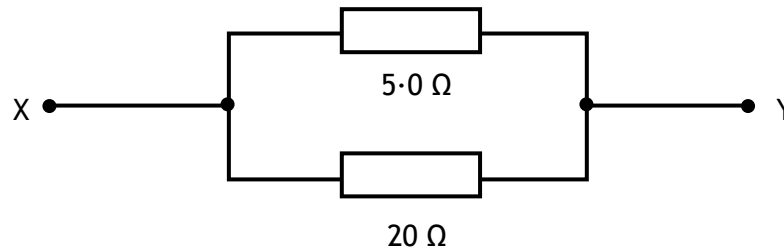


Homework 3 - Practical Electrical and Electronic Circuits

1. Identify which of the following devices converts heat energy into electrical energy.

- A Solar cell
- B Resistor
- C Thermocouple
- D Transistor
- E Thermistor

2. A 5.0Ω resistor and a 20Ω resistor are connected in parallel as shown below.

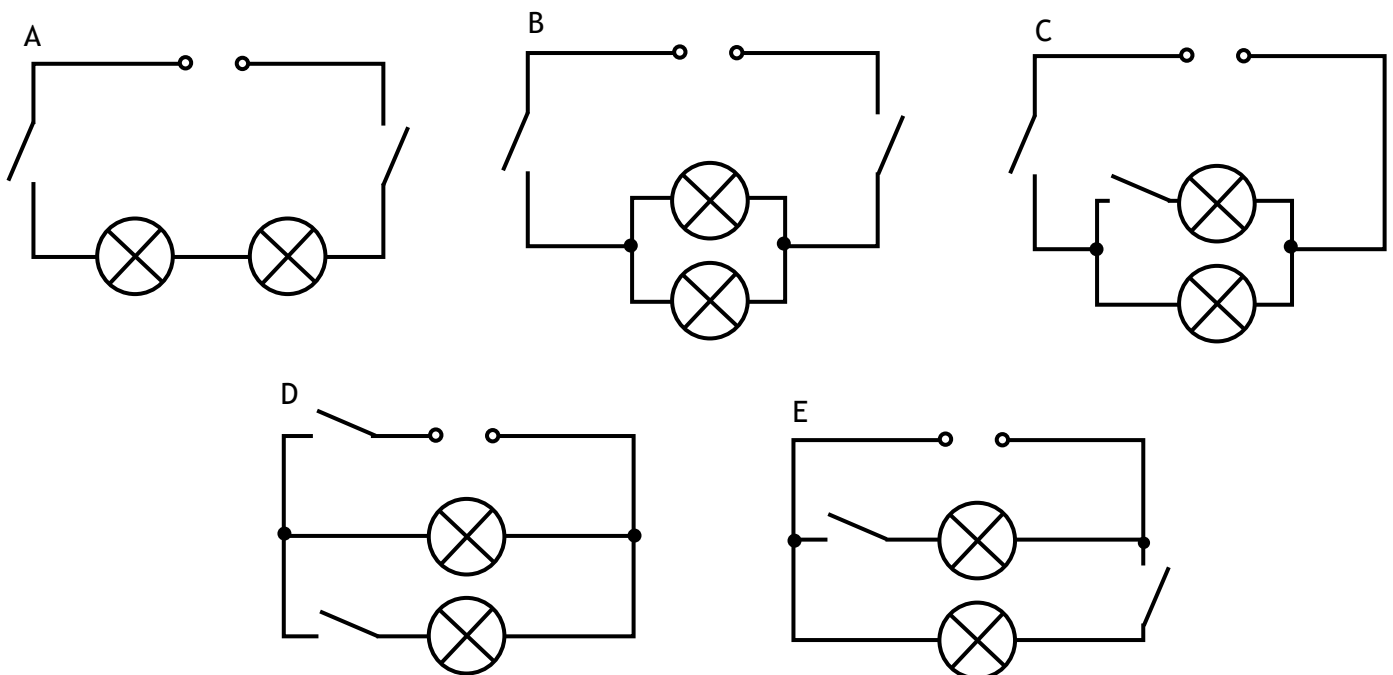


Calculate the total resistance between X and Y.

- A 0.25Ω
- B 4.0Ω
- C 12.5Ω
- D 15Ω
- E 25Ω

3. A room in a house has two lamps X and Y. With different switch positions, either lamp X or lamp Y or both lamps X and Y can be on.

Identify which circuit would allow the lamps to operate in this way.



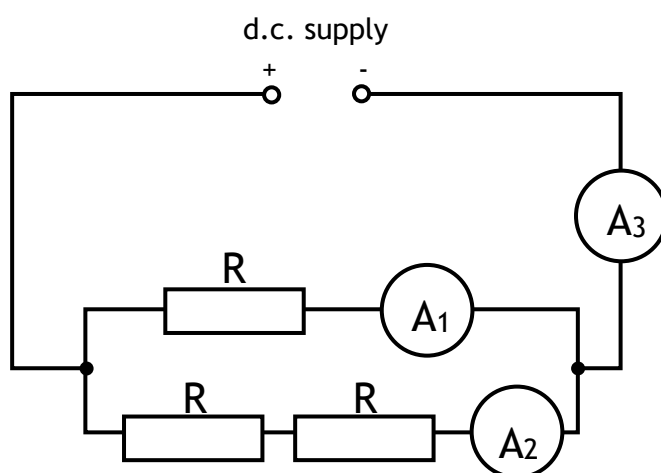
4. Identify which row in the following table correctly shows input and output devices.

	<i>Input device</i>	<i>Output devices</i>	
A	microphone	loudspeaker	LED
B	solar cell	thermocouple	LED
C	loudspeaker	microphone	relay
D	LED	loudspeaker	solar cell
E	thermocouple	microphone	LED

5. Identify which row in the following table shows the correct circuit symbols for an LED and an NPN transistor.

	<i>LED</i>	<i>NPN Transistor</i>
A		
B		
C		
D		
E		

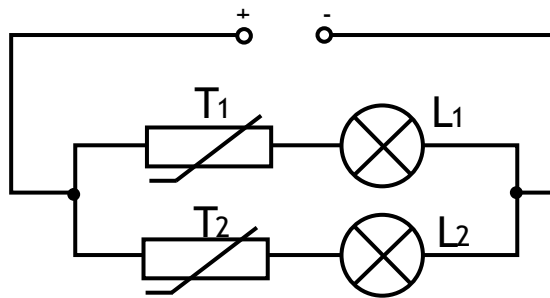
6. Three identical resistors are connected with three ammeters to a d.c. supply as shown. The reading on ammeter A_3 is 0.6 A.



Identify which row in the following table shows the readings on ammeters A_1 and A_2 .

	<i>Ammeter A_1</i>	<i>Ammeter A_2</i>
A	0.2 A	0.4 A
B	0.3 A	0.3 A
C	0.4 A	0.2 A
D	0.6 A	0.3 A
E	0.6 A	0.6 A

7. Identical thermistors T_1 and T_2 are connected with lamps L_1 and L_2 as shown.

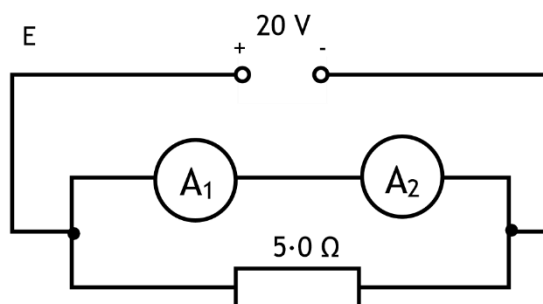
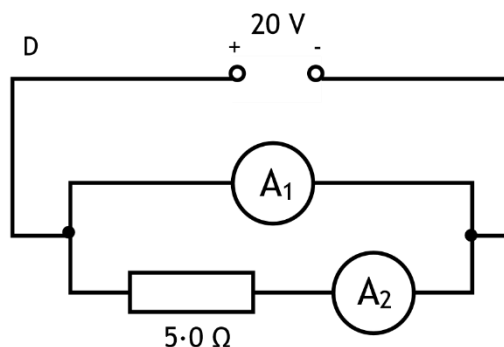
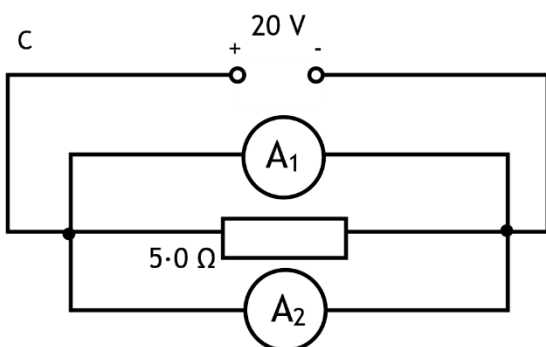
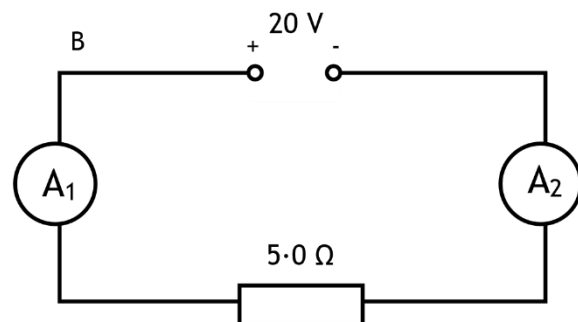
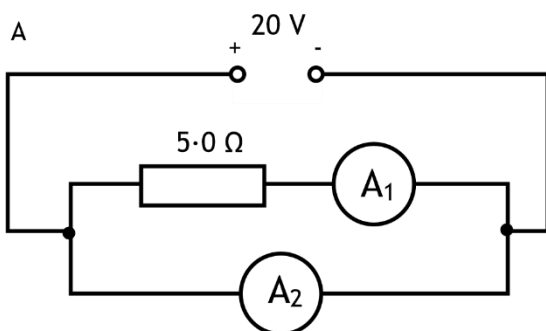


The resistance of a thermistor decreases when the temperature increases.
 T_1 is heated and T_2 is not heated.

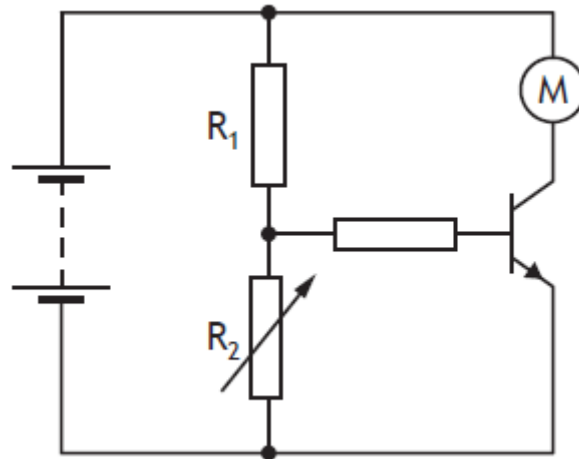
Identify what happens to the brightness of L_1 and L_2 .

	Lamp L_1	Lamp L_2
A	gets dimmer	stays the same
B	stays the same	stays the same
C	gets brighter	gets brighter
D	gets dimmer	gets brighter
E	gets brighter	stays the same

8. A student suspects that ammeter A_1 may be inaccurate. A_2 is known to be accurate. Identify which circuit should be used to compare A_1 with A_2 .



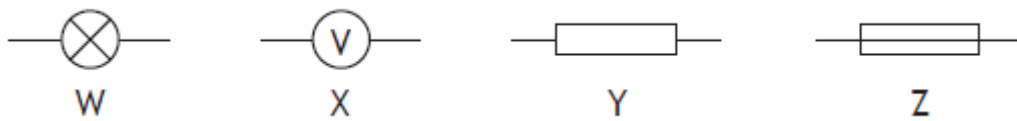
9. A circuit is set up as shown.



The purpose of the transistor is to

- A supply energy to the circuit
- B decrease the voltage across R_1
- C change electrical energy to kinetic energy
- D supply energy to the motor
- E switch on the motor.

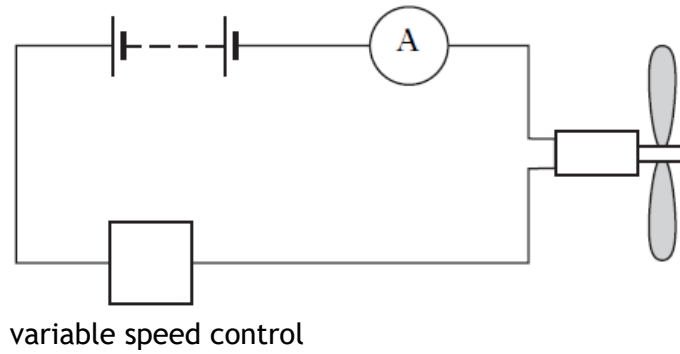
10. Four circuit symbols, W, X, Y and Z, are shown.



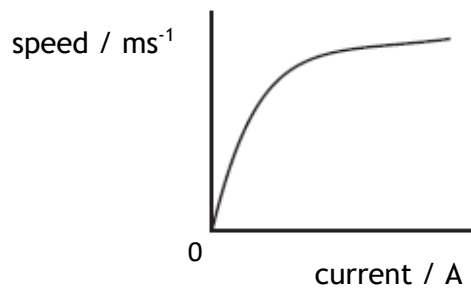
Identify which row in the table correctly names each of these circuit symbols.

	W	X	Y	Z
A	battery	ammeter	resistor	variable resistor
B	battery	ammeter	fuse	resistor
C	lamp	ammeter	variable resistor	resistor
D	lamp	voltmeter	resistor	fuse
E	lamp	voltmeter	variable resistor	fuse

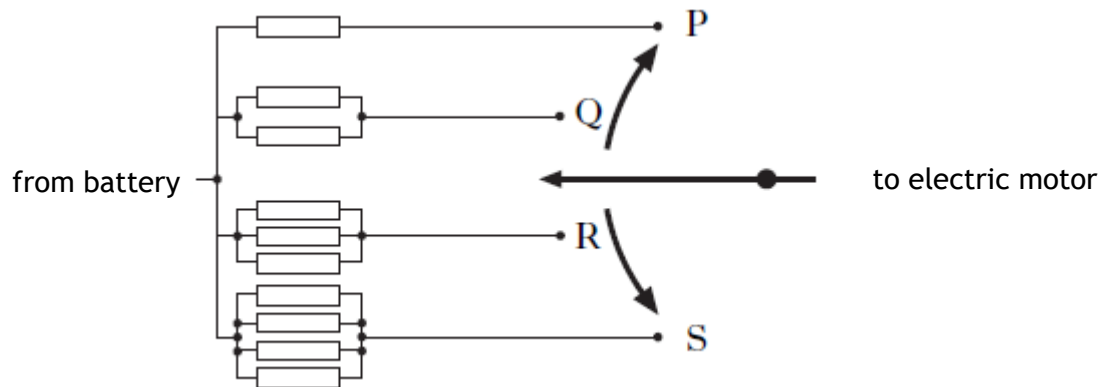
11. A car fan uses a battery powered electric motor. The diagram below shows the apparatus used to investigate the effect of current on the speed of the electric motor.



The graph below shows the relationship between current and speed during the investigation.

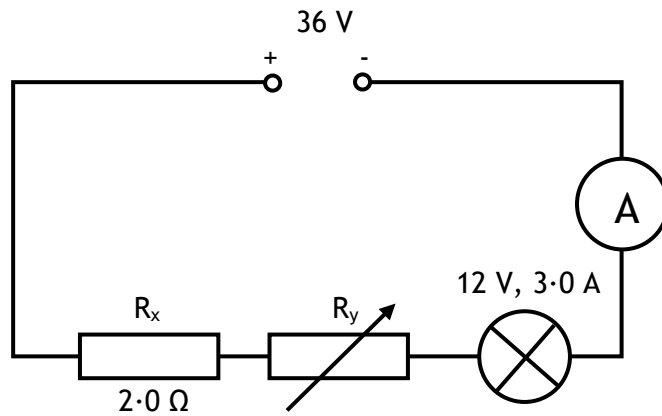


- (a) The current is altered using the variable speed control.
State what happens to the current when the resistance of the variable speed controller is reduced.
- (b) The settings of the variable speed control use different combinations of **identical** resistors, as shown.

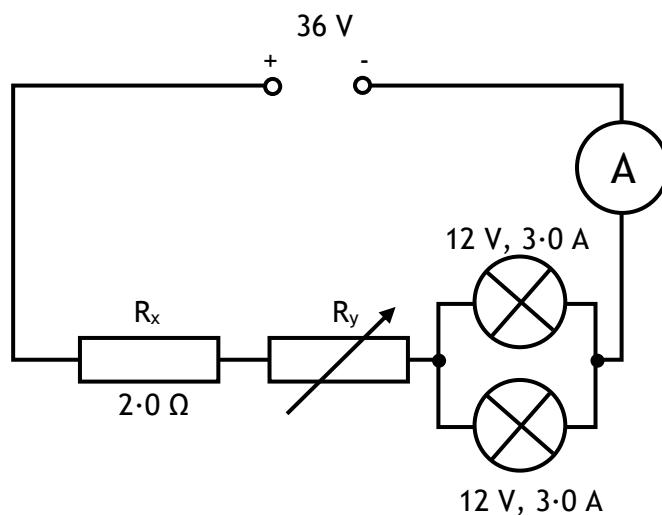


- (i) State which position the variable speed control should be set at to achieve the maximum motor speed.
- (ii) Justify your answer.

12. A student designs the circuit shown to operate a 12 V, 3.0 A lamps from a 36 V supply.

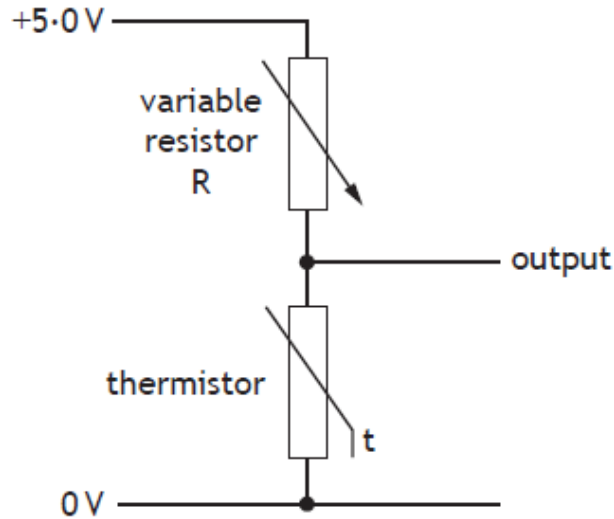


- (a) State the reading on the ammeter when the lamp is operating correctly.
- (b) The resistance of R_x is 2.0Ω .
Calculate the resistance of R_y which allows the lamp to operate correctly.
- (c) The student connects a second, identical, lamp as shown in the diagram below.

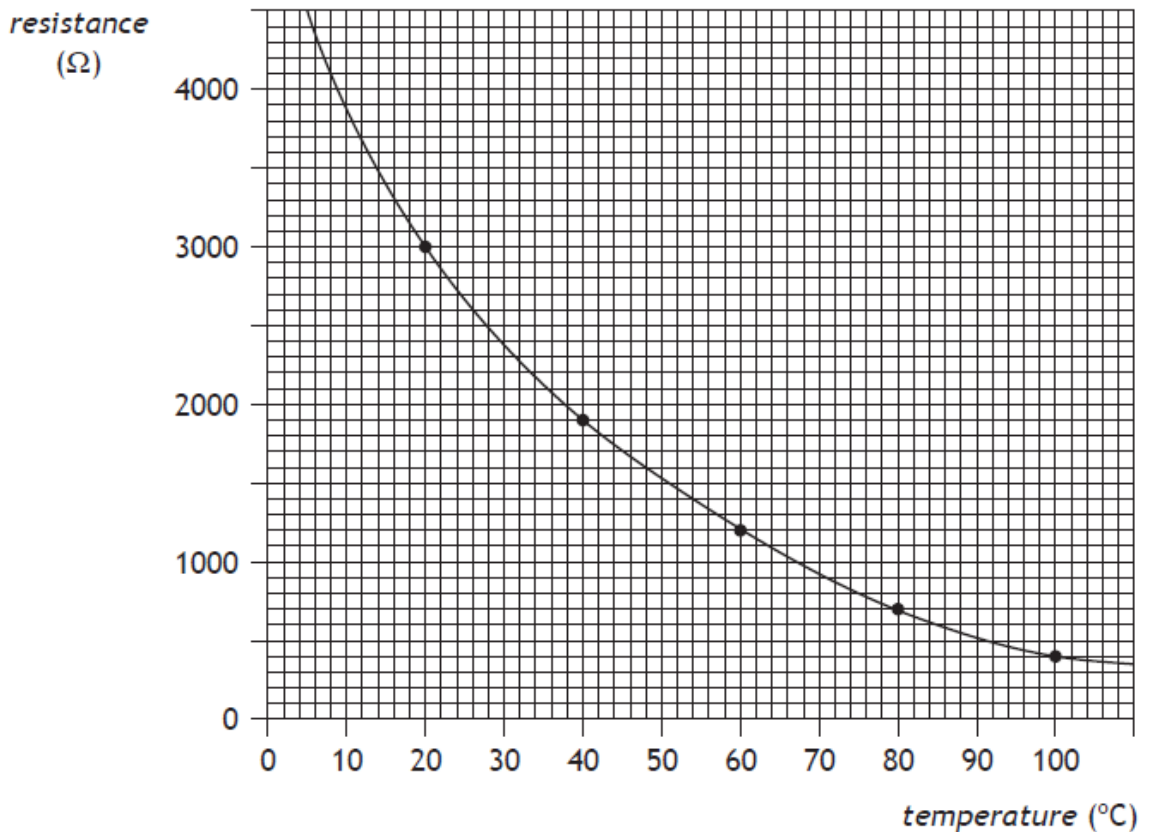


Explain why the resistance of R_y has to be adjusted to allow both lamps to operate correctly.

13. A thermistor is used as a temperature sensor in a circuit to monitor and control the temperature of water in a tank. Part of the circuit is shown.

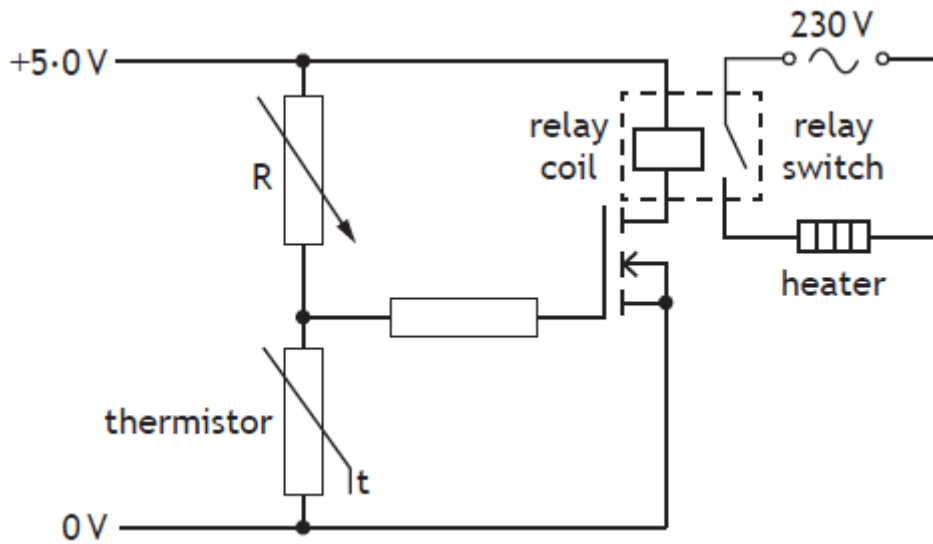


- (a) The variable resistor R is set at a resistance of 1050 Ω .
 - (i) Calculate the resistance of the thermistor when the voltage across the thermistor is 2.0 V.
 - (ii) The graph shows how the resistance of the thermistor varies with temperature.



Use the graph to determine the temperature of the water when the voltage across the thermistor is 2.0 V.

(b) The circuit is now connected to a switching circuit to operate a heater.



- (i) Explain how the circuit operates to switch on the heater when the temperature falls below a certain value.
- (ii) The resistance of the variable resistor R is now increased.
What effect does this have on the temperature at which the heater is switched on?
You **must** justify your answer.