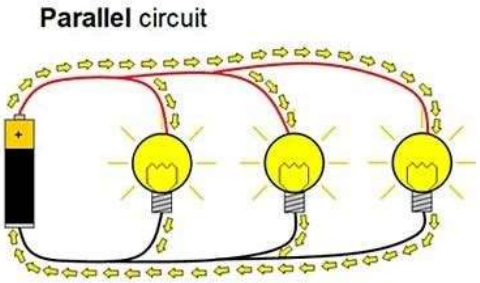
Name: Class:

Total Possible Marks: 23

Parallel Circuits



10

1. Electrical (a) components connected in (b) parallel each have their own (c) branch in a (d) circuit connected to the positive and negative (e) terminals of the (f) supply. If one of them is removed or (g) disconnected it will not affect those that remain because (h) current can still flow in a complete (i) loop from one end of the power supply to the other through the (j) branches in the circuit that are still connected.

components	*disconnected*	*circuit*	*supply*	*branch*
terminals	*branches*	*current*	*loop*	*parallel*

5

2. From the list of statements below, decide which are true and which are false.

a. **T** F In parallel circuits all of the components get the full source potential difference.

b. T **F** Each branch in a parallel circuit receives a proportion of the total potential difference of the power supply. * This is of course incorrect. Each branch in a parallel circuit has the same potential difference as the power supply so the potential difference is the same across all components which are connected in parallel .

c. **T** F In parallel circuits the total current flowing around the circuit is equal to the total of all of the currents flowing through the separate branches.

d. T **F** If 2 identical components are connected in parallel they will share the current across the branch. * This is incorrect, 2 identical components connected in parallel will experience the same level of current flowing through each one

e. **T** F The total resistance in a parallel circuit is less than the resistance of the branch with the smallest resistance * this is true, but it is a concept that may be difficult to understand immediately

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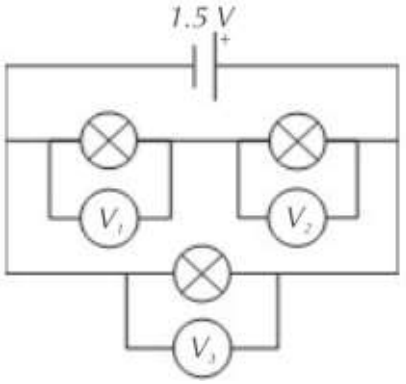
3. Consider the simple parallel circuit shown in the diagram. The circuit shows a potential different source of 1.5V and three volt meters connected in parallel (as they should be) across 3 separate filament bulbs.



1

a. What will be the reading shown on V1 ?

The reading on V1 will be 0.75 V as although this is a parallel circuit, for the purposes of the filament lamps on that branch, they are connected in series and will therefore share the potential difference.

1

b. What will be the reading shown on voltmeter V3?

The reading on V3 will be 1.5 V as it is the only component (the filament lamp) on that particular branch of the circuit.

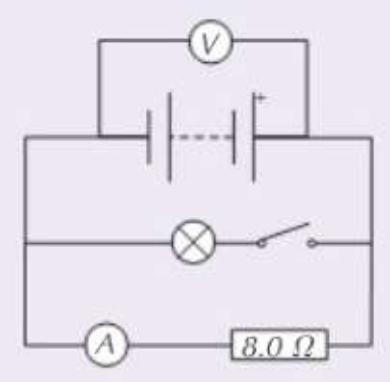
1

c. Write down a simple expression to show the relative voltages on meters V1, V2 and V3 with regard to the potential difference source voltage.

1.5 V = V1 + V2 = V3

2

4. The diagram on the left shows a parallel circuit with a filament bulb on the first branch and an 8 ohm resistor on the second branch. When the switch shown is closed, ammeter A reads 0.75 A



1

a. What is the potential difference shown on voltmeter V?

Remember from parallel circuits that the current flowing around the circuit is split across all different branches of the circuit but that all components receive the same potential difference. With this in mind calculate the potential difference across the branch containing the 8 ohm resistor from the equation V = IR, knowing that the value for I is 0.75 and the resistance of the resistor R is as shown, 8 ohms.

V is therefore 0.75 × 8 = 6 V

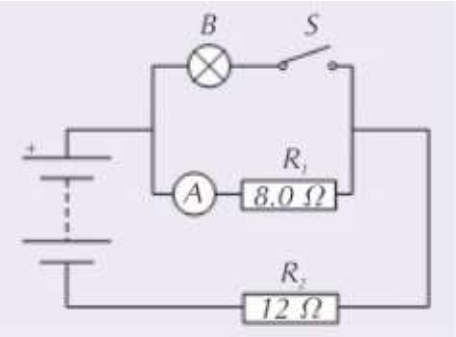
1

b. The total current in the circuit is 2.0 A calculate the resistance of the filament lamp in the first branch.

We now know that the source potential difference is 6 V from our answer to the previous section, therefore the resistance of the filament bulb will be the source potential difference divided by the current flowing through the filament bulb. Remember that the current "splits" and as the total current is given as 2 A we know that the current flowing through the filament bulb (when the switch is closed of course) must be 2 - 0.75 = 1.25 A. The resistance of the filament bulb is therefore 6 divided by 1.25 = 4.8 ohms.

___ 3

5. Look at the circuit shown to the right and answer the following questions:



___ 1 a. If switch 'S' is open, and meter A reads 0.5 A calculate the potential difference shown by voltmeter V.

With the switch open, the circuit becomes a simple series circuit with the 2 resistors (8 ohms and 12 ohms) in series with the ammeter. The total resistance of the circuit with the switch open is therefore 20 ohms. The current in this situation is given as 0.7 A therefore the potential difference is 0.7 × 20 = 14 V.

___ 1 b. If switch 'S' is closed and meter A reads 0.5 A, find the potential difference across lamp B.

The potential difference is the same on each branch of the parallel part of the circuit. So you can just find the voltage on the lower branch by using the resistance of, and the current through resistor R1. With the switch closed, as we have been told, ammeter A reads 0.5 A so the potential difference across resistor R1 must be 0.5 × 8 = 4 V

___ 1 c. If switch 'S' is closed find the potential difference across resistor R2

This circuit is in fact a series circuit with a bunch of components at the top performing part of the circuit, and the single resistor R2 also in the series circuit. In the previous question we established that the potential difference across the 8 ohm resistor and the filament lamp B would be the same as components in parallel receive the same potential difference. Given the fact that in series circuits the potential differences split and knowing that the potential difference across the top part of the circuit is 4 V, the potential difference across R2 must be 14 - 4 = 10 V