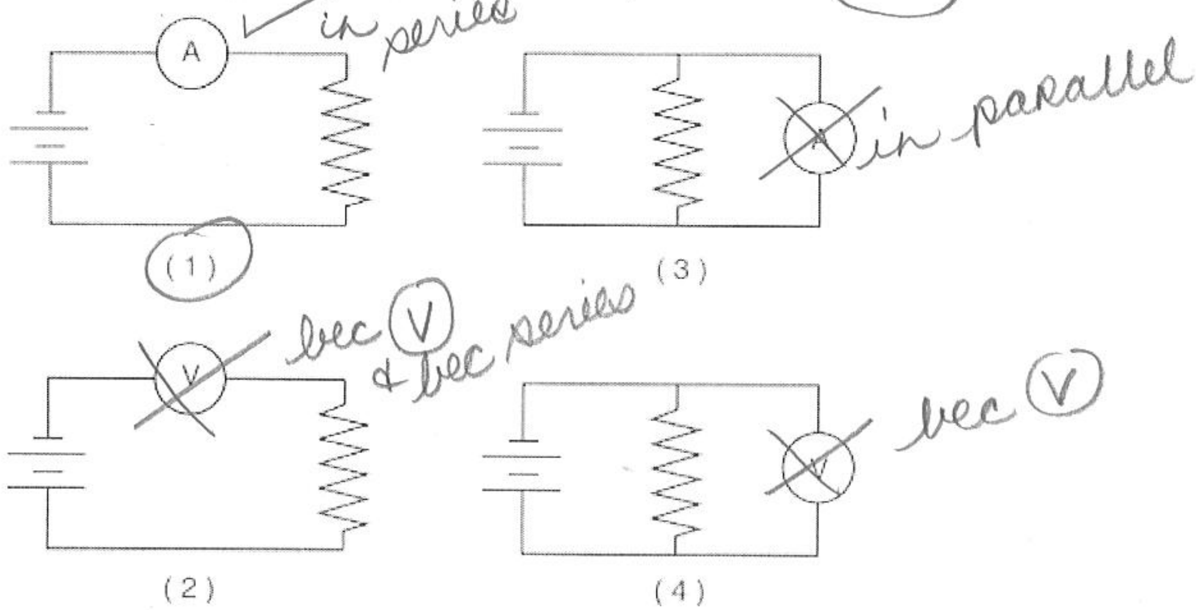
Series and Parallel Circuit Questions

1)

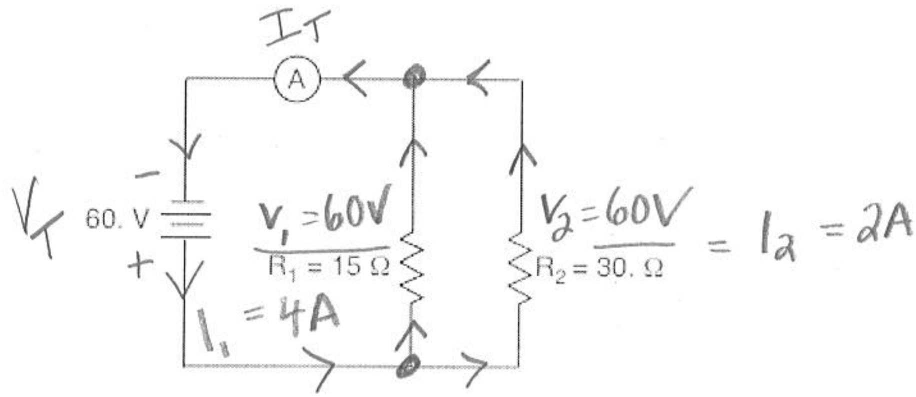
Which circuit diagram represents the correct way to measure the current in a resistor?



2)

A 15-ohm resistor, 30.-ohm resistor, and an ammeter are connected as shown with a 60.-volt battery.

P //



(1) Calculate the equivalent resistance of R_1 and R_2. [Show all work, including the equation and substitution with units.] [2]

(2) Determine the current measured by the ammeter. [1]

X Calculate the rate at which the battery supplies energy to the circuit. [Show all work, including the equation and substitution with units.] [2]

(3) If another resistor were added in parallel to the original circuit, what effect would this have on the current through resistor R_1? [1]

(I) adding a R in P $\downarrow R_T \therefore \uparrow I_T$

(II) but V_T not changed so still 60V across each R so. still 4A across R_1

prove your answer

+ 10 Ω R in P ⟹ do the math

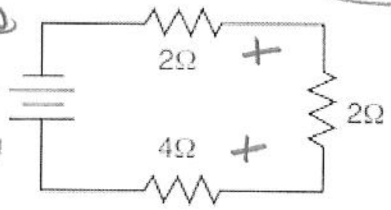
new $R_T = 5\Omega$ + new $I_T = 12A$

3)

R_T

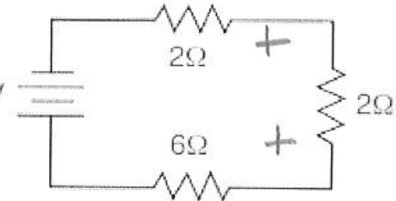
Which circuit has the largest equivalent resistance?

Series



$R_T = 8\Omega$

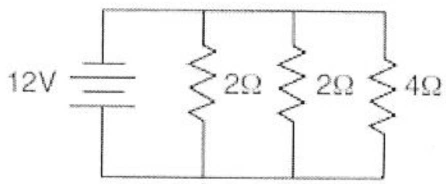
(1)



$R_T = 10\Omega$

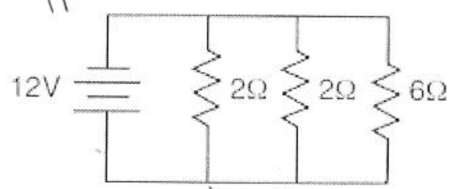
(3)

||



(2)

||



(4)

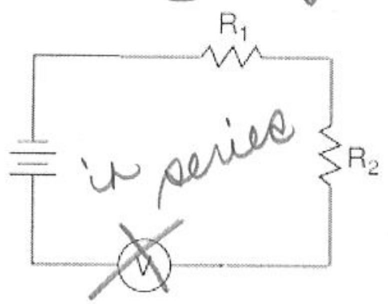
in || $R_T <$ smallest R

$\therefore R_T < 2\Omega$

4)

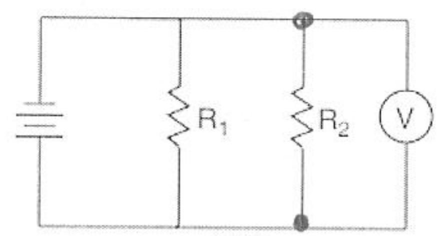
Which circuit diagram represents voltmeter V connected correctly to measure the potential difference across resistor R_2?

$V_2 = ?$



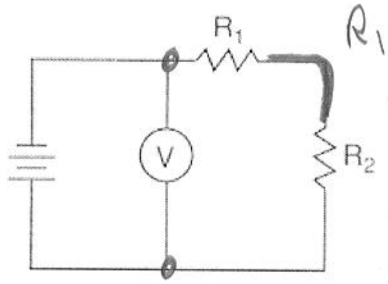
in series

(1)



across R_2 ✓

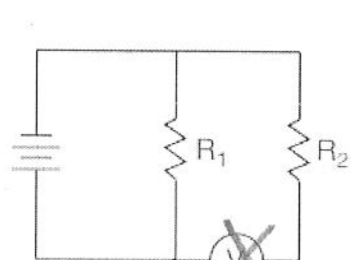
(3)



$R_1 + R_2$ are in series

(2)

this (V) is reading total R across both R.



(4) in series

5)

Which combination of units can be used to express electrical energy? = J is the unit for E = start somewhere

~~(1)~~ $\frac{\text{volt}}{\text{coulomb}}$

~~(2)~~ $\frac{\text{coulomb}}{\text{volt}}$

(3) volt•coulomb

~~(4)~~ volt•coulomb•second

$(1)\ \frac{V}{C} = \frac{\frac{J}{\cancel{C}}}{C} \cdot \frac{1}{C} = \frac{J}{C^2}$ X

$(II)\ \frac{C}{V} = \frac{C}{\frac{J}{C}} \cdot \frac{C}{J} = \frac{C^2}{J}$

$*(III)\ V \cdot C = \frac{J}{\cancel{C}} \cdot \cancel{C} = J$

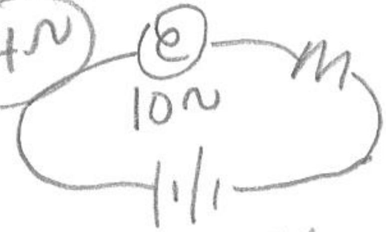
$(IV) = \frac{J}{\cancel{C}} \cdot \cancel{C} \cdot s = Js$

6)

A student constructed a series circuit consisting of a 12.0-volt battery, a 10.0-ohm lamp, and a resistor. The circuit does *not* contain a voltmeter or an ammeter. When the circuit is operating, the total current through the circuit is 0.50 ampere.

V_T

In the space *in your answer booklet*, draw a diagram of the series circuit constructed to operate the lamp, using symbols from the *Reference Tables for Physical Setting/Physics*. [1]



$R_T = 24\,\Omega$ Determine the equivalent resistance of the circuit. [1] $\frac{V_T}{I_T} = \frac{12V}{0.5A} = 24\,\Omega$

Determine the resistance of the resistor. [1] $14\,\Omega$

$R_T = R_1 + R_2 - R_2$

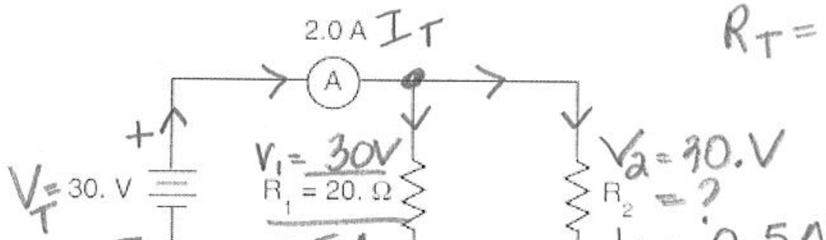
$-R_2 = 24\,\Omega - 10\,\Omega = 14\,\Omega$

$V_T = 12V$

$I_T = 0.5$

7)

A 20.-ohm resistor, R_1, and a resistor of unknown resistance, R_2, are connected in parallel to a 30.-volt source, as shown in the circuit diagram below. An ammeter in the circuit reads 2.0 amperes.



$R_T = \frac{V_T}{I_T} = \frac{30.V}{2.0A} = 15\,\Omega$

$\frac{V}{I} = \frac{\cancel{I}R}{\cancel{I}} = \frac{30.V}{0.5A}$

$R_2 = 60\,\Omega$

Determine the equivalent resistance of the circuit. [1] $15\,\Omega = R_T$

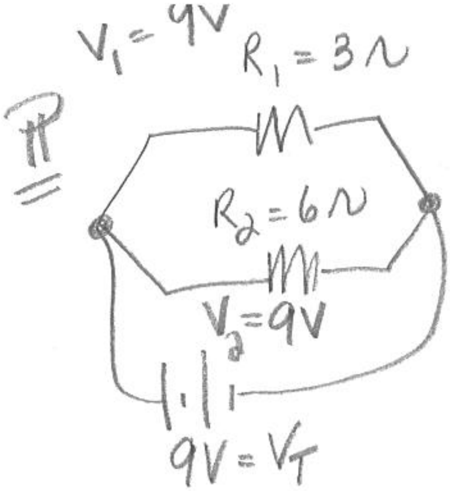
Calculate the resistance of resistor R_2. [Show all work, including the equation and substitution with units.] [2]

$R_2 = 60\,\Omega$

8)

$V_T = V_1 = V_2$

A 3-ohm resistor and a 6-ohm resistor are connected in parallel across a 9-volt battery. Which statement best compares the potential difference across each resistor?



∥

✓ (1) The potential difference across the 6-ohm resistor is the same as the potential difference across the 3-ohm resistor. T

(2) The potential difference across the 6-ohm resistor is twice as great as the potential difference across the 3-ohm resistor.

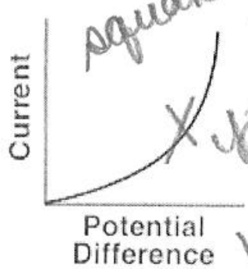
(3) The potential difference across the 6-ohm resistor is half as great as the potential difference across the 3-ohm resistor.

(4) The potential difference across the 6-ohm resistor is four times as great as the potential difference across the 3-ohm resistor.

9)

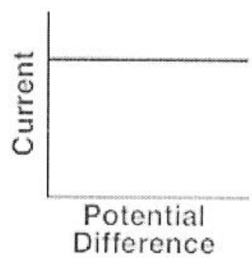
The resistance of a circuit remains constant. Which graph best represents the relationship between the current in the circuit and the potential difference provided by the battery?

Ohm's Law
$V = IR$
$\uparrow V = \uparrow I$ in a direct variation

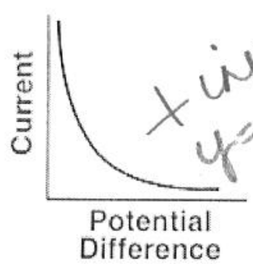


(1)

I, V — square — $y = ax^2$ ✗

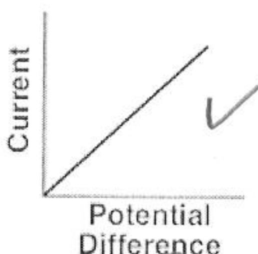


(3)



(2)

✗ inverse $y = \frac{k}{x}$



(4)

✓ direct variation

this is the way we were supposed to graph it since voltage was the independent variable but then you don't get R as the slope (you get conductivity)

10)

An electric circuit consists of a variable resistor connected to a source of constant potential difference. If the resistance of the resistor is doubled, the current through the resistor is

think dimmer switch

(1) halved
(2) doubled
(3) quartered
(4) quadrupled

R + I are inversely related

$V_1 = I_1 R_1$ $V_1 = 1V$ $I_1 = 1A$ $R_1 = 1\Omega$

$1V = (1A)(1\Omega)$

$1V = (?)(2\Omega)$ $V_2 = 1V$ $I_2 = ?$ $R_2 = 2\Omega$

11)

A 15-ohm resistor and a 20.-ohm resistor are connected in parallel with a 9.0-volt battery. A single ammeter is connected to measure the total current of the circuit.

I_T

In the space *in your answer booklet*, draw a diagram of this circuit using symbols from the *Reference Tables for Physical Setting/Physics*. [Assume the availability of any number of wires of negligible resistance.] [2]

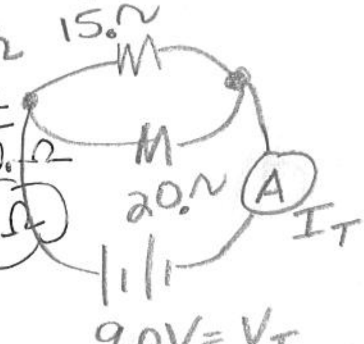
R_T

Calculate the equivalent resistance of the circuit. [Show all work, including the equation and substitution with units.] [2]

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1^{\times 4}}{15\,\Omega_{\times 4}} + \frac{1^{\times 3}}{20.\,\Omega_{\times 3}}$$

$$\frac{1}{R_T} = \frac{4}{60.\,\Omega} + \frac{3}{60.\,\Omega} = \frac{7}{60.\,\Omega}$$

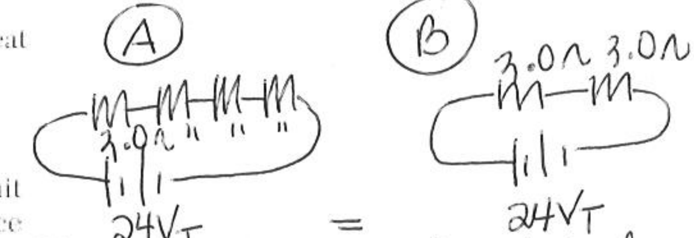
$$\frac{R_T}{1} = \frac{60.\,\Omega}{7} = 8.6\,\Omega$$



12)

Circuit *A* has four 3.0-ohm resistors connected in series with a 24-volt battery, and circuit *B* has two 3.0-ohm resistors connected in series with a 24-volt battery. Compared to the total potential drop across circuit *A*, the total potential drop across circuit *B* is

(1) one-half as great
(2) twice as great
(3) the same
(4) four times as great



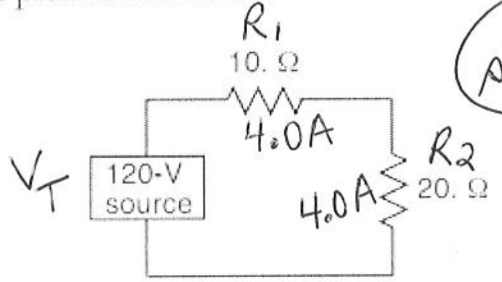
=

- potential drop = |
- same V but
- diff R_T
- diff I_T

13)

The diagram below represents a circuit consisting of two resistors connected to a source of potential difference.

series



What is the current through the 20.-ohm resistor?

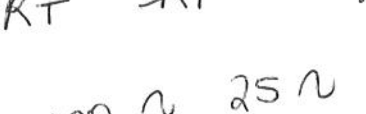
(1) 0.25 A
(2) 6.0 A
(3) 12 A
(4) 4.0 A

$$R_T = R_1 + R_2 = 10.\,\Omega + 20.\,\Omega = 30.\,\text{-}$$

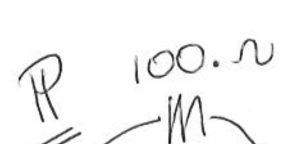
$$\frac{V_T}{R_T} = \frac{I_T \cancel{R_T}}{\cancel{R_T}} = \frac{120\,V}{30.\,\Omega} = I_T = 4.0\,A = I_1 = I$$

14)

A simple circuit consists of a 100.-ohm resistor connected to a battery. A 25-ohm resistor is to be connected in the circuit. Determine the *smallest* equivalent resistance possible when both resistors are connected to the battery. [1]



125Ω = R_T
series



$$\frac{1}{R_T} = \frac{1}{100.\,\Omega} + \frac{1}{25}$$

$$\frac{1}{R_T} = \frac{1}{100.\,\Omega} + \frac{4}{100.}$$

$$R_T = \frac{100.\,\Omega}{5} = 20$$

put 25Ω R into P for an R_T of 20.Ω

15)

23 Which circuit has the *smallest* equivalent resistance?

$\frac{2\Omega}{2} = 1\Omega$

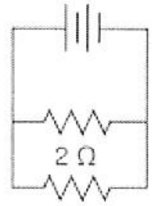
$= \frac{1}{2\Omega} + \frac{1}{2\Omega}$

$= \frac{2}{2\Omega}$

$= \frac{2\Omega}{2}$

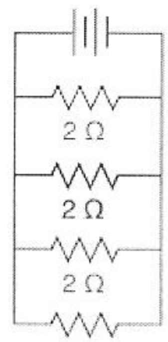
$= 1\Omega$

P



~~(1)~~

P



(3)

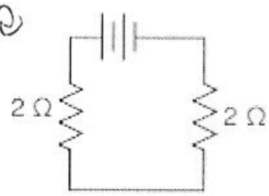
$\frac{2\Omega}{4} = 0.5\Omega$

$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \frac{1}{R_4}$

$\frac{1}{R_T} = \frac{1}{2\Omega} + \frac{1}{2\Omega} + \frac{1}{2\Omega} + \frac{1}{2\Omega} = \frac{4}{2\Omega}$

$R_T = \frac{2\Omega}{4} = 0.5\Omega$

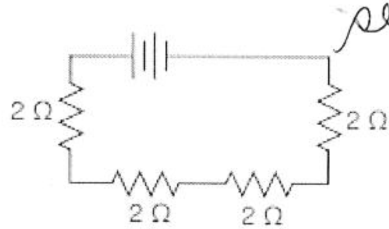
series



~~(2)~~

$R_T = 2\Omega + 2\Omega$
$= 4\Omega$

series



~~(4)~~

$R_T = 2\Omega \cdot 4 = 8\Omega$