

**Mark the best answer for each question on your scantron. (1 point each)**

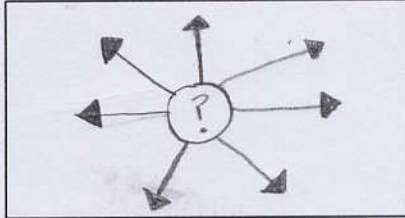
1. What is the SI unit of charge?
  - A) Joule
  - B) Volt
  - C) Ampere
  - D) Coulomb
2. Materials in which electrons are free to roam around are considered to be good ...
  - A) Conductors
  - B) Insulators
3. Which material will carry electricity best?
  - A) chalk
  - B) copper
  - C) wood
  - D) rubber
4. If 10 Coulombs of electrons go through a wire in 2 seconds, how much current is going through the wire?
  - A) 10 A
  - B) 20 A
  - C) 5 A
  - D) 8 A
5. If 20 amps of current goes through a wire, how many coulombs will go through the wire in three seconds?
  - A) 6.6 C
  - B) 60 C
  - C) 23 C
  - D) 17 C
6. In a good insulator, electrons are usually
  - A) Free to move around.
  - B) Free to move around after an impurity has been added.
  - C) Semi-free to move around
  - D) Tightly bound in place.
7. Which of the following is a synonym for potential difference?
  - A) Voltage
  - B) Current
  - C) Resistance
  - D) Diode
8. How many different forces would act on a proton placed in both an electrical field and a gravitational field?
  - A) One
  - B) Two
  - C) None
9. An electrical field has...
  - A) Magnitude
  - B) Direction
  - C) Both A and B
  - D) Neither A nor B
10. Electrical Potential energy is the energy a charged object has because of its...
  - A) Position
  - B) Mass
  - C) Motion
  - D) Momentum
11. If two negative charges are held close together and then released, the charges will
  - A) Accelerate towards each other.
  - B) Accelerate away from each other.
  - C) Move at a constant speed away from each other.
  - D) Not move.
12. Which produces more light, two light bulbs in series or in parallel?
  - A) Parallel
  - B) Series
  - C) They are equally bright

13. Which has more resistance to breathing through it, a short straw or a long straw?

- A) Short
- B) Long
- C) They have the same resistance

14. What is the charge on the following diagram?

- A) Positive
- B) Negative
- C) Neutral



15. The lightning is caused by friction of ice crystals in clouds?

- A) True
- B) False

16. The occupants of a car, driving through a thunderstorm, are at risk of being struck by lightning.

- A) True
- B) False

17. Why is it important to use the thick wires for carrying electricity for long distances?

- A) thick wires have less resistance and therefore are not likely to heat up as much as thin wires.
- B) Thick wires are stronger than thin wires
- C) California electrical code states you must use thick wires for long distances.

18. All Electrons are identical.

- A) True
- B) False

19. Electrical charge can be stored.

- A) True
- B) False

20. It takes work to separate opposite charges.

- A) True
- B) False

21. Objects become charged when electrons move onto them or off of them.

- A) True
- B) False

22. Protons flow through wires.

- A) True
- B) False

23. A capacitor is a device for storing charge and energy.

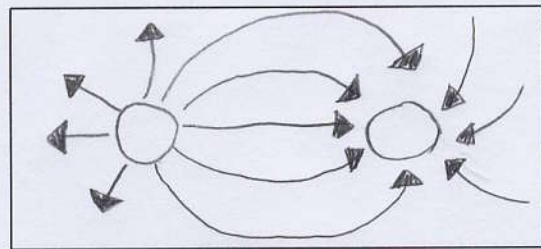
- A) True
- B) False

24. Electrons and protons have the same charge and therefore attract each other.

- A) True
- B) False

25. What is the charge on the left side of the following diagram?

- A) Positive
- B) Negative



27. Which is not a source of potential difference?

- A) Wet Cell
- B) Generator
- C) Dry Cell
- D) Free Cell
- E) Solar Cell

$$\text{current} = \text{voltage} / \text{resistance}$$

28. In Ohms Law, which variable is directly proportional to current?

- A) Voltage
- B) Resistance



29. In Ohms Law, which variable is inversely proportional to current?

- A) Voltage
- B) Resistance

30. If the resistance in a circuit remains constant while the voltage increases, what happens to the current?

- A) Current increases
- B) Current stays the same
- C) Current decreases
- D) None of the above

31. What is the SI unit of electrical resistance?

- A) Coulomb
- B) Ohm
- C) Ampere
- D) Volt

32. In Ohm's Law, if you double the voltage in a circuit then the current should....

- A) Double
- B) decrease to half
- C) stay the same
- D) decrease a little

33. PG & E provides which of the following in this science room?

- A) electrons used in the lights
- B) the push of electrons used in the lights
- C) protons used in the lights
- D) the push of protons used in the lights

34. What is the SI unit of resistance?

- A) Volts
- B) Coulombs
- C) Amperes
- D) Ohms

35. Charge flows through a circuit.

- A) True
- B) False

36. Voltage is established across a circuit.

- A) True
- B) False

37. Electrical resistance is greater in a shorter wire than a long wire.

- A) True
- B) False

38. Electrical resistance is greater in a hot wire than a cool wire

- A) True
- B) False

39. Electrical resistance is greater in a thicker wire than a thin wire.

- A) True
- B) False

40. A wire that is thin and long has more resistance than a short fat wire.

- A) True
- B) False

41. What is power measured in?

- A) Joules
- B) Energy
- C) Meters
- D) Watts

$$\text{current} = \text{voltage} / \text{resistance}$$

42. What is the current in a coiled heating element of a 240-V stove, if the resistance is 80-ohms at its operating temperature.

- A) 320 A
- B) 30 A
- C) 3 A
- D) 0.333 A

43. What is the current in a 20-ohm light bulb connected to a 120-V circuit?

- A) 60 A
- B) 6 A
- C) 0.1 A
- D) 0.01 A

44. What is the resistance of a circuit that has a potential of 12 Volts and a current of 2 Amps?

- A) 24 Ohms
- B) 14 Ohms
- C) 6 Ohms
- D) 10 Ohms

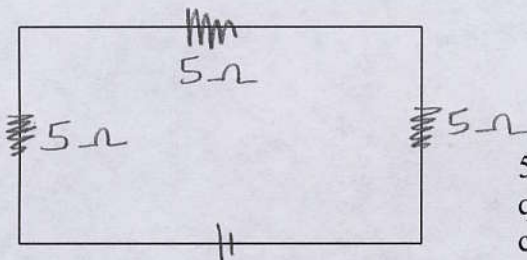


45. If the filament resistance in an automobile headlamp is 5-ohms, how many volts does it need to push 10 Amps of current through it?

- A) 5 Volts
- B) 50 Volts
- C) 2 Volts
- D) 15 Volts

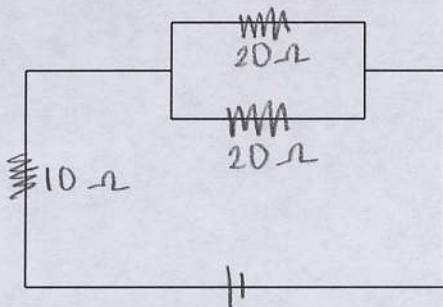
46. What is the current of the following circuit?

- A) 50 A
- B) 15 A
- C) 5 A
- D) 2 A



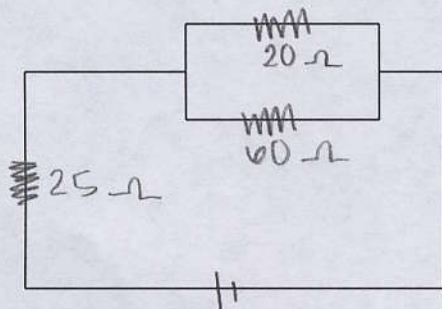
47. What is the equivalent resistance of the following circuit?

- A) 20  $\Omega$
- B) 0  $\Omega$
- C) 1  $\Omega$
- D) 5  $\Omega$



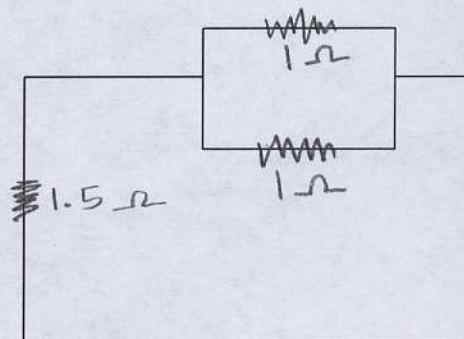
48. What is the equivalent resistance of the following circuit?

- A) 40  $\Omega$
- B) 30  $\Omega$
- C) 8  $\Omega$
- D) 50  $\Omega$



49. What is the equivalent resistance of the following circuit?

- A) 60  $\Omega$
- B) 20  $\Omega$
- C) 18  $\Omega$
- D) 2  $\Omega$



50. If the voltage across the circuit in question 49 is 90 Volts, what would the current be in that circuit?

- A) 4.5 A
- B) 1.33 A
- C) 5 A
- D) 45 A



Mark the best answer for each question on your scantron. (1 point each)

1. What is the SI unit of charge?

- ☒ A) Coulomb  
☐ B) Volt  
☐ C) Ampere  
☐ D) Joule

2. Materials in which electrons are free to roam around are considered to be good ...

- ☐ A) Insulators  
☒ B) Conductors

3. Which method of charge transfer involves physical contact?

- ☐ A) Induction *← Not touching*  
☐ B) Reduction  
☐ C) Deduction  
☒ D) Conduction *← touching*

4. What force is the key to the development of an electrostatic charge on ebonite rods?

- ☐ A) Coulomb  
☐ B) Induction  
☐ C) Gravity  
☒ D) Friction *Rubbing unlike materials together can produce a charge*

5. Coulomb's law says that the force between any two charges depends ...

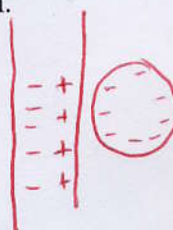
- ☐ A) Directly on the magnitude of the charges.  
☐ B) Inversely on the square of the distance between the charges.  
☒ C) Both of the above  
☐ D) None of the above

6. In a good insulator, electrons are usually

- ☒ A) Tightly bound in place.  
☐ B) Free to move around after an impurity has been added.  
☐ C) Semi-free to move around *— semiconductor*  
☐ D) Free to move around.

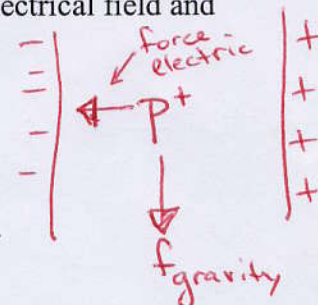
7. The reason a charged balloon will stick to a wall is that ...

- ☐ A) The charge is slightly sticky and acts like glue.  
☐ B) Electrons transfer back and forth between the wall and the balloon.  
☒ C) Induced opposite charges in the wall are closer than other wall charges.  
☐ D) The balloon material simply sticks to walls.



8. How many different forces would act on a proton placed in both an electrical field and a gravitational field?

- ☐ A) One  
☒ B) Two  
☐ C) None



9. An electrical field has...

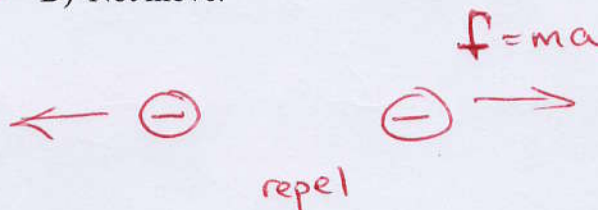
- ☐ A) Magnitude  
☐ B) Direction  
☒ C) Both A and B  
☐ D) Neither A nor B

10. Electrical Potential energy is the energy a charged object has because of its...

- ☒ A) Position  
☐ B) Mass  
☐ C) Motion  
☐ D) Momentum

11. If two negative charges are held close together and then released, the charges will

- ☐ A) Accelerate towards each other.  
☒ B) Accelerate away from each other.  
☐ C) Move at a constant speed away from each other.  
☐ D) Not move.



*↑*  
 conductor

$$F = k \frac{q_1 q_2}{r^2}$$



12. A small, positively charged object near a positively charged sphere is moved closer to the sphere. The electric potential energy of the small object...

- A) Decreases.
- ☒ B) Increases.
- C) Stays the same.

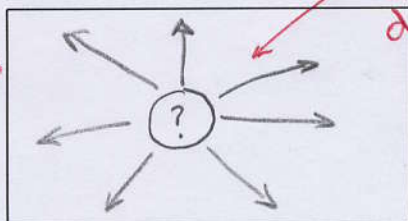
13. What is the SI unit of electrical potential?

- A) Joules
- ☒ B) Volts
- C) Coulombs
- D) Amperes

*Volt = Joule / Coulomb*

14. What is the charge on the following diagram?

- ☒ A) Positive
- B) Negative
- C) Neutral



15. The lightning is caused by friction of ice crystals in clouds?

- ☒ A) True
- B) False

16. The occupants of a car, driving through a thunderstorm, are at risk of being struck by lightning.

- A) True
- ☒ B) False

*lightening will go around the body of a conductor not inside*

17. Electrical charge is conserved.

- ☒ A) True
- B) False

*always*

18. All Electrons are identical.

- ☒ A) True
- B) False

19. Electrical charge can be stored. - Capacitor

- ☒ A) True
- B) False

20. It takes work to separate opposite charges.

- ☒ A) True
- B) False

21. Objects become charged when electrons move onto them or off of them.

- ☒ A) True
- B) False

22. Protons flow through wires.

- A) True
- ☒ B) False

*(electrons flow through wires)*

23. A capacitor is a device for storing charge and energy.

- ☒ A) True
- B) False

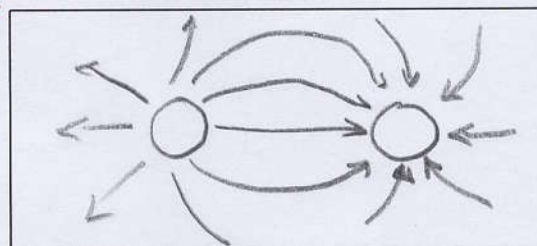
24. Electrons and protons have the same charge and therefore attract each other.

- A) True
- ☒ B) False

*opposite then true*

25. What is the charge on the left side of the following diagram?

- ☒ A) Positive
- B) Negative



27. Which is not a source of potential difference?

- A) Wet Cell
- B) Generator
- ☒ C) Free Cell
- D) Dry Cell
- E) Solar Cell

*← car battery*

*← "AA" battery*

**current = voltage / resistance**

28. In Ohms Law, which variable is directly proportional to current?

- A) Resistance
- ☒ B) Voltage

29. In Ohms Law, which variable is inversely proportional to current?

- A) Voltage
- ☒ B) Resistance



30. If the resistance in a circuit remains constant while the voltage increases, what happens to the current?

- ☒ A) Current decreases
- ☐ B) Current stays the same
- ☐ C) Current increases
- ☐ D) None of the above

31. What is the SI unit of electrical resistance?

- ☐ A) Coulomb
- ☐ B) Volt
- ☐ C) Ampere
- ☒ D) Ohm

32. Which two electrical device allows electricity to flow in one direction?

- ☐ A) Capacitor
- ☒ B) Diode
- ☐ C) Generator
- ☐ D) Conductor

33. PG & E provides which of the following in this science room?

- ☐ A) protons used in the lights
- ☐ B) the push of protons used in the lights
- ☐ C) electrons used in the lights
- ☒ D) the push of electrons used in the lights

34. What is the SI unit of energy?

- ☒ A) Joules
- ☐ B) Coulombs
- ☐ C) Amperes
- ☐ D) Volts

35. Charge flows through a circuit.

- ☒ A) True
- ☐ B) False

36. Voltage is established across a circuit.

- ☒ A) True
- ☐ B) False

37. Electrical resistance is greater in a shorter wire than a long wire.

- ☐ A) True
- ☒ B) False

38. Electrical resistance is greater in a hot wire than a cool wire

- ☒ A) True
- ☐ B) False

39. Electrical resistance is greater in a thicker wire than a thin wire.

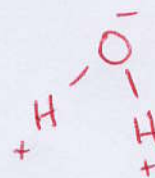
- ☐ A) True
- ☒ B) False

40. A wire that is thin and long has more resistance than a short fat wire.

- ☐ A) True
- ☒ B) False

41. Water has an electric dipole.

- ☒ A) True
- ☐ B) False



$$\text{current} = \text{voltage} / \text{resistance}$$

42. What is the current in a coiled heating element of a 240-V stove, if the resistance is 80-ohms at its operating temperature.

- ☐ A) 30 A
- ☒ B) 3 A
- ☐ C) 0.333 A
- ☐ D) 320A

$$I = \frac{V}{R} = \frac{240V}{80\Omega} = 3A$$

43. What is the current in a 20-ohm light bulb connected to a 120-V circuit?

- ☒ A) 6 A
- ☐ B) 0.1 A
- ☐ C) 0.01 A
- ☐ D) 60 A

$$I = \frac{V}{R} = \frac{120V}{20\Omega} = 6A$$

44. What is the resistance of a circuit that has a potential of 12 Volts and a current of 2 Amps?

- ☐ A) 14 Ohms
- ☒ B) 6 Ohms
- ☐ C) 10 Ohms
- ☐ D) 24 Ohms

$$R = \frac{V}{I} = \frac{12V}{2A} = 6\Omega$$

45. If the filament resistance in an automobile headlamp is 5-ohms, how many volts does it need to push 10 Amps of current through it?

- A) 50 Volts
- B) 2 Volts
- C) 15 Volts
- D) 5 Volts

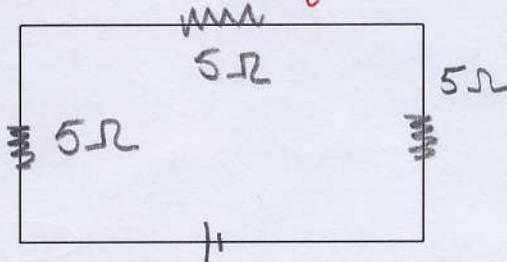
$$V = IR$$

$$= 10A \cdot 5\Omega$$

$$= 50V$$

46. What is the equivalent resistance of the following circuit?

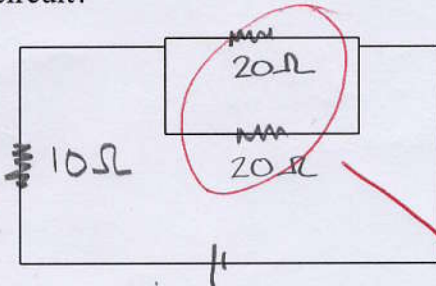
- A) 15  $\Omega$
- B) 5  $\Omega$
- C) 2  $\Omega$
- D) 50  $\Omega$



$$R_{eq} = 5\Omega + 5\Omega + 5\Omega$$

47. What is the equivalent resistance of the following circuit?

- A) 0  $\Omega$
- B) 1  $\Omega$
- C) 5  $\Omega$
- D) 20  $\Omega$



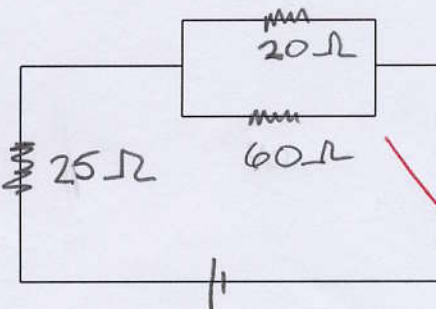
$$\frac{1}{R_{eq}} = \frac{1}{20\Omega} + \frac{1}{20\Omega}$$

$$\frac{1}{R_{eq}} = \frac{2}{20}$$

$$R_{eq} = \frac{20}{2} = 10\Omega$$

48. What is the equivalent resistance of the following circuit?

- A) 30  $\Omega$
- B) 8  $\Omega$
- C) 50  $\Omega$
- D) 40  $\Omega$



$$\frac{1}{R_{eq}} = \frac{1}{20\Omega} + \frac{1}{60\Omega}$$

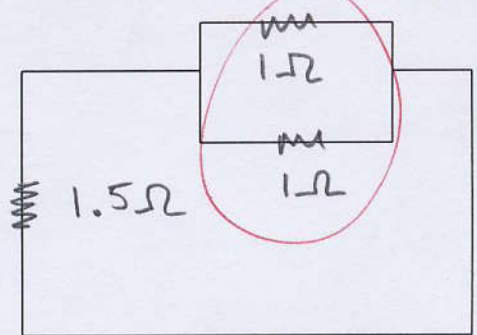
$$= \frac{3}{60\Omega} + \frac{1}{60\Omega} = \frac{4}{60\Omega}$$

$$R_{eq} = \frac{60\Omega}{4} = 15\Omega$$

$$25\Omega + 15\Omega = 40\Omega$$

49. What is the equivalent resistance of the following circuit?

- A) 20  $\Omega$
- B) 18  $\Omega$
- C) 2  $\Omega$
- D) 60  $\Omega$



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

50. What would the current be of the above circuit if the voltage across the circuit is 90 Volts?

- A) 1.33 A
- B) 5 A
- C) 45 A
- D) 4.5 A

$$I = \frac{V}{R} = \frac{90V}{2\Omega} = 45A$$



# Circuits

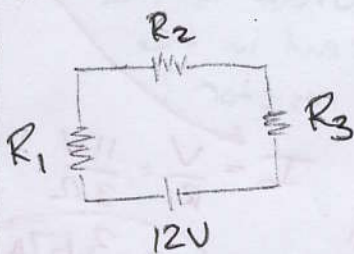
Name Key  
Date \_\_\_\_\_  
Period \_\_\_\_\_

$V = IR$

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

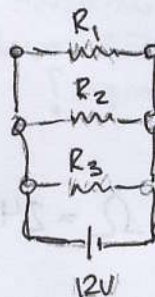
Parallel:  $\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

1.



$R_1 = 2\Omega$   
 $R_2 = 4\Omega$   
 $+ R_3 = 8\Omega$   
 $R_{eq} = ? \quad 14\Omega$

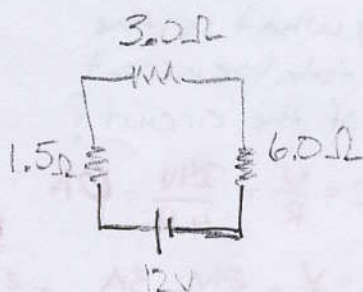
2.



$R_1 = 2\Omega$   
 $R_2 = 4\Omega$   
 $R_3 = 8\Omega$   
 $R_{eq} = ?$   
 $\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$   
 $= \frac{4}{8} + \frac{2}{8} + \frac{1}{8}$   
 $\frac{1}{R_{eq}} = \frac{7}{8}$

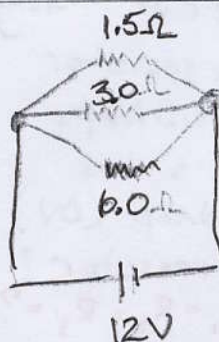
$R_{eq} = \frac{8}{7}$  or  $1.14\Omega$

3.



$R_{eq} = ?$   
 $3.0\Omega$   
 $1.5\Omega$   
 $+ 6.0\Omega$   
 $10.5\Omega$

4.



$R_{eq} = ?$   
 $\frac{1}{R_{eq}} = \frac{1}{1.5} + \frac{1}{3.0} + \frac{1}{6.0}$   
 $\frac{1}{R_{eq}} = \frac{4}{6} + \frac{2}{6} + \frac{1}{6} = \frac{7}{6}$   
 $R_{eq} = \frac{6}{7}$  or  $0.86\Omega$

5. How much current is going through the  $6.0\Omega$  resistor in question #3?

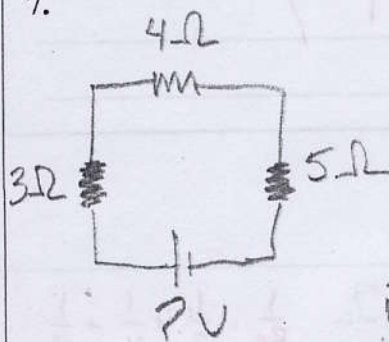
$I = \frac{V}{R} = \frac{12V}{10.5\Omega} = 1.14A$

6. How much current is going through the  $6.0\Omega$  resistor in question #4?

$I = \frac{V}{R} = \frac{12V}{6.0\Omega} = 2A$



7.



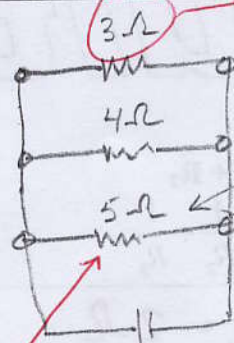
What is the potential difference (aka voltage of the battery) if the current in the 5Ω resistor is 2.0 Amps?

$$R_{eq} = 12\Omega$$

$$I = 2.0A$$

$$V = IR = 2.0A \cdot 12\Omega = 24V$$

8.



If the current in 5Ω resistor is 2.2 amps

What is the current in the 3Ω resistor?

$$V = IR$$

$$= 2.2A \cdot 5\Omega$$

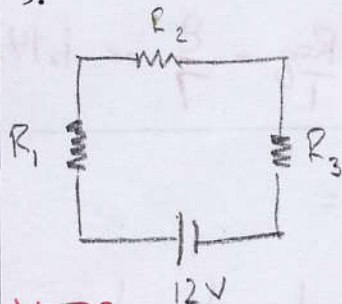
$$= 11V$$

↑ Voltage on all resistors

$$I = \frac{V}{R} = \frac{11V}{3\Omega}$$

$$= 3.67A$$

9.



If  $R_1 = R_2 = R_3$  and the current through each resistor is 4.0 Amps what is the voltage drop ( $\Delta V$ ) on each resistor?

$$V = IR$$

$$R = \frac{V}{I} = \frac{12V}{4A} = 3\Omega$$

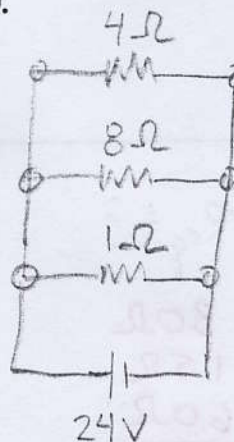
So  $R_1 = R_2 = R_3 = ?$

$$\Delta V = 4A \cdot 1\Omega = 4V$$

$$R_1 + R_2 + R_3 = 3\Omega$$

$$\Delta R_1 = R_2 = R_3 = 1\Omega$$

10.



a) What is the current in each resistor?

b) What is the total current of the circuit?

$$I = \frac{V}{R} = \frac{24V}{4\Omega} = 6A$$

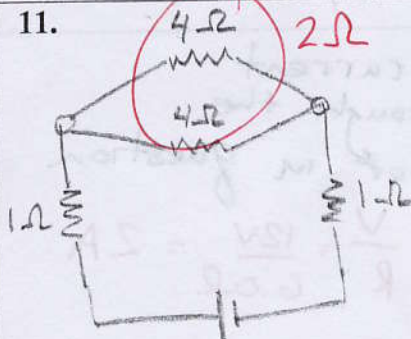
$$I = \frac{V}{R} = \frac{24V}{8\Omega} = 3A$$

$$I = \frac{V}{R} = \frac{24V}{1\Omega} = 24A$$

$$6A + 3A + 24A = 33A$$

total

11.



$$R_{eq} = ?$$

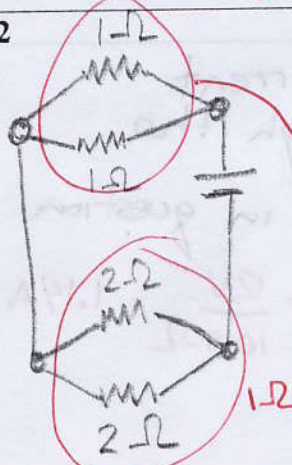
$$R_{eq} = 1\Omega + 2\Omega + 1\Omega$$

$$= 4\Omega$$

$$\frac{1}{R_{eq}} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4}$$

$$R_{eq} = \frac{4}{2} \text{ or } 2$$

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$$R_{eq} =$$

$$\frac{1}{R_{eq}} = \frac{1}{1} + \frac{1}{1} = \frac{2}{1}$$

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

$$R_{eq \text{ total}} = 1\Omega + \frac{1}{2}\Omega$$

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

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{2} = \frac{2}{2} = 1$$