Current Electricity JEE Main PYQ - 2

Total Time: 25 Minute **Total Marks:** 40

Instructions

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1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

Navigating & Answering a Question

1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

Current Electricity

1. A copper wire is stretched to make it 0.5% longer. The percentage change in its electrical resistance if its volume remains unchanged is: **(+4, -1)**

[9•Jan.•2019•I]

a. 2.50%

b. 0.50%

c. 1.00%

d. 2.00%

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2. A d.c. main supply of e.m.f. $220\,V$ is connected across a storage battery of e.m.f. $200\,V$ through a resistance of $1\ \Omega$. The battery terminals are connected to an external resistance 'R'. The minimum value of 'R', so that a current passes through the battery to charge it is : **(+4, -1)**

[Online April 9, 2014]

a. 7 Ω

b. 9 Ω

c. 11 Ω

d. Zero

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3. A potentiometer wire AB having length L and resistance $12\,r$ is joined to a cell D of emf ε and internal resistance r. A cell C having $emf\ \varepsilon/2$ and internal resistance $3r$ is connected. The length AJ at which the galvanometer as shown in fig. shows no deflection is : **(+4, -1)**

[10 Jan. 2019 I]

a. $\frac{5}{12}$ L

b. $\frac{11}{24}$ L

c. $\frac{11}{12}$ L

d. $\frac{13}{24}$ L

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4. A resistance is shown in the figure. Its value and tolerance are given respectively by : **(+4, -1)**

[9 Jan. 2019 I]

a. $27\,K\Omega, 20\%$

b. $270\,K\Omega, 5\%$

c. $270\,K\Omega, 10\%$

d. $27\,K\Omega, 10\%$

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5. A uniform metallic wire has a resistance of $18\ \Omega$ and is bent into an equilateral triangle. Then, the resistance between any two vertices of the triangle is : **(+4, -1)**

[10•Jan.•2019•I]

a. $8\ \Omega$

b. $12\ \Omega$

c. $4\ \Omega$

d. $2\ \Omega$

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6. A uniform wire of length l and radius r has a resistance of $100\,\Omega$. It is recast into a wire of radius $\frac{r}{2}$. The resistance of new wire will be : **(+4, -1)**

[Online•April•9,•2017]

a. $1600\,\Omega$

b. $400\,\Omega$

c. $200\,\Omega$

d. $100\,\Omega$

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7. An ideal battery of $4\,V$ and resistance R are connected in series in the primary circuit of a potentiometer of length $1\,m$ and resistance 5Ω. The value of R, to give a potential difference of $5\,mV$ across $10\,cm$ of potentiometer wire, is : **(+4, -1)**

[12•Jan.•2019•I]

a. 490Ω

b. 480Ω

c. 395Ω

d. 495Ω

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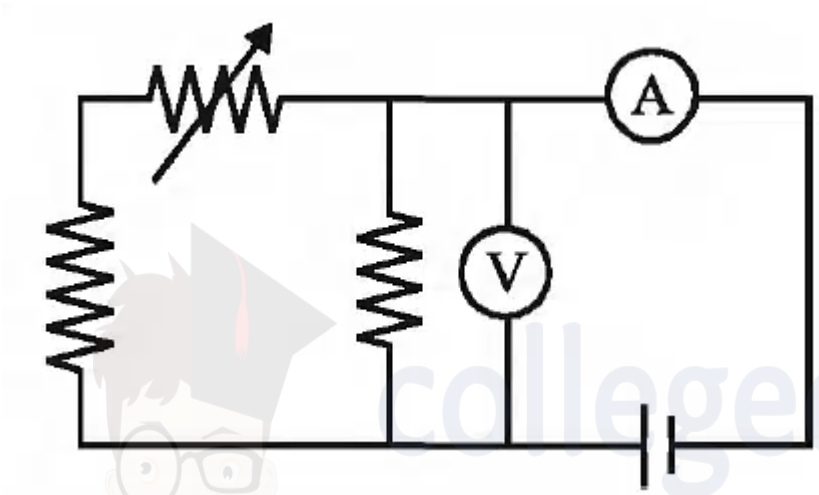
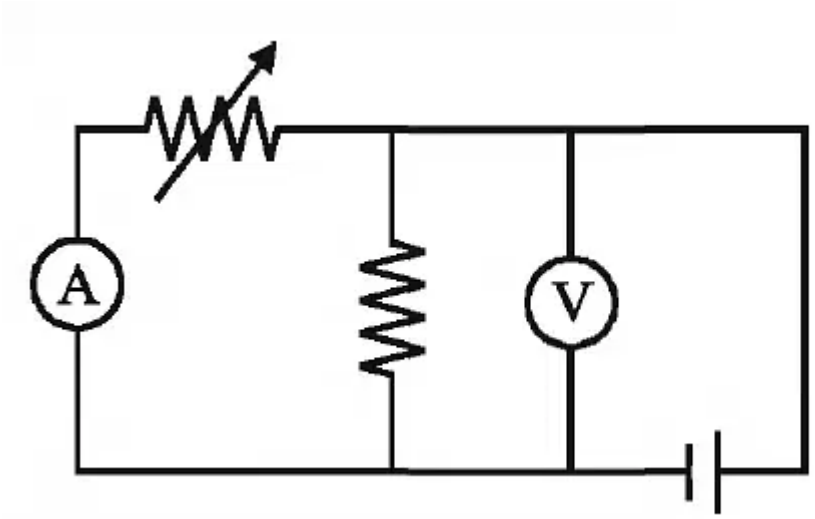
8. Correct set up to verify Ohm?s law is : **(+4, -1)**

[Online April 23, 2013]

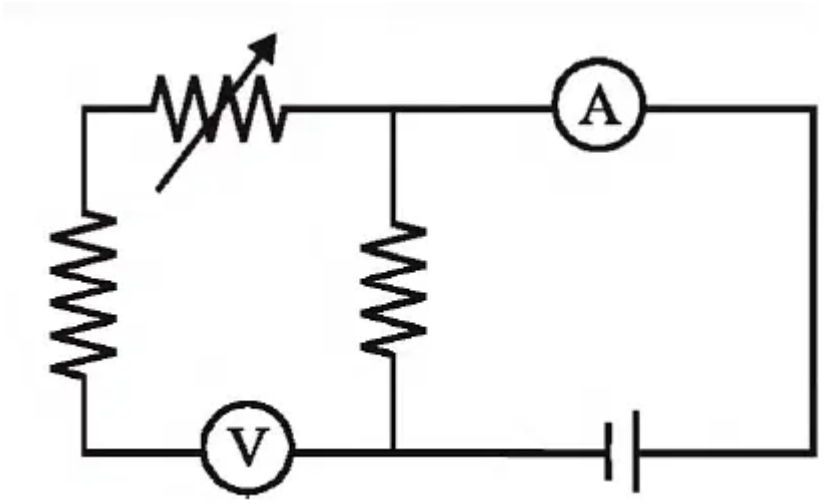
a.



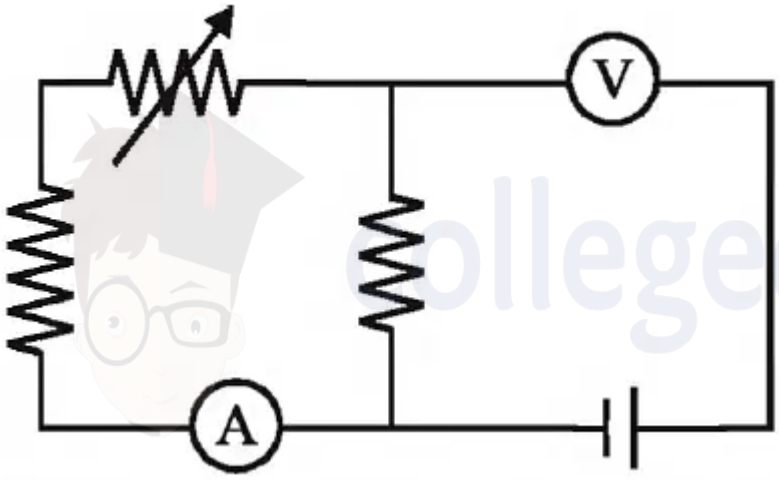
b.



c.



d.



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9. Two identical cells, when connected either in parallel or in series gives same current in an external resistance 5Ω The internal resistance of each cell will be__ Ω **(+4, -1)**

[31-Jan-2023•Shift•1]

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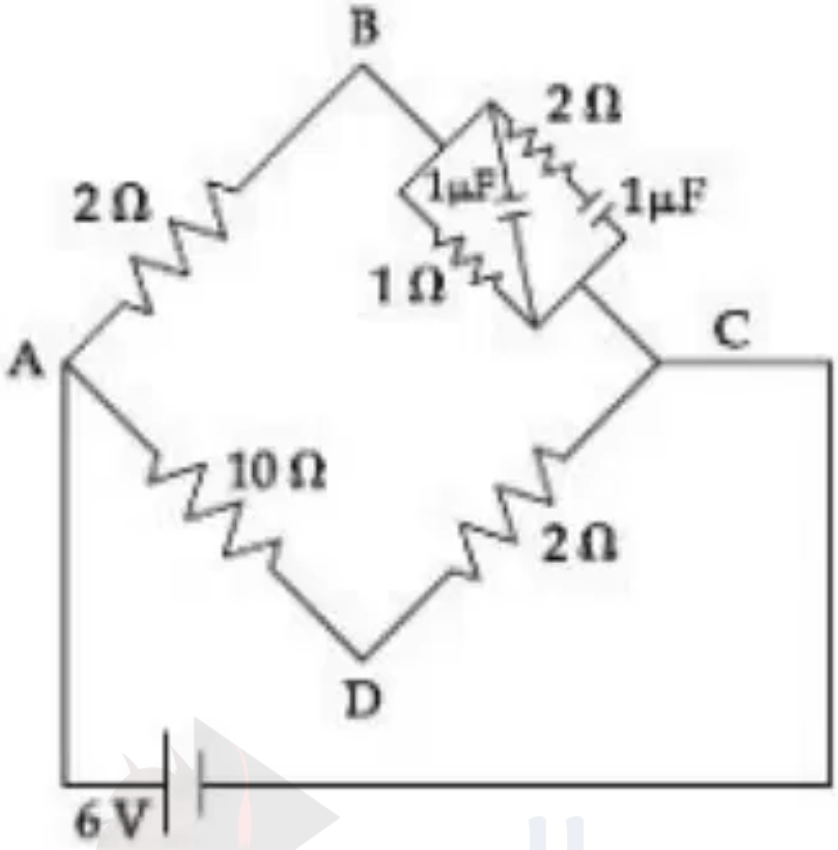
10. For the given circuit, in the steady state, $|V_B - V_D| =$___V **(+4, -1)**

[31-Jan-2023 Shift 2]



Answers

1. **Answer: c**

Explanation:

$R = \frac{\rho \ell}{A}$ and volume (V) = Aℓ.

$R = \frac{\rho \ell^2}{V}$

$\Rightarrow \frac{\Delta R}{R} = \frac{2\Delta \ell}{\ell} = 1\%$

Therefore, The correct answer is option (C): 1.00%

Concepts:

1. Current Electricity:

Current electricity is defined as the flow of electrons from one section of the circuit to another.

Types of Current Electricity

There are two types of current electricity as follows:

Direct Current

The current electricity whose direction remains the same is known as direct current. Direct current is defined by the constant flow of electrons from a region of high electron density to a region of low electron density. DC is used in many household appliances and applications that involve a battery.

Alternating Current

The current electricity that is bidirectional and keeps changing the direction of the charge flow is known as alternating current. The bi-directionality is caused by a sinusoidally varying current and voltage that reverses directions, creating a periodic back-and-forth motion for the current. The electrical outlets at our homes and industries are supplied with **alternating current**.

2. **Answer: c**

Explanation:

$(20 - I_1)\, R = 200$
$R = \frac{200}{(20 - I_1)}$
$R - >$Minimum
when $20 - I1 - >$ maximum & I_1 cannot be zero
so $R \simeq 11\,\Omega$

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3. **Answer: d**

Explanation:

$i = \frac{\varepsilon}{13r}$
$i\left(\frac{x}{L}12r\right) = \frac{\varepsilon}{2}$
$\frac{\varepsilon}{13r}\left[\frac{x}{L}.12r\right] = \frac{\varepsilon}{2} \Rightarrow x = \frac{13L}{24}$

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4. Answer: d

Explanation:

Color code :
Red violet orange silver

$R = 27 \times 10^3\ \Omega \pm 10\%$
$= 27\ K\Omega \pm\ 10\%$

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5. **Answer: c**

Explanation:

R_{eq} between any two vertex will be
$\frac{1}{R_{eq}} = \frac{1}{12} + \frac{1}{6} \Rightarrow R_{eq} = 4\Omega$

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6. Answer: a

Explanation:

$R = \frac{\rho l}{A} \quad Al = V$
$R = \frac{\rho v}{A^2}$
$\rho \rightarrow$ constant
$v \rightarrow$ constant
$R \propto \frac{1}{A^2} \propto \frac{1}{r^2}$
$R \propto \frac{1}{r^4}$
$R_2 = 16\, R_1 = 1600\, \Omega$

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7. Answer: c

Explanation:

Let current flowing in the wire is i.
$\therefore i = \left(\frac{4}{R+5}\right) A$
If resistance of 10 m length of wire is x
then $x = 0.5\Omega = 5 \times \frac{0.1}{1}\Omega$
$\therefore \Delta V = P$ d. on wire = i. x
$5 \times 10^{-3} = \left(\frac{4}{R+5}\right).(0.5)$
$\therefore \frac{4}{R+5} = 10^{-2} R + 5 = 400\Omega$
$\therefore R = 395\Omega$

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8. Answer: a

Explanation:

In ohm's law, we check $V = IR$ where I is the corrent flowing through a resistor and V is the potential difference across that resistor. Only option (a) fits the above criteria. Remember that ammeter is connected in series with resistance and voltmeter parallel with the resistance.

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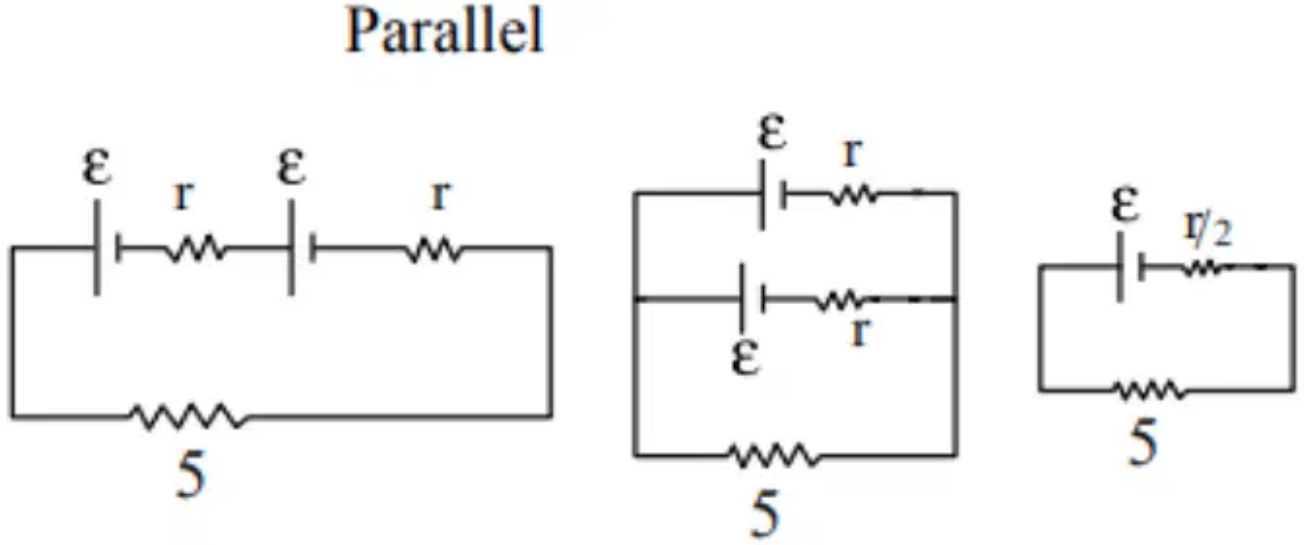
9. **Answer: 5 - 5**

Explanation:

The correct answer is 5.



$i = \frac{2\varepsilon}{5+2r} \ldots (1)$

$i = \frac{\varepsilon}{\frac{r}{2}+5} \ldots (2)$

Equating (1) and (2)

$\frac{2\varepsilon}{5+2r} = \frac{\varepsilon}{\frac{r}{2}+5}$

$\Rightarrow r + 10 = 5 + 2r$

$r = 5$

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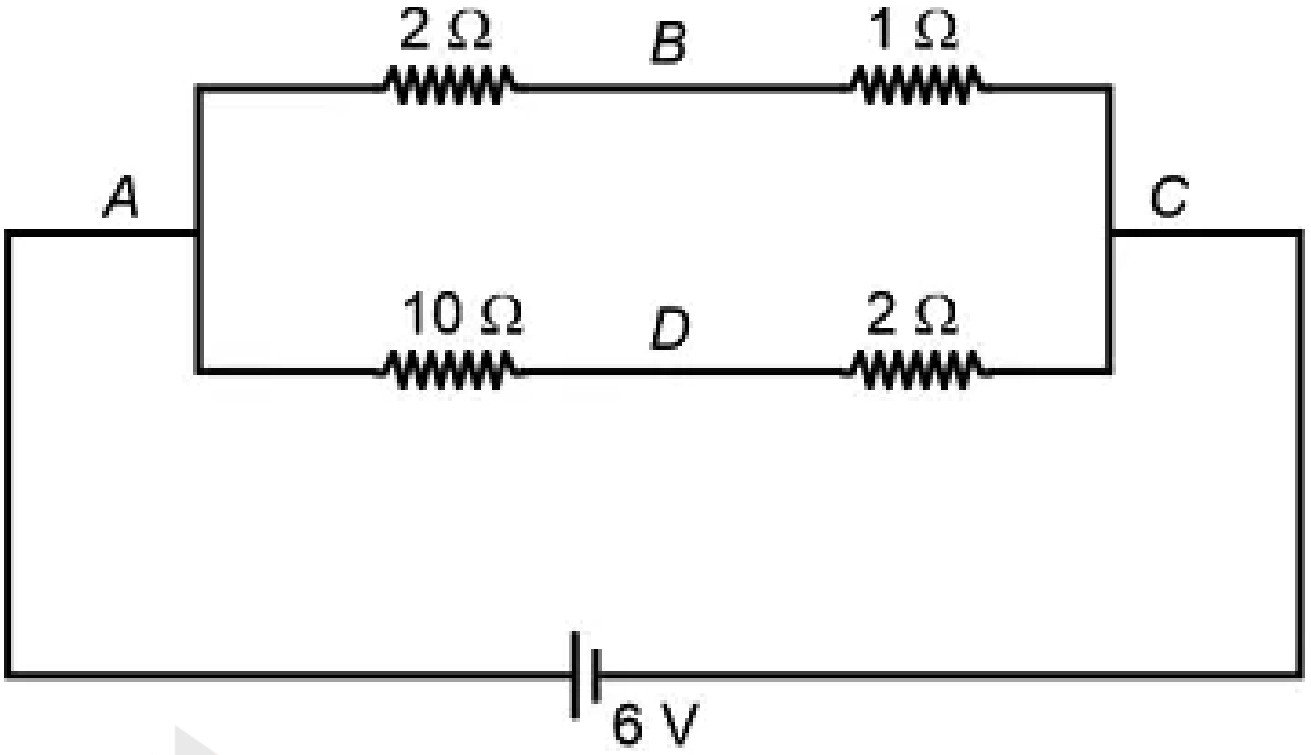
10. **Answer: 1 - 1**

Explanation:

In steady state, capacitor behaves as an open circuit. Circuit is:



$\Rightarrow i_{AB} = \frac{6}{3} = 2A \ \& \ i_{AD} = \frac{6}{12} = 0.5A$

$\Rightarrow V_B + 2 \times 2 - 10 \times 0.5 = V_D$

$\Rightarrow V_B + V_D = 1$ volt

So, the correct answer is 1.

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