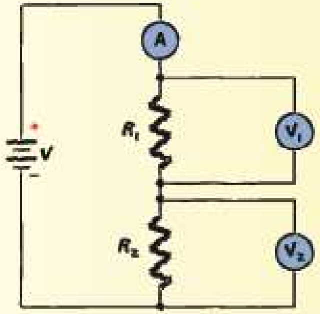
POTENTIAL DIFFERENCE IN A SERIES CIRCUIT Two resistors, 47 Ω and 82 Ω, are connected in series across a 45-V battery.

a. What is the current in the circuit?

b. What is the potential difference across each resistor?

c. If you replace the 47-Ω resistor with a 39-Ω resistor, will the current increase, decrease, or remain the same?

d. What is the new potential difference across the 82-Ω resistor?



1 ANALYZE AND SKETCH THE PROBLEM

Draw a schematic of the circuit.

KNOWN	UNKNOWN
$\Delta V_{source} = 45$ V	$I = ?$
$R_1 = 47\ \Omega$	$\Delta V_1 = ?$
$R_2 = 82\ \Omega$	$\Delta V_2 = ?$

2 SOLVE FOR THE UNKNOWN

a. To determine the current, first find the equivalent resistance.

$I = \frac{\Delta V_{source}}{R}$ and $R = R_1 + R_2$

$= \frac{\Delta V_{source}}{R_1 + R_2}$ ◀ Substitute $R = R_1 + R_2$.

$= \frac{45\ V}{47\ \Omega + 82\ \Omega}$ ◀ Substitute $\Delta V_{source} = 45\ \Omega$, $R_1 = 47$ V, $R_2 = 82\ \Omega$.

$= 0.35$ A

b. Use $\Delta V = IR$ for each resistor.

$\Delta V_1 = IR_1$

$= (0.35\ A)(47\ \Omega)$ ◀ Substitute $I = 0.35$ A, $R_1 = 47\ \Omega$.

$= 16$ V

$\Delta V_2 = IR_2$

$= (0.35\ A)(82\ \Omega)$ ◀ Substitute $I = 0.35$ A, $R_2 = 82\ \Omega$.

$= 29$ V

c. Calculate current, this time using 39 Ω as R_1.

$I = \frac{\Delta V_{source}}{R_1 + R_2}$

$= \frac{45\ V}{39\ \Omega + 82\ \Omega}$ ◀ Substitute $\Delta V_{source} = 45$ V, $R_1 = 39\ \Omega$, $R_2 = 82\ \Omega$.

$= 0.37$ A

The current will increase.

d. Determine the new voltage drop in R_2.

$\Delta V_2 = IR_2$

$= (0.37\ A)(82\ \Omega)$ ◀ Substitute $I = 0.37$ A, $R_2 = 82\ \Omega$

$= 3.0\times10^1$ V

45. A series circuit has two voltage drops: 5.50 V and 6.90 V. What is the supply voltage?

$$V = 5.50\ V + 6.90\ V = 12.4\ V$$

49. Ammeter 1 in **Figure 18** reads 0.20 A.

a. What is the total resistance of the circuit?

b. What is the potential difference across the battery?

c. How much power is delivered to the 22-Ω resistor?

d. How much power is supplied by the battery?

a. What is the total resistance of the circuit?

$R = R_1 + R_2 = 15\ \Omega + 22\ \Omega = 37\ \Omega$

b. What is the battery voltage?

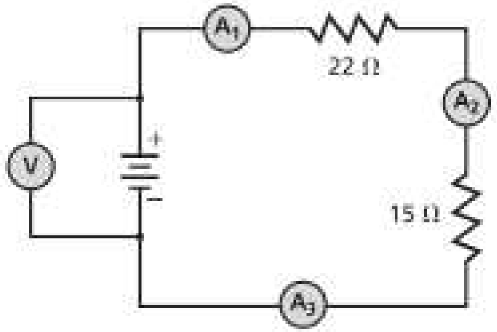
$V = IR = (0.20\ A)(37\ \Omega) = 7.4$ V

c. How much power is delivered to the 22-Ω resistor?

$P = I^2R = (0.20\ A)^2(22\ \Omega) = 0.88$ W

d. How much power is supplied by the battery?

$P = IV = (0.20\ A)(7.4\ V) = 1.5$ W



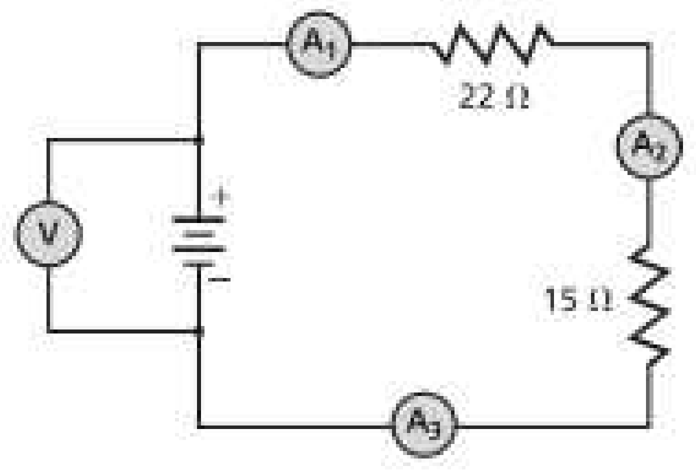
2	يحل مسائل لإيجاد التيار وفروق الجهد والمقاومات في دائرة توالي. Solve problems to find the current, voltages and resistances in a series circuit.	Example 1 مثال تقويم الوحدة 4- 45،49،50 Unit 4 Assessment- 45,49,50	84 98

50. Ammeter 2 in **Figure 18** reads 0.50 A.

a. Find the potential difference across the 22-Ω resistor.

b. Find the potential difference across the 15-Ω resistor.

c. Find the potential difference across the battery.



a. Find the voltage across the 22-Ω resistor.

$V = IR = (0.50\ A)(22\ \Omega) = 11\ V$

b. Find the voltage across the 15-Ω resistor.

$V = IR = (0.50\ A)(15\ \Omega) = 7.5\ V$

c. What is the battery voltage?

$V = V_1 + V_2 = (11\ V) + (7.5\ V) = 19\ V$

3	يحسب المقاومة المكافئة في دائرة توالي يشرح خصائص دائرة التوازي. Calculate the equivalent resistance and the total current passing through a series circuit Calculate the equivalent resistance of a parallel circuit	تقويم الوحدة 4(4)44 و43 Unit 4 Assessment- 43,44	98

Calculate the equivalent resistance of these series-connected resistors: 680 Ω, 1.1 kΩ, and 10 kΩ.

$$R = 680\ \Omega + 1100\ \Omega + 10{,}000\ \Omega = 12\ \text{k}\Omega$$

Calculate the equivalent resistance of these parallel-connected resistors: 680 Ω, 1.1 kΩ, and 10.2 kΩ.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$R = \frac{1}{\left(\frac{1}{0.68\ \text{k}\Omega} + \frac{1}{1.1\ \text{k}\Omega} + \frac{1}{10.2\ \text{k}\Omega}\right)} = 0.40\ \text{k}\Omega$$

43. Calculate the equivalent resistance of these series-connected resistors: 680 Ω, 1.1 kΩ, and 11 kΩ.

44. Calculate the equivalent resistance of these parallel-connected resistors: 680 Ω, 1.1 kΩ, and 10.2 kΩ.

58. Calculate the equivalent resistance of these series-connected resistors: 680 Ω, 1.1 kΩ, and 10 kΩ.

$$R = 680\ \Omega + 1100\ \Omega + 10{,}000\ \Omega = 12\ \text{k}\Omega$$

59. Calculate the equivalent resistance of these parallel-connected resistors: 680 Ω, 1.1 kΩ, and 10.2 kΩ.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$R = \frac{1}{\left(\frac{1}{0.68\ \text{k}\Omega} + \frac{1}{1.1\ \text{k}\Omega} + \frac{1}{10.2\ \text{k}\Omega}\right)} = 0.40\ \text{k}\Omega$$

4	يستخدم دائرة مجزئ الجهد كدائرة توالي لحساب المقاومات وانخفاض الجهد عبر مكونات الدائرة Use the voltage divider circuit as a series circuit to calculate resistances and voltage drop across the components.	مثال2 Examples 2	85

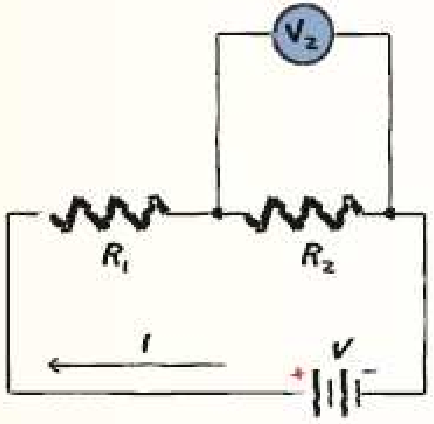
EXAMPLE PROBLEM 2

Find help with **order of operations.** **Math Handbook**

VOLTAGE DIVIDER A 9.0-V battery and two resistors, 390 Ω and 470 Ω, are connected as a voltage divider. What is the potential difference across the 470-Ω resistor?

1 ANALYZE AND SKETCH THE PROBLEM

Draw the battery and resistors in a series circuit.



KNOWN

$\Delta V_{source} = 9.0$ V

$R_1 = 390$ V

$R_2 = 470$ V

UNKNOWN

$\Delta V_2 = ?$

2 SOLVE FOR THE UNKNOWN

$$R = R_1 + R_2$$

$$I = \frac{\Delta V_{source}}{R}$$

$$= \frac{\Delta V_{source}}{R_1 + R_2}$$ ◀ Substitute $R = R_1 + R_2$

$$\Delta V_2 = IR_2$$

$$= \frac{\Delta V_{source} R_2}{R_1 + R_2}$$ ◀ Substitute $I = \frac{V_{source}}{R_1 + R_2}$

$$= \frac{(9.0\ \text{V})(470\ \Omega)}{390\ \Omega + 470\ \Omega}$$ ◀ Substitute $\Delta V_{source} = 9.0$ V, $R_1 = 390\ \Omega$, $R_2 = 470\ \Omega$

$$= 4.9\ \text{V}$$

5	State Kirchhoff's loop rule and relate it to the conservation of energy. State Kirchhoff's junction rule and relate it to the conservation of charge. يذكر قاعدة الحلقة لكيرشوف، ويربطها بقانون حفظ الطاقة. يذكر قاعدة الوصلة لكيرشوف، ويربطه بقانون حفظ الطاقة.	كما ورد في الكتاب As mentioned in textbook	89 90

- **Kirchhoff's Loop Rule** states that the sum of the voltage differences around **the loop** must be equal to ***zero***.

➢ **The loop rule is based on the law of conservation of energy.**

- **Kirchhoff's Junction Rule** states that In an electric circuit, the **total current into** a section of that circuit must **equal** the **total current out** of that same section.

- **The junction rule describes currents and is based on the law of conservation of charge.**

Q.7: Kirchhoff's Rules — Mark(s): 5/5

What are the two Kirchhoff's Rules to analyze complex electric circuit?

ما هما قاعدتا كرشوف لتحليل الدوائر الكهربائية المركبة؟

★ Loop and junction rules
قاعدتا الحلقة والوصلة

series nd parallel rules
قاعدتا التوالي والتوازي

Q.5: Kirchhoff's Rules — Mark(s): 5/5

On which law of conservation does the loop rule rely to analyze complex electric circuit?

أي من قوانين الحفظ ترتكز عليها قاعدة الحلقة في تحليل الدوائر الكهربائية المركبة؟

★ the law of conservation of energy
قانون حفظ الطاقة

the law of conservation of charge
قانون حفظ الشحنة

the law of conservation of mass
قانون حفظ الكتلة

6	Apply Kirchhoff's junction rule to electric circuits. يطبق قاعدة الوصلة لكيرشوف على الدوائر الكهربائية.	كما ورد في الكتاب As mentioned in textbook Section 2 review - مراجعة القسم 2 30	90 95

19. Total Current A parallel circuit has four branch currents: 120 mA, 250 mA, 380 mA, and 2.1 A. How much current passes through the power source?

20. Total Current A series circuit has four resistors. The current through one resistor is 810 mA. How much current passes through the power source?

$I_T = I_1 + I_2 + I_3 + I_4$

$= 120\ mA + 250\ mA + 380\ mA + 2.1\ A$

$= 0.12\ A + 0.25\ A + 0.38\ A + 2.1\ A$

$= 2.9\ A$

Total Current A series circuit has four resistors. The current through one resistor is 810 mA. How much current is supplied by the source?

810 mA. Current is the same everywhere in a series circuit.

Current If I_3 is 1.7 A and I_1 is 1.1 A, what is the current through bulb 2?

Current If I_3 measures 1.7 A and I_1 measures 1.1 A, how much current is flowing in bulb 2?

$I_3 = I_1 + I_2$

$I_2 = I_3 - I_1 = 1.7\ A - 1.1\ A = 0.6\ A$

7	Define a short circuit and describe its effects.	يعرف دائرة القصر ويوضح أثرها.	كما ورد في الكتاب As mentioned in textbook	91

In an electric circuit, fuses and circuit breakers prevent circuit overloads that can occur when too many appliances are turned on at the same time or when a short circuit occurs in one appliance. A **short circuit** occurs when a circuit with very low resistance is formed. When appliances are connected in parallel, each additional appliance placed in operation reduces the equivalent resistance in the circuit and increases the current through the wires. This additional current might produce enough thermal energy to melt the wiring's insulation, cause a short circuit, or even begin a fire.

8	يوضح الدائرة الكهربائية المركبة. Describe a combined series-parallel circuit.	كما ورد في الكتاب As mentioned in textbook	93

Combined Series-Parallel Circuits

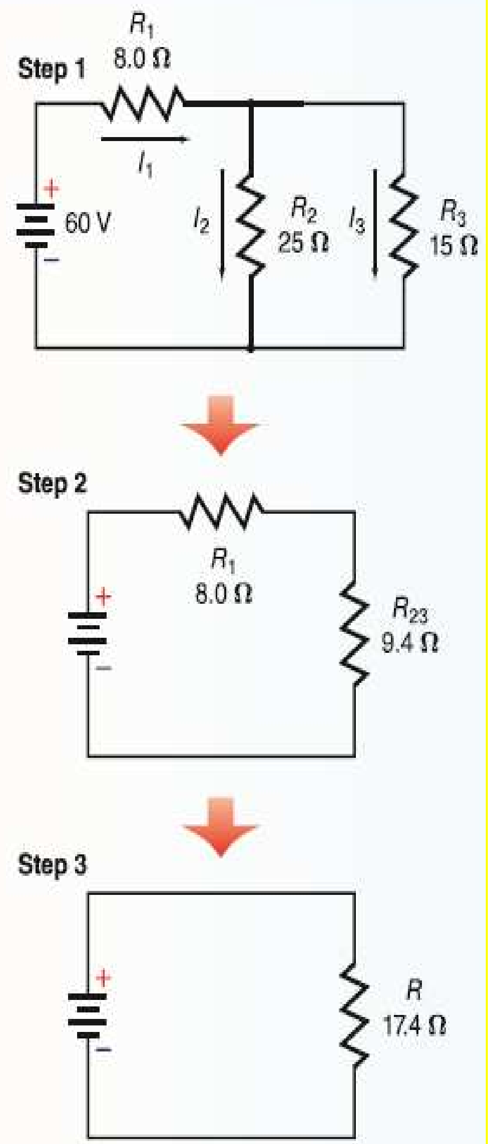
Have you ever noticed the light dim when you turned on a hair dryer? The light and the hair dryer are connected in parallel across 120 V. Because of the parallel connection, the current through the light should not have changed when you turned on the hair dryer. Yet the light did dim, so the current must have changed. The dimming occurred because the household wiring has a small resistance. As shown in **Figure 13,** this resistance was in series with the parallel circuit. A circuit that includes series and parallel branches is a **combination series-parallel circuit**. The following are strategies for analyzing such circuits.

PROBLEM-SOLVING STRATEGIES

SERIES-PARALLEL CIRCUITS

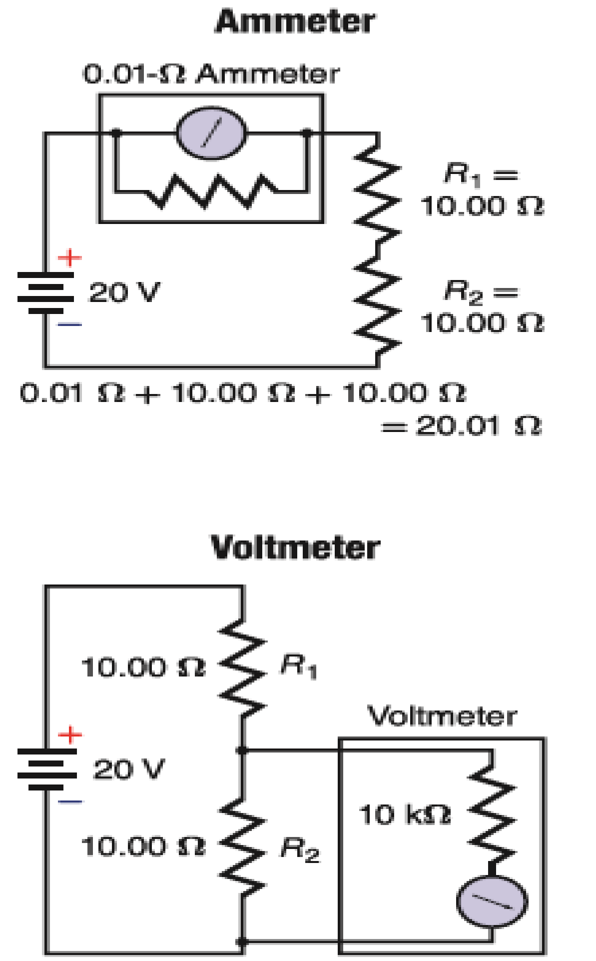
When analyzing a combination series-parallel circuit, use the following steps to break down the problem.

1. Draw a schematic diagram of the circuit.
2. Find any parallel resistors. Resistors in parallel have separate current paths. They must have the same potential differences across them. Calculate the single equivalent resistance of a resistor that can replace them. Draw a new schematic using that resistor.
3. Are any resistors (including the equivalent resistor) now in series? Resistors in series have one and only one current path through them. Calculate a single new equivalent resistance that can replace them. Draw a new schematic diagram using that resistor.
4. Repeat steps 2 and 3 until you can reduce the circuit to a single resistor. Find the total circuit current. Then go backward through the circuits to find the currents through and the potential differences across individual resistors.



9	يذكر خصائص الفولتميتر والاميتر من حيث مقاومة كل منهما. يحدد التوصيل الصحيح لأجهزة الأميتر والفولتميتر في الدائرة الكهربائية. State the properties of voltmeters and ammeters, in terms of their resistance. Identify the correct placements of ammeters and voltmeters in electric circuits	كما ورد في الكتاب As mentioned in textbook	95

Figure 16 An ammeter is connected in series with two resistors. The small resistance of the ammeter slightly alters the current in the circuit. A voltmeter is connected in parallel with a resistor. The high resistance of the voltmeter results in a negligible change in the circuit current and voltage.



10	Describe the properties of magnets. يوضح خواص المغناطيس	كما ورد في الكتاب As mentioned in textbook	107

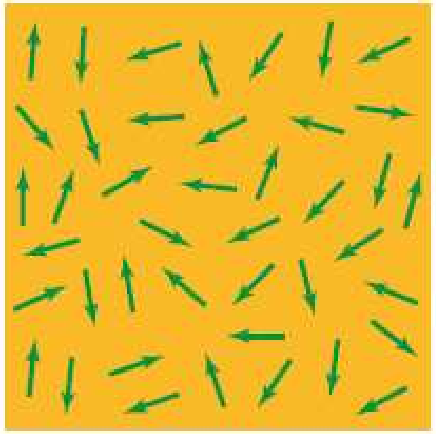
Like poles repel.

Unlike poles attract.

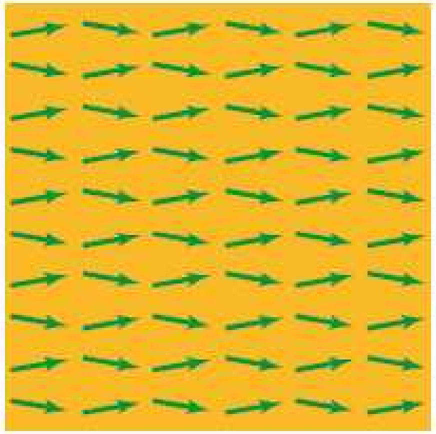
1. *Magnets are polarized- two poles north and south poles*
2. *Earth is a magnet-*
3. *Like poles repels and unlike pole attracts*
4. **Magnetization-** If the ferromagnetic material is **next** to a **strong magnet**, most of the object's domains preferentially **align to point in the same direction** as **the poles of the external magnet**
5. **Iron, nickel, and cobalt** are **strongly attracted.** , called **ferromagnetic materials**, can become temporary magnets
6. *Brass, copper, Gold and Aluminum are common metals that are not attracted to Magnets*

11	يوضح النطاقات المغناطيسية ويربطها بالخصائص المغناطيسية للمواد عالية النفاذية. Describe magnetic domains and relate them to the magnetic properties of ferromagnetic materials.	كما ورد في الكتاب As mentioned in textbook	108

Figure 5 Domains in a nonmagnetized ferromagnetic material point in random directions (top). When a strong magnet is placed near a ferromagnetic material, the domains in that ferromagnetic material align with those of the external magnet (bottom).



Nonmagnetized Material



Magnetized Material

- Each atom in a **ferromagnetic material** acts like a **tiny magnet**.
- **Magnetic domains are a group of neighboring atoms whose poles are aligned.**
- **Magnetization-** If the ferromagnetic material is **next** to a **strong magnet**, most of the object's domains preferentially **align to point in the same direction** as **the poles of the external magnet**
- **Iron, nickel, and cobalt** are **strongly attracted.** , called **ferromagnetic materials**, can become temporary magnets

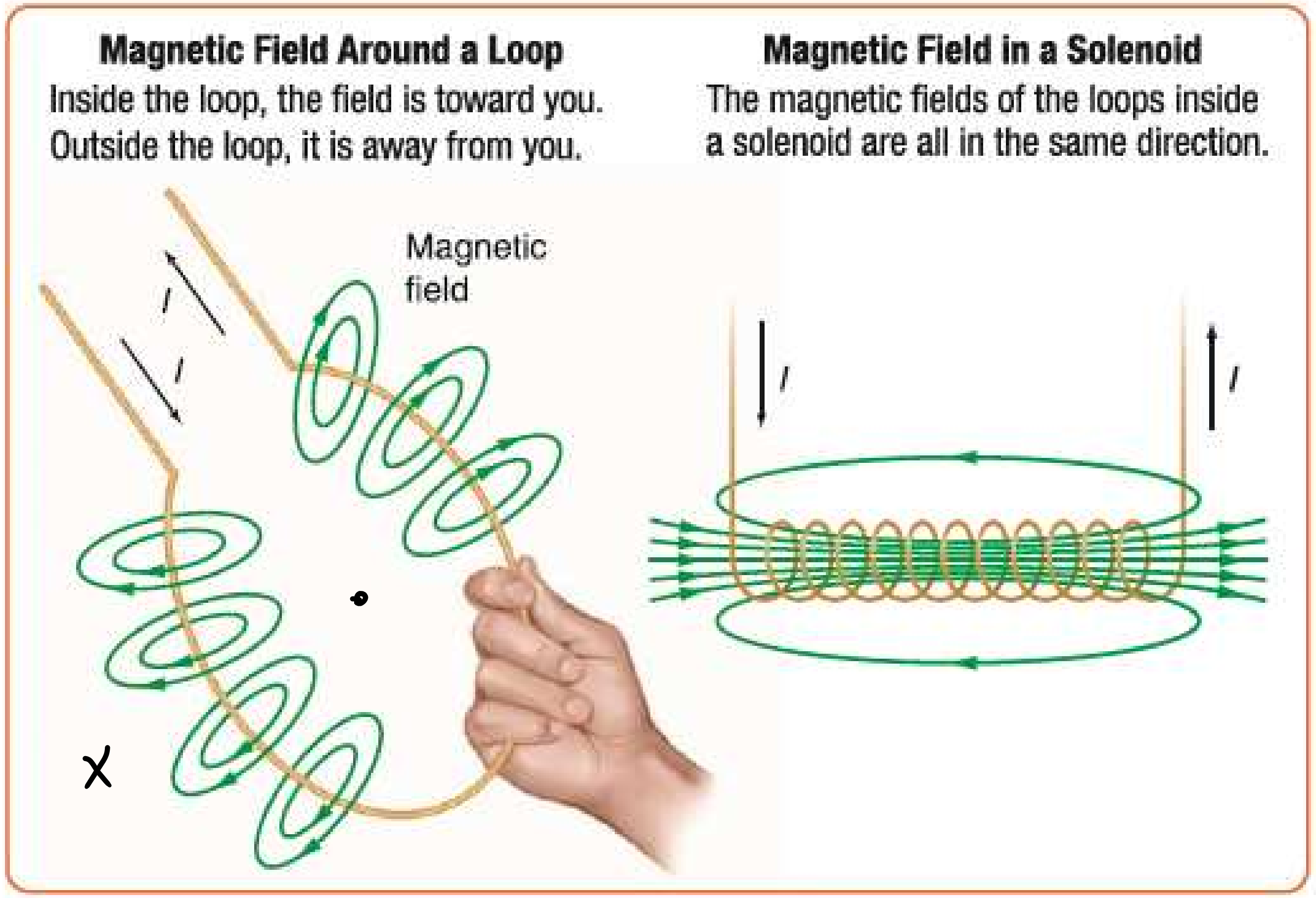
Creating permanent magnets The only naturally occurring magnet is the mineral magnetite. The lodestones that ancient sailors used were nothing more than pieces of magnetite. If magnetite is the only naturally occurring magnet, how, then, are commercial permanent magnets made?

When an object containing certain ferromagnetic materials is heated in the presence of a strong magnet, thermal energy frees the atoms in each of the object's domains. The domains can rotate and align with the magnet's poles. The object is then cooled while it is still in the presence of the strong magnet. After cooling, the object's atoms are less free to rotate. Therefore, when the strong magnet is removed from the object, the object remains magnetized. A permanent magnet has been created. If this permanent magnet is later reheated or dropped, however, the atoms can jostle out of alignment, reordering the domains and removing the magnetic properties.

12	Define magnetic flux. يعرف التدفق المغناطيسي.	كما ورد في الكتاب As mentioned in textbook	110

Magnetic field lines Scientists visualize magnetic fields using magnetic field lines, such as those shown in **Figure 7.** Like electric field lines, magnetic field lines are not real. They are used to show the direction as well as the strength of a magnetic field. The number of magnetic field lines passing through a surface perpendicular to the lines is the **magnetic flux**. The flux per unit area is proportional to the strength of the magnetic field. Magnetic flux is most concentrated at magnetic poles, where magnetic field strength is the highest.

13	يرسم خطوط المجال المغناطيسي حول حلقة سلكية تحمل تيارا كهربائيا ويطبق قاعدة اليد اليمنى لتحديد اتجاه المجال المغناطيسي. Draw the magnetic field lines around a loop of current-carrying wire and apply the right-hand rule to indicate the direction.	كما ورد في الكتاب As mentioned in textbook	112



55. Figure 28 shows the end view of an electromagnet that is carrying current.

a. What is the direction of the magnetic field inside the loops?

Into the page

b. What is the direction of the magnetic field outside the loops?

Out of the page

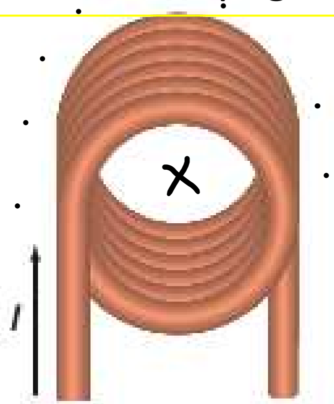
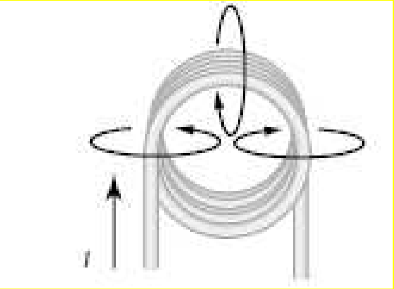


Figure 28



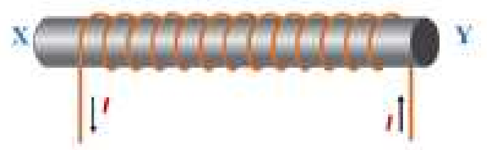
14	يرسم خطوط المجال المغناطيسي داخل وحول ملف لولبي يحمل تيارا كهربائيا ويحدد قطبيه. Draw the magnetic field lines inside and around a solenoid carrying current and identify its poles.	كما ورد في الكتاب As mentioned in textbook	112

✓ **Right-hand rule 2 for a solenoid**-If you curl your fingers around the solenoid in the direction of the conventional (positive) current, as in Figure, your thumb will point toward the solenoid's north pole

Figure 12 Imagine you are holding the solenoid with your right hand. Your thumb will point toward the solenoid's north pole when you curl your fingers in the direction of the conventional current.

Right-Hand Rule

Q.13: *2* Magnetic field in a solenoid

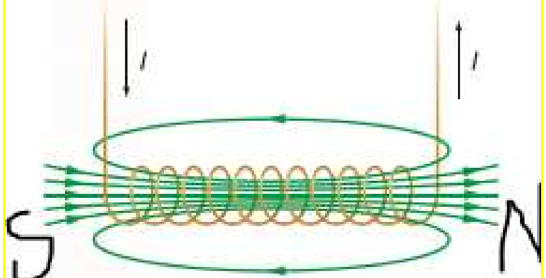


يبين الشكل ملفاً لولبياً أثناء مرور تيار كهربائي به. أي من صفوف الجدول الآتية يبين بشكل صحيح اتجاه المجال المغناطيسي داخل الملف وموضع كل من قطبيه؟

The figure shows a solenoid while a current is passing through it. Which of the following rows correctly shows the direction of the magnetic field inside the solenoid and the poles of the solenoid?

	Direction of the magnetic field inside the solenoid اتجاه المجال المغناطيسي داخل الملف اللولبي	North pole of the solenoid(N) القطب الشمالي للملف اللولبي	South pole of the solenoid(S) القطب الجنوبي للملف اللولبي
A	X → Y	Y	X
B	Y → X	Y	X
C	X → Y	X	Y
D	Y → X	X	Y

Magnetic Field in a Solenoid
The magnetic fields of the loops inside a solenoid are all in the same direction.



15	يوضح المغناطيس الكهربي والعوامل التي تؤثر على شدة مجاله المغناطيسي ومميزاته على المغناطيس الدائم. Describe an electromagnet, the factors affecting its strength, and its advantages over a permanent magnet.	كما ورد في الكتاب As mentioned in textbook	112

1. **An Electromagnet** is a magnet whose **magnetic field** is **produced** by **electric current.**

2. **The strength of the magnetic field in a solenoid is proportional to the current in the solenoid's loops.**

3. **It is also proportional to the number of loops. The more loops there are in a solenoid and the closer they are spaced, the greater the solenoid's magnetic field strength.**

4. **The magnetic field strength of a solenoid also can be increased by placing an iron-containing rod inside it.**

When there is an electric current in a solenoid, the solenoid has a magnetic field similar to the field of a permanent magnet. This kind of magnet is an electromagnet. An **electromagnet** is a magnet whose magnetic field is produced by electric current.

Loops and field strength Solenoids can be exceptionally strong electromagnets, producing magnetic fields much stronger than those around permanent magnets. The strength of the magnetic field in a solenoid is proportional to the current in the solenoid's loops. It is also proportional to the number and spacing of loops. The more loops there are in a solenoid and the closer they are spaced, the greater the solenoid's magnetic field strength.

The magnetic field strength of a solenoid also can be increased by placing an iron-containing rod inside it. An iron rod strengthens the solenoid's magnetism because the solenoid's field produces a temporary magnetic field in the iron, just as a permanent magnet produces a temporary magnet in a ferromagnetic object.

16	حل مسائل لإيجاد التيار وفروق الجهد والمقاومات في دائرة توازي. Solve problems to find the current, voltages and resistances in a parallel circuit.	Example 3 مثال Ch4 Assessment -59 تقويم الوحدة 4 - 59	88 99

EXAMPLE PROBLEM 3

Get help with resistance and current: Personal Tutor

EQUIVALENT RESISTANCE AND CURRENT IN A PARALLEL CIRCUIT Three resistors, 60.0 Ω, 30.0 Ω, and 20.0 Ω, are connected in parallel across a 90.0-V battery.

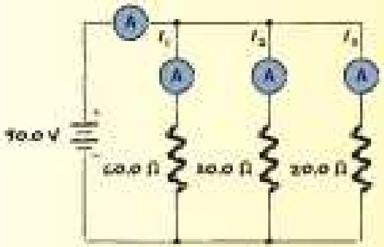
a. Find the current through each branch of the circuit.

b. Find the equivalent resistance of the circuit.

c. Find the current through the battery.

1 ANALYZE AND SKETCH THE PROBLEM

- Draw a schematic of the circuit.
- Include ammeters to show where you would measure each of the currents.



KNOWN	UNKNOWN	
$R_1 = 60.0\ \Omega$	$I_1 = ?$	$I = ?$
$R_2 = 30.0\ \Omega$	$I_2 = ?$	$R = ?$
$R_3 = 20.0\ \Omega$	$I_3 = ?$	
$\Delta V = 90.0\ \text{V}$		

2 SOLVE FOR THE UNKNOWN

a. Because the voltage across each resistor is the same, use $I = \frac{\Delta V}{R}$ for each branch.

$$I_1 = \frac{\Delta V}{R_1} = \frac{90.0\ \text{V}}{60.0\ \Omega} = 1.50\ \text{A}$$

◀ Substitute $\Delta V = 90.0$ V, $R_1 = 60.0\ \Omega$.

$$I_2 = \frac{\Delta V}{R_2} = \frac{90.0\ \text{V}}{30.0\ \Omega} = 3.00\ \text{A}$$

◀ Substitute $\Delta V = 90.0$ V, $R_2 = 30.0\ \Omega$.

$$I_3 = \frac{\Delta V}{R_3} = \frac{90.0\ \text{V}}{20.0\ \Omega} = 4.50\ \text{A}$$

◀ Substitute $\Delta V = 90.0$ V, $R_3 = 20.0\ \Omega$.

b. Use the equivalent resistance equation for parallel circuits.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_3} = \frac{1}{56.0\ \Omega} + \frac{1}{33.0\ \Omega} + \frac{1}{18.0\ \Omega} = 0.100\ \Omega^{-1}$$

◀ Substitute $R_1 = 56.0\ \Omega$, $R_2 = 33.0\ \Omega$, $R_3 = 18.0\ \Omega$.

$$R = 10.0\ \Omega$$

c. Use $I = \frac{\Delta V}{R}$ to find the total current.

$$I = \frac{\Delta V}{R} = \frac{90.0\ \text{V}}{10.0\ \Omega} = 9.00\ \text{A}$$

◀ Substitute $\Delta V = 90.0$ V, $R = 10.0\ \Omega$.

---

59. For **Figure 22**, the battery develops 110 V.

a. Which resistor is the hottest?

b. Which resistor is the coolest?

c. What will ammeter 1 read?

d. What will ammeter 2 read?

e. What will ammeter 3 read?

f. What will ammeter 4 read?

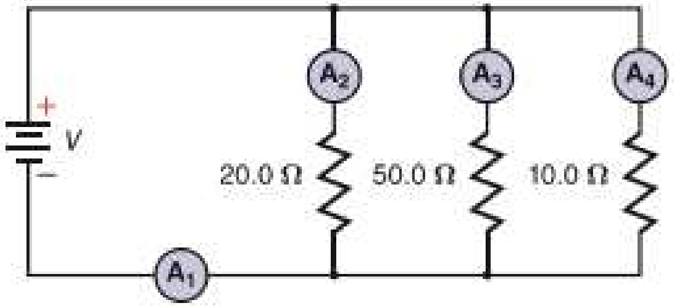
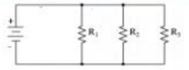


Figure 22

Parallel circuit

There are several paths for the current
The current produced by the battery is not the same current passes through each resistor $I = I_1 + I_2 + I_3$
The potential difference across the battery is the same across each branch $V = V_1 = V_2 = V_3$
The equivalent resistance is $\frac{1}{R_{eq}} = \left[\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right]$
To find the current through the entire circuit $I = \frac{V_{Battery}}{R_{eq}}$ To find the current through each branch $I_1 = \frac{V_1}{R_1}, I_2 = \frac{V_2}{R_2}, I_3 = \frac{V_3}{R_3}$
To find the voltage across the battery $V_{Battery} = I \times R_{eq}$ Or $V = I_1 \times R_1 = I_2 \times R_2 = I_3 \times R_3$

---

a. Which resistor is the hottest?

10.0 Ω. Since $P = V^2/R$ and V is constant in a parallel circuit, the smallest resistor will dissipate the most power.

b. Which resistor is the coolest?

50.0 Ω. Since $P = V^2/R$ and V is constant in a parallel circuit, the largest resistor will dissipate the least power.

c. What will ammeter 1 read?

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$R = \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)} = \frac{1}{\left(\frac{1}{20.0\ \Omega} + \frac{1}{50.0\ \Omega} + \frac{1}{10.0\ \Omega}\right)} = 5.88\ \Omega$$

$$I = \frac{V}{R} = \frac{1.1\times10^2\ \text{V}}{5.88\ \Omega} = 19\text{A}$$

d. What will ammeter 2 read?

$$I = \frac{V}{R} = \frac{1.1\times10^2\ \text{V}}{20.0\ \Omega} = 5.5\ \text{A}$$

e. What will ammeter 3 read?

$$I = \frac{V}{R} = \frac{1.1\times10^2\ \text{V}}{50.0\ \Omega} = 2.2\ \text{A}$$

f. What will ammeter 4 read?

$$I = \frac{V}{R} = \frac{1.1\times10^2\ \text{V}}{10.0\ \Omega} = 11\ \text{A}$$

17	يحسب المقاومة المكافئة في دائرة كهربائية مركبة. يحسب فرق الجهد ومقدار التيار الكهربائي المار والقدرة الكهربائية المبددة لكل مقاوم في دائرة كهربائية مركبة Calculate the equivalent resistance of combined series-parallel circuits. Calculate the voltage, current, and power dissipation for any resistor in a combined series-parallel circuit.	Example 4 مثال Ch4 Assessment -73 ,78 تقويم الوحدة 4 - 73و78	94 100

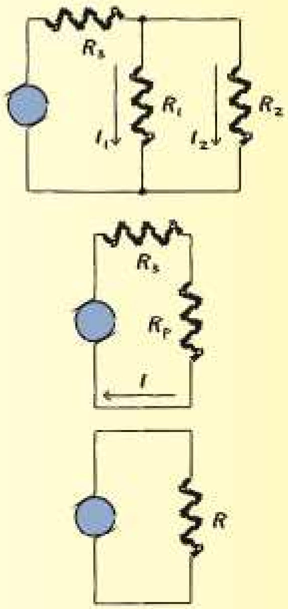
EXAMPLE PROBLEM 4

Find help with **significant digits.** Math Handbook

SERIES-PARALLEL CIRCUIT A hair dryer with a resistance of 12.0 Ω and a lamp with a resistance of 125 Ω are connected in parallel to a 125-V source through a 1.50-Ω resistor in series. Find the current through the lamp when the hair dryer is on.

1 ANALYZE AND SKETCH THE PROBLEM

- Draw the series-parallel circuit including the hair dryer and the lamp.
- Replace R_1 and R_2 with a single equivalent resistance, R_p.



KNOWN		UNKNOWN	
$R_1 = 125\ \Omega$	$R_3 = 1.50\ \Omega$	$I = ?$	$I_1 = ?$
$R_2 = 12.0\ \Omega$	$\Delta V_{source} = 125\ V$	$R = ?$	$R_p = ?$

2 SOLVE FOR THE UNKNOWN

Find the equivalent resistance for the parallel circuit, then find the equivalent resistance for the entire circuit, and then calculate the current.

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{125\ \Omega} + \frac{1}{12.0\ \Omega}$$ ◀ Substitute $R_1 = 125\ \Omega$, $R_2 = 12.0\ \Omega$.

$R_P = 10.9\ \Omega$

$$R = R_3 + R_p = 1.50\ \Omega + 10.9\ \Omega = 12.4\ \Omega$$ ◀ Substitute $R_3 = 1.50\ \Omega$, $R_p = 10.9\ \Omega$.

$$I = \frac{\Delta V_{source}}{R} = \frac{125\ V}{12.4\ \Omega} = 10.1\ A$$ ◀ Substitute $\Delta V_{source} = 125\ V$, $R = 12.4\ \Omega$.

$$\Delta V_3 = IR_3 = (10.1\ A)(1.50\ \Omega) = 15.2\ V$$ ◀ Substitute $I = 10.1\ A$, $R_3 = 1.50\ \Omega$.

$$\Delta V_1 = \Delta V_{source} - \Delta V_3 = 125\ V - 15.2\ V = 1.10\times10^2\ V$$ ◀ Substitute $\Delta V_{source} = 125\ V$, $V_3 = 15.2\ V$.

$$I_1 = \frac{\Delta V_1}{R_1} = \frac{1.10\times10^2\ V}{125\ \Omega} = 0.880\ A$$ ◀ Substitute $\Delta V_1 = 1.10\times10^2\ V$, $R_1 = 125\ \Omega$.

73. Refer to **Figure 23** and assume that all the resistors are 30.0 Ω. Find the equivalent resistance.

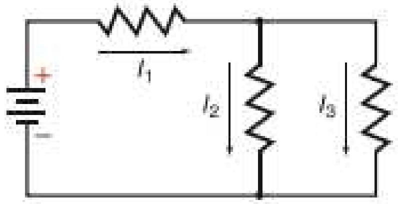


Figure 23

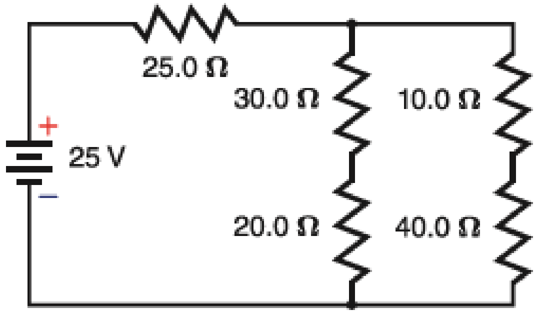
The parallel combination of the two 30.0-Ω resistors has an equivalent resistance of 15.0 Ω.

So $R = 30.0\ \Omega + 15.0\ \Omega = 45.0\ \Omega$

78. Ranking Task Consider the resistors in the circuit in **Figure 24.** Rank them from least to greatest specifically indicating any ties, using the following criteria:

a. the current through each

b. the potential difference across each



17	يحسب المقاومة المكافئة في دائرة كهربائية مركبة. يحسب فرق الجهد ومقدار التيار الكهربائي المار والقدرة الكهربائية المبددة لكل مقاوم في دائرة كهربائية مركبة Calculate the equivalent resistance of combined series-parallel circuits. Calculate the voltage, current, and power dissipation for any resistor in a combined series-parallel circuit.	Example 4 مثال Ch4 Assessment -73 ,78 تقويم الوحدة 4 - 73و78	94 100

78. Ranking Task Consider the resistors in the circuit in **Figure 24.** Rank them from least to greatest specifically indicating any ties, using the following criteria:

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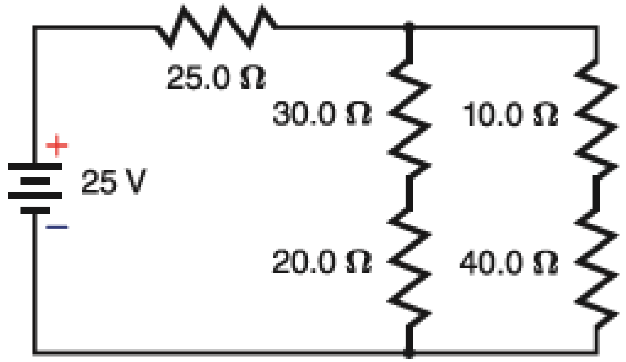


a. Determine the total resistance.

The 30.0-Ω and 20.0-Ω resistors are in series.

$R_1 = 30.0\ \Omega + 20.0\ \Omega = 50.0\ \Omega$

The 10.0-Ω and 40.0-Ω resistors are in series.

$R_2 = 10.0\ \Omega + 40.0\ \Omega = 50.0\ \Omega$

R_1 and R_2 are in parallel.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$R = \frac{1}{\left(\frac{1}{R_1} + \frac{1}{R_2}\right)}$$

$$= \frac{1}{\left(\frac{1}{50.0\ \Omega} + \frac{1}{50.0\ \Omega}\right)}$$

$= 25.0\ \Omega$ and is in series with the 25.0-Ω resistor

$R_{Total} = 25.0\ \Omega + 25.0\ \Omega = 50.0\ \Omega$

b. Determine the current through the 25-Ω resistor.

use Ohm's law and R_{Total}

$$I = \frac{V}{R_{Total}} = \frac{25\ V}{50.0\ \Omega} = 0.50\ A$$

c. Which resistor is the hottest? Coolest?

$P = I^2R = (0.50\ A)^2(25.0\ \Omega) = 6.25\ W$

18	يطبق قاعدة اليد اليمنى لتحديد اتجاه القوة المؤثرة على سلك يمر به تيار وموضوع في مجال مغناطيسي. يطبق المعادلة ($F = ILB\sin(\theta)$)لحساب مقدار القوة المؤثرة على جزء مستقيم من سلك يحمل تيارا كهربائيا في مجال مغناطيسي منتظم. **Apply the right-hand rule to find the direction of the force on a current-carrying wire placed in an external magnetic field.** **Apply the equation $F = ILB\sin(\theta)$ to calculate the magnitude of the force on a straight segment of a current-carrying wire placed in a uniform magnetic field.**	**Example 1 مثال** **Applications 21,23 تطبيقات** **تقويم الوحدة 5 -70 و71** **Ch5 Assessment 70, 71**	**116** **126**

21. A wire that is 75 cm long and carrying a current of 6.0 A is at right angles to a uniform magnetic field. The magnitude of the force acting on the wire is 0.60 N. What is the strength of the magnetic field?

$$B = \frac{F}{IL} = \frac{0.60\ \text{N}}{(6.0\ \text{A})(0.75\ \text{m})} = 0.13\ \text{T}$$

23. How much current would be required to produce a force of 0.38 N on a 10.0-cm length of wire at right angles to a 0.49-T field?

$$F = BIL$$

$$I = \frac{F}{BL} = \frac{0.38\ \text{N}}{(0.49\ \text{T})(0.100\ \text{m})} = 7.8\ \text{A}$$

70. A current-carrying wire is placed between the poles of a magnet, as shown in **Figure 31.** What is the direction of the force on the wire?

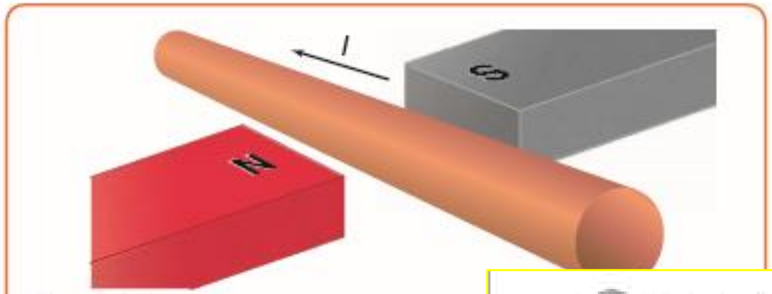
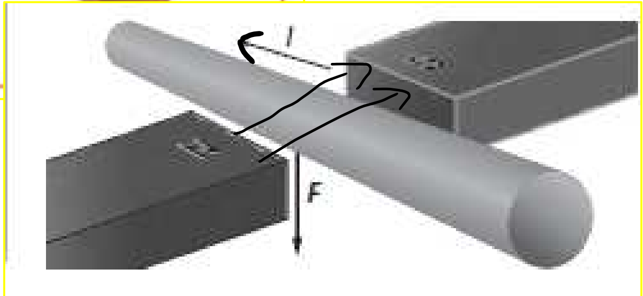


Figure 31



71. The force on a 0.80-m wire that is perpendicular to Earth's magnetic field is 0.12 N. What is the current in the wire? Use 5.0×10^{-5} T for Earth's magnetic field.

$F = BIL$, so

$$I = \frac{F}{BL} = \frac{0.12\ \text{N}}{(5.0\times10^{-5}\ \text{T})(0.80\ \text{m})}$$

$$= 3.0\times10^{3}\ \text{A} = 3.0\ \text{kA}$$

19	يشرح أهمية مجزئ الجهد لتوليد فرق الجهد المطلوب. يشرح كيف تعمل المنصهرات وقواطع الدائرة الكهربائية وقاطع التيار بسبب الأعطال على حماية الدوائر الكهربائية Explain how fuses, circuit breakers and ground-fault interrupters protect electric circuits and make them safe to operate. Explain the importance of a voltage-divider circuit to achieve a desired potential difference. Describe the principle and working of a simple electric motor and the energy conversions that occur.	كما ورد في الكتاب As mentioned in textbook	83 91

Safety Devices

In an electric circuit, fuses and circuit breakers prevent circuit overloads that can occur when too many appliances are turned on at the same time or when a short circuit occurs in one appliance. A **short circuit** occurs when a circuit with very low resistance is formed. When appliances are connected in parallel, each additional appliance placed in operation reduces the equivalent resistance in the circuit and increases the current through the wires. This additional current might produce enough thermal energy to melt the wiring's insulation, cause a short circuit, or even begin a fire.

A **fuse** is a short piece of metal that acts as a safety device by melting and stopping the current when too large a current passes through it. Engineers design fuses to melt before other elements in a circuit are damaged. A **circuit breaker,** shown in **Figure 11,** is an automatic switch that acts as a safety device by stopping the current if the current gets too large and exceeds a threshold value.

Usually, current follows a single path from the power source through an electrical appliance and back to the source. An appliance malfunction or an accidental drop of the appliance into water can result in additional current pathways. A **ground-fault interrupter** (GFI) is a device that contains an electronic circuit that detects small current differences between the two wires in the cord connected to an appliance. An extra current path, such as one through water, could cause this difference. The GFI stops the current when it detects such differences. This often protects a person from electrocution.

Household circuits Some of the most common uses of fuses, circuit breakers, and GFIs are in household circuits. How are these household circuits designed? Are the lights and outlets in a household circuit wired in series or in parallel? Think about what would happen if all the lights and outlets in a household circuit were wired in series. You would only be able to turn everything on and off at once. This is not what we observe in real houses.

The top panel of **Figure 12** shows a simplified household circuit. Notice that this is a parallel circuit with a 15-A fuse connected in series with the 120-V power source. Each resistor represents a light or an electrical appliance. The current in any one branch of the circuit does not depend on the currents in the other branches. This explains how you can turn off the bathroom light without turning off the television. Everything turns off if the fuse wire melts, however.

Let's consider a specific example. Suppose that the three resistors in **Figure 12** represent a 240-W television, a 720-W straightening iron, and a 1440-W hair dryer. We want to know if the fuse will melt, or "blow," if all three appliances are turned on at the same time.

You can use $I = \frac{P}{\Delta V}$ to find the current through each appliance.

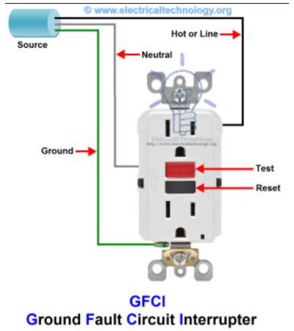
For the television, $I_{TV} = \frac{240\ W}{120\ V} = 2.0\ A$. For the straightening iron, $I_{iron} = \frac{720\ W}{120\ V} = 6.0\ A$. The current through the hair dryer is $I_{dryer} = \frac{1440\ W}{120\ V} = 12\ A$.

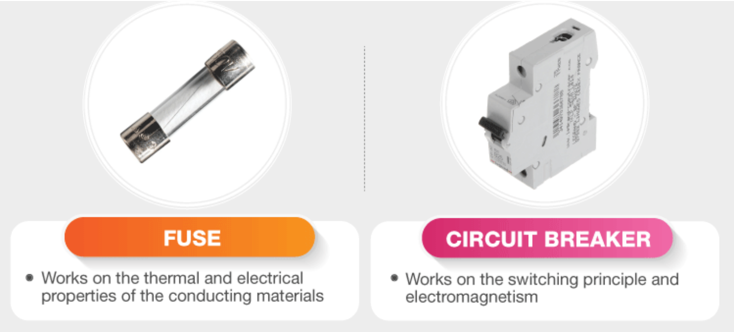
From Kirchhoff's junction rule, we can see that the current through the fuse equals the sum of the currents through the television, the straightening iron, and the hair dryer.

$$I_{fuse} = I_{TV} + I_{iron} + I_{hair}$$
$$= 2.0\ A + 6.0\ A + 12\ A$$
$$= 20\ A$$

Is this enough current to blow the fuse? The fuse in **Figure 12** is rated at 15 A, so the 20-A current from the television, the straightening iron, and the hair dryer would blow the fuse. This would stop current throughout the circuit.

19	يشرح أهمية مجزئ الجهد لتوليد فرق الجهد المطلوب. يشرح كيف تعمل المنصهرات وقواطع الدائرة الكهربائية وقاطع التيار بسبب الأعطال على حماية الدوائر الكهربائية Explain how fuses, circuit breakers and ground-fault interrupters protect electric circuits and make them safe to operate. Explain the importance of a voltage-divider circuit to achieve a desired potential difference.	كما ورد في الكتاب As mentioned in textbook	83 91





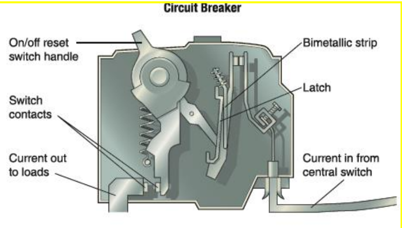


Figure 11 When there is too much current through the bimetallic strip in a circuit breaker, the heat that is generated causes the strip to bend and release the latch. The handle moves to the off position, causing the switch to open and the current to stop.

- <u>circuit breakers, fuses, and ground-fault interrupters (GFIs) are safety devices</u> are added to circuits *<u>to prevent damage</u>*.
- In an electric circuit, fuses and circuit breakers <u>**prevent circuit overloads that can occur when too many appliances are turned on at the same time**</u> **or** <u>**when a short circuit occurs in one appliance**</u>
- **A fuse** **is a short piece of metal that acts as a safety device by melting and stopping the current when too large a current passes through itFuses are designed to melt before other elements in a circuit are damaged.**
- **A circuit breaker is an automatic switch that acts as a safety device by stopping the current if the current gets too large and exceeds a threshold value**When there is **too much current** through the bimetallic strip in a circuit breaker, the **heat** that is generated causes the **strip to bend and release the latch**. The handle moves to the off position, <u>**causing the switch to open and the current to stop.**</u>
- **A ground-fault interrupter (GFI) is a device that contains an electronic circuit that detects small current differences between the two wires in the cord connected to an appliance. An extra current path, such as one through water, could cause this difference. The GFI stops the current when it detects such differences. This often protects a person from electrocution.**

Explain the importance of a voltage-divider circuit to achieve a desired potential difference.	As mentioned in textbook	

You could use a type of series circuit called a voltage divider. A **voltage divider** produces a source of potential difference that is less than the potential difference across the battery.

Consider the circuit shown in **Figure 4.** Two resistors (R_1 and R_2) are connected in series across a battery with potential difference V. The equivalent resistance of the circuit is

$$R = R_1 + R_2.$$

The current is represented by the following equation:

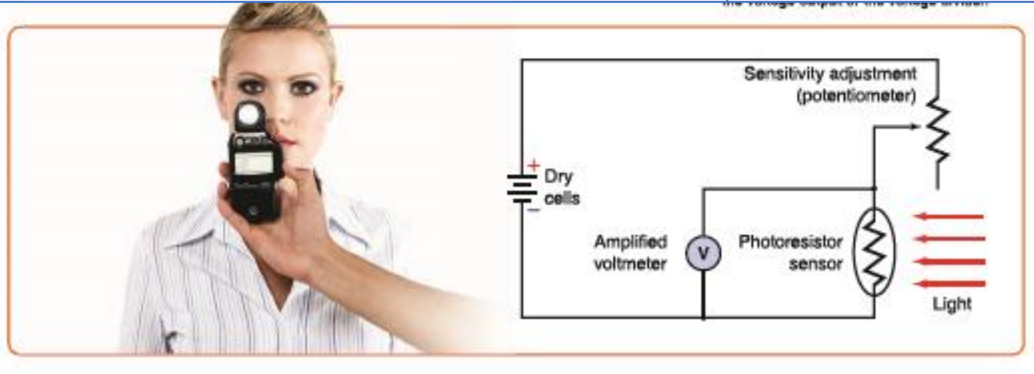
$$I = \frac{\Delta V}{R} = \frac{\Delta V}{R_1 + R_2}$$

The desired voltage (5 V) is the voltage drop (ΔV_2) across resistor R_2: $\Delta V_2 = IR_2$. Substitute the earlier equation into this equation as shown:

$$\Delta V_2 = IR_2 = \left(\frac{\Delta V}{R_1 + R_2}\right)R_2 = \frac{\Delta V R_2}{R_1 + R_2}$$

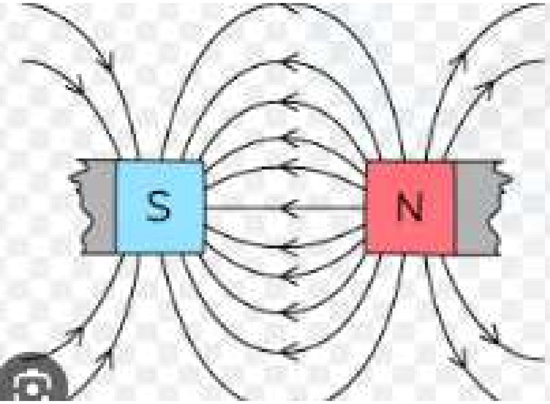
By choosing the right resistors, you can produce a potential difference of 5 V across a portion of an electric circuit even if you only have a 9-V battery available.

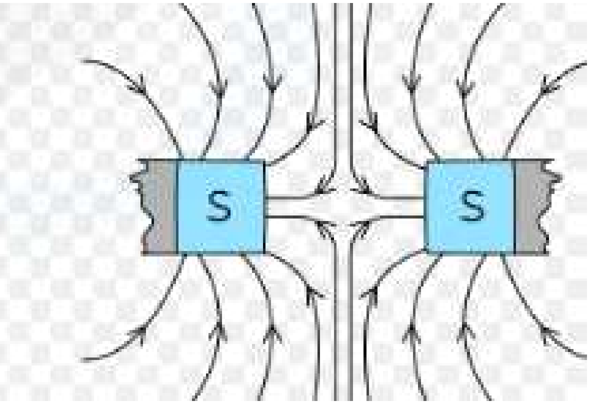
Figure 5 Light meters used in photography use a voltage divider. The amount of light striking the photoresistor sensor determines the voltage output of the voltage divider.



$$\Delta V_2 = IR_2 = \left(\frac{\Delta V}{R_1 + R_2}\right)R_2 = \frac{\Delta V R_2}{R_1 + R_2}$$

19	Describe the principle and working of a simple electric motor and the energy conversions that occur.		
	يوضح القوى المغناطيسية التي تؤثر عند تقريب مغناطيسين متشابهين او مختلفين في مغناطيسين دائمين من بعضهما (من حيث التفاعل واتجاه خطوط المجال). Describe the forces that occur when like or unlike poles of two permanent magnets are brought close together (in terms of the interaction between the magnetic fields and the orientation of the magnetic field lines).	كما ورد في الكتاب As mentioned in textbook	110





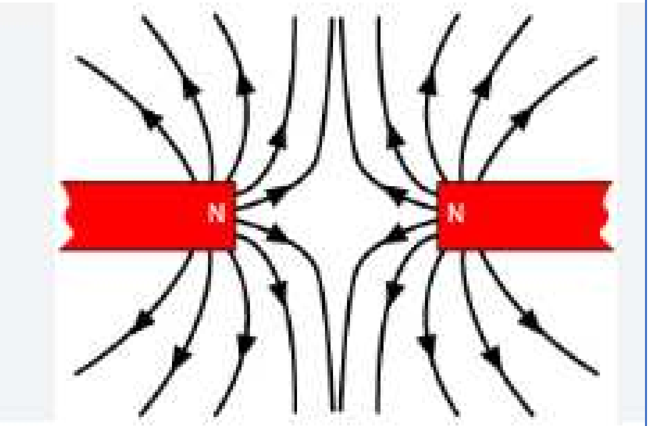
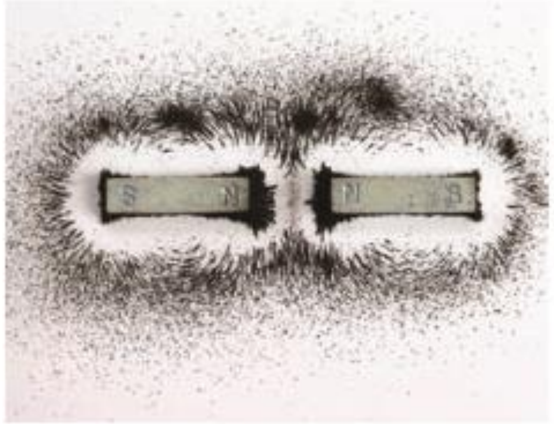
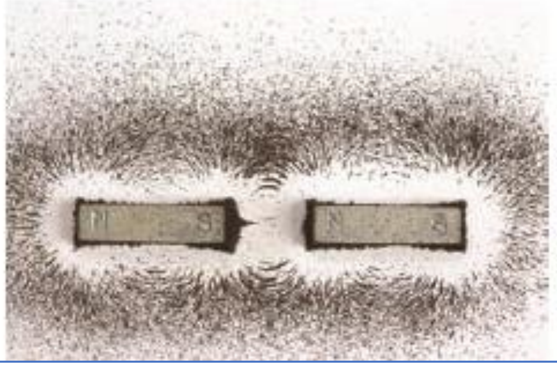


Figure 8 Iron filings can be used to visualize the magnetic field around two like poles (top) and around two unlike poles (bottom). The iron filings help us understand how like poles repel and unlike poles attract.



Like poles repel.



Forces on permanent magnets Magnetic fields exert forces on magnets. When like poles of two magnets are close together, the field produced by the north pole of one magnet pushes the north pole of the second magnet away in the direction of the field lines, as shown by the iron filings in the top panel of **Figure 8.** Now look at the bottom panel of **Figure 8.** The field from the north pole of one magnet now acts on the south pole of the second magnet, attracting it in a direction opposite the field lines. The magnetic field is continuous, forming arcs from one magnet to the other.

20	يطبق المعادلة ($F = qvBsin(\theta)$) لحساب مقدار القوة المؤثرة على جسيم مشحون يتحرك في مجال مغناطيسي. يطبق قاعدة اليد اليمنى لتحديد اتجاه القوة المؤثرة على جسيم مشحون يتحرك في مجال مغناطيسي. Apply the equation $F = qvBsin(\theta)$ to calculate the magnitude of the force acting on a charged particle moving in a magnetic field. Apply the right-hand rule to determine the direction of the force acting on a charged particle moving in a magnetic field.	مثال 2، تطبيق 26 Example2, Exercise 26	120

26. What are the magnitude and direction of the force acting on the proton shown in **Figure 20?**

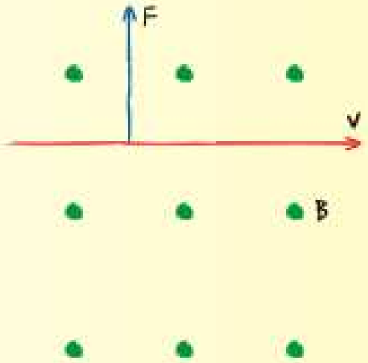
EXAMPLE PROBLEM 2

Get help with **force on a charged particle.** Personal Tutor

FORCE ON A CHARGED PARTICLE IN A MAGNETIC FIELD A beam of electrons travels at 3.0×10^{6} m/s through a uniform magnetic field of 4.0×10^{-2} T at right angles to the field. How strong is the force acting on each electron?

1 ANALYZE AND SKETCH THE PROBLEM

Draw the beam of electrons and its direction of motion (v). Indicate the magnetic field (B) and the force on the electron beam (F). Note that the direction of force is opposite that given by the right-hand rule because of the electron's negative charge.



KNOWN	UNKNOWN
$v = 3.0\times10^{6}$ m/s	$F = ?$
$B = 4.0\times10^{-2}$ T	
$q = -1.602\times10^{-19}$ C	

2 SOLVE FOR THE UNKNOWN

$F = qvB$

$= (-1.602\times10^{-19}\ \text{C})(3.0\times10^{6}\ \text{m/s})(4.0\times10^{-2}\ \text{T})$ ◀ Substitute $q = -1.602\times10^{-19}$ C, $v = 3.0\times10^{6}$ m/s, $B = 4.0\times10^{-2}$ T

$= -1.9\times10^{-14}$ N

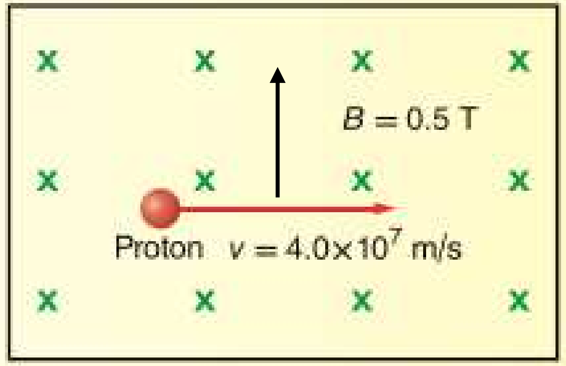


Figure 20

An electron passes through a magnetic field at right angles to the field at a velocity of 4.0×10^{6} m/s. The strength of the magnetic field is 0.50 T. What is the magnitude of the force acting on the electron?

$F = Bqv$

$= (0.50\ \text{T})(1.60\times10^{-19}\ \text{C})(4.0\times10^{6}\ \text{m/s})$

$= 3.2\times10^{-13}$ N

All the Best for Your Exam…