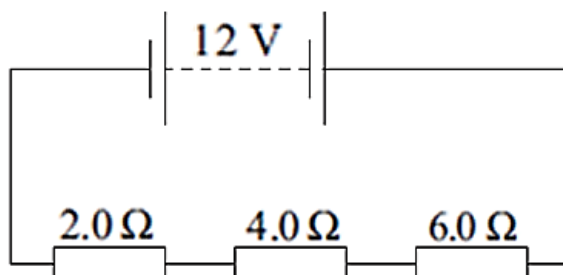


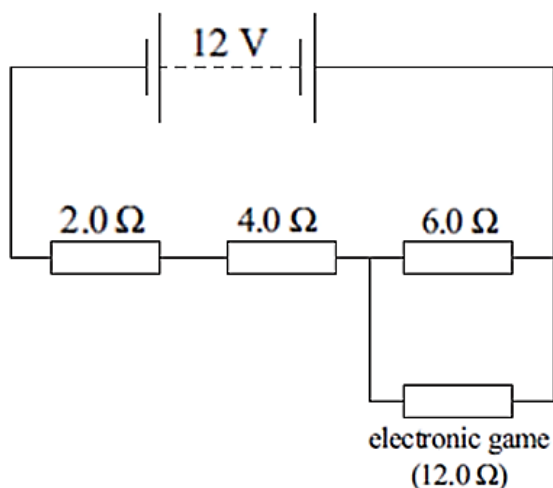
ELECTRICITY: CIRCUIT QUESTIONS

ELECTRIC CIRCUITS (2009;2)

Sean has a yacht with a 12 V power supply. He has various low voltage devices that he wants to run off the power supply. He connects three resistors in series with the power supply as shown in the diagram below.



- Calculate the current through the circuit.
- Sean connects an electronic game with a resistance of 12.0 Ω in parallel with the 6.0 Ω resistor.

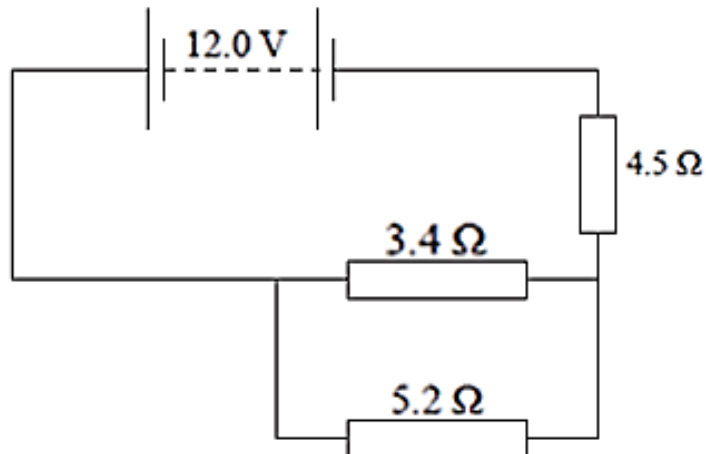


Calculate the voltage across the electronic game.

- Sean switches the electronic game to "standby mode". This causes the resistance of the electronic game to increase. Explain how this affects the voltage across the 4.0 Ω resistor.
- Sean is worried that he might accidentally connect the electronic game back to front (positive to negative). He decides to insert a diode in the wire to protect the game. Describe the function of a diode.

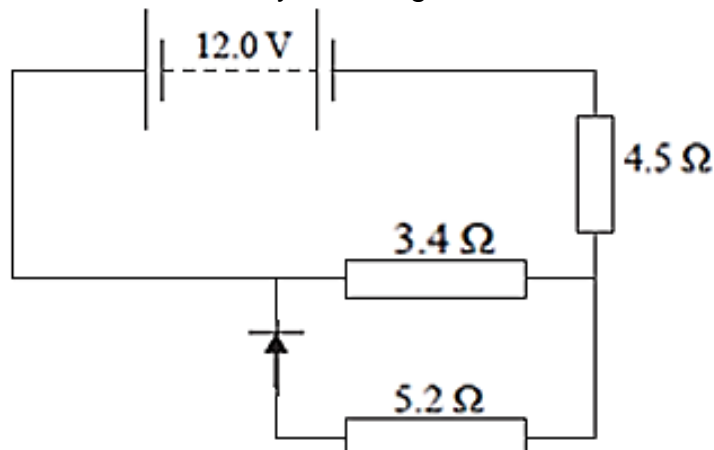
DC ELECTRICITY (2008;2)

Martha and Mere connected the following circuit using several resistors and a power supply.



- How much energy does the battery give to each Coulomb of charge?
- Show that the total resistance in this circuit is 6.56Ω .
- Calculate the current through the 4.5Ω resistor.
- Show that the voltage across the 3.4Ω resistor is 3.8 V .
- State the voltage across the 5.2Ω resistor. Give reasons for your answer.

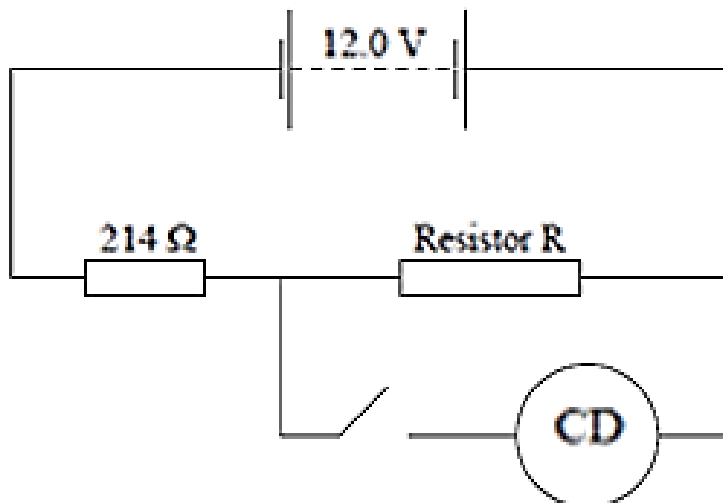
Martha and Mere then reconnect their circuit by including a diode as shown in the circuit below.



- Explain how adding the diode would affect the current through the 4.5Ω resistor.
- Calculate the heat energy produced by the 3.4Ω resistor in one minute when the diode is connected in the circuit as shown in the above diagram.

ELECTRIC CIRCUITS (2007;2)

Ella has a battery-operated CD player that she wants to connect to her car battery. The voltage of her car battery is 12.0 V and her CD player is marked "4.5 V, 25 mA". She knows she cannot connect it directly to the car battery, so she decides to connect it in a circuit as shown in the diagram below. The switch is initially closed.



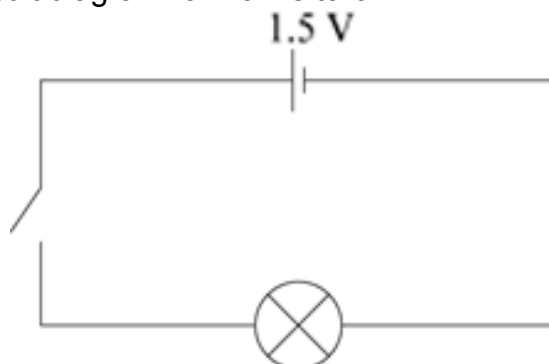
- Calculate the resistance of the CD player.
- Calculate the voltage across the 214 Ω resistor if the CD player has the correct voltage across it when the switch is closed.
- Show that the appropriate value of resistor R is 450 Ω .

Ella now opens the switch.

- Explain what happens to the voltage across the 214 Ω resistor when she opens the switch.
- The switch remains open. Explain which resistor produces more heat in a given time.
- Ella does not have a 450 Ω resistor, but she does have three 300 Ω resistors. Draw a diagram to show how she could connect the three 300 Ω resistors to give a total of 450 Ω .

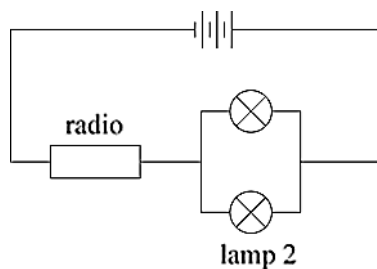
DC ELECTRICITY (2006;1)

Tom was out camping one weekend. He had taken some spare 1.5 volt cells with him. The diagram below shows the circuit diagram for Tom's torch.



- When the cell is switched on, the resistance of the lamp is 5.00 Ω . Calculate the current flowing through the lamp.
- How many joules of energy does the cell supply to each coulomb of charge that flows out of the cell?
- The torch was used for 3 minutes. Calculate the number of coulombs of charge that flowed through the lamp in 3 minutes.

Three 1.5 V cells are connected as shown below.

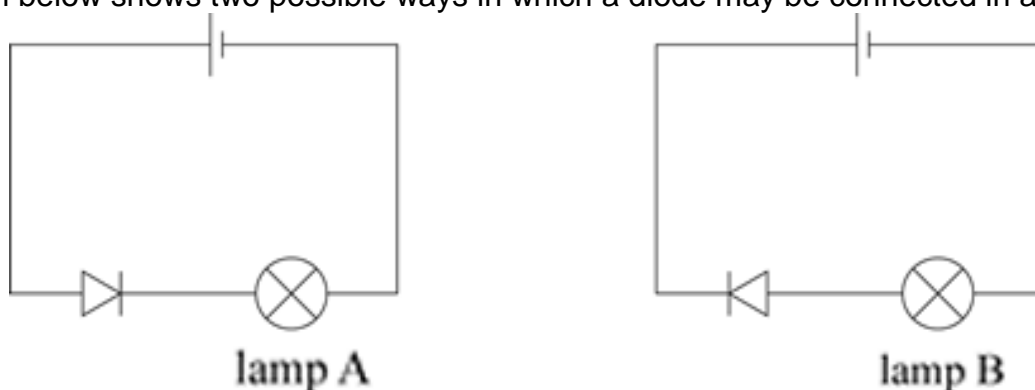


- (e) Calculate the total voltage supplied by the cells.

The resistance of each of these lamps is 4.00Ω and the resistance of the radio is 14.0Ω .

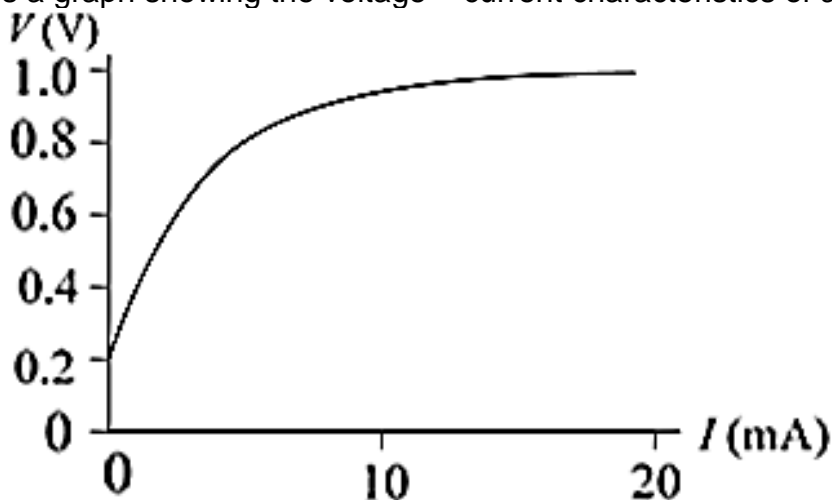
- (f) Calculate the total resistance of the circuit. Express your answer to the correct number of significant figures.
 (g) Calculate the voltage across lamp 2.

The diagram below shows two possible ways in which a diode may be connected in a circuit.



- (h) With reference to the diagrams above, state which lamp glows when the diode is connected in the circuit. Explain the behaviour of each of the lamps, in terms of the resistance of the diode.

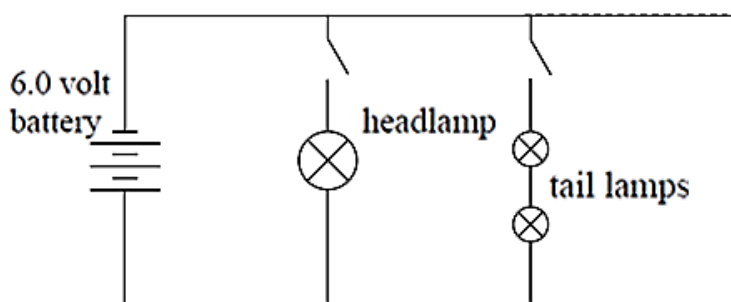
The diagram below is a graph showing the voltage – current characteristics of a particular diode.



- (i) Using the above graph, determine the voltage at which the diode will start to conduct.
 (j) State what physical quantity is represented by the gradient of the graph line.

MIKE'S MOTORBIKE (2005;2)

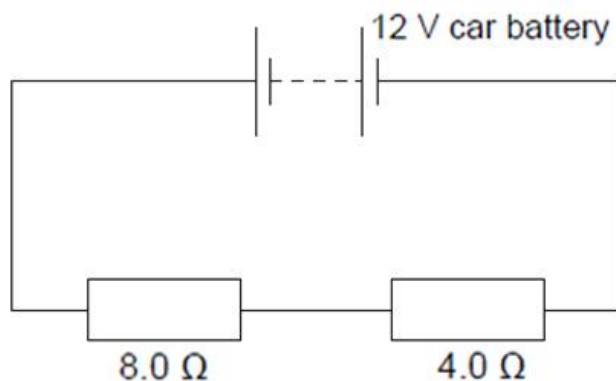
Mike is restoring an old motorbike. The wiring is damaged and he decides to replace it. His sister Moana designs a lighting circuit and draws a wiring diagram. Part of it is shown below. Mike then connects the lighting circuit on the motorbike. All the lamps are designed to operate at 6.0 V.



- The headlamp has a resistance of 1.2Ω when it is switched on. Show that the electric current through the headlamp is 5.0 A.
- Calculate the power output of the headlamp when it is operating normally. Give the correct unit with your answer.
- Explain clearly what will happen to the current in the headlamp in the short time after its switch is first closed.
- The battery is producing 6.0 A when both switches are closed. Calculate the resistance of each tail lamp, assuming that they are identical.

THE CD PLAYER (2004;1)

Amelia has a CD player that requires a 4.0 V DC power supply. To save the expense of buying new batteries, she decides to operate her CD player from her car's battery. Her friend Shona suggests using a voltage divider, and designs the following circuit.

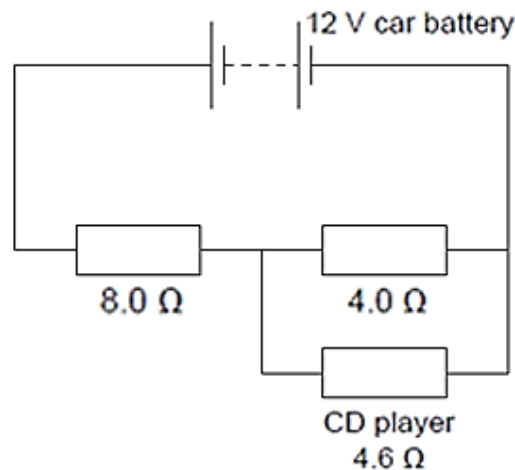


- Calculate the total resistance of the circuit.
- Calculate the current that would flow from the battery.
- Calculate the voltage across the 4.0Ω resistor.
- Shona examines the CD player. The label states:

4.0 V	3.5 W
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Show that the CD player's resistance is 4.6Ω .

The CD player has a resistance of 4.6Ω . Shona hopes that by connecting it in parallel with the 4.0Ω resistor, it will have 4.0 V across it and will work normally. When she tries it, she finds it does not work properly.



- (e) Calculate the total resistance of the new circuit.
- (f) Explain what happens to the voltage across the 8.0Ω resistor when the CD player is put in the circuit.
- (g) Show that the current through the 8.0Ω resistor is 1.2 A .
- (h) Calculate the voltage across the CD player.

Shona could only find two 2.0Ω resistors and two 16.0Ω resistors to use to make the voltage divider.

- (i) Draw two diagrams to show how she could make a 4.0Ω resistor and an 8.0Ω resistor from the ones available
- (j) Shona thought it was a good idea to put a diode into the circuit in case she connects the battery back to front by mistake. She tries it in the position shown. Explain how this will affect the CD player.