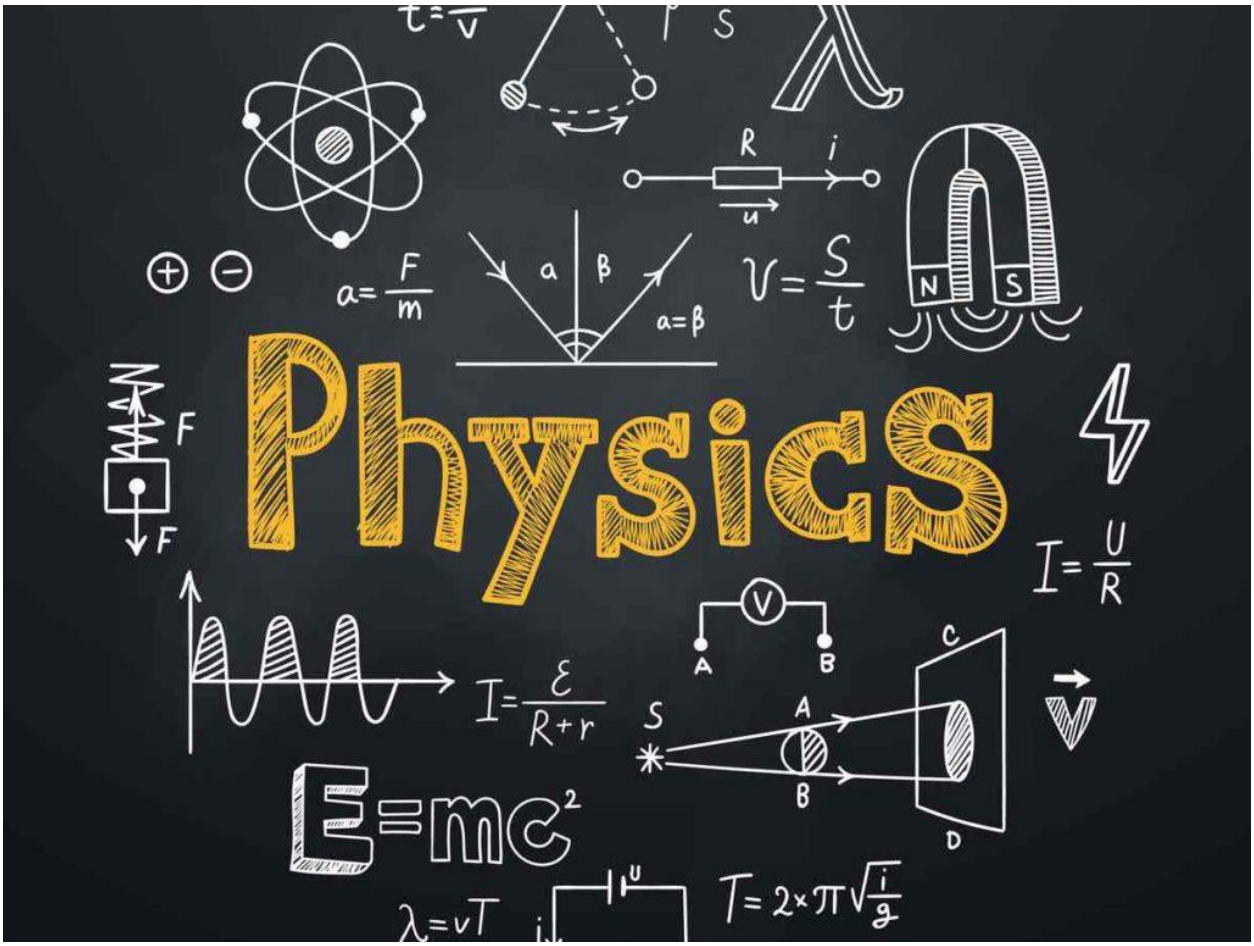
MS/ Rahma (online private teacher)
Mobile number/ 557368293

a

EOT Revision

Term 2 2024

Grade 12 (General)



MS/ Rahma (online private teacher)
Mobile number/ 557368293

Page 82 (MSQ)

Academic Year / العام الدراسي	2024/2023	* / السؤال*	Learning Outcome/Performance Criteria / ناتج التعلم/ معايير الأداء**	Reference(s) in the Student Book (English Version) / مثال/تمرين Example/Exercise	صفحة Page
Term / الفصل	2	1	Explain the characteristics of a series circuit. يشرح خصائص دائرة التوالي.	كما ورد في الكتاب As mentioned in textbook	82

the **equivalent resistance** of the circuit. For resistors in series, the same current would exist in the circuit with a single resistor (R) that has a resistance equal to the sum of the individual resistances.

EQUIVALENT RESISTANCE FOR RESISTORS IN SERIES
The equivalent resistance of resistors in series equals the sum of the individual resistances of the resistors.

$$R = R_1 + R_2 + \ldots$$

Notice that the equivalent resistance is greater than that of any individual resistor. Therefore, if the battery voltage does not change, adding more devices in series always decreases the current. To find the current through a series circuit, first calculate the equivalent resistance and then use the following equation.

CURRENT
The current through a series circuit is equal to the potential difference across the power source divided by the equivalent resistance.

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

Online learning
Term 3 2024

Series circuit

A circuit such as this, in which there is only one path for the current, is called a series circuit

$I = I_1 = I_2 = I_3$ equals

$V_{battery} = V_1 + V_2 + V_3$ divided

$= R_{eq} = R_1 + R_2 + R_3$

The characteristics of a series circuit?

1- The equivalent resistance greater than any individual resistance.
2- All resistors have the same current.
3- Adding more devices decreases the current.

MS/ Rahma (online private teacher)
Mobile number/ 557368293

1. Three 22 Ω resistors are connected in series across a 125 V generator. What is the equivalent resistance of the circuit? What is the current in the circuit?
2. A 12 Ω, a 15 Ω, and a 5 Ω resistor are connected in a series circuit with a 75 V battery. What is the equivalent resistance of the circuit? What is the current in the circuit?
3. A string of lights has ten identical bulbs with equal resistances connected in series. When the string of lights is connected to a 117 V outlet, the current through the bulbs is 0.06 A. What is the resistance of each bulb?
4. A 9 V battery is in a circuit with three resistors connected in series.
   a. If the resistance of one of the resistors increases, how will the equivalent resistance change?
   b. What will happen to the current?
   c. Will there be any change in the battery voltage?
5. **CHALLENGE** Calculate the potential differences across three resistors, 12 Ω, 15 Ω, and 5 Ω, that are connected in series with a 75 V battery. Verify that the sum of their potential differences equals the potential difference across the battery.

$$R = R_1 + R_2 + R_3 = 22\ \Omega + 22\ \Omega + 22\ \Omega = 66\ \Omega \quad (1$$

$$I = \frac{\Delta V}{R} = \frac{125\ V}{66\ \Omega} = 2.9\ A$$

$$R = R_1 + R_2 + R_3 = 12\ \Omega + 15\ \Omega + 5\ \Omega = 32\ \Omega \quad (2$$

$$I = \frac{\Delta V}{R} = \frac{75\ V}{32\ \Omega} = 2.3\ A$$

$$R = \frac{\Delta V}{I} = \frac{117\ V}{0.06\ A} = 2.0 \times 10^3\ \Omega \quad (3$$

$$R_{\text{مصباح}} = \frac{R}{10} = \frac{2.0 \times 10^3\ \Omega}{10} = 2.0 \times 10^2\ \Omega$$

(4

a- Req will increase

b- Current will decrease علاقه عكسية بين المقاومه والتيار

c- The voltage will not change

(5

$$\Delta V_1 = IR1 = (2.3\ A)(12\ \Omega) = 28\ V$$
$$\Delta V_2 = IR2 = (2.3\ A)(15\ \Omega) = 35\ V$$
$$\Delta V_3 = IR3 = (2.3\ A)(5\ \Omega) = 12\ V$$
$$\Delta V_1 + \Delta V_2 + \Delta V_3 = 28\ V + 35\ V + 12 = 75\ V = \text{جهد البطارية}$$

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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

Page 83 (FRQ)

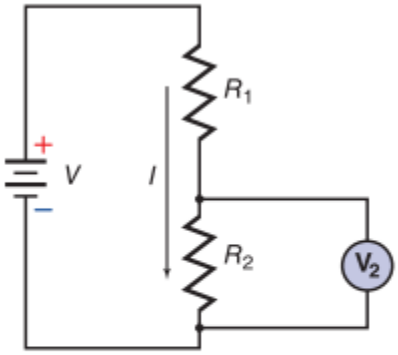


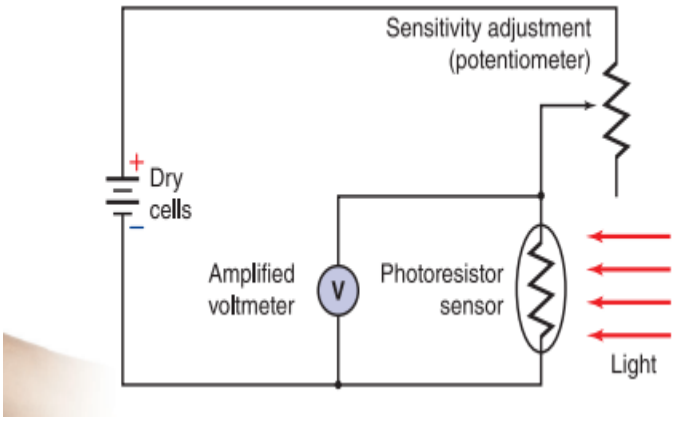
Figure 4 This voltage-divider circuit demonstrates how a voltage of desired magnitude can be achieved by choosing the right combination of resistors.

Voltage divider:

Produces a source of potential difference that is less than the potential difference across the battery.

يولد مجزي الجهد مصدرا لفرق جهد أقل من جهد البطارية

$$\Delta V_2 = \frac{\Delta V R_2}{R_1 + R_2}$$



Light meters

Used in photography use a voltage divider. The amount of light striking the photoresist or sensor determines the voltage output of the voltage **divider.**

Photoresistor

-Voltage dividers used with sensors as Photoresistor.

-It depend on the amount of light strikes it.

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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

Page 84 (MSQ)

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

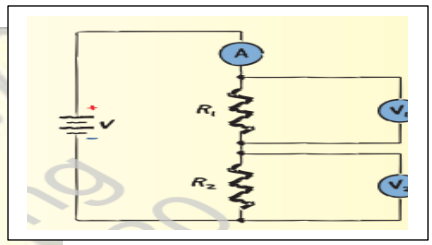
a. What is the current in the circuit?

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?

MS/ Rahma (online private teacher)
Mobile number/ 557368293



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

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

$$= \frac{\Delta V_{source}}{R_1 + R_2}$$ ◄ 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 $I = 0.37\ A$, $R_2 = 82\ \Omega$

$$= 3.0 \times 10^1\ V$$

Online Learning
Term 3 AY 1...

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

Page 85(MSQ)

MS/ Rahma (online private teacher)
Mobile number/ 557368293

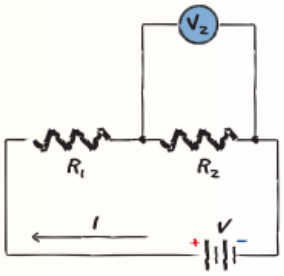
Online Learning
Term 3 AY 19/2

EXAMPLE 2

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

$$= \frac{(9.0\ V)(470\ \Omega)}{390\ \Omega + 470\ \Omega}$$

◀ Substitute $\Delta V_{source} = 9.0\ V,\ R_1 = 390\ \Omega,\ R_2 = 470\ \Omega$

$$= 4.9\ V$$

APPLICATIONS

11. A 22 Ω resistor and a 33 Ω resistor are connected in series and are connected to a 120 V power source.

a. What is the equivalent resistance of the circuit?

b. What is the current in the circuit?

c. What is the potential difference across each resistor?

12. Three resistors of 3.3 kΩ, 4.7 kΩ, and 3.9 kΩ are connected in series across a 12 V battery.

a. What is the equivalent resistance?

b. What is the current through the resistors?

c. Find the total potential difference across the three resistors.

13. CHALLENGE Select a resistor to be used as part of a voltage divider along with a 1.2 kΩ resistor. The potential difference across the 1.2 kΩ resistor is to be 2.2 V when the supply is 12 V.

MS/ Rahma (online private teacher)
Mobile number/ 557368293

(11

$$R = R_1 + R_2 = 22\,\Omega + 33\,\Omega = 55\,\Omega \quad .a$$

$$I = \frac{V}{R} = \frac{120\,\text{V}}{55\,\Omega} = 2.2\,\text{A} \quad .b$$

$$V_1 = IR_1 = \left(\frac{V}{R}\right)R_1 = \left(\frac{120\,\text{V}}{55\,\Omega}\right)(22\,\Omega) = 48\,\text{V} \quad .c$$

$$V_2 = IR_2 = \left(\frac{120\,\text{V}}{55\,\Omega}\right) = 72\,\text{V}$$

$$V = 48\,\text{V} + 72\,\text{V} = 120\,\text{V} \quad .d$$

(12

$$R = 3.3\ \text{k}\Omega + 4.7\ \text{k}\Omega + 3.9\ \text{k}\Omega = 11.9\ \text{k}\Omega \quad \text{a.}$$

$$I = \frac{\Delta V}{R} = \frac{12\,V}{1.19 \times 10^4\,\Omega} = 1.0\ \text{mA} = 1.0 \times 10^{-3}\ \text{A} \quad \text{b.}$$

$$\Delta V = 3.3\ \text{V} + 4.7\ \text{V} + 3.9\ \text{V} = 11.9\ \text{V} \quad \text{c.}$$

(13

$$\Delta V_2 = \frac{\Delta V R_2}{R_1 + R_2} \quad \Rightarrow \quad R_1 = \frac{\Delta V R_2}{\Delta V_2} - R_2$$

$$= \frac{(12.0\ \text{V})(1.2\ \text{k}\Omega)}{2.2\ \text{V}} - 1.2\ \text{k}\Omega$$

$$= 5.3\ \text{k}\Omega$$

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

Page 88 (FRQ)

A parallel circuit: - A circuit in which there are several current paths

$$I = I_1 + I_2 + I_3.$$

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

$$I = \frac{\Delta V}{R}$$

MS/ Rahma (online private teacher)
Mobile number/ 557368293

EXAMPLE 3

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.

SOLVE FOR THE UNKNOWN

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

$$I_1 = \frac{\Delta V}{R_1}$$

$$= \frac{90.0\ \text{V}}{60.0\ \Omega} \quad \blacktriangleleft \text{ Substitute } \Delta V = 90.0\ \text{V}, R_1 = 60.0\ \Omega$$

$$= 1.50\ \text{A}$$

$$I_2 = \frac{\Delta V}{R_2}$$

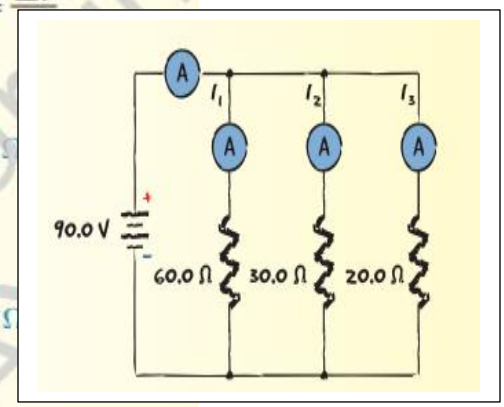
$$= \frac{90.0\ \text{V}}{30.0\ \Omega} \quad \blacktriangleleft \text{ Substitute } \Delta V = 90.0\ \text{V}, R_2 = 30.0\ \Omega$$

$$= 3.00\ \text{A}$$

$$I_3 = \frac{\Delta V}{R_3}$$

$$= \frac{90.0\ \text{V}}{20.0\ \Omega} \quad \blacktriangleleft \text{ Substitute } \Delta V = 90.0\ \text{V}, R_3 = 20.0\ \Omega.$$

$$= 4.50\ \text{A}$$



b. Use the equivalent resistance equation for parallel circuits.

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

$$= \frac{1}{60.0\ \Omega} + \frac{1}{30.0\ \Omega} + \frac{1}{20.0\ \Omega} \quad \blacktriangleleft \text{ Substitute } R_1 = 60.0\ \Omega, R_2 = 30.0\ \Omega, R_3 = 20.0\ \Omega.$$

$$= 0.100\ \Omega^{-1}$$

$$R = 10.0\ \Omega$$

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

$$I = \frac{\Delta V}{R}$$

$$= \frac{90.0\ \text{V}}{10.0\ \Omega} \quad \blacktriangleleft \text{ Substitute } \Delta V = 90.0\ \text{V}, R = 10.0\ \Omega.$$

$$= 9.00\ \text{A}$$

Online Learning Term 3 Aid

MS/ Rahma (online private teacher)
Mobile number/ 557368293

APPLICATIONS

14. You connect three 15.0 Ω resistors in parallel across a 30.0 V battery.

a. What is the equivalent resistance of the parallel circuit?

b. What is the current through the entire circuit?

c. What is the current through each branch of the circuit?

15. Suppose you replace one of the 15.0 Ω resistors in the previous problem with a 10.0 Ω resistor.

a. How does the equivalent resistance change?

b. How does the current through the entire circuit change?

c. How does the current through one of the 15.0 Ω resistors change?

16. You connect a 120.0 Ω resistor, a 60.0 Ω resistor, and a 40.0 Ω resistor in parallel across a 12.0 V battery.

a. What is the equivalent resistance of the parallel circuit?

b. What is the current through the entire circuit?

c. What is the current through each branch of the circuit?

17. CHALLENGE You are trying to reduce the resistance in a branch of a circuit from 150 Ω to 93 Ω. You add a resistor to this branch of the circuit to make this change. What value of resistance should you use, and how should you connect this resistor?

(14

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}=\frac{1}{15.0\ \Omega}+\frac{1}{15.0\ \Omega}+\frac{1}{15.0\ \Omega}=\frac{3}{15.0\ \Omega}\Rightarrow R=5.00\ \Omega \quad \text{a.}$$

$$I=\frac{\Delta V}{R}=\frac{30.0\ \text{V}}{5.00\ \Omega}=6.00\ \text{A} \quad \text{b.}$$

$$I=\frac{\Delta V}{R_1}=\frac{30.0\ \text{V}}{15.0\ \Omega}=2.00\ \text{A} \quad \text{c.}$$

(15 a . تصبح أصغر مقدارا. b . يصبح أكبر مقدارا . c . تبقى كما هي (التيارات مستقلة)

Parallel

(16

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}=\frac{1}{120.0\ \Omega}+\frac{1}{60.0\ \Omega}+\frac{1}{40.0\ \Omega}\Rightarrow R=20.0\ \Omega \quad \text{a.}$$

$$I=\frac{\Delta V}{R}=\frac{12.0\ \text{V}}{20.0\ \Omega}=0.600\ \text{A} \quad \text{b.}$$

$$I_1=\frac{\Delta V}{R_1}=\frac{12.0\ \text{V}}{120.0\ \Omega}=0.100\ \text{A} \qquad I_2=\frac{\Delta V}{R_2}=\frac{12.0\ \text{V}}{60.0\ \Omega}=0.200\ \text{A} \qquad I_3=\frac{\Delta V}{R_3}=\frac{12.0\ \text{V}}{40.0\ \Omega}=0.300\ \text{A} \quad \text{c.}$$

التوصيل على التوازي هو المطلوب لتقليل مقدار المقاومة

(17

$$\frac{1}{R}=\frac{1}{R_A}+\frac{1}{R_B}\Rightarrow\frac{1}{R_A}=\frac{1}{R}-\frac{1}{R_B}=\frac{1}{93\ \Omega}-\frac{1}{150\ \Omega}\Rightarrow R_A=2.4\times10^2\ \Omega$$

مقدار المقاومة التي يجب إضافتها يساوي $2.4\times10^2\ \Omega$ وتوصل على التوازي مع المقاومة150 Ω

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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
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 القسم2 30	90 95

Page 89 – 90 (MSQ)

قانون كيرشوف Kirchhoff's Rules	
قاعده الوصلة the junction rule	قاعده الحلقه the loop rule
Based on the law of conservation of charge قانون حفظ الشحنه (charge can neither be created nor destroyed)	Based on low of conservation energy مبني علي قانون حفظ الطاقه الطاقه لا تفني ولا تستحدث من عدم
In an electric circuit the total current into a section of that circuit must equal the total current out of that same section.	The sum of increases in electric potential energy around a loop in electric circuit equals the sum of decreases in electric potential around that loop.

SECTION 1 REVIEW

18. **MAIN**IDEA Compare and contrast the voltages and the currents in series and parallel circuits.

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?

21. **Circuits** You connect a switch in series with a 75 W bulb to a 120 V power source.
    a. What is the potential difference across the switch when it is closed (turned on)?
    b. What is the potential difference across the switch when it is opened (turned off)?

22. Compare Kirchhoff's loop rule to walking around in a loop on the side of a hill.

23. Explain how Kirchhoff's junction rule relates to the law of conservation of charge.

24. **Critical Thinking** The circuit in **Figure 10** has four identical resistors. Suppose that a wire is added to connect points A and B. Answer the following questions, and explain your reasoning.
    a. What is the current through the wire?
    b. What happens to the current through each resistor?
    c. What happens to the current through the battery?
    d. What happens to the potential difference across each resistor?

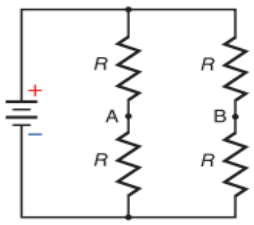


Figure 10

Copyright © McGraw-Hill Education

MS/ Rahma (online private teacher)
Mobile number/ 557368293

مراجعة القسم 1 صفحة 90 :

(18 (1) في دوائر التوالي تكون التيارات المارّة في كل جهاز متساوية، ويكون مجموع الهبوط في الجهد مساويًا لجهد المصدر.

(2)في دوائر التوازي يكون الهبوط في الجهد عبر كل جهاز هو نفسه، ويكون مجموع التيارات المارّة في جميع الحلقات مساويًا لتيار المصدر.

(19 $$I = I_1 + I_2 + I_3 + I_4 = 120\ \text{mA} + 250\ \text{mA} + 380\ \text{mA} + 2.1\ \text{A}$$
$$= 0.12\ \text{A} + 0.25\ \text{A} + 0.38\ \text{A} + 2.1\ \text{A}$$
$$= 2.9\ \text{A}$$

(20 بما ان المقاومات موصولة على التوالي فالتيار المارّ في أي مقاومة هو نفسه في المقاومة الأخرى، وهو نفسه تيار المصدر، أي أن تيار المصدر يساوي 810 mA .

(21 a. $0\ \text{V}\ ;\ \Delta V = IR$ عندما $R = 0$

b. $0\ \text{V};\ \Delta V = IR$ عندما $R = 0$

(22 حينما تتجول في حلقة على جانب إحدى التلال ثم تعود إلى نقطة البداية، فإن مجموع الزيادات في الارتفاع صعودا إلى التل يساوي مجموع الانخفاضات هبوطا من التل .حينما تسري شحنة كهربائية حول حلقة في دائرة كهربائية، فإن مجموع الزيادات في الجهد الكهربائي يساوي مجموع الانخفاضات في الجهد.

(24 a. 0 A، لأن جهد النقطة A يساوي جهد النقطة B .

b. لا شيء c. لا شيء d. لا شيء

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

MS/ Rahma (online private teacher)
Mobile number/ 557368293

Safety devices

1 - A short circuits: - دائرة القصر

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 circuit قاطع الدائرة الكهربائية	**A fuse المنصهر الكهربائي**
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. عبارة عن مفتاح كهربي آلي يعمل على فتح الدائرة الكهربية عندما يتجاوز مقدار التيار المار فيها القيمة المسموح بها	A 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. عبارة عن قطعة قصيرة من فلز تنصهر عندما يمرفيها تيار كبير ، وسمك القطعة الفلزية ُيحدد مقدار التيار اللازم لعمل الدائرة الكهربائية

A ground –fault interrupter

(GFI) is advice that contain an electronic circuit that detects small current differences between the two wires in the cord connected to an appliance (use in kitchen and bathrooms)

هو أداة تحتوي على دائرة إلكترونية تستشعر الفروقات البسيطة في التيار الكهربي الناجمة عن مسار إضافي للتيار فتعمل تلك القواطع على فتح الدائرة الكهربية "

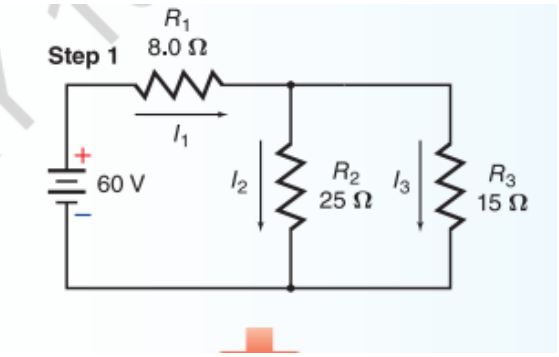
MS/ Rahma (online private teacher)
Mobile number/ 557368293

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

(Page 93 MSQ)

Combined Series-Parallel Circuits

series and parallel branches is a **combination series-parallel circuit.** The following are strategies for analyzing such circuits.



	يحسب المقاومة المكافئة في دائرة كهربائية مركبة.	Example 4 مثال	94

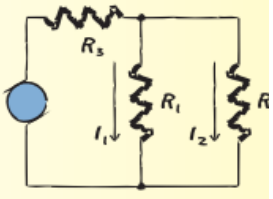
Page 94(FRQ)

EXAMPLE 4

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

MS/ Rahma (online private teacher)
Mobile number/ 557368293

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{125\ \Omega} + \frac{1}{12.0\ \Omega}$$
$$R_P = 10.9\ \Omega$$
$$R = R_3 + R_p = 1.50\ \Omega + 10.9\ \Omega$$
$$= 12.4\ \Omega$$
$$I = \frac{\Delta V_{source}}{R} = \frac{125\ V}{12.4\ \Omega}$$
$$= 10.1\ A$$
$$\Delta V_3 = IR_3 = (10.1\ A)(1.50\ \Omega) = 15.2\ V$$
$$\Delta V_1 = \Delta V_{source} - \Delta V_3 = 125\ V - 15.2\ V$$
$$= 1.10\times10^2\ V$$
$$I_1 = \frac{\Delta V_1}{R_1} = \frac{1.10\times10^2\ V}{125\ \Omega}$$
$$= 0.880\ A$$

25. A series-parallel circuit, similar to the one in Example 4, has three resistors: one uses 2.0 W, the second 3.0 W, and the third 1.5 W. How much current does the circuit require from a 12 V battery?

26. If the 13 lights shown in **Figure 14** are identical, which of them will burn brightest?

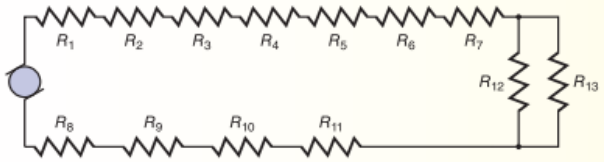


Figure 14

27. CHALLENGE A series-parallel circuit has three appliances on it. A blender and a stand mixer are in parallel, and a toaster is connected in series as shown in **Figure 15.** Find the current through the blender.

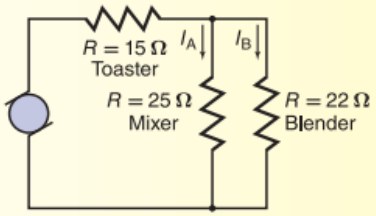


Figure 15

تطبيق صفحة 94 :

(25 باستخدام قانون حفظ الطاقة(القدرة)

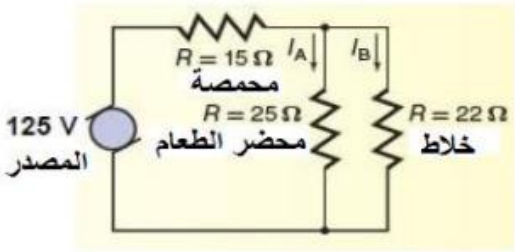
$$P_{\text{كلية}} = P_1 + P_2 + P_3 = 2.0\ W + 3.0\ W + 1.5\ W = 6.5\ W$$

$$P_{\text{كلية}} = IV \Rightarrow I = \frac{P_{\text{كلية}}}{V} = \frac{6.5\ W}{12\ V} = 0.54\ A$$

MS/ Rahma (online private teacher)
Mobile number/ 557368293

(26 ستكون المصابيح الـ (11)المتصلة على التوالي أكثر سطوعًا، في حين يكون تيار كل مصباح من المصباحين المتصلين على التوازي نصف التيار الذي يمر في المصابيح الـ (11)،وعليه سيكون سطوع كل من هذين المصباحين ربع سطوح أي من المصابيح الـ(11) .

(27



$$\frac{1}{R} = \frac{1}{25\ \Omega} + \frac{1}{22\ \Omega} \Rightarrow R = 12\ \Omega$$

$$I = \frac{\Delta V_{source}}{R} = \frac{125\ V}{27\ \Omega} = 4.6\ A$$

$$\Delta V_{\text{محمصة}} = IR_{\text{محمصة}} = (4.6\ A)(15\ \Omega) = 69\ V$$

$$\Delta V_{\text{خلاط}} = \Delta V_{\text{المصدر}} - \Delta V_{\text{محمصة}}$$
$$= 125\ V - 69\ V = 56\ V$$

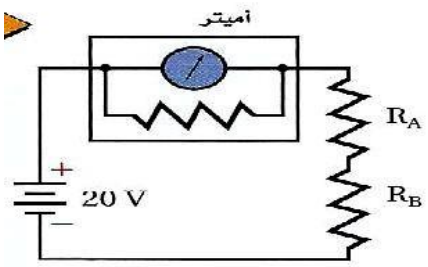
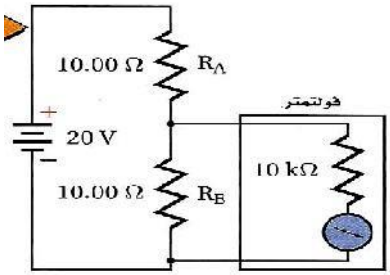
$$I_{\text{خلاط}} = \frac{\Delta V_{\text{خلاط}}}{R_{\text{خلاط}}} = \frac{56\ V}{22\ \Omega} = 2.5\ A$$

95	كما ورد في الكتاب As mentioned in textbook	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	9

Page 95**(MSQ)**

وجه المقارنة	الأميتر AMMETERS	الفولتميتر VOLTMETERS
استخدامه USEING	يستخدم في قياس شدة التيار الكهربائي المارفي أي فرع أو جزء من دائرة كهربائية Measure the current in the circuit	يستخدم في قياس الهبوط في الجهد عبرجزء من دائرة كهربائية Measure the potential deference energy (voltage)
طريقة توصيله في الدائرة الكهربائية	يوصل على التوالي في الدائرة الكهربائية Series connection	يوصل على التوازي في الدائرةالكهربائية Parallel connection

MS/ Rahma (online private teacher)
Mobile number/ 557368293

طريقة تصميمه	يصمم بحيث تكون مقاومته أقل ما يمكن ،وذلك بتوصيل مقاومة صغيرة جداً على التوازي مع ملفه Connect with small resistance in parallel	يصمم بحيث تكون مقاومته أكبر ما يمكن، وذلك بتوصيل مقاومة كبيرة جداً على التوالي مع ملفه Connect with high resistance in series
الرسم التوضيحي		

6. Which statement is true?

A. The resistance of a typical ammeter is very high.

B. The resistance of a typical voltmeter is very low.

C. Ammeters have zero resistance.

D. A voltmeter causes a small change in current.

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

MS/ Rahma (online private teacher)
Mobile number/ 557368293

SECTION 2 REVIEW

28. MAIN IDEA Explain in your own words what a combination series-parallel circuit is.

*Refer to **Figure 17** for questions 29–33 and 35.*

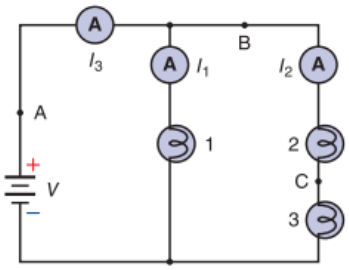


Figure 17

29. Brightness How do the brightness of the bulbs compare?

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

31. Circuits in Series The wire at point C is broken and a small resistor is inserted in series with bulbs 2 and 3. What happens to the brightness of the two bulbs? Explain.

32. Battery Voltage A voltmeter connected across bulb 2 measures 3.8 V, and a voltmeter connected across bulb 3 measures 4.2 V. What is the potential difference across the battery?

33. Circuits Using information from the previous problem, determine whether bulbs 2 and 3 are identical.

34. Circuit Protection Describe three common safety devices associated with household wiring.

35. Critical Thinking How could you rearrange the circuit to make the three bulbs in **Figure 17** burn with equal intensity? Is there more than one way to do this?

Copyright © McGraw-Hill Education

28) يحتوي تركيب الدائرة المركبة على أجزاء موصّلة على التوالي وأجزاء أخرى موصلة على التوازي.

29) المصباحان 2 و3 متساويان في سطوعهما، ولكنهما أقل من سطوع المصباح 1 .

30) $I_3 = I_1 + I_2 \Rightarrow I_2 = I_3 - I_1 = 1.8\ \text{A} - 1.2\ \text{A} = 0.6\ \text{A}$

31) تخفُتض اضاءتُهما بالتساوي، ويقلّ التيار في كل منهما بالمقدار نفسه.

32) $V = V_1 + V_2 = 3.8\ \text{V} + 4.2\ \text{V} = 8.0\ \text{V}$

33) كلا، سيكون لكل من المصابيح المتماثلة الموصَولة على التوالي قيم فرق جهد متطابقة، لأن التيار المار بها واحد.

34) المنصهرات وقواطع الدائرة الكهربائية وقواطع التيار بسبب الأعطال الأرضية.

35) نعم، يمكنك ترتيب الدائرة بحيث تكون جميع المصابيح موصلة على التوالي مع بعضها البعض . يمكنك ، كبديل آخر، ترتيب الدائرة بحيث تكون جميع المصابيح موصلة على التوازي مع بعضها البعض .

2	بحل 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

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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

Page 98 (MSQ)

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.

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

46. A parallel circuit has two branch currents: 3.45 A and 1.00 A. What is the current through the electric potential source?

$$R = 680\ \Omega + 1100\ \Omega + 11{,}000\ \Omega = 13\ \text{k}\Omega \quad (43$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \left(\frac{1}{0.68\ \text{k}\Omega} + \frac{1}{1.1\ \text{k}\Omega} + \frac{1}{10.2\ \text{k}\Omega}\right) \quad (44$$

$$\Rightarrow R = 0.40\ \text{k}\Omega$$

$$V = 5.50\ \text{V} + 6.90\ \text{V} = 12.4\ \text{V} \quad (45$$

$$I = 3.45\ \text{A} + 1.00\ \text{A} = 4.45\ \text{A} \quad (46$$

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?

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.

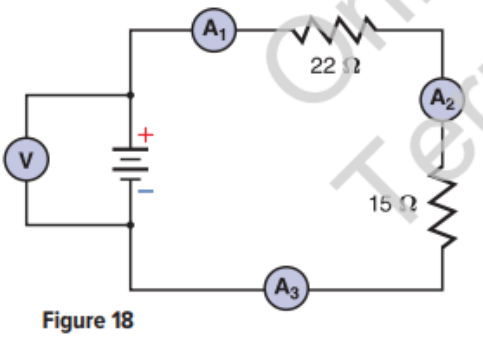


Figure 18

MS/ Rahma (online private teacher)
Mobile number/ 557368293

(49

$$R = R_1 + R_2 = 15\,\Omega + 22\,\Omega = 37\,\Omega \quad .a$$
$$V = IR = (0.20\,\text{A})(37\,\Omega) = 7.4\,\text{V} \quad .b$$
$$P = I^2R = (0.20\,\text{A})^2(22\,\Omega) = 0.88\,\text{W} \quad .c$$
$$P = IV = (0.20\,\text{A})(7.4\,\text{V}) = 1.5\,\text{W} \quad .d$$

(50

$$V = IR = (0.50\,\text{A})(22\,\Omega) = 11\,\text{V} \quad .a$$
$$V = IR = (0.50\,\text{A})(15\,\Omega) = 7.5\,\text{V} \quad .b$$
$$V = V_1 + V_2 = (11\,\text{V}) + (7.5\,\text{V}) = 19\,\text{V} \quad .c$$

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

Page 99 (MSQ)

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?

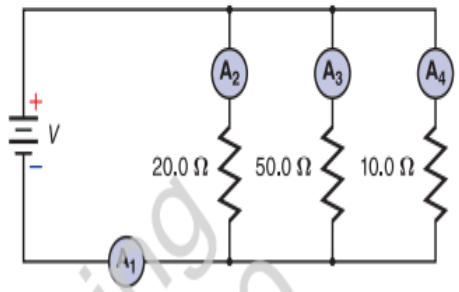


Figure 22

حيث $P = \frac{V^2}{R}$ والجهد (الثابت المقدار في المقاومات الموصولة على التوازي لذا تستنفد المقاومة الأقل قدرة أكبر. 10.0

حيث $P = \frac{V^2}{R}$ والجهد (الثابت المقدار في المقاومات الموصولة على التوازي لذا تستنفد المقاومة الأكبر قدرة أقل. 50.0

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \left(\frac{1}{20.0\,\Omega} + \frac{1}{50.0\,\Omega} + \frac{1}{10.0\,\Omega}\right) \Rightarrow R = 5.88\,\Omega \Rightarrow I = \frac{V}{R} = \frac{1.1\times10^2\,\text{V}}{5.88\,\Omega} = 19$$

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

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

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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

Page 100 (FRQ)

Mastering Problems

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

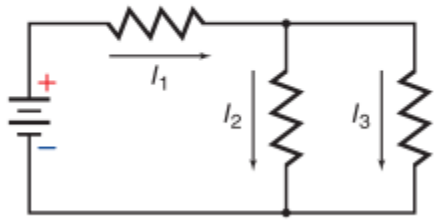
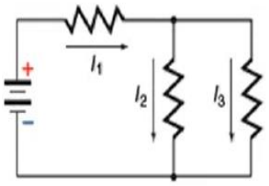


Figure 23



الشكل 23

$$\frac{1}{R_{2,3}} = \frac{1}{30.0} + \frac{1}{30.0} = \frac{2}{30.0}$$

$$\frac{1}{R_{2,3}} = \frac{2}{30.0}$$

$$R_{2,3} = \frac{30.0\Omega}{2} = 15.0\Omega$$

$R_{iqlي توالي} = R_1 + R_{2,3}$

$$R_{iql} = 30.0\Omega + 15.0\Omega = 45.0\Omega$$

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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

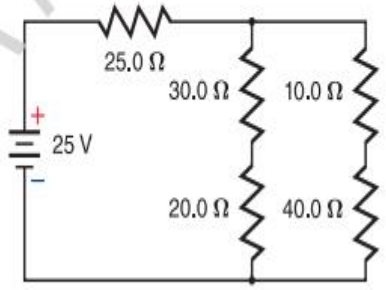


Figure 24

$$I_{30.0\,\Omega} = I_{20.0\,\Omega} = I_{10.0\,\Omega} = I_{40.0\,\Omega} < I_{25.0\,\Omega} \quad \text{a.}$$

$$V_{10.0\,\Omega} < V_{20.0\,\Omega} < V_{30.0\,\Omega} < V_{40.0\,\Omega} < V_{25.0\,\Omega} \quad \text{b.}$$

CHAPTER 10
Magnetic Fields

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

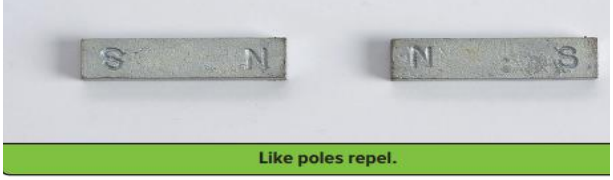
Page 107 (MSQ)

The properties of the magnet:-

1- Polarized (they have two opposite • ends called poles)
2- Like poles repel and unlike poles attract.
3- It's impossible to get a monopole from a magnet.

4- If you suspend a bar magnet on a string, in what direction the magnet will point when it comes to rest?

It is always pointing in the north-south direction, the north pole point to the geographic north pole of the earth, and the south pole point to the geographic south pole of the earth



Like poles repel.

MS/ Rahma (online private teacher)
Mobile number/ 557368293

Magnet attract; - Iron – nickel – cobalt and materials containing these elements called ferromagnetic and become temporary magnet.

Magnet cannot attract: - brass – copper – aluminum.

Why a steel nail can become temporary magnet?

Because, it made of iron with tiny amount of carbon and other materials.

What happen when remove a nail from a magnet?

The nail gradually loses most of its magnetism.

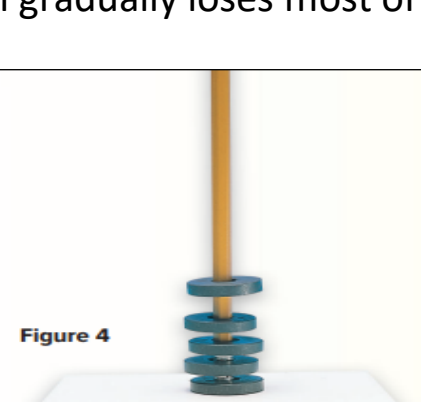


Figure 4

in the following ways?

a. The two north poles are brought close together.

b. A north pole and a south pole are brought together.

2. **Figure 4** (at left) shows five disk magnets floating above one another. The north pole of the top-most disk faces up. Which poles are on the top side of each of the other magnets?

3. The ends of a compass needle are marked N and S. How would you explain to someone why the pole marked N points north? A complete answer should involve Earth's magnetic poles.

4. **CHALLENGE** When students use magnets and compasses, they often touch the magnets to the compasses. Then they find that the compasses point south. Explain why this might occur.

1- A) repulsive B- attractive

2- South – north- south – north

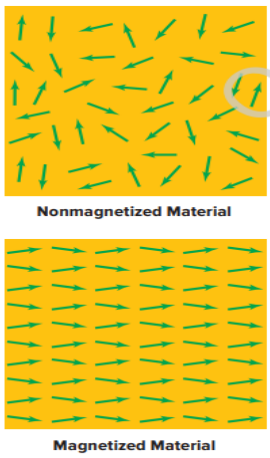
3- It is always pointing in the north-south direction, the north pole point to the geographic north pole of the earth, and the south pole point to the geographic south pole of the earth

4- When the compass touches the magnet, the compass's magnetization reverses

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

Page 108 (MSQ)

MS/ Rahma (online private teacher)
Mobile number/ 557368293



Domain: - which is a group of neighboring atoms whose poles are aligned. Ferromagnetic material that is not magnetized has random direction.

What happen if the ferromagnetic material next to strong magnet?

Most of domain will align in the same direction as the poles of the magnet and become a temporary magnet.

What happen when remove the external magnet?

The domain return to a random arrangement and loses its magnetism.

How long takes for a temporary magnet to lose its magnetism?

It depend on the interaction between the atoms which depend on the microscopic structure of the materials.

Steps to make permanent magnet:-

A. Heating an object contains ferromagnetic materials in the presence of strong magnet.

B. The domains can rotate and align with the magnet's poles.

D. The object is then cooled, and its atoms become less free to rotate.

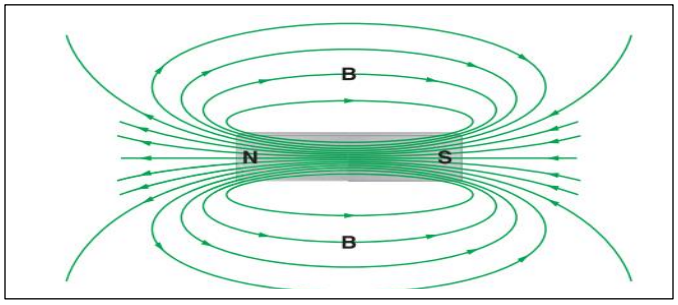
What happen if the permanent magnet reheated or dropped?

The atom will jostle out of alignment and removing the magnetic properties.

12	Define magnetic flux. يعرف التدفق المغناطيسي.	كما ورد في الكتاب As mentioned in textbook	110
	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). يوضح القوى المغناطيسية التي تؤثر عند تقريب مغناطيسين متشابهين او مختلفين في مغناطيسين دائمين من بعضهما (من حيث التفاعل واتجاه خطوط المجال).	كما ورد في الكتاب As mentioned in textbook	110

MS/ Rahma (online private teacher)
Mobile number/ 557368293

Page 110 (MSQ & FRQ)



Magnetic flux التدفق المغناطيسي:

The number of magnetic field lines passing through a surface perpendicular to the lines

Magnetic field line used to show the direction and the strength of a magnetic field.

The direction of a magnetic field line is the direction in which the north pole of a compass points in a magnetic field

Properties of magnetic field line:-

- Magnetic field lines are not real.
- Field lines emerge from a magnet's north pole and enter its south pole.
- Field lines form closed loops continuing through a magnet from its south pole to its north pole.
- Magnetic flux is most concentrated at magnetic poles

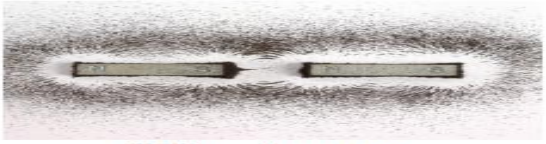
The forces occurs when two permanent magnets are brought close together

Like poles:-

the north pole of one magnet pushes the north pole of the second magnet away in the direction of the field lines .

Unlike poles: - the north pole of one magnet attracting the south pole of the second magnet in a direction opposite the field lines and forming arcs from one magnet to another

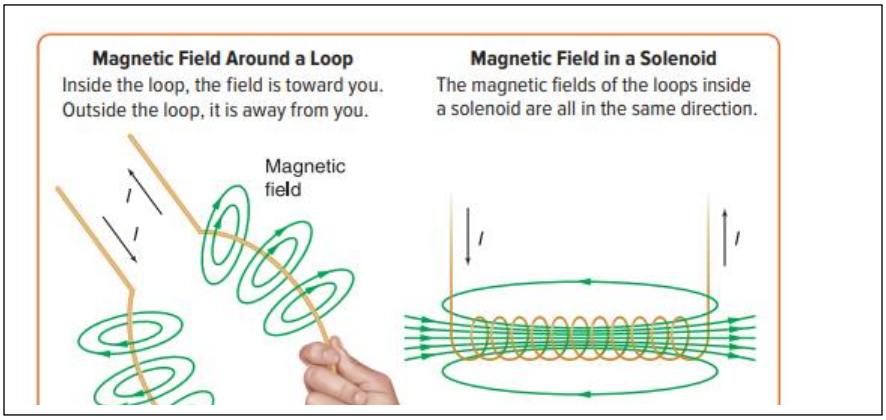
Like poles repel.



Unlike poles attract.

MS/ Rahma (online private teacher)
Mobile number/ 557368293

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 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
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



Page 12 (MSQ)

A solenoid:-

A wire is connected to a circuit and coiled into many sprial loops.

The Magnetic field in a loops of solenoid : are all in the same direction.

The magnetic field around a loop : inside the loop (the field toword you)

Outside the loop (it is away from you)

An electromagnetic :-

Is a magnet whose magnetic field is produced by electric current.

The factor affect on the strength of the electomagnet (soelnoid) the magnetic field is proportional to

1- The current in the solenid's loops.
2- Number and spacing of loops (when nubmber of loops increase and the space between it decrease (closer together producing stronger magnetic field).

MS/ Rahma (online private teacher)
Mobile number/ 557368293

How can increase the strength of a soelnoid ? by placing an iron rod inside it because the solenid's field produces atemporary magnetic feid in the iron as a temporary magnet.

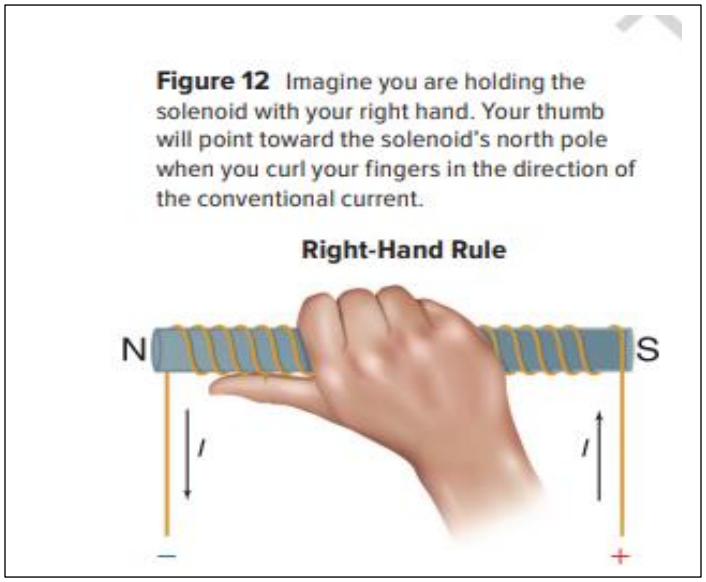
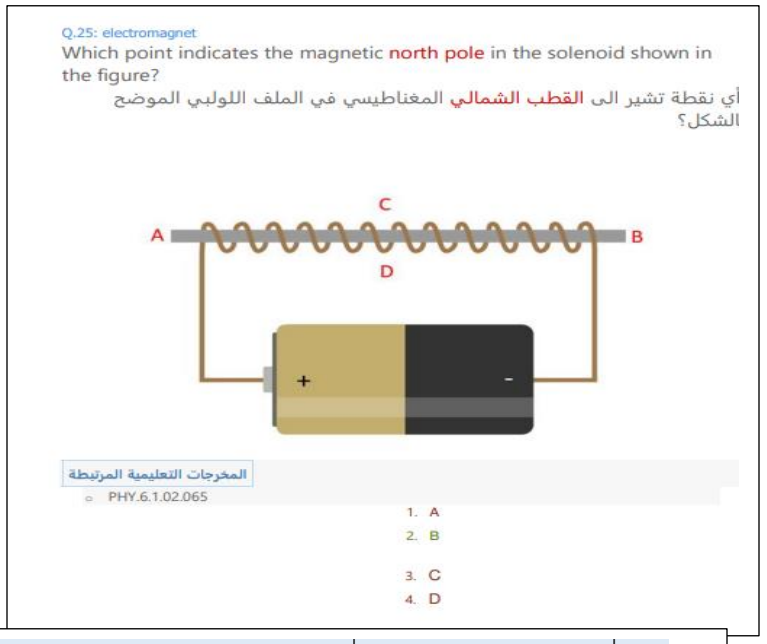


Figure 12 Imagine you are holding the solenoid with your right hand. Your thumb will point toward the solenoid's north pole when you curl your fingers in the direction of the conventional current.

Right-Hand Rule



Q.25: electromagnet

Which point indicates the magnetic north pole in the solenoid shown in the figure?

أي نقطة تشير الى القطب الشمالي المغناطيسي في الملف اللولبي الموضح الشكل؟

المخرجات التعليمية المرتبطة

PHY.6.1.02.065

1. A
2. B
3. C
4. D

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

5. How does the strength of a magnetic field that is 1 cm from a current-carrying wire compare with each of the following?

a. the strength of the field 2 cm from the wire

b. the strength of the field 3 cm from the wire

6. A long, straight current-carrying wire lies in a north-south direction.

a. The north pole of a compass needle placed above this wire points toward the east. In what direction is the current?

b. If a compass were placed underneath this wire, in which direction would the compass needle point?

7. A student makes a magnet by winding wire around a nail and connecting it to a battery, as shown in **Figure 13.** Which end of the nail—the pointed end or the head—is the north pole?

8. You have a battery, a spool of wire, a glass rod, an iron rod, and an aluminum rod. Which rod could you use to make an electromagnet that can pick up steel objects? Explain.

9. CHALLENGE The electromagnet in the previous problem works well, but you would like to make the strength of the electromagnet adjustable by using a potentiometer as a variable resistor. Is this possible? Explain.

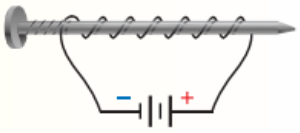


Figure 13

5- A- The strength will decrease by 2 times b- will decrease by 3 times.

6- A- from south to north b- to the west

7- The head of the nail.

8- The iron rod because it is ferromagnetic material make temporary magnet.

9- by connect the electromagnet in series with a variable resistor when the resistor increase the current and the magnetic field decrease.

MS/ Rahma (online private teacher)
Mobile number/ 557368293

18	يطبق قاعدة اليد اليمنى لتحديد اتجاه القوة المؤثرة على سلك يمر به تيار وموضوع في مجال مغناطيسي. يطبق المعادلة ($F = ILBstn(\theta)$) لحساب مقدار القوة المؤثرة على جزء مستقيم من سلك يحمل تيارا كهربائيًا 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 $F = ILBstn(\theta)$ 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

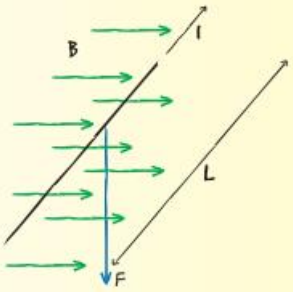
Page 116 (FRQ)

EXAMPLE 1

CALCULATE THE STRENGTH OF A MAGNETIC FIELD A straight wire carrying a 5.0 A current is in a uniform magnetic field oriented at right angles to the wire. When 0.10 m of the wire is in the field, the force on the wire is 0.20 N. What is the strength of the magnetic field (B)?

1 ANALYZE AND SKETCH THE PROBLEM

- Sketch the wire and show the direction of the current with an arrow, the magnetic field as B, and the force on the wire as F.
- Determine the direction of the force using the right-hand rule for the force on a current-carrying wire in a magnetic field. The field, the wire, and the force are all at right angles.



KNOWN
$I = 5.0$ A
$L = 0.10$ m
$F = 0.20$ N

UNKNOWN
$B = ?$

KNOWN
$I = 5.0$ A
$L = 0.10$ m
$F = 0.20$ N

UNKNOWN
$B = ?$

2 SOLVE FOR THE UNKNOWN

B is uniform, and because B and I are perpendicular to each other, $F = ILB$

$$F = ILB$$

Solve for B.

$$B = \frac{F}{IL}$$

$$= \frac{0.20\ \text{N}}{(5.0\ \text{A})(0.10\ \text{m})}$$ ◀ Substitute $F = 0.20$ N, $I = 5.0$ A, $L = 0.10$ m.

$$= 0.40\ \text{N/A·m} = 0.40\ \text{T}$$

B is 0.40 T from left to right and perpendicular to I and F.

3 EVALUATE THE ANSWER

e Learning
AY 19/20

MS/ Rahma (online private teacher)
Mobile number/ 557368293

APPLICATIONS

19. Explain the method you could use to determine the direction of force on a current-carrying wire at right angles to a magnetic field. Identify what must be known to use this method.

20. A wire that is 0.50 m long and carrying a current of 8.0 A is at right angles to a 0.40 T magnetic field. How strong is the force that acts on the wire?

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?

22. A 40.0 cm long copper wire carries a current of 6.0 A and weighs 0.35 N. A certain magnetic field is strong enough to balance the force of gravity on the wire. What is the strength of the magnetic field?

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?

19- Right hand rule, each of the current and the magnetic field direction.

20- F = BIL = (0.40 N/A.m)(8.0 A)(0.50 m) = 1.6 N

21-

$$F = BIL$$

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

22-

$$B = \frac{F}{IL} = \frac{0.35\ \text{N}}{(6.0\ \text{A})(0.400\ \text{m})} = 0.15\ \text{T}$$

23-

$$F = BIL$$

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

Q.10: Forces on Current-Carrying Wires

What is the direction of the magnetic force on the current-currying wire in the figure?

ما هو اتجاه القوة التي يؤثر بها المجال المغناطيسي على السلك الذي يحمل تيارا في الشكل أدناه؟

المخرجات التعليمية المرتبطة

PHY.6.1.02.066

1. upward
للأعلى
2. downward

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

MS/ Rahma (online private teacher)
Mobile number/ 557368293

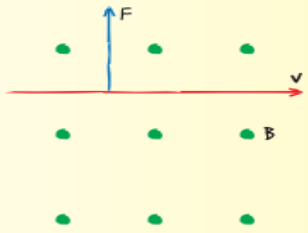
Page 120 (FRQ)

EXAMPLE 2

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

UNKNOWN
$F = ?$

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

APPLICATIONS

25. In what direction is the force on an electron if that electron is moving east through a magnetic field that points north?

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

27. A stream of doubly ionized particles (missing two electrons and thus carrying a net positive charge of two elementary charges) moves at a velocity of 3.0×10^{4} m/s perpendicular to a magnetic field of 9.0×10^{-2} T. How large is the force acting on each ion?

28. Triply ionized particles in a beam carry a net positive charge of three elementary charge units. The beam enters a magnetic field of 4.0×10^{-2} T. The particles have a speed of 9.0×10^{6} m/s and move at right angles to the field. How large is the force acting on each particle?

29. A singly ionized particle experiences a force of 4.1×10^{-13} N when it travels at a right angle through a 0.61 T magnetic field. What is the particle's velocity?

30. CHALLENGE Doubly ionized helium atoms (alpha particles) are traveling at right angles to a magnetic field at a speed of 4.0×10^{4} m/s. The force on each particle is 6.4×10^{-16} N. What is the magnetic field strength?

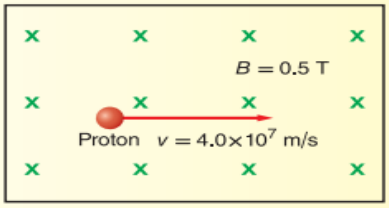


Figure 20

25- downward.

26-

$$F = Bqv$$
$$= (0.50\ \text{T})(1.60\times10^{-19}\ \text{C})(4.0\times10^{6}\ \text{m/s}$$
$$= 3.2\times10^{-13}\ \text{N}$$

upward

27-

$$F = Bqv$$
$$= (9.0\times10^{-2}\ \text{T})(2)(1.60\times10^{-19}\ \text{C})(3.0\times10^{4}\ \text{m/s})$$
$$= 8.6\times10^{-16}\ \text{N}$$

28-

$$F = Bqv$$
$$= (4.0\times10^{-2}\ \text{T})(3)(1.60\times10^{-19}\ \text{C})(9.0\times10^{6}\ \text{m/s}$$
$$= 1.7\times10^{-13}\ \text{N}$$

29-

$$F_B = qvB \Rightarrow v = \frac{F_B}{q.B}$$
$$v = \frac{4.1\times10^{-13}\ N}{(1.60\times10^{-19}\ C)(0.61T)}$$
$$v = 4.2\times10^{6}\ \frac{m}{s}$$

MS/ Rahma (online private teacher)
Mobile number/ 557368293

30-

$$B = \frac{6.4\times10^{-16}\,N}{(2\times1.60\times10^{-19}\,C)(4.0\times10^{4}\,m/s)}$$

$$B = 0.05T$$

18	يطبق قاعدة اليد اليمنى لتحديد اتجاه القوة المؤثرة على سلك يمر به تيار وموضوع في مجال مغناطيسي. يطبق المعادلة ($F = ILBsin(\theta)$) لحساب مقدار القوة المؤثرة على جزء مستقيم من سلك يحمل تيارا كهربائيًا 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 $F = ILBsin(\theta)$ 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

Page 126 (FRQ)

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?

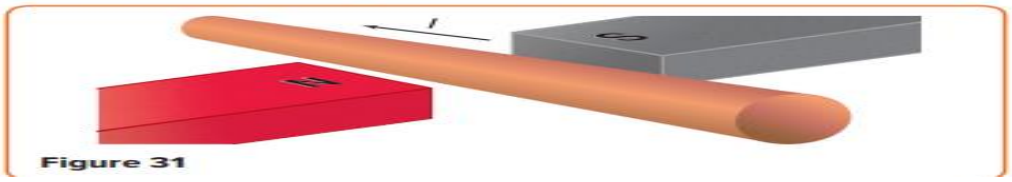


Figure 31

By applying right hand rule the force direction is downward

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.

$$F = ILB\sin 90 = ILB$$

$$F = ILB$$

$$I = \frac{F}{LB}$$

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

$$I = 3.0\times10^{3}\,A = 3.0A$$

مع اطيب تمنياتي لجميع الطلاب بالتوفيق والنجاح

ولا تنسونا من صالح الدعاء