

Ultimate Electric Circuits Review Assignment

Key Formulae:

$$I = \frac{Q}{\Delta t}$$

$$V = IR$$

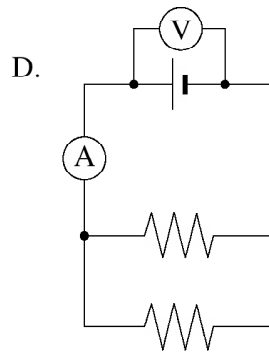
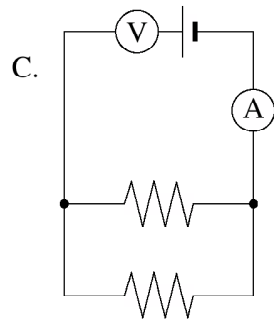
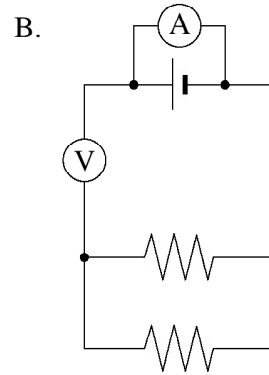
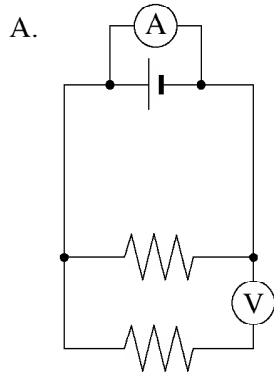
$$V_{\text{terminal}} = \mathcal{E} \pm Ir$$

$$P = VI$$

0108

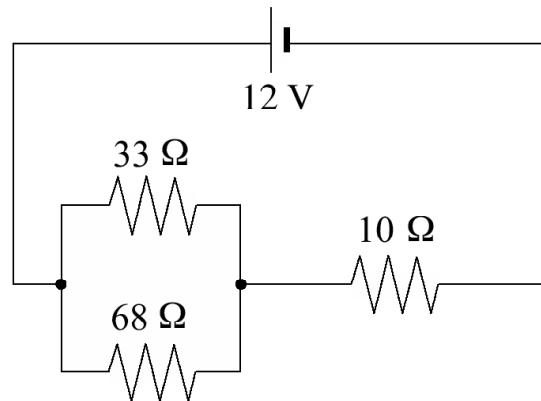
1.

Which of the following diagrams shows an ammeter correctly placed to measure the circuit current and a voltmeter correctly placed to measure the potential difference across the battery?



2.

What is the current through the $10\ \Omega$ resistor in the circuit shown below?



- A. $0.11\ \text{A}$
- B. $0.37\ \text{A}$
- C. $1.2\ \text{A}$
- D. $1.7\ \text{A}$

3.

~~Transformers are commonly used in which electrical device?~~

- ~~A. toaster~~
- ~~B. television set~~
- ~~C. electric kettle~~
- ~~D. incandescent bulb~~

0106

4.

Current is a measure of

- A. the number of charges stored in a cell.
- B. the amount of energy given to a charged object.
- C. the charge passing a point in a circuit in a given time.
- D. the resistance to the flow of charged particles in a circuit.

0108

5. A 12 V battery transfers 33 C of charge to an external circuit in 7.5 s.

a) What current flows through the circuit? **(2 marks)**

b) What is the resistance of the circuit? **(2 marks)**

c) What is the power output of the battery? **(2 marks)**

d) The external circuit is most likely to consist of: (circle the correct response)

i. a bulb ii. a kettle iii. a calculator **(1 mark)**

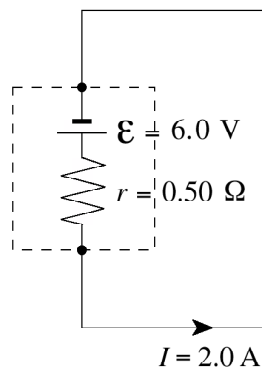
6.

Two identical light bulbs, wired in parallel to a battery, are equally bright. When one of the bulbs burns out, however, the other bulb is observed to glow brighter. Using principles of physics, explain why the battery causes the remaining bulb to glow more brightly. (4 marks)

0106

7.

The battery in the diagram below is delivering a current of 2.0 A.

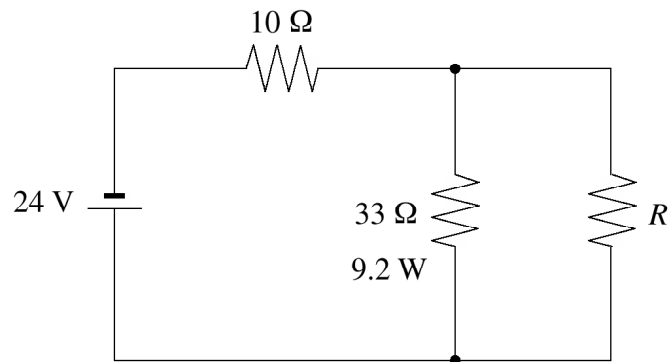


What will be the reading on a voltmeter connected to the battery terminals?

- A. 1.0 V
- B. 5.0 V
- C. 6.0 V
- D. 7.0 V

8.

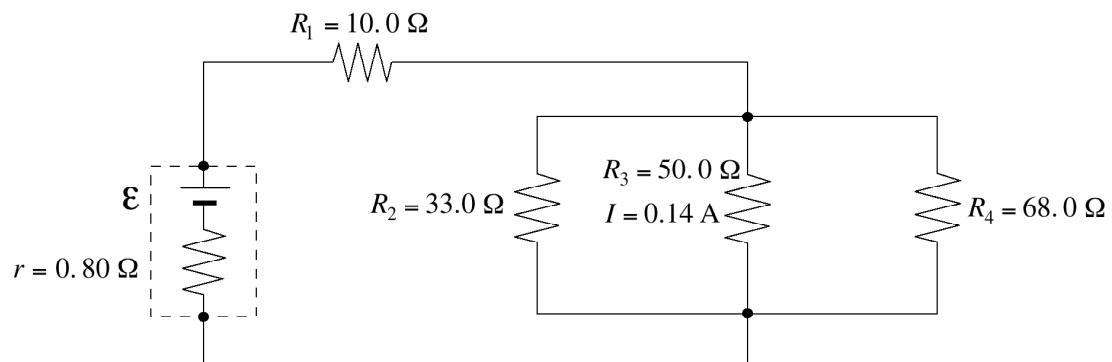
What is the total power dissipated by the three resistors in the circuit shown below?



- A. 12 W
- B. 16 W
- C. 23 W
- D. 30 W

9.

The current through the 50.0 Ω resistor in the circuit below is 0.14 A.



a) Determine the emf of the battery.

(5 marks)

b) Determine the power dissipated in the battery's internal resistance. (2 marks)

0101

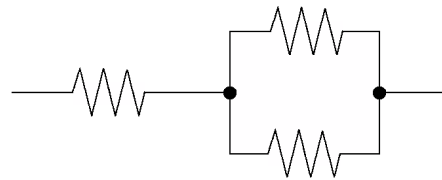
10.

Which of the following combinations of three identical resistors has the least equivalent resistance?

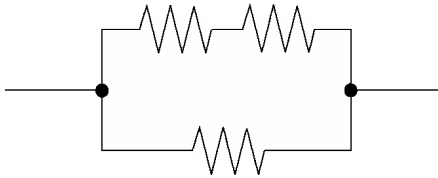
A.



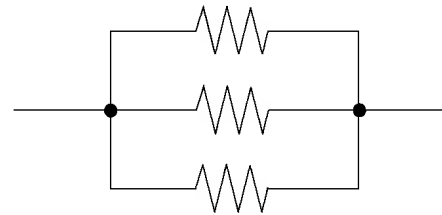
B.



C.



D.



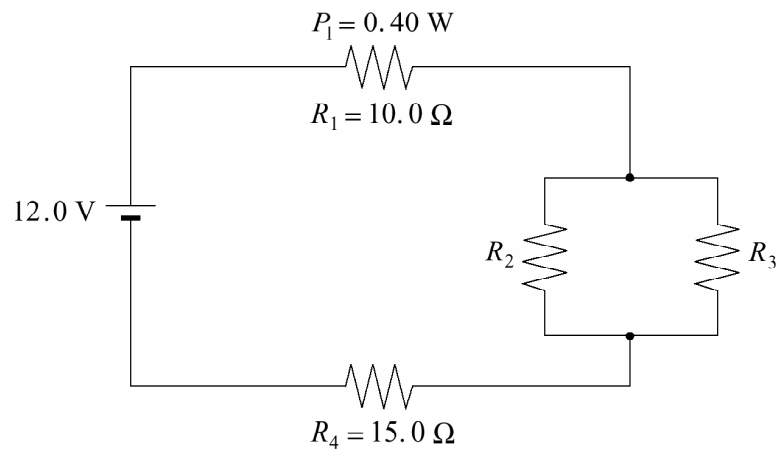
11.

An electrical device with a constant resistance draws 0.75 A when connected to a 4.8 V source. What are the current and power for this device when it is connected to a 6.0 V source?

| | CURRENT (A) | POWER (W) |
|----|-------------|-----------|
| A. | 0.75 | 3.6 |
| B. | 0.75 | 5.6 |
| C. | 0.94 | 3.6 |
| D. | 0.94 | 5.6 |

12.

In the circuit below, resistor R_1 dissipates 0.40 W . Resistors R_2 and R_3 are identical.



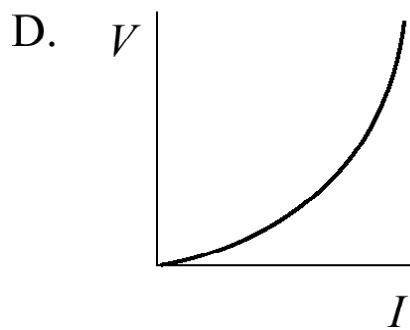
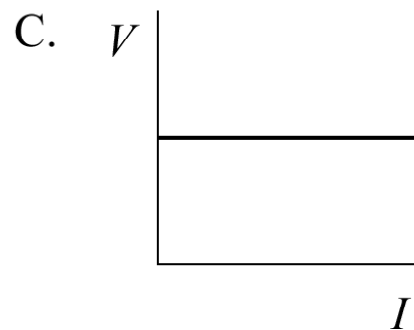
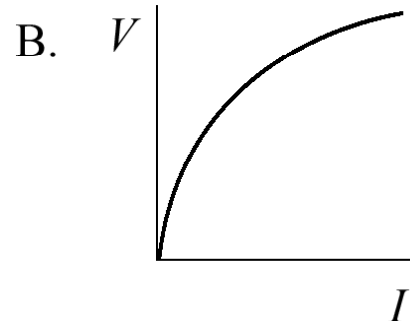
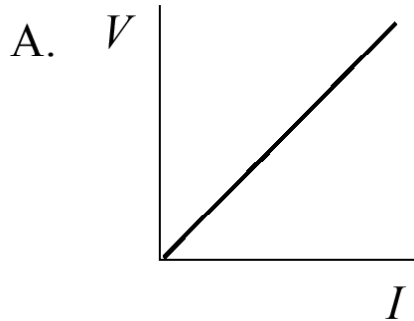
What is the resistance of R_2 ?

(7 marks)

0008

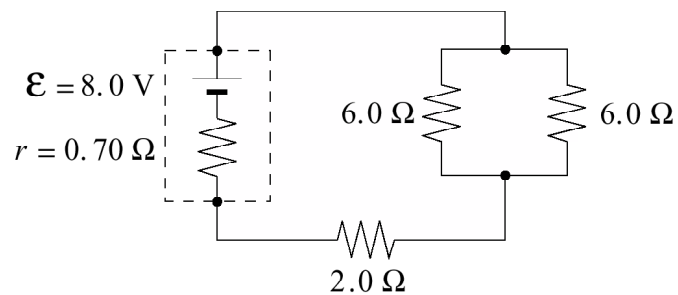
13.

Which of the following graphs illustrates Ohm's law?



14.

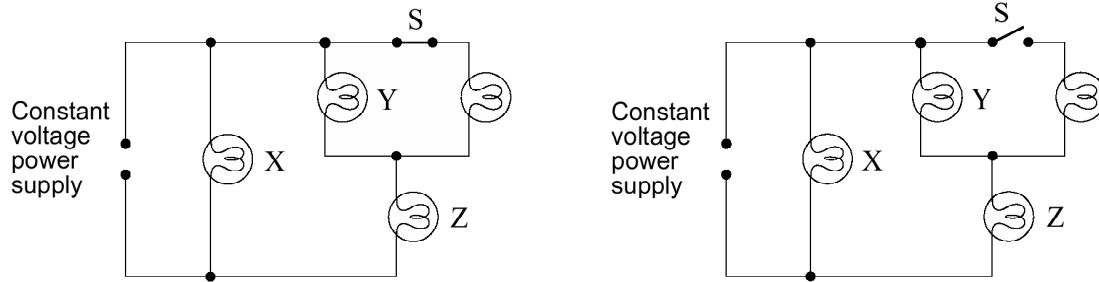
In the following circuit, what is the terminal voltage of the battery?



- A. 6.9 V
- B. 7.0 V
- C. 8.0 V
- D. 9.0 V

15.

If switch S is opened, how does the brightness of each bulb (X, Y, and Z) compare to the situation when the switch was closed?

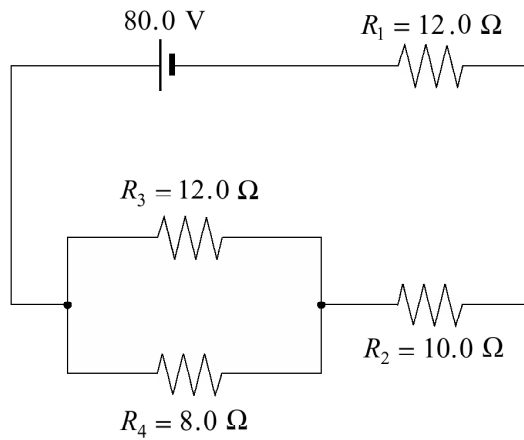


| | BULB X | BULB Y | BULB Z |
|----|--------|----------|----------|
| A. | same | same | same |
| B. | same | dimmer | brighter |
| C. | same | brighter | dimmer |
| D. | dimmer | dimmer | dimmer |

16.

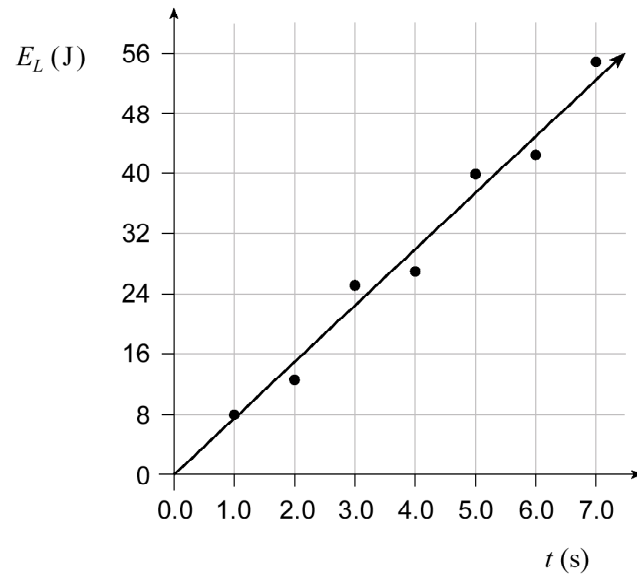
What is the power dissipated in the 8.0Ω resistor in the circuit as shown?

(7 marks)



17.

The graph shows the light energy E_L emitted by a bulb versus time t .



a) Find the power output of the bulb.

(2 marks)

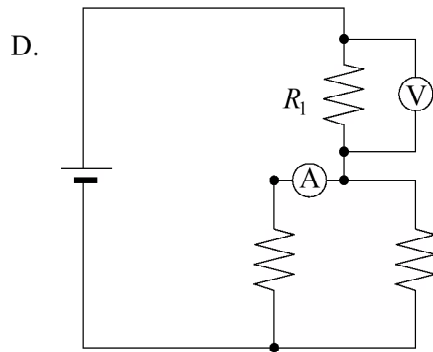
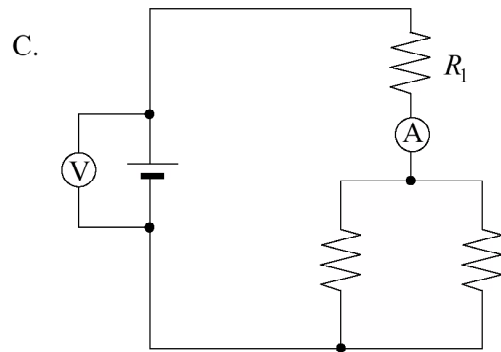
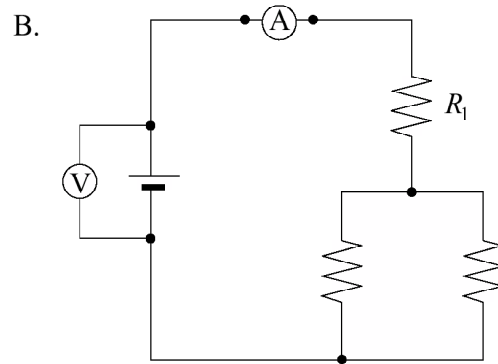
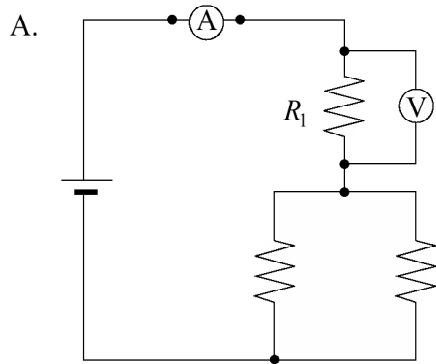
b) If this bulb is 20% efficient, find the power delivered to the bulb.

(3 marks)

0006

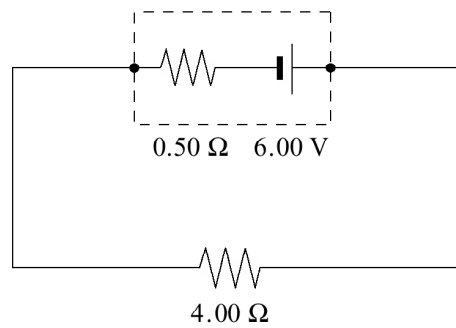
18.

Which one of the following shows the correct placement of an ammeter and a voltmeter to determine the power output of resistor R_1 ?



19.

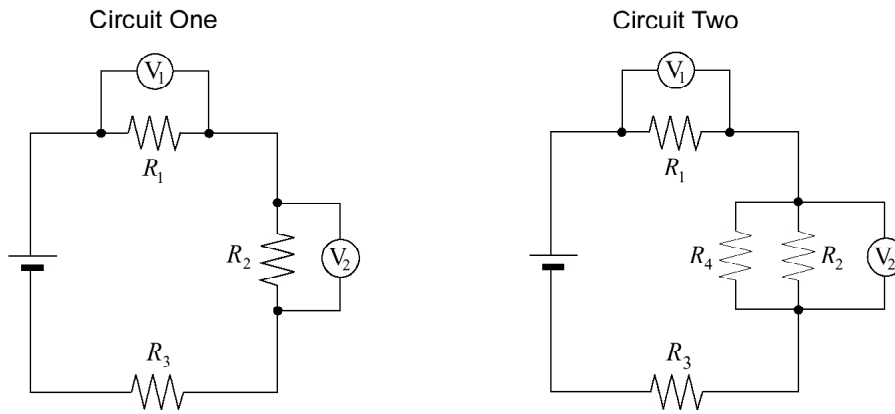
What is the terminal voltage of the battery in the circuit shown below?



- A. 5.25 V
- B. 5.33 V
- C. 6.00 V
- D. 6.67 V

20.

In circuit one, resistors and voltmeters are connected as shown. In circuit two, an additional resistor R_4 is placed in parallel with resistor R_2 .

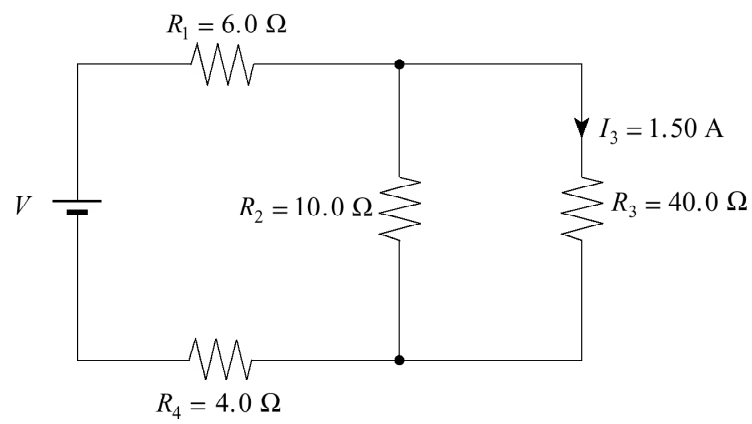


How have the values of V_1 and V_2 in circuit two changed compared to those in circuit one?

| | V_1 | V_2 |
|----|-----------|-----------|
| A. | no change | decreased |
| B. | decreased | increased |
| C. | increased | decreased |
| D. | increased | no change |

21.

A current of 1.50 A flows through the 40.0 Ω resistor.



What is the potential difference of the power supply?

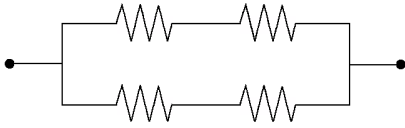
(7 marks)

0001

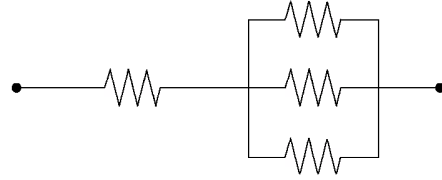
22.

Which of the following arrangements would draw the largest current when connected to the same potential difference? All resistors have the same value.

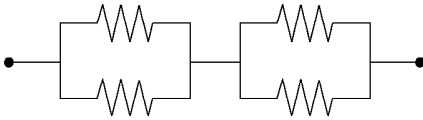
A.



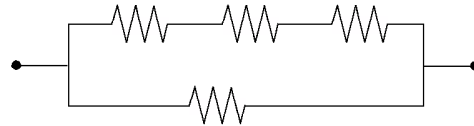
B.



C.

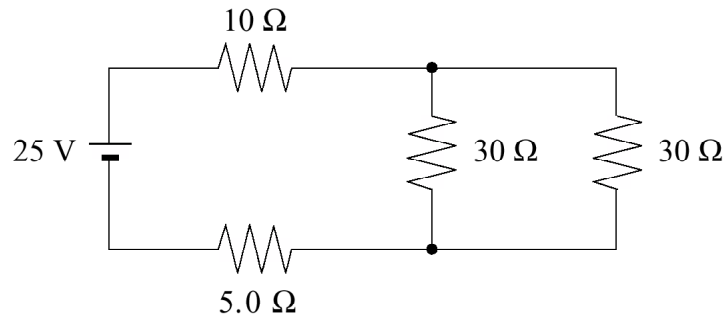


D.



23.

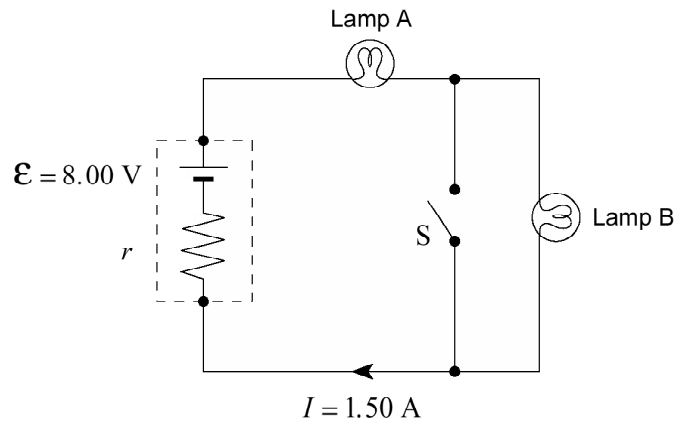
What is the power dissipated by the 5.0Ω resistor in the following circuit?



- A. 0.56 W
- B. 3.5 W
- C. 6.2 W
- D. 130 W

24.

The circuit shown consists of an 8.00 V battery and two light bulbs. Each light bulb dissipates 5.0 W. Assume that the light bulbs have a constant resistance. Switch S is open.



- a) If a current of 1.50 A flows in the circuit, what is the internal resistance r of the battery?
(4 marks)

9908

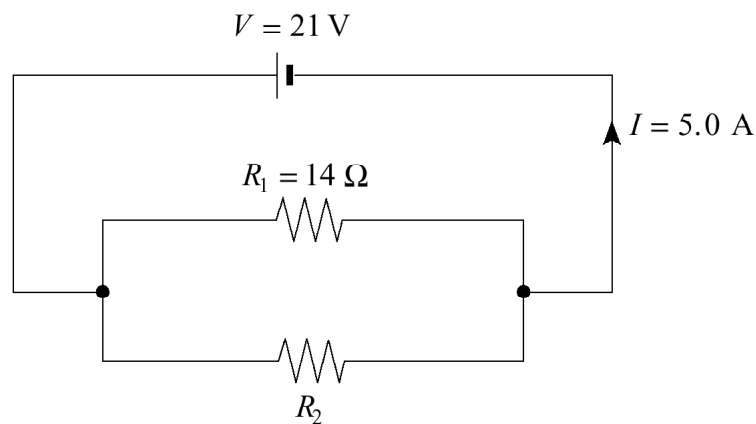
25.

Electricity is transmitted at high potential to

- A. operate heavy equipment.
- B. maximize current in the transmission lines.
- C. minimize the energy lost as heat in the transmission lines.
- D. produce alternating currents because they always require high voltages.

26.

Find the current flowing through resistor R_2 in the circuit shown below.



- A. 1.5 A
- B. 2.5 A
- C. 3.5 A
- D. 5.0 A

27.

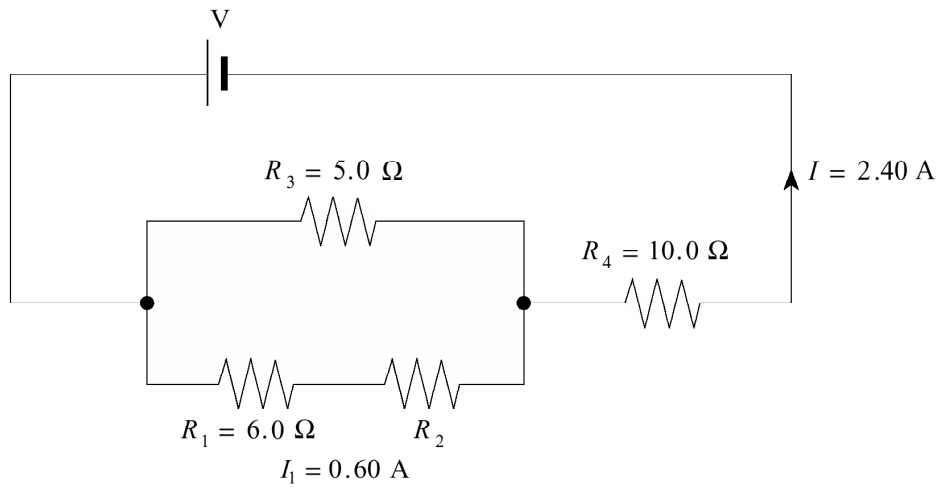
A cell has an internal resistance of 0.50Ω . It has a terminal voltage of 1.4 V when connected to a 5.0Ω external resistance. What will its terminal voltage be if the 5.0Ω resistor is replaced by a 10.0Ω resistor?

- A. 0.70 V
- B. 1.4 V
- C. 1.5 V
- D. 2.8 V

28.

a) Find the value of resistor R_2 .

(5 marks)



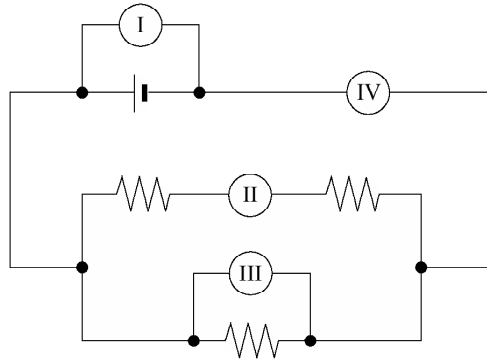
b) Find the potential difference of the power supply, V .

(2 marks)

9906

29.

The circuit shown below includes two ammeters and two voltmeters. Identify the correct placement of these meters.



| | AMMETERS | VOLTMETERS |
|----|----------|------------|
| A. | I, II | III, IV |
| B. | I, III | II, IV |
| C. | II, IV | I, III |
| D. | III, IV | I, II |

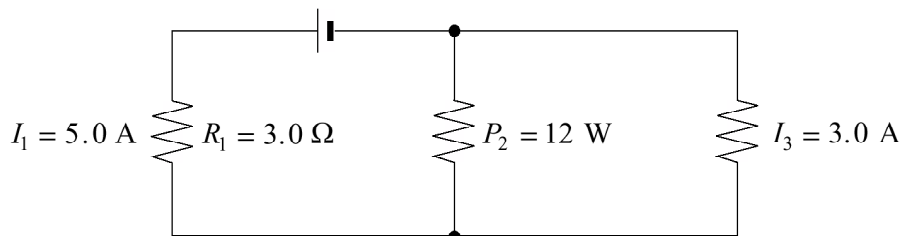
30.

A 120 V supply is connected to a heater of resistance 15Ω . What must the resistance of another heater be in order to produce the same power output when connected to a 240 V supply?

- A. 3.8Ω
- B. 7.5Ω
- C. 30Ω
- D. 60Ω

31.

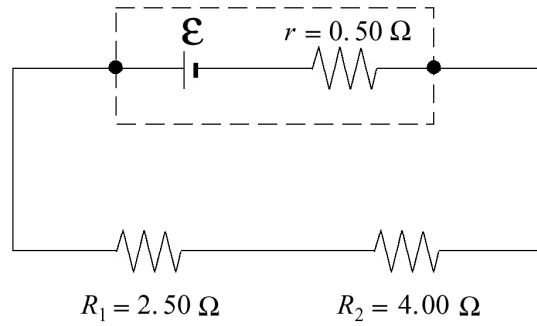
What is the voltage of the power supply shown in the diagram?



- A. 12 V
- B. 19 V
- C. 21 V
- D. 27 V

32.

The cell shown in the diagram supplies a 1.80 A current to the resistors R_1 and R_2 .



a) What is the terminal voltage of the cell?

(3 marks)

b) What is the emf of the cell?

(4 marks)

9901

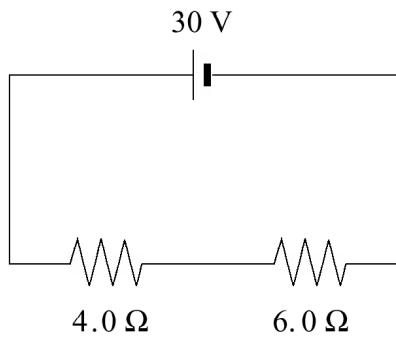
33.

Which household electrical appliance consumes the least energy in a typical month?

- A. Stove
- B. Dryer
- C. Clock
- D. Refrigerator

34.

What is the power output of the $6.0\ \Omega$ resistor in the diagram?



- A. 36 W
- B. 54 W
- C. 90 W
- D. 150 W

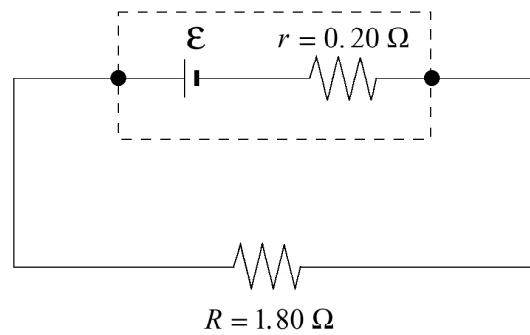
35.

A 12 V power supply is connected to an $8.0\ \Omega$ resistor for 50 s. How much charge passes through the resistor?

- A. 1.9 C
- B. 75 C
- C. 900 C
- D. 4 800 C

36.

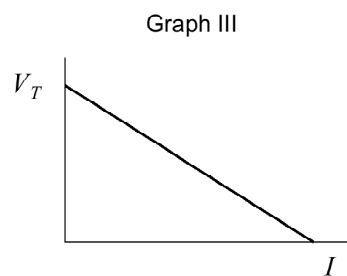
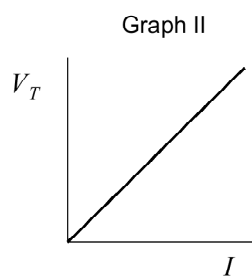
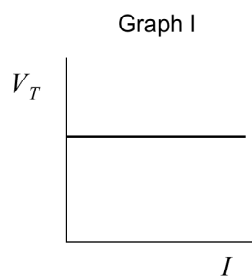
The cell shown delivers a 1.50 A current to the external circuit and has a terminal voltage of 2.70 V .



a) What is the emf of the cell?

(4 marks)

- b) The $1.80\ \Omega$ external resistance is replaced by other resistors and the current and terminal voltage are measured in each case. Which graph best represents terminal voltage V_T versus current I as these resistors are changed? **(2 marks)**



- Graph I
- Graph II
- Graph III

(Check one response.)

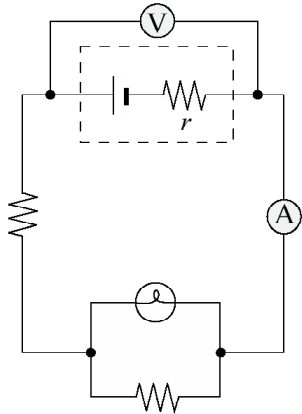
- c) Using principles of physics, explain your answer to b). **(3 marks)**

9806

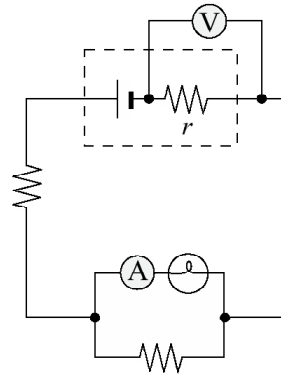
37.

In which of the following circuits is the voltmeter placed correctly to measure the terminal voltage of the battery, and the ammeter placed correctly to measure the current through the light bulb (⦿) ?

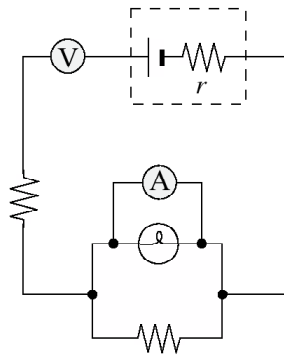
A.



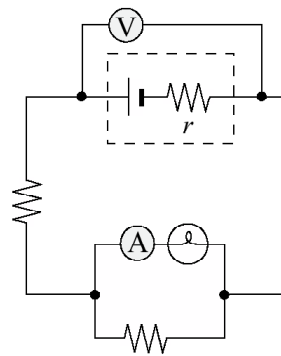
B.



C.

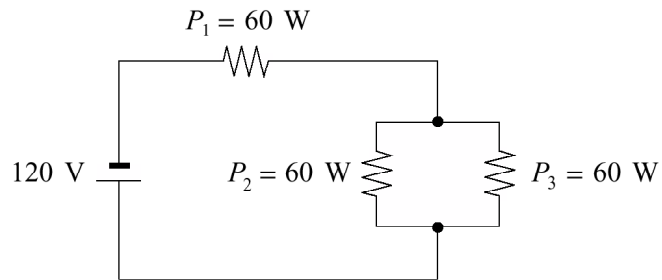


D.



38.

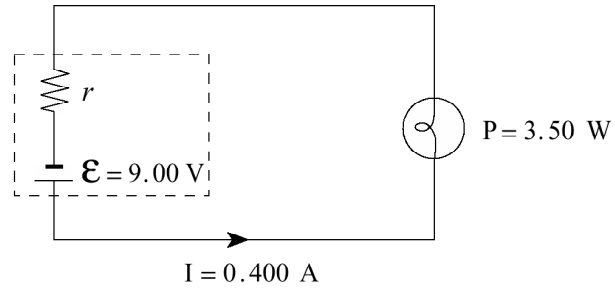
What is the current leaving the battery in the circuit below?



- A. 1.3 A
- B. 1.5 A
- C. 2.0 A
- D. 4.0 A

39.

The circuit shown in the diagram below consists of a 9.00 V battery and a 3.50 W light bulb.



- a) If a current of 0.400 A leaves the battery, what is the internal resistance, r , of the battery? **(5 marks)**

b) The light bulb is now replaced by a lower resistance (brighter) light bulb. The terminal voltage will now be

- less than before.
- the same as before.
- greater than before.

(Check one response.)

(1 mark)

c) Using principles of physics, explain your answer to b).

(3 marks)

9801

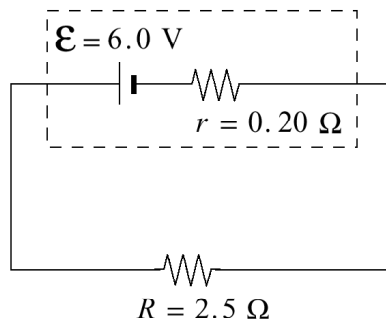
40.

Which of the following statements provides valid reasoning for the transmission of electric energy at high potential:

- A. At high potential there will be low current resulting in low power loss.
- B. At high potential there will be high current resulting in high power loss.
- C. At high potential there will be low line resistance resulting in low power loss.
- D. At high potential there will be high line resistance resulting in high power loss.

41.

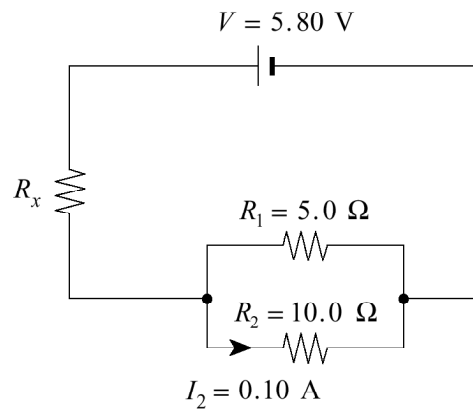
What is the terminal voltage of the battery in the circuit shown in the diagram?



- A. 0.44 V
- B. 5.6 V
- C. 6.0 V
- D. 6.4 V

42.

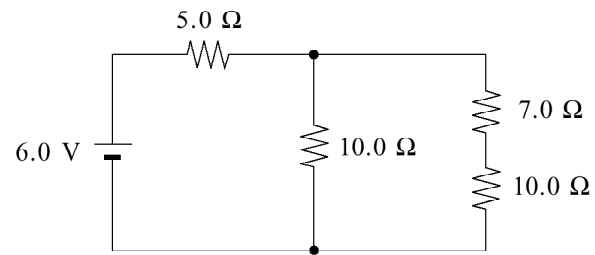
What is the power dissipated in the unknown resistor R_x in the circuit below?



- A. 0.30 W
- B. 1.4 W
- C. 1.7 W
- D. 2.0 W

43.

Consider the circuit shown below.



- a) What is the current through the $7.0\ \Omega$ resistor? **(5 marks)**
- b) How much charge flows through the $7.0\ \Omega$ resistor in a 30 s interval? **(2 marks)**

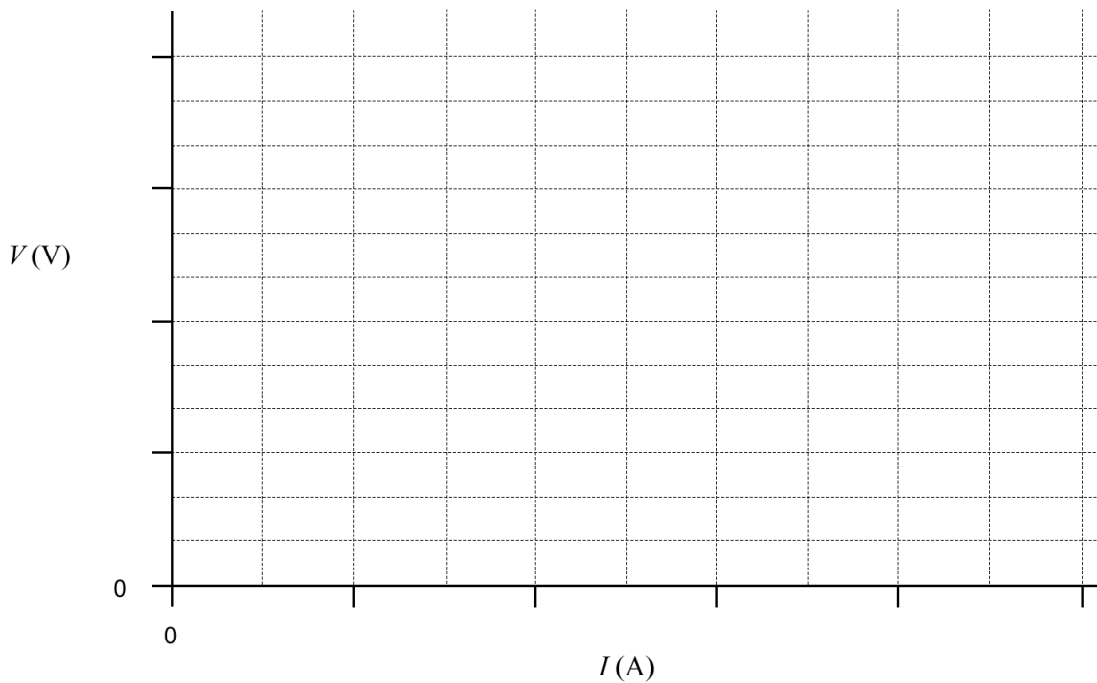
44.

A student connects a power supply to a circuit and measures the potential difference V at its terminals and the current I delivered to the circuit.

| | | | | | |
|---------|------|------|------|------|------|
| V (V) | 0.0 | 3.0 | 6.0 | 9.0 | 12.0 |
| I (A) | 0.00 | 0.25 | 0.50 | 0.75 | 1.00 |

a) Plot a graph of V versus I on the axes below.

(2 marks)



b) Calculate the slope of the line, expressing your answer in appropriate units. **(2 marks)**

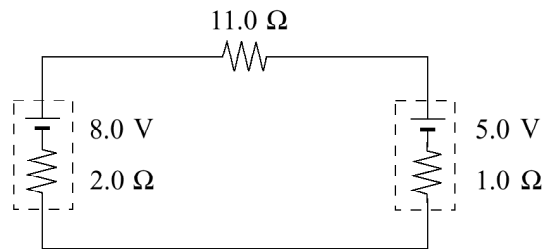
c) What does the slope of the line represent?

(1 mark)

9708

45.

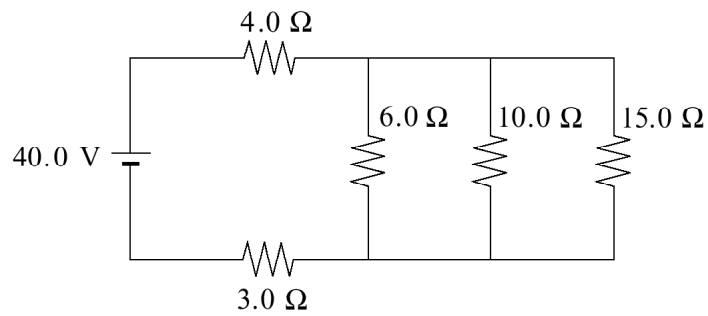
What current flows through the $11.0\ \Omega$ resistor?



- A. $0.21\ \text{A}$
- B. $0.27\ \text{A}$
- C. $0.93\ \text{A}$
- D. $1.2\ \text{A}$

46.

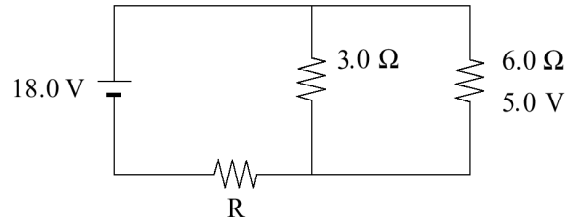
Calculate the current through the $6.0\ \Omega$ resistor in the circuit shown.



- A. $1.1\ \text{A}$
- B. $2.0\ \text{A}$
- C. $4.0\ \text{A}$
- D. $6.7\ \text{A}$

47.

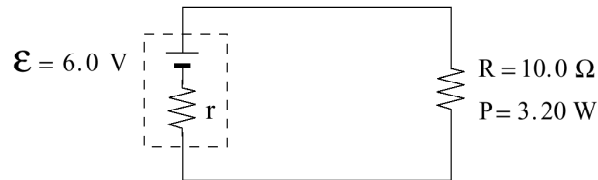
In the following circuit, determine the value of resistor R.



- A. 3.2 Ω
- B. 5.2 Ω
- C. 9.0 Ω
- D. 23 Ω

48.

A battery provides 3.20 W of power to an external resistance. What power is dissipated as heat by the internal resistance within the battery?



- A. 0.19 W
- B. 3.4 W
- C. 3.6 W
- D. 60 W

9808

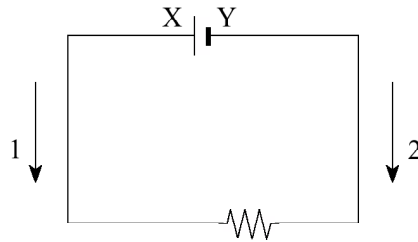
49.

Which of the following household electrical appliances has the greatest rate of energy consumption?

| | ITEM | VOLTAGE | CURRENT |
|----|-------------------|---------|---------|
| A. | Video Camera | 6.0 V | 1.6 A |
| B. | Radio | 4.5 V | 0.45 A |
| C. | Cassette Recorder | 6.0 V | 2.2 A |
| D. | Ghetto Blaster | 12 V | 1.4 A |

50.

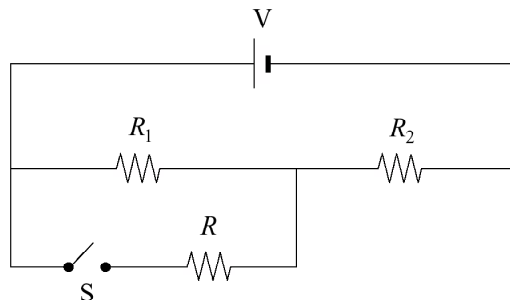
Which of the following correctly labels arrows 1 and 2 and polarities X and Y in the circuit below?



| | ARROW 1 | ARROW 2 | POLARITY X | POLARITY Y |
|----|----------------------|----------------------|------------|------------|
| A. | Electron Flow | Conventional Current | Positive | Negative |
| B. | Electron Flow | Conventional Current | Negative | Positive |
| C. | Conventional Current | Electron Flow | Positive | Negative |
| D. | Conventional Current | Electron Flow | Negative | Positive |

51.

Switch S is originally open as shown in the circuit below.



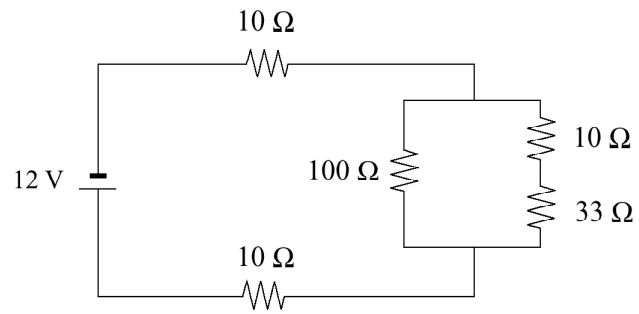
How does the current through resistors R_1 and R_2 change when switch S is closed?

| | CURRENT THROUGH R_1 | CURRENT THROUGH R_2 |
|----|-----------------------|-----------------------|
| A. | increases | increases |
| B. | increases | decreases |
| C. | decreases | increases |
| D. | decreases | decreases |

52.

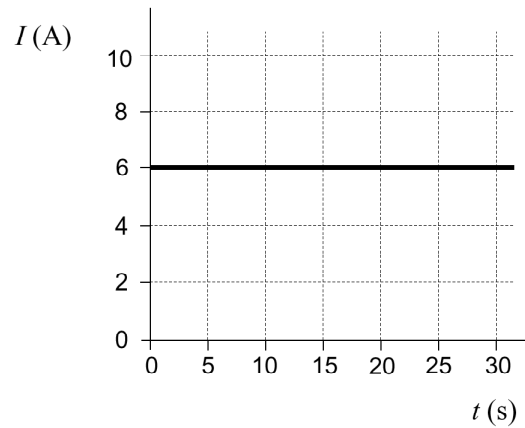
What is the power dissipated in the $33\ \Omega$ resistor in the circuit shown below?

(7 marks)



53.

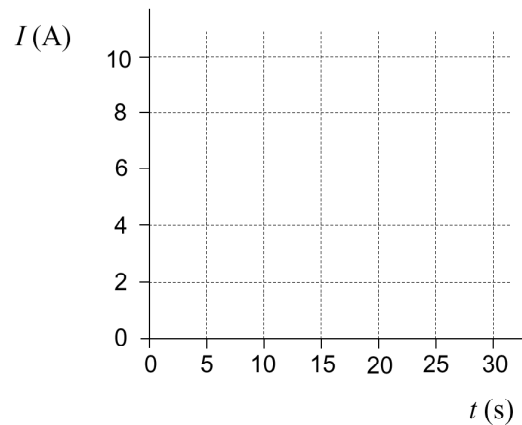
A power supply was connected to a resistor and a student plotted the graph of current, I , flowing through the resistor versus time, t , as shown below.



a) Calculate the area under the graph between $t = 0$ s and $t = 30$ s. **(2 marks)**

b) What does the area represent? **(1 mark)**

c) The same power supply is connected to a resistor of greater resistance. For this new set-up, sketch a possible graph on the axes below and label it c). **(2 marks)**

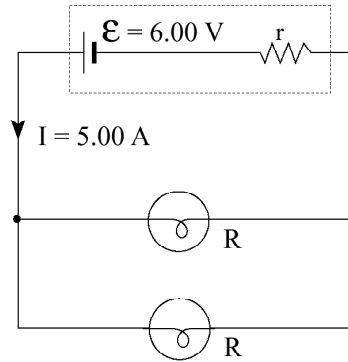
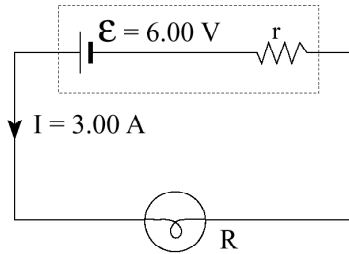


Scholarship Questions

9406

54.

When a power supply whose emf is 6.00 V is connected to a light bulb, it delivers a 3.00 A current. When the same supply is connected to two identical bulbs wired in parallel, the current from the supply is 5.00 A .



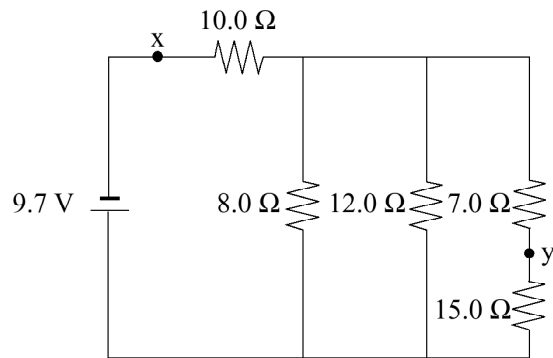
Find the internal resistance of the supply.

(10 marks)

9508

55.

The diagram below shows an electrical circuit.



Find the potential difference between points x and y.

(12 marks)

Answers:

1. D
2. B
3. B
4. C
5. a) 4.4 A b) 2.7 Ω c) 53 W d)
(i)
6. see solution key
7. B
8. B
9. a) 12 v b) 0.16 W
10. D
11. D
12. 70 Ω
13. A
14. B
15. C
16. 26 W
17. a) 7.6 W b) 38 W
18. A
19. B
20. C
21. 135 v
22. D
23. B
24. a) 0.89 Ω
25. C
26. C
27. C
28. a) 9 Ω b) 33.0 v
29. C
30. D
31. C
32. a) 11.7 v b) 12.6 v
33. C
34. B
35. B
36. a) $\epsilon=3.00$ v b) Graph III
c) If R is increased in value, the total resistance of the circuit increases, and the total current I decreases. There is then a smaller potential difference across r so that the terminal voltage is higher.
37. D
38. B
39. a) $r= 0.63 \Omega$ b) less than before
c) The total resistance of the circuit will decrease, therefore the current through the battery will increase. More potential will be dropped across the internal resistance, therefore the terminal voltage will decrease.
40. A
41. B
42. B
43. a) 0.20 A b) 6.0 C
44. b) 12 Ω c) resistance of the circuit
45. A
46. B
47. B
48. A
49. D
50. C
51. C
52. 0.95 W
53. a) 180 C b) the charge delivered
c) see solution key
54. $r= 0.40 \Omega$
55. 7.9 v