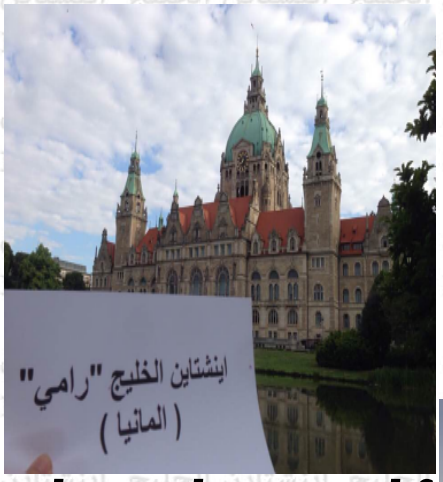
سلسلة أينشتاين الخليج فى الفيزياء



Einstein_Gulf

أسئلة مراجعة

Einstein_Gulf

Einstein_Gulf

Current and Resistance

1. In a certain circuit, the current as a function of time is given as:

$$i(t) = 3t^2 - 2t$$

where i is measured in milliamps and t is measured in seconds. How much charge passes through this circuit during the interval $0 < t < 5.00\ s$?

A. 28.0 mC
B. 65.0 mC
C. 100 mC
D. 150 mC

2. Which of the following statements are true regarding current density?

I. It is the current flowing per unit area
II. It is a vector quantity with a direction opposite to that of the negative charges
III. Its SI unit is Am^{-1}

A. I only
B. II only
C. I and II only
D. I, II and III

3. A conductor carries a current of 50 μA. If the area of cross-section of the conductor is 50 mm², then value of the current density is ___.

A. $10^{-6}\ Am^{-2}$
B. $10^{-3}\ Am^{-2}$
C. $0.5\ Am^{-2}$
D. $1.0\ Am^{-2}$

4. Ohm's Law states that the potential difference across a device is equal to ____.

A. the current flowing through the device times the resistance of the device
B. the current flowing through the device divided by the resistance of the device
C. the resistance of the device divided by the current flowing through the device
D. the current flowing through the device times the cross-sectional area of the device

5. Which of the following are the correct units for conductance and conductivity?

	Conductance	Conductivity
A.	Siemens (S)	$(\Omega m)^{-1}$
B.	Ohms (Ω)	Ωm
C.	Ωm	Ohms (Ω)
D.	$(\Omega m)^{-1}$	Siemens (S)

6. A potential difference of 2.0 V is applied across a wire of cross sectional area 2.5 mm^2. The current which passes through the wire is $3.2 \times 10^{-3}\ A$. What is the resistance of the wire?

A. $2.8 \times 10^2\ \Omega$
B. $3.6 \times 10^2\ \Omega$
C. $4.2 \times 10^2\ \Omega$
D. $6.3 \times 10^2\ \Omega$

سلسله مذكرات أينشتاين الخليج طريقك للتفوق والنجاح

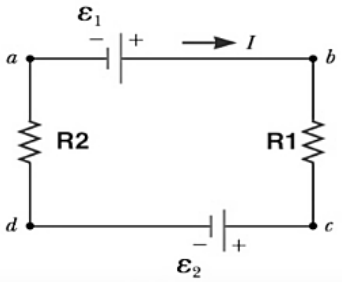
1. Kirchhoff's junction rule is an example of ____.

A. conservation of energy
B. conservation of charge
C. conservation of mass
D. conservation of potential

2. Kirchhoff's loop rule is an example of ____.

A. conservation of energy
B. conservation of charge
C. conservation of mass
D. conservation of potential

7. Which of the following equations represent the current I in the circuit below.



A. $I = \frac{\varepsilon_1 - \varepsilon_2}{R_1 + R_2}$

B. $I = \frac{\varepsilon_1 + \varepsilon_2}{R_1 + R_2}$

C. $I = \frac{\varepsilon_1 - \varepsilon_2}{R_1 - R_2}$

D. $I = \frac{\varepsilon_1 + \varepsilon_2}{R_1 - R_2}$

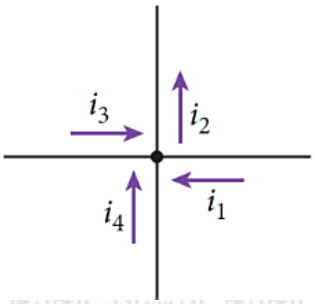
9. A particular wire has a diameter of 1.7 mm and length of 1.3 m. If its resistance is 15 mΩ, what is the resistivity of the metal from which it is made?

A. 1.0×10^{-7} Ωm
B. 2.6×10^{-8} Ωm
C. 4.4×10^{-6} Ωm
D. 1.8×10^{-5} Ωm

10. A 20 cm long and 1.0 mm diameter thick copper wire of resistivity 1.7×10^{-8} Ωm is connected across a 3.0 V battery. The current through the wire is ___.

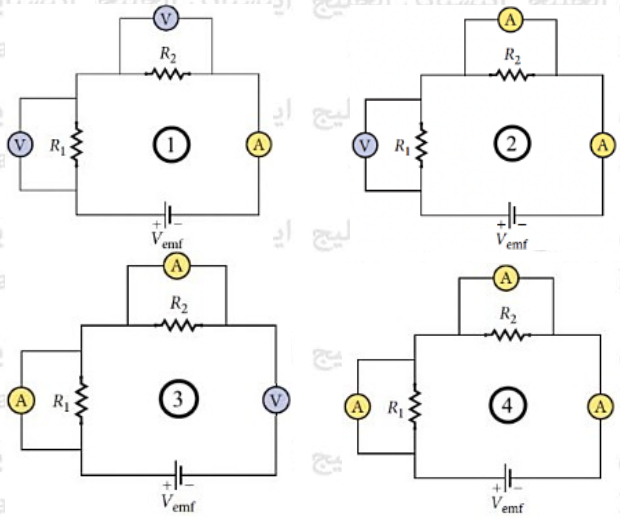
A. 7.00 A
B. 125 A
C. 693 A
D. 789 A

5. For the junction shown in the figure, which equation correctly expresses the sum of the currents?



A. $i_1 + i_2 + i_3 + i_4 = 0$
B. $i_1 - i_2 + i_3 + i_4 = 0$
C. $-i_1 + i_2 + i_3 - i_4 = 0$
D. $i_1 - i_2 - i_3 - i_4 = 0$

10. Which of the circuits shown in the figure will not function properly?



A. 1 only
B. 3 only
C. 2 and 4
D. 2, 3 and 4

11. An ammeter can be used to measure different ranges of current by adding a _____ resistor connected in _____with the ammeter.

A.	shunt	series
B.	shunt	parallel
C.	multiplier	series
D.	multiplier	parallel

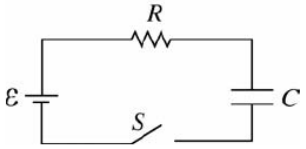
12. In an RC circuit, $\mathcal{E} = 6\ V, R = 2000\ \Omega$ and $C = 4\ mF$. What is the time constant?

A.	$0.5\ s$	C.	$2.0\ s$
B.	$1.5\ s$	D.	$8.0\ s$

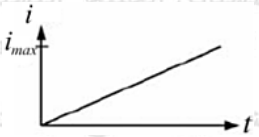
18. An RC circuit is built using a 1.0 MΩ resistor, an initially uncharged 20 μF capacitor, and a battery with a terminal voltage of 5.0 V. Which equation would be used to determine the charge in coulombs on the plates of the capacitor as a function of time?

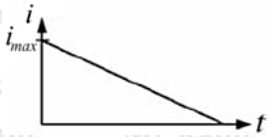
A. $q = 100 \times 10^{-6}(1 - e^{-t/20})$
B. $q = 100 \times 10^{-6}(1 - e^{t/20})$
C. $q = 100 \times 10^{-6}(e^{-t/20})$
D. $q = (1 - e^{-t/20})$

23. The capacitor C in the circuit below is initially uncharged. The switch S is then closed.

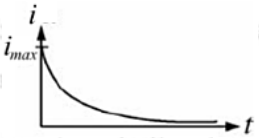


Which of the following best represents the current i through the resistor R as a function of time t?

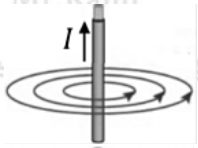
A. 

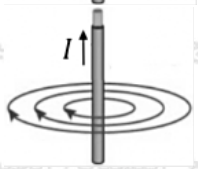
B. 

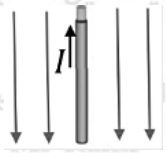
C. 

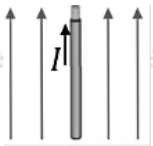
D. 

2. A long straight wire carries a current *I*. Which of the following is a correct representation of the magnetic field lines due to the current in the wire?

A. 

B. 

C. 

D. 

3. The Biot-Savart Law in its differential form is ____.

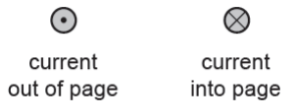
A. $d\vec{B} = \frac{\mu_0}{4\pi}\frac{I(d\vec{l}\times\hat{r})}{r^2}$

B. $d\vec{B} = \frac{\mu_0}{4\pi}\frac{I(d\vec{l}\times\hat{r})}{r}$

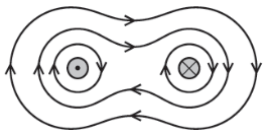
C. $d\vec{l} = \frac{\mu_0}{4\pi}\frac{B(d\vec{B}\times\hat{r})}{r^2}$

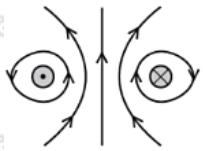
D. $d\vec{l} = \frac{\mu_0}{4\pi}\frac{B(d\vec{B}\times\hat{r})}{r}$

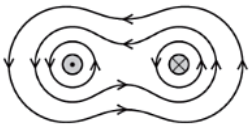
7. Two long, straight wires hang vertically, close to each other. The wires carry currents in opposite directions as shown below.

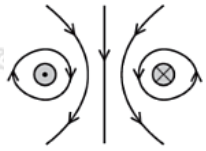


Which diagram shows the magnetic field pattern around the wires?

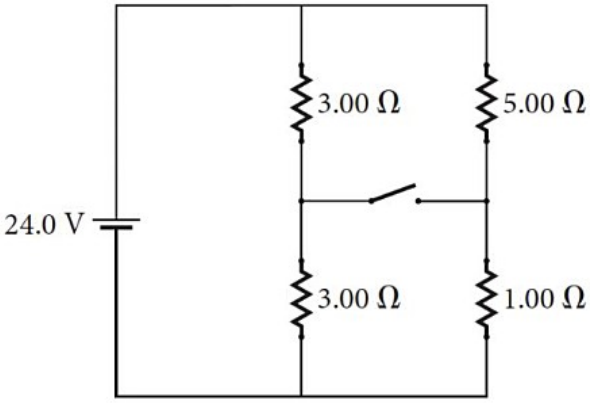
A. 

B. 

C. 

D. 

11. The figure below shows a circuit with four resistors.



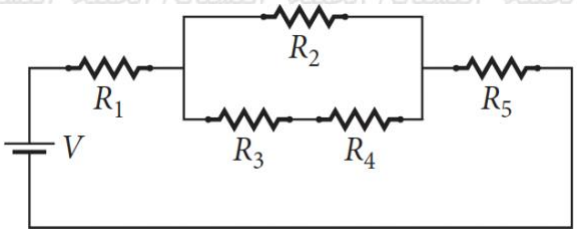
a. What is the equivalent resistance of the circuit when the switch is open?

b. What is the current in the circuit when the switch is open?

c. What is the equivalent resistance of the circuit when the switch is closed?

d. What is the current in the circuit when the switch is closed?

12. For the circuit shown in the figure, $R_1 = 6.00\ \Omega, R_2 = 6.00\ \Omega, R_3 = 2.00\ \Omega, R_4 = 4.00\ \Omega, R_5 = 3.00\ \Omega$, and the potential difference is 12.0 V.



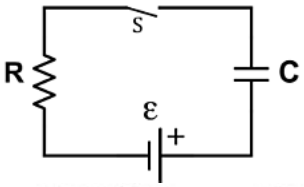
a. What is the equivalent resistance for the circuit?

b. What is the current through R_5?

c. What is the potential drop across R_3?

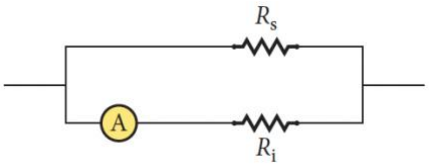
5. Consider a series RC circuit for which $R = 1.0\ M\Omega$, $C = 5.0\ \mu F$, and $\mathcal{E} = 30\ V$as in the figure below.

a. Find the time constant of the circuit.



b. Find the charge on the capacitor 10 s after the switch is closed.

4. An ammeter produces a full-scale reading when a current of $i_{int} = 5.10\ mA$ passes through it. The ammeter has an internal resistance of $R_i = 16.8\ \Omega$. To use this ammeter to measure a maximum current of $i_{max} = 20.2\ A$, what should be the resistance of the shunt resistor, R_s, connected in parallel with the ammeter?



أينشتاين الخليج

(Note: do not round off the numbers in the steps while calculating as the shunt value is very small)

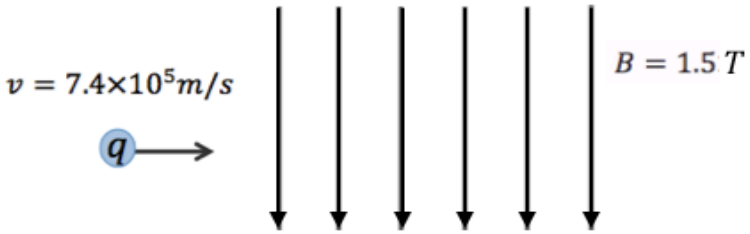
2. A laboratory electromagnet produces a magnetic field of magnitude 1.50 T. A proton moves through this field with a speed of $6.00 \times 10^6\ m/s$.

a. Find the magnitude of the maximum magnetic force that could be exerted on the proton.

b. What is the magnitude of the maximum acceleration of the proton?

سلسله مذكرات أينشتاين الخليج طريقك للتفوق والنجاح

2. A negatively charged particle enters perpendicularly into a region of uniform magnetic field of strength 1.5 T at a constant speed of $7.4 \times 10^5 m/s$. It experiences a magnetic force of $1.8 \times 10^{-13} N$.



a. What is the direction of the magnetic force on the charge as it enters the magnetic field?

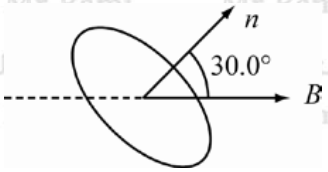
b. What is the magnitude of the charge on the particle?

c. What is the work done on the charge by the magnetic force? Explain your answer.

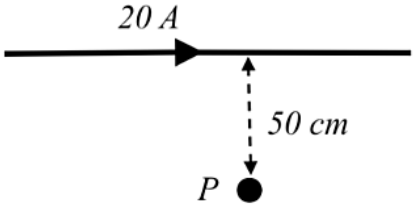
3. A particle of net charge $3.2 \times 10^{-19}\ C$ is moving in a circular orbit of radius 21 cm in a uniform 0.30 T magnetic field perpendicular to the velocity of the electron. If the speed of the particle is $2.0 \times 10^6\ m/s$, what is the mass of the particle?

4. A straight wire of length 2.00 m carries a current of 24.0 A. It is placed on a horizontal tabletop in a uniform horizontal magnetic field. The wire makes an angle of 30.0° with the magnetic field lines. If the magnitude of the force on the wire is 0.500 N, what is the magnitude of the magnetic field?

8. A circular coil with a radius of 10.0 cm has 100 turns of wire and carries a current, $I = 1.00\ mA$. It is free to rotate in a region with a constant horizontal magnetic field given by $B = (0.0100\ T)\hat{x}$. If the unit normal vector to the plane of the coil makes an angle of 30.0° with the horizontal, what is the magnitude of the net torque acting on the coil?



3. A wire carries a current of 20 A and is placed 50 cm from a point P as shown in the figure below.



a. Calculate the magnitude of the magnetic field strength at point P, due to the current in the wire.

I

b. What is the direction of the magnetic field at the point P?

c. What is the magnitude of the magnetic field at a point **P'** which is at a distance four times that of **P** from the wire?

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